The Political Economy of Drones

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ABSTRACT

This paper provides a political economy analysis of the evolution of Unmanned Aerial Vehicles (UAV), or "drones" in the United States. Focus is placed on the interplay between the polity and private economic influences and their impact on the trajectory of political, economic, and, in this case, military outcomes. We identify the initial formation of the drone industry, trace how the initial relationships between the military and the private sector expanded over time, and discuss how the industry has expanded. Understanding the history and evolution of UAV technology, as well as the major players in the industry today, is important for ongoing policy debates regarding the use of drones both domestically and internationally.

KEYWORDS: Unmanned Aerial Vehicles, Drones, Political Economy, Public Choice Military-Industrial Complex

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1 Introduction

World governments spent more than $6.6 billion on Unmanned Aerial Vehicles and Unmanned Aerial Systems (UAVs, UAS), or "drone," technology in 2012. This number is expected to increase to $11.4 billion a year over the next decade for a worldwide UAV market worth more than $89 billion (PR Newswire 2012). While the number of drones currently in operation is unknown, the International Institute for Strategic Studies has identified 56 different types of UAVs in use in eleven different countries (Guardian 2012). Present estimates place the number of drones in use by the U.S. government above 7,000, compared to fewer than fifty in 2000 (Tomiuc 2012). Although the U.S. presently dominates the world in terms of drone use, China, France, Germany, India, Israel, India, and Russia among others, are either known or suspected to have stocks of UAVs and still other nations have expressed interest in purchasing the technology (Defense Industry Daily 2013).

Drones are a core component of U.S. military operations and their use has controversial implications both domestically and abroad (see Miller 2012, Boyle 2013). The rise of UAV technology has effectively lowered the cost of military engagements and allowed the U.S. to undertake significant military action in Pakistan, Yemen, and Somalia without declaring war or deploying a significant number of troops. However, controversy has emerged regarding the accuracy of this technology as means of targeted warfare, as well as their efficacy, and ethical ramifications (Strawser 2010, Singer 2009). Questions regarding the identity of drone targets and the unknown number of civilian causalities have sparked further debate. Estimates of civilian casualties range from 150 to thousands (Roggio and Mayer 2013, New America Foundation 2013). According to one estimate, for every one target killed by a U.S. drone strike, fifty innocent people are also killed (Kilcullen and Exum 2009).

Further, there has been a strong push by domestic manufacturers of UAV technology for the U.S. government to relax many of the rules currently prohibiting drone sales abroad and preventing the use of drones in domestic airspace. Numerous government organizations have also pushed to expand drone use. The U.S. Air Force, Army, Navy, and Special Forces all use drone technology and have worked with private contractors to research, develop and test new drones for use domestically and abroad. The Department of Homeland Security (DHS) and the U.S. Customs and Border Protection agency (CBP) have sought to expand the use of drones along the U.S.-Mexico border (Costantini 2012). State and local police have also taken an interest in the technology. By July 20, 2012, the FAA had authorized 106 state and local government entities to fly drones in U.S. airspace (Jeffrey 2012). The push for expanded use has raised concerns over safety, privacy, and government abuse, prompting immense scrutiny from both sides of the political isle with many state lawmakers introducing legislation that attempts to restrict or ban the use of drone technology domestically (Goodale 2013, Crump and Stanley 2013).

This paper provides the first political economy analysis of drones through the lens of public choice economics. Ideally, decisions regarding the use of drones (and national defense more generally) would be made to protect the U.S. and to promote the general interests of U.S. citizens. However, in contrast to this "public interest" view, the "public choice" model predicts that decisions made by politicians regarding UAV technology will be driven by the incentives created by political institutions rather than by some higher ideal (see Buchanan 2003). The public choice perspective emphasizes that the payoffs attached to various courses of action result from the nature of political rules, and those acting within that system will respond accordingly to

these payoffs (Brennan and Buchanan 1985). This means that an array of political influences, and not some higher ideal of the "public interest," will drive how the use of drones evolves.

When studying issues of defense, particular attention must be paid to the role of actors in both the polity and in private industry. In developed countries, such as the U.S., the government maintains a monopoly on defense but relies heavily on private industry for defense-related production. These public-private linkages influence each other and, in doing so, influence the trajectory of defense policy and production. Within this context, the goal of our analysis is twofold. First, we identify the initial formation of these entanglements, or network relationships, as they relate to UAV technology. Second, we trace how these linkages increase, strengthen and expand during times of crises to generate benefits for (both public and private) Big Players—actors whose decisions and exercise of power (monetary, political, etc.) are able to influence and shape the course of events (see Koppl and Yeager 1996 and Butos and Koppl 1993). Higgs (1987) and Smith, Wagner and Yandle (2011) emphasize that moments of crisis (real or perceived) encourage new interactions and expand previously existing linkages between "Big Players" in the polity and the market as the demand for political action breaks down traditional separations.

Our analysis contributes to three strands of literature. First, we extend the literature in public choice and political economy as it relates to entanglements between public and private actors (Higgs 1987; Wagner 2009a,b, 2013; Smith, Wagner, and Yandle 2011). Acemoglu and Robinson (2013) have recently emphasized the importance of appreciating political economy issues when designing policies. Given the current, and foreseeable, controversies over drones, a public choice analysis of the topic is important for informing policy discussions. Second, and related, we contribute to the literature on the "military-industrial complex." Research in this area

focuses on the connection between the military, political, and private sectors (see Melman 1970, 1971; Adams 1981; Pursell 1972; Hossein-Zadeh 2006; Duncan and Coyne 2013a,b). We extend this literature by analyzing the intricacy, breadth, and strength of the relationships between the Big Players in the UAV industry. Understanding the history of this technology, as well as the major players in the industry today, is of central importance to designing effective policies. Third, we contribute to the literature on the military history of the U.S. (Weigley 1960; Millett, Maslowski and Feis 2012, Williams 2013) by tracing how the emergence and evolution of UAV technology by the U.S. military.

The subsequent sections analyze the drone industry in the U.S. from its origins to the present and examine three distinct time periods. We use the term "drone" and "UAV" broadly to refer to any aircraft without a human pilot controlled either by remote control or autonomously via computer. Section 2 discusses the origins of the linkages between private and public actors in the UAV industry from 1900-1948. Its purpose is to provide context of the initial emergence of drone technology and early entanglements in the drone industry. Section 3 examines the Cold War through the pre-9/11 period. It was during this time that earlier linkages matured and modern drone technology emerged. Section 4 analyzes the post-9/11 period with particular focus on how this crises created an opening for the expansion of the drone industry. Established entanglements worked to drive this progression and, in the process, subsumed other private and public actors. Section 5 concludes.

2 The Origins of Entanglement: 1900-1948

Unmanned aerial vehicle (UAV) technology evolved along with the aviation industry in the U.S. Indeed, the first attempt at creating an UAV occurred soon after the invention of the airplane in

1903. As early as 1913, the U.S. Navy provided funds for the development of a radio-controlled aircraft (Hunsaker 1954). By 1915, inventors Elmer Sperry and Peter Cooper Hewitt were working to develop a pilotless aerial torpedo—the first drone (Newcome 2004: 16).

In 1915, the U.S. Navy created the Naval Consulting Board (NCB), an organization dedicated to the creation of new technologies, organizing the process of receiving inventions from the public, and increasing the Navy's technological capabilities (Scott 1920: 3-4). Consisting of approximately two dozen private citizens in various industries, including Sperry and Cooper, the NCB had the effect of entangling the military with the private sector (including the infant drone industry). Through their connection, Sperry and Cooper obtained an audience with the Secretary of the Navy and were ultimately allocated $200,000 (more than $4.2 million in 2012 dollars) to further develop their unmanned aerial torpedo (Pearson 1969: 71).

It is at this juncture one finds the foundations of the mutually beneficial relationship between the government and private military contractors and observes the emergence of future Big Players in the drone industry. William E. Boeing, founder of the Boeing Airplane Company, for example, worked throughout the period to design and build aircraft. In 1917, having heard of the Navy's desire for planes, Boeing had one of his planes deconstructed, sent to naval offices in Florida, and reassembled for military testing. The company quickly received an order for fifty planes (PBS 2013a). Glenn L. Martin, (founder of the Glenn L. Martin Company, now Lockheed Martin), organized his own firm in 1918 building specialty aircraft—including a design for a military bomber (National Aviation 2013a). Leroy Grumman (Grumman Aeronautical Engineering Company, now Northrop Grumman), served as a pilot in WWI and through the military had obtained a degree in aeronautical engineering (Fetherston 1998). After completing his education, the Navy stationed Grumman at Loening Aeronautical Engineering Corporation to

oversee the construction of Navy aircraft (Thruelsen 1976: 21). Seeing the potential profits from military contracts, Grumman resigned his Navy commission in 1920 to work for Loening. His military ties would remain important, however, as Grumman started his own company (Thruelsen 1976: 36). It was also during the interwar period that John Northrop (founder of Northrop Aircraft, later Northrop Grumman) and Allan and Malcolm Loughead (Lockheed Aircraft Company, later Lockheed Martin) began to develop their products which would later be used by the military.

Although the military produced many of its own weapons during the period, the private defense industry took active steps to influence and shape the trajectory of military production. In 1919, the American Defense Preparedness Association (ADPA) was created by the industry with the goal of "increas[ing] weapons technology, improv[ing] defense management, and maintain[ing] a strong science-industry defense team [which would be] continually responsive to all needs of the development, production, logistics, and management phase of national preparedness" (National Defense Industrial Association 2013). The ADPA and other organizations would become immensely important in the development of the UAV industry as private industry sought to strengthen its ties with the military.

A renewed emphasis on UAV technology emerged in 1935. Following a visit to the British Royal Navy and observing the British advancements in creating target drones, Admiral William Standley returned to the States and ordered the development of similar technologies for the American fleets (Newcome 2004: 63). The Army Air Corps Act of 1926 (AACA), which had created a set of rules for negotiating contracts between the military and the private sector, allowed the Navy to utilize private contracts in order to engineer the drones. In the mid-1930s, a division of Northrop Aircraft was contracted to complete the task of creating the UAVs.

Although other companies were simultaneously contracted, it was Northrop's Radioplane Co. that would ultimately obtain success and create the OQ-2A target drone. The Navy then contracted the firm to produce an additional 1,000 of the drones for use in antiaircraft gunnery training (National Museum 2011).

At the start of WWII in 1939, both the Navy and Army used the enhanced contracting abilities granted by the ACCA to develop and use unmanned aerial technology. These abilities were expanded again after President Franklin D. Roosevelt declared a state of emergency on December 8, 1939. Following the declaration, Congress passed the Navy Reconstruction Act, allowing the Secretary of the Navy to, "negotiate contracts for the acquisition, construction, repair, or alteration of complete naval vessels or aircraft, or any portion thereof...with or without competitive bidding" (quoted in Brown 2005: 7). The War Powers Acts issued in the early 1940s were particularly important from the public choice perspective. These Acts altered the rules under which the government could contract with private firms making it easier for the military to bypass much of the formal acquisition process (Brown 2005: 8). Instead of contracting with companies that offered the lowest price, the military could now contract more freely with those companies with whom it had already established a relationship. It followed that as the military looked to develop more drones for reconnaissance, anti-aircraft training, and attack drones, that those companies which had preexisting relationships with the military, like Northrop's Radioplane Co., were awarded contracts.

The passage of these acts, combined with the demands of WWII worked to expand the defense and aviation industries and further solidified the relationship between the U.S. military and private defense contractors. In 1943, for example, the U.S. Army's Air Tactical Service Command (ATSC) initiated a deal with Lockheed Aircraft Corporation to develop and produce a

new string of jet fighters (Lockheed Martin 2013c). Boeing had used its own funds beginning in 1938 to develop a new bomber. When the Air Corp announced its formal request and design specifications for bombers to manufacturers at the start of the war, Boeing responded quickly, obtained the contract, and, by 1942, had received an order for 500 aircraft (Bowers 1989: 319). Northrop would be commissioned by the Army to build more than 700 "Black Widows," aircraft which could find and destroy enemy targets in the dark and inclement weather (Smithsonian 2013b).

Not only did these exchanges provide the U.S. military with a cadre of advanced war machines, but they also worked to expand the defense companies immensely. To give but one example of how these government contracts impacted private contractors, consider that by 1945, Grumman had seen such an increase in business that it added thousands of people to its payroll. At its peak during the war, the company employed more than 20,500 individuals and produced more than 650 aircraft monthly (Thruelsen 1976: 218). This expansion matters because as the private defense industry grew so too did its influence on lawmakers in Washington, D.C.

The war effort also expanded the demand for drones as evidenced by the number of UAV-related contracts the military granted to private firms during the war. The Army contracted with Radioplane Co. again in 1939 to manufacture what would become the OQ target drone series. The Navy would also contract the company for the technology and more than 15,000 of the drones were used to train American anti-aircraft gunners throughout the war (Newcome 2004: 58). McDonnell Aircraft (later a part of Boeing) was contracted to build an unspecified number of "Katydid Drones" in an effort to compete with the German V-1 rockets (Smithsonian 2013a). Boeing was commissioned to convert "war-weary" B-17 "Flying Fortress" bombers into radio-controlled assault drones (Parsch 2003). Ryan Aeronautical (now part of Northrop

Grumman), Lockheed Aircraft Corporation, Glenn L. Martin Company, and Vought (now part of Northrop Grumman) all contracted with the U.S. Army Air Force, U.S. Air Force, or Navy during the war to design and manufacture various types of drones (Parsch 2010).

For our analysis, World War II was significant in that it ushered in what has been called a "permanent war economy"—a situation characterized by constant funding for military equipment and supplies in order to develop and amass enhanced military capabilities during times of both war and peace (see Melman 1985 and Duncan and Coyne 2013a,b). Whereas the previous concept of war was one of responding to immediate and actual threats and aggression (e.g. an attack on American ships, etc.), the new military ideal was to maintain a state of constant preparation for future potential conflict. One consequence of this constant preparation was the establishment of a more permanent relationship between government and the private defense industry. Duncan and Coyne (2013a: 2) describe how such an economy, "set in motion a process...whereby private actors respond[ed] to the opportunities presented by a state of permanent war and adjust[ed] their behaviors to take advantage of new profit opportunities....[T]he private economy [became] increasingly intertwined with the state."

The rise of the permanent war economy had important implications for the entanglement between the private defense industry and the government. While the experiences of the World Wars had allowed for many defense firms to further specialize their products (e.g. Grumman's continued production of naval technology), the emergence of the permanent war economy worked to increase the importance of networking and social relationships between contractors and the military for the acquisition of contracts. Higgs (2007: 308) argues that following the end of WWII, military contracts, "came to turn not on price, but on technical and scientific capabilities, size, experience, and established reputation as a military supplier—vaguer attributes

that are easier to fudge for one's friends." This implies that those firms who had received contracts and built political relationships with the government before the war were more likely to be the recipients of contracts after the war. Indeed, following the conclusion of WWII, we see how the entanglements established during WWI, the interwar years, and WWII increased, strengthened, and generated further benefits for the Big Players in the market and the polity. For example, Lockheed's services were retained by the military for the continued production of military aircraft after WWII. The Glenn L. Martin Company began ventures in commercial aircraft, but received contracts to produce missiles and rockets for the U.S. military (Lockheed Martin 2013c). Grumman, in keeping with its past connection to the U.S. Navy, obtained long-term contracts with naval forces to design and manufacture new combat aircraft (Treadwell 1990: 90, 99, 120).

Efforts were made by actors both in the U.S. military and in private firms to maintain and strengthen the relationships which had been forged during the war. In 1948, the ADPA changed its name to the American Ordnance Association in order to reflect the changes brought about by the creation of the Department of Defense and expanded its activities to include all branches of the military. The National Security Industrial Organization (NSIO) was formed from the Navy Industrial Association during the period in an effort to "establish and foster a close working relationship and effective two-way communication between government, primary defense, and the industry which supports it" (NDIA 2013). The Association looked to influence relationships between the military and weapons manufacturers in areas of research and development, procurement, and many other areas (*Ibid*). Brown (2005: 8) describes the push from both the market and the polity to continue the contracting which had taken place in war time.

> [T]hese relationships had...produced some of the most important weapons of the war....In the years that followed...Congress and the president, at the behest of the

> armed forces and representatives of the industry, drafted new laws to improve military procurement and encourage further cooperation between private industry and the government, with the understanding that such collaboration would strengthen the armed forces and yield even more impressive and powerful weapons.

At this point, the entanglements underpinning the current drone industry were well established. These relationships would further mature during the Cold War period.

3 Modern Drones and the Maturation of Entanglement: Cold War – pre-9/11

The sustained threat of the Soviet Union, further worked to expand the relationship between the military and private defense industry and increased interest in more advanced UAV technology. Although drones in the past were used almost solely for target practice and training purposes, the military also saw UAV technology as a potential tool for reconnaissance missions. Throughout the Cold War period, "radioplanes" were manufactured for the U.S. military by numerous corporations including Northrop, Lockheed, Beechcraft (now Raytheon), and the Globe Company (Goebel 2012). In 1955, Radioplane modified an early drone model to include a series of film cameras. The U.S. Army introduced these drones in 1959 and would utilize the technology throughout the Cold War for reconnaissance (Newcome 2004: 59). Although no open conflict ever occurred between the United States and the Soviet Union, reconnaissance flights were a fairly common, but dangerous mission. From 1946-1990, 23 aircraft and 179 servicemen were lost during reconnaissance flights related to Cold War operations (Newcome 2004: 71). Although most losses from such missions were kept quiet by both the U.S. and the U.S.S.R., the danger of the missions combined with the political turmoil experienced when airmen were

captured prompted the U.S. Air Force to embark on a number of "surveillance drone" programs with companies like Radioplane, Northrop and others to produce nearly 1,500 drones. (Newcome 2004: 72-73).

The Cold War led to further developments in drone technology due to the "Space Race" between the U.S. and the Soviet Union and the nuclear arms race. Both of these events further increased the U.S. military's demand for new technology. Drones were seen as potentially useful in weapons testing after nuclear tests by pilots resulted in radiation-related illness and fatalities. The increased desire for UAV technology can again be seen in the number of private companies contracted by the military to produce UAVs. From 1946 through the 1960s, the Navy, Army, and Air Force contracted with Ryan Aeronautical, Beech, Curtiss, McDonnell, Globe, Martin, Radioplane, Northrop, Vought, and Lockheed to produce UAVs (Pasch 2010).

These investments contributed to even more advanced UAV technologies in the 1980s and 1990s. As a result of increased defense spending during the Reagan Administration, "microelectromechanical" system sensors (MEMS), mini global positioning systems (GPS), and micro electronics became well developed, allowing for more advanced UAVs. Military operations abroad in Grenada, Lebanon, and Libya increased demand for inexpensive, unmanned, reconnaissance, and battle damage assessment (BDA) capabilities for field commanders. This demand, combined with the enhanced technology of the period led to further contracting between the U.S. military and drone manufacturers and yielded drones still in use today. In 1985, for example, the Secretary of the Navy ordered an expedited acquisition of UAVs for fleet operations. The RQ-2A Pioneer was introduced during this period and would operate in the Persian Gulf, Bosnia, Yugoslavia, and Somalia (U.S. Navy 2009).

Following the end of the Cold War and the collapse of the Soviet Union in the early 1990s, many of the existing Big Players in the private defense industry consolidated. Lockheed and Martin merged to become Lockheed Martin. Northrop and Grumman also merged. Lockheed Martin acquired British Aerospace and other smaller firms. Northrop Grumman and Boeing also made a series of acquisitions during the period. Mergers and acquisitions allowed the players in the defense industry to enhance their production capabilities while also increasing their political influence. A larger corporation with multiple locations meant that multiple agents in Congress would have a vested interest in growing the industry so as to bring money and employment to their districts. Hartung (2011: 20-21) describes how the acquisitions of British Aerospace and McDonnell Douglas by Lockheed Martin and Boeing were able to garner important political support for the companies,

> Boeing was able to beef up [political ties by acquiring] McDonnell Douglas....British Aerospace came to join the Lockheed Martin Team. This gave Lockheed Martin a leg up in persuading Britain to weigh in on its behalf. It is one thing to have a given state or senator in one's corner. It is quite another to have a sovereign state and longtime U.S. ally like the United Kingdom ready to go to bat for you.

The first Gulf War would prove a critical point in the development of the UAV industry. According to a May 1991 report from the Navy, "at least one UAV was airborne at all times during Desert Storm" (quoted in Frontline 2013). The conflict saw 522 separate drone launches and over 1,600 hours of flying time. During operations in Iraq, the military, seeing the effectiveness of the UAVs, contracted familiar companies in the industry to create and manufacture new drones. A report from the Oversight and Investigations Subcommittee and Committee on Armed Services in 1993 stated the impact of the technologies in the field,

> [U]nmanned aerial vehicles (UAVs) provided substantial imagery support to Marine, Army, and Navy units during Operation Desert Storm. They were so good many more could have been used....These systems were employed for

> battlefield damage assessment...targeting...and surveillance missions, particularly in high-threat airspace....We could have used three times as many as we had. The Army took its solitary set of UAVs into the war and is now looking for many more. In one instance, Iraqi troops actually attempted to surrender to a UAV loitering over their position (quoted in Frontline 2013).

The performance of drones in Desert Storm was sufficient to once again increase the demand for the technology. This general increase in demand was compounded, however, by two broader changes in the military.

First, following the collapse of the Soviet Union, the U.S. military began to "transform itself in response to new threats" (Lyons 2004: 27). In prior decades, from before WWI through the Cold War, the U.S. had built up its arsenal to defend against the increases in its adversaries' weapon stocks. With the collapse of the Soviet Union in the early 1990s, however, the military lacked a clear antagonist and instead began to engage a "collection of asymmetric threats" (*Ibid*). While amassing weapons systems like bombers and tanks may have served to defeat the enemies of previous wars, such technology became impractical to build and deploy against multiple, smaller threats. Second, it was during this period that the U.S. Armed Forces sought to transform their role from one of traditional war fighters to one of "peacekeepers" (*Ibid*). Throughout the 1990s, the military undertook humanitarian operations in Somalia, Bosnia and Herzegovina, Rwanda, Kosovo, and elsewhere. Unlike previous military engagements, the goal was often not to force surrender of an enemy of the state, but to bring an end to conflict and provide humanitarian assistance (Seybolt 2008). Again, the use of traditional full-scale military operations and equipment proved difficult and often impractical with modern drone technologies seen as the main alternative.

It was this changing landscape of international politics and U.S. military operations which laid the final groundwork for the widespread use of drones in the new millennium. The

shift from full-scale military operations to smaller engagements, combined with the success of prior drone use and new technological achievements would set the stage for drones to be used on a never before seen scale.

4 The Post-9/11 Expansion of Drones and Entanglement

The increased demand for drone technology following the Gulf conflict was augmented substantially by the post-9/11 conflicts in Afghanistan and Iraq. These conflicts, coupled with the broader Global War on Terror, created an opening for the expanded use of drones on an unprecedented scale. This is evident in the Department of Defense spending on Unmanned Aerial Systems (UAS) shown in Figure 1.

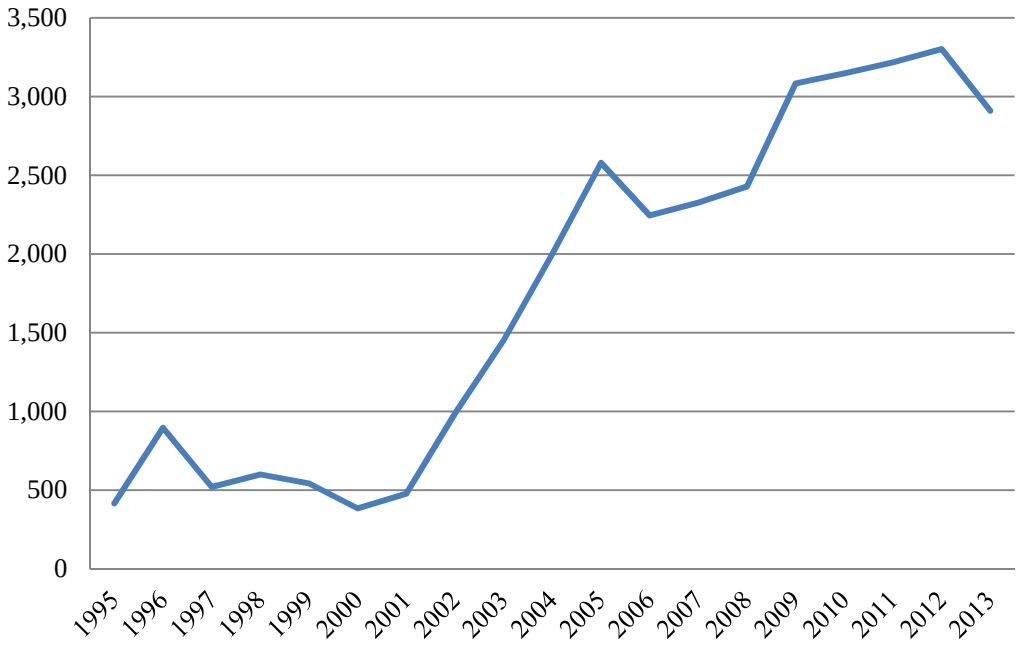

Figure 1 DOD Spending on UAS: 1995-2013 (in millions)[1]

As illustrated by Figure 1, spending on drones increased significantly in the post-9/11 period from $363 million in 2001 ($4.77 million in 2013 dollars) to $2.9 billion in 2013. Further, between 2002 and 2010, the DOD's UAS inventory increased 40-fold (Gertler 2012: i). While only five percent of military aircraft were unmanned in 2005, by 2012 UAVs accounted for one third of *all* military aircraft (Gertler 2012: 9). An inventory of the DOD's unmanned aerial systems in 2003 counted only 163 UAS is use. The 2012 inventory, meanwhile, reported the DOD maintained a total of 7,454 unmanned aerial systems—an increase of over 4,400 percent in less than a decade (Gertler 2012: 8).[2] The political economy framework can shed light on how this dramatic increase in drones came about.

One key driver was increased demand for drones by the military for combat purposes. Just as humanitarian missions in the 1990s had shown the expense and ineffectiveness of traditional military engagements, the multiple post-9/11 conflicts provided further evidence that "traditional" combat operations were no longer suitable. David H. Lyon (2004: pp. 27-28), chief of Advanced Munitions Concepts with the U.S. Army Research Laboratory, described the changing demands of military engagements in response to the threats posed by the U.S.'s new enemies and suggested a trajectory for military equipment and engagements.

> [T]he U.S. Army can no longer afford the time and resources required to mass heavy vehicles prior to execution of an attack, as past doctrine dictated. Instead, the U.S. Army will consist of a collection of smaller, rapidly transportable units with the ultimate goal of deploying anywhere on the globe within 72 hours....Even with highly advanced technologies...the only way to achieve success...is to possess an unprecedented level of battlefield situational awareness. This will

[1] Source: DOD, UAS Roadmap 2005-2030 (p.37) and DOD FY2009-2034 Unmanned Systems Integrated Roadmap (p. 4). All figured adjusted to 2013 dollars.

[2] These inventories do not include small UAVs, micro UAVs (small enough to be "man-portable"), or "lighter-than-air" (inflatable) platforms.

> allow the U.S. Army systems to locate and engage targets at distances that far exceed enemy capabilities, such that significant attrition will cripple the enemy's ability to fight effectively, long before closing within traditional engagement ranges.

Drones provided all these modern features. They were smaller, well-equipped, and easier to deploy than traditional equipment. The data gathering abilities of UAVs allowed for enhanced situational awareness. Their attack capabilities provided the military a chance to engage targets much faster than mobilizing ground units. Further, drones were able to enter and remain in environments which were not conducive to manned aircraft and remain in flight for over 24 hours. They are also able to perform additional functions such as surveying land and measuring cellular, radio, and other technological coverage over a variety of terrains (Unmanned Aerial Vehicle Systems Association 2013).

In addition to the changing organization of military engagements, the type of conflict in Iraq and Afghanistan gave the UAV technology additional appeal. While previous conflicts (e.g. WWI, WWII, and Vietnam) were often fought out in the open or on the battlefield, these military operations engaged enemies across a variety of terrains. As opposed to fighting an organized unit of enemy troops, the U.S. military was often seeking a particular individual or small group without precise knowledge of their location. Given the geographic realities of these battles, UAVs, some able to remain in flight for forty hours or more, could track and attack targets more effectively than traditional combat methods.

Drones also provided a mechanism for engaging in conflict while limiting U.S. soldier fatalities. Soldier deaths in post-9/11 conflicts, particularly in Iraq, were met with sharp criticism from citizens, the popular press, and both sides of the political aisle (Kuhnhenn 2008, NBC

News 2007). By using drones, many missions would no longer require as many U.S. soldiers in the field, decreasing the number of casualties.

Although the military demand created by Afghanistan, Iraq and the broader War on Terror were central to the expansion of the drone industry, it was not the sole driver of the industry's growth. Established Big Players in the defense industry, like Lockheed Martin, Northrop Grumman, Boeing, General Dynamics, and General Atomics saw U.S. military engagements as opportunities to earn significant profits. It is not difficult to see why. These engagements would mean more defense spending, including on UAV technologies. Consider that by 2012, world governments were spending more than $6.6 billion on UAVs annually. Profits are expected to increase to $11.4 billion annually over the next decade for a world market to more than $89 billion a year (PR Newswire 2012). According to the GAO, the 2012 DOD acquisition plan for UAVs will require extensive payments to drone manufacturers. More than $34.9 billion will be needed to purchase the desired number of drones from manufacturers (Gertler 2012: 33). In addition to the profits from the manufacture of new drones, the industry may expect additional revenues from drone repairs and modifications. Given these potential profits, coupled with the increased demand from the military, the result, as predicted by the political economy model, was intense rent-seeking by those in the defense industry.

Consider that top drone manufacturers have spent millions on lobbying expenditures since the Global War on Terror began in 2001. For example, leading up to and in the year following the U.S. invasion of Afghanistan, General Atomics, the maker of the Reaper, Warrior, Avenger, and Predator drones significantly increased its lobbying expenditures. Between 2000 and 2002, General Atomics' lobbying increased by a compound rate of over 49 percent per year.

During the same period, Northrop Grumman increased their expenditures at a compound rate of nearly 27 percent per year (CRP 2013).

Lobbying by the big players in the drone industry—Lockheed Martin, Northrop, Boeing, General Dynamics, and General Atomics—increased again over the 2008 election cycle. Between 2006 and 2008, the Big Players in the drone industry increased their lobbying at a compound rate of 17.41 percent per year compared to nine percent for total lobbying in the U.S. (CRP 2013). Lockheed, General Dynamics and Boeing increased their lobbying expenditures at a compound rate of 22, 12, and 35 percent, respectively, between 2006 and 2008 (CRP 2013). While overall lobbying in the U.S. decreased at a compound rate of 4 percent per year between 2010 and 2012, lobbying for the drone industry fell less than one percent (CRP 2013). Northrop Grumman, Lockheed Martin, and General Atomics, however, continued to *increase* their lobbying expenditures. Between 2010 and 2012, Northrop, Lockheed, and General Atomics increased their lobbying expenditures at compound rates of three, six, and eight percent, respectively, per year (CRP 2013).

In addition to increasing the overall level of lobbying spending Lockheed Martin, Northrop Grumman, Boeing, General Dynamics and General Atomics each retained multiple lobbying firms, many of which employed former government workers. In 2012, for example, 72.8 percent of lobbyists employed by Lockheed had formerly held a government job. Similarly, 67.3 percent of Northrop lobbyists, 71.9 percent of those retained by General Dynamics, 76.5 percent of Boeing's, and 72.2 percent of General Atomics' lobbyists were former government employees (CRP 2013). This "revolving door" between government and lobbying firms lowered the cost of traversing the Congressional landscape to have maximum influence on key decision makers.

Several of the lobbying firms retained by the top drone manufacturers were connected directly to former Congressmen. Former Congressman David Hobson, for example, was a House representative from 1991-2009 and a member of the House Appropriations Committee and Subcommittee on Defense. Following his political tenure, Hobson founded his own lobbying firm, now retained by Lockheed Martin (CRP 2013). Jack Edwards, a long time member of the House, began working as a consultant for a D.C. lobbyist following his term. In 2012 alone, the firm received more than half a million dollars for its services from Lockheed, Northrop, and General Dynamics (CRP 2013). Former Congressman Sonny Callahan, likewise began working as a lobbyist following his stint at the Capitol and also started his own firm. The two firms collectively received more than $1.33 million in funds from drone makers during Callahan's tenure (CRP 2013). Former House member John Breaux and former Senate Majority leader Trent Lott began their own bipartisan lobbying firm, Breaux Lott Leadership Group in 2008 and are also retained by the industry's Big Players, like Lockheed Martin (CRP 2013).

The attempt by the major players in the drone market to influence the activities of the government may also be seen in campaign contributions. While lobbying is generally conducted in an attempt to advance or hinder particular legislation, by contributing to a campaign, drone manufacturers look to curry the favor of politicians and influence the politics surrounding their industry more generally. Just as lobbying expenditures for the industry increased around elections and other major events like the invasions of Iraq and Afghanistan, so too did campaign contributions from the top drone manufacturers.

Between 2000 and 2002, total campaign contributions from Lockheed, Northrop, Boeing, General Atomics and General Dynamics increased by over 13 percent to more than $10 million (CRP 2013). The elections of 2008 saw an increase in contributions of over 28 percent from

2006. In the elections of November, 2012, Lockheed, Northrop, Boeing, General Dynamics and General Atomics increased their campaign spending to over $11.9 million—an increase of more than 104 percent from the year before while Northrop Grumman, increased their contributions at a much faster rate—nearly 200 percent between 2010 and 2012 (CRP 2013). These campaign funds provided monetary incentives for members of Congress to be favorable toward spending on defense, including on expanding spending on UAV technologies.

In 2007, Congress passed the Fiscal 2007 Authorization Act, legislation that would all but guarantee the mass expansion of the industry. Among other requirements, the Act required the Secretary of Defense to,

> Develop a policy to be applicable throughout the Department of Defense, on research, development, test and evaluation, procurement and operation of unmanned systems....[The policy must include] *a preference for unmanned systems in acquisition programs for new systems*, including a requirement under any such program for the development of a manned system for a certification that an unmanned system is incapable of meeting program requirements (John Warner National Defense Authorization Act for 2007, section 941, emphasis added).

Thus, Congress drastically altered the way in which new systems were to be designed. Instead of looking to develop unmanned systems to serve the same tasks as existing manned systems, unmanned systems would now be the assumed *starting point* for new technologies. Unmanned systems were to be developed for tasks unless some other need required new systems to be manned. The impact on the drone industry was drastic and rapid. By 2010, spending on drones increased to $3.3 billion (Gertler 2012: i). By 2011, the DOD had increased their spending on drones to $4 billion annually (Brinkerhoff 2011, Waldman 2013). As a result of the expansion, all the major players—drone manufactures, the military and Congress—reaped substantial benefits.

Perhaps the best demonstration of the impact the drone industry has had on Congress occurred in 2009 with the formation of the Congressional Unmanned Systems Caucus (CUSC). The CUSC is a group of approximately fifty members of the House of Representatives dedicated to expanding the drone industry:[3]

> [The Unmanned Systems Caucus seeks to] educate members of the Congress and public on the strategic, tactical, and scientific value of unmanned systems; actively support further development and acquisition of more systems, and to more effectively engage the civilian aviation community....We acknowledge the overwhelming value of these systems to defense, intelligence, homeland security, law enforcement, and the scientific communities....We recognize the urgent need to rapidly deploy more Unmanned Systems in support of ongoing civil, military, and law enforcement operations....We work with the military...and other stakeholders...[to] support our world-class industrial base that engineers, develops, manufactures, and tests unmanned systems creating thousands of American jobs....We support policies and budgets that promote a larger, more robust national security unmanned system capability (CUSC 2013).

It is not difficult to understand why the representatives in the CUSC desire to expand the industry. *Every* member of the caucus comes from a state with some connection to drone manufacturers meaning they have a vested interest in expanding the industry to generate benefits for their constituents.

Congressman Buck McKeon, one of the caucus' co-chairs, for example, represents the district in which Northrop Grumman manufactures its Global Hawk drones. His representative state, California, is poised to gain immensely from increased drone production. A 2013 report by the Association for Unmanned Aerial Vehicle Systems International (AUVSI), the industry's largest lobbyist, found that enhanced drone production would bring more revenue to California

[3] A similar caucus was created in the Senate in 2012 with a mission to "educate Senators and staff on the capabilities and concerns of UAS and to work closely together to best shape the UAS policymaking process (Harder and Heisten 2012). Just as the House UAS caucus contains members with vested interests in the continued expansion of the drone industry, so too does the Senate caucus. Also like the House caucus, the group in the Senate maintains close ties to the AUVSI and drone manufacturers. Michael Toscano, President of the AUVSI stated the Senate caucus would "enable AUVSI to work with the Senate and stakeholders on the important issues that face the unmanned systems community as the expanded use of the technology transitions to the civil and commercial markets....It is our hope to establish the same open dialogue with the Senate caucus as we have for the past three years with the House Unmanned Systems Caucus" (quoted in Aero News Network 2012).

than any other state (AUVSI 2013: 3). Henry Cuellar, the caucus' second co-chair, represents a district just outside of San Antonio, the home of branches of Lockheed Martin, Northrop Grumman and Boeing. The same AUVSI report found that Texas is poised to reap some of the most extensive benefits from the expansion of the drone industry and is third in potential revenue behind California and Washington State (AUVSI 2013: 3). Other members of the caucus have similar connections and hail from states which will also gain significantly from further drone production. More than half the members of the CUSC represent the ten states which the drone industry projects will see the most gains in terms of jobs and additional revenue with the increase in UAV production (AUVSI 2013: 3).

These relationships illustrate the logic of public choice, that the policies surrounding drones (like policy in general) are driven by the incentives facing policymakers. The Big Players in the market and the polity (i.e. the military, elected officials, and drone manufacturers) utilize a variety of means, including lobbying, campaign finance, political clout, and other pressures to influence the other groups and reap various benefits for their members. The central issue is whether these narrow interests align with broader notions of the public interest as it relates to defense.

5 Conclusion

The public controversy surrounding the use of drones by the U.S. government is a recent phenomenon. But as our analysis shows, the UAV technology itself is anything but new. Instead, there is long history of linkages between the U.S. government and private producers of these technologies. Our central purpose has been to document this history. In itself, this has value

purely as an exercise in U.S. military history and political economy. But beyond this, the political economy of drones has important implications for current policy debates.

The current controversy over drones is multifaceted. On the one hand there is debate about the international use of drones. These controversies focus on the effectiveness of drones in targeted killings, the legality of drone use in the context of state sovereignty, and the ethics of drone use due to the possibility of collateral damage. At the same time, there is ongoing debate about the domestic use of drones related to privacy and civil liberties. Regardless of how these debates ultimately unfold, the creation of new policies surrounding the use and manufacture of UAVs is certain. It is in this policy arena where our analysis has the potential to illuminate and inform.

One of the central insights from public choice is that policy is not designed in a vacuum. Instead, public choice scholars emphasize that policy is the outcome of a process influenced by several key categories of actors: individual voters, interest groups, bureaucrats, and elected officials. Further, this policy process unfolds in the context of existing relationships, networks, and power distributions between the players based on past interactions and policies. Our analysis sheds light on both the historical context and current key parties relevant to UAV technologies. This is particularly relevant for policy regarding drones. Given the existing entanglements and ability of "Big Players" to influence outcomes, first-best policies may be impossible or at best exceedingly difficult to obtain. While Big Players don't have complete influence over policy, they do have the ability to significantly alter outcomes, calling into question if drone-related policies align with the interests of U.S. citizens more broadly.

Ignoring the political realities highlighted in our analysis may result in ineffective, or worse, damaging policies. For example, given the current controversies over the domestic use of

drones, several states have passed bans on the use of UAV technology in their airspace. While this might contribute to the protection of privacy and civil liberties on some margins, such blanket laws also run the risk of undermining private innovation that might yield widespread economic benefits for U.S. citizens (see Dourado 2013).

Lastly, our work sets forth a significant challenge to those undertaking the construction of drone policy. How does one design policies which constrain the narrow interests of those involved in the drone industry while maintaining the potential benefits offered by UAV technologies. Given the entrenched entanglements discussed throughout this paper, this is no easy task. Such issues, however, must occupy the foreground of any policy discussion if we are to avoid perverse outcomes and obtain the best possible policies.

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