Surveillance Drones:
Privacy Implications of the Spread of Unmanned Aerial Vehicles (UAVs) in Canada

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Table of Contents

List of figures and tables

Summary- Privacy implications of the spread of UAVs in Canada

In May 2014 an Ottawa resident asked the City to investigate why a drone was buzzing round the neighbourhood.[1] He discovered that even finding the right department to call was not straightforward. But many other Canadians are likely to have similar experiences because drone use is – so to speak – on the rise.

Drones, officially called "unmanned aerial vehicles," are used in Canada primarily for surveillance of various kinds, although photographers and film crews are also enthusiastic to exploit their capabilities. Understandably, the industry objects to the term "drones" because of the military connotations, but "drone" is the common term. It is unlikely that the Ottawa citizen was concerned about possible warheads, just about what the machine could see and why it was watching.

This report shares the resident's interest in where drones came from, what they are used for and in particular, what new challenges they raise for privacy, civil liberties and human rights. The angle taken refers especially to the commercial sphere (and thus is subject to PIPEDA), although as we note, the public-private sector distinction is more and more blurred today.[2] Interestingly, UAV production owes a lot to Canadian innovations, and a short version of that story is told here.

The findings: The number of surveillance drones being flown in Canada is increasing rapidly year by year and for many purposes, some of which are unclear. We provide statistics from Access to Information and Privacy (ATIP) requests. Drones are keenly marketed by a growing group of manufacturers and their use is overseen by Transport Canada and Industry Canada. We interviewed key players. We offer a snapshot of Canadian opinion on drone development that hints strongly about where the sensitive issues lie. We commissioned a survey in 2014.

The report offers facts and insights on each of these areas, leading up a section that situates drones in relation to privacy. We are entering unknown territory in some ways – for example, UAVs can operate high above those caught in the camera who will neither see the machine or hear its drone. This is quite different from, say, fixed and visible cameras in the street for which the official guidelines recommend warning signage.

Many related issues are touched upon before we offer several clear and practical recommendations that need immediate attention if drone development in Canada is to proceed in a way that respects basic privacy rights.

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[1] Jon Willing, "City of Ottawa investigates drone aircraft powers," *Ottawa Citizen*, May 29 (2014), http://www.ottawasun.com/2014/05/29/city-of-ottawa-investigates-drone-aircraft-powers.
[2] See Colin Bennett, Kevin Haggerty, David Lyon and Valerie Steeves, eds., *Transparent Lives: Surveillance in Canada*, (Athabasca University Press, 2014), PDF available at: www.surveillanceincanada.org/.

Introduction

> *No question, there are moral issues connected to the use of drones. But drones are going to play a huge role in the way nations defend their interests in the coming decades.*
> Senator Colin Kenny in the *National Post*, February 28, 2012

Surveillance drones are a fresh development that, like all other surveillance, is deeply ambiguous. The social benefits are clearly articulated by their promoters, but potential new challenges to privacy, civil liberties, and human rights receive comparatively little attention. While acknowledging the considerable scope for positive civilian exploitation of the capacities of Unmanned Aerial Vehicles (UAVs), this report focuses primarily on the need to consider the social, legal, and ethical challenges from the outset.

We discuss aerial vehicles, sometimes automated but normally piloted from the ground, that carry cameras and, on occasion, sensing devices. We use 'drone' and 'UAV' interchangeably, even though, arguably, the term 'Unmanned Aerial System (UAS)' is preferable. While drones do offer new challenges, using the term 'UAS' reminds us that they also exist within wider technical networks and data management practices in which the need for ethics and guidelines is acknowledged. In this way, drone development may be accompanied by appropriate regulation and indeed by design features that may limit potential harms and promote the common good.

UAV devices vary in terms of size, technological and aerial capabilities, and the purposes for which they are used. Because of this, discussions about the uses of these technologies by both public agencies and private organizations, as well as interpretations about these practices as they relate to privacy regulation are not straightforward. Understanding the variations in the types and capabilities of UAV technologies is crucial to more adequately understand the full extent of the surveillance and privacy implications associated with the technologies. More specifically, it is necessary to more accurately address the privacy considerations raised in relation to the current landscape of data regulation in Canada.

UAVs introduce new data visualization capabilities due to their use for persistent (or semi-persistent) collection of a range of data-types from multiple aerial vantage points. The collection of a broad range of data-types by UAVs, and their broader integration into UAS systems as a whole, offers new opportunities for the use, sharing, and other management of this data in ways that impact upon the privacy of Canadians. What is clear about the proliferation of UAVs is that the technology inevitably integrates into wider technical networks, fuses with discrete organizational interests, and ties into a host of data management practices. The surveillance capabilities that UAVs provide must be understood within a broader ecosystem of digital information communication practices and regulations that span

across the public and private sector. There is a great concern that UAV applications may collect personal information, intentionally or inadvertently.

There is currently no clear opportunity for involvement, dialogue or even consultation with civil society groups or privacy advocates although the Unmanned Systems Canada organization, the primary body responsible for UAV development, is open to such possibilities. Yet major issues are raised that call for a broader discussion, such as: How far do drones collect core personal information as opposed to providing situational awareness? Are qualitative shifts in personal data collection and management signaled by the use of drones? Do proposed uses comply with the Personal Information Protection and Electronic Documents Act (PIPEDA)?

This report refers primarily to the legal world of PIPEDA and as such is concerned with privacy in the private sector (rather than in government and policing). Therefore, we examine how drones are developed commercially in Canada and how they are used by corporate bodies for many surveillance purposes. However, the connections and interplay between public and private sectors are extensive and growing more complex. This alone is warrant for reconsidering how personal data protection is organized relative to such emerging technologies but it is also a reason for noting the blurred boundaries that affect our report and recommendations.

What's new about this report? It builds on others[3] but has several distinctive features. One: drones in Canada have a distinguished military and technological past and we explore this, linking it with the enthusiasm for new development opportunities opening up today. Two: because the private sector is particularly in view, in-depth interviews were conducted with industry leaders to better understand their perspective and priorities. Three: although relatively few Canadians have a clear sense of how drones are built and used in Canada, or for what purposes, we engaged the polling company Vision Critical to obtain some revealing public opinion findings that inform our study.

[3] See: Office of the Privacy Commissioner of Canada, "Drones in Canada: Will the proliferation of domestic drone use in Canada raise new concerns for privacy?," Report prepared by the Research Group of the Office of the Privacy Commissioner of Canada (March 2013), http://www.priv.gc.ca/information/research-recherche/2013/drones_201303_e.asp; Phoenix Strategic Perspectives Inc., "Survey of Canadians on Privacy-Related Issues," Prepared for the Office of the Privacy Commissioner of Canada (January 2013), http://www.priv.gc.ca/information/por-rop/2013/por_2013_01_e.pdf; Chris Parsons and Adam Molnar, "Watching Below: Dimensions of Surveillance-by-UAVs in Canada," Block G Privacy and Security Report (2013), Anne Cavoukian, "Privacy and Drones: Unmanned Aerial Vehicles," Information and Privacy Commissioner, Toronto, Canada, Privacy by Design (August 2012), http://www.ipc.on.ca/images/Resources/pbd-drones.pdf; Shayna Gersher, "Canada's Domestic Regulatory Framework for RPAS: A Call for Public Deliberation," *Journal of Unmanned Vehicle Systems* 02(01)(2014): 1-4, http://www.nrcresearchpress.com/toc/juvs/02/01.

What does our report say? There are four main sections, followed by our conclusions and recommendations.

1. How we got here: A brief history of drones in Canada leading to today's technologies and opportunities.
2. Marketing drones: Understanding how manufacturers and technical experts work with others to develop and promote drone use.
3. Drone awareness: Probing public opinion to discover how Canadians perceive and assess the use of drones in varying contexts.
4. Drones and privacy: How drone development challenges existing regulations and law and what are the key questions confronting us.
5. What to do next: Our findings are discussed and distilled into several vital questions that must be addressed as the use of drones expands in Canada.

How was the study conducted? The research team engaged in several complementary methods, allowing us to see drone development from a number of angles; historical, technological, commercial, social, ethical and legal. These included: documentary research, Access to Information and Privacy (ATIP) requests, expert interviews[4], opinion polling[5] and collaborative teamwork.

The crucial question we address in this report is this: how can drones be developed to minimize privacy and civil liberties harms and to serve the common good?

[4] Thirteen interviews were completed in November 2013 with representatives of the various stakeholders involved in UAV development and use in Canada at the Unmanned Systems Canada Conference, including government, industry, law enforcement, and academia. Thirteen questions dealing with historical development, public opinion, marketing, and future directions of UAVs in Canada were covered. Informed consent was obtained from all participants and the process was approved by Queen's General Research Ethics Board (GREB).

[5] The research team developed a set of questions for the survey that was carried out by the polling company, Vision Critical in January 2014. The survey aimed to understand awareness and perceptions surrounding the use of drones to identify and collect information in Canada. The questions asked individuals whether they had basic awareness of various UAV applications in Canada, as well as assessed support for how they are being used and in what scenarios. The poll included responses from 3,045 individuals across Canada in an online environment sourcing from the Angus Reid Forum. English and French speaking individuals were polled and samples were balanced by age, gender and region.

1.0 How we got here: A brief history of drones in Canada leading to today's technologies and opportunities

This section highlights core advances in UAV technology in the Canadian context. To begin, a general history of UAV development is presented, highlighting the importance of the coupling of radio-control and internal navigation technologies to the genesis of the modern day UAV. This is done to highlight the historical development of UAVs from an individualized craft, to their current status as key data gathering components of larger, integrated, systems of surveillance. After reviewing early global developments in UAV advancements, a Canadian history of UAV technology is covered, including the emergence of the first UAV in Canada. In addition, a comprehensive overview of the CL series UAVs is offered (which dominated the early Canadian UAV development and manufacturing market of the 1960s and 1970s), noting in particular the full adoption of UAV technology as a means of developing 'battlefield awareness,' or a detailed technologically constructed understanding of spaces, as well as the firm establishment of UAV technology into Armed Forces practices of Intelligence, Surveillance and Reconnaissance (ISR). Following this, we review the major experimental and applied milestones in the development and live use of UAVs in the Canadian Forces and domestic police services. Market growth, UAV applications, capabilities, and the legislation and regulation of UAVs are also discussed. Finally, the current state of drone use in Canada is covered, along with the main regulatory bodies in the industry and an analysis of Special Flight Operation Certificates (SFOCs) approved between 2007-2012.

1.1 General history of UAV development

UAVs, popularly know as 'drones,' are aircraft that operate without an internal pilot, usually by remote operation through wireless signals.[6] In military terminology, UAVs are now recognized as a subset of Unmanned Vehicle Systems (UVS).[7] Modern day UAVs are marked by their surveillance capabilities. The lineage of these aircraft has been largely shaped by the combination of radio control, wireless communications, and internal navigation technologies. Radio-control emerged as a result of Nicholas Tesla's patenting of the technology in 1895, while internal navigation did not surface until the early twentieth century with developments in gyroscope technology, used for maintaining orientation. The first application of a gyroscopic device to the flight of an aircraft took place in 1909.[8] The coupling of

[6] There are also programs to develop more 'independent' drone UAVs that would operate with either preprogrammed or heuristic (learning) systems.
[7] Definitions from Association for Unmanned Vehicle Systems International (AUVSI), http://www.auvsi.org.
[8] J.C. Hunsaker, *Elmer Ambrose Sperry 1860-1930: A Biographical Memoir*. National Academy Biographical Memoirs Vol. XXVIII (Washington: National Academy of Sciences, 1954), 232-233.

these innovations greatly shaped the trajectory of modern day UAV design and construction, but, like many examples of exponential technological growth, it was the military capacities of UAVs that prompted the research and design of these craft which allowed them to reach new heights.

Dr. Elmer Ambrose Sperry is credited with making substantial early contributions to gyroscope technology for boats that, once acquired and explored by US Navy researchers, would begin to change the design of early UAVs. In particular, the 'Curtis-Sperry Aerial Torpedo' debuted in the US on March 06, 1918 as the first 'striking device' (unmanned weapons deployed at a distance) to successfully integrate radio control and internal navigation capabilities, providing the initial design and vision for the later developed ballistic missiles.[9] This UAV is the first working example of a device that would eventually be labelled as an 'Aerial Torpedo' UAV characterized by its capacity to home in on and successfully navigate to an intended target for the purpose of destruction (i.e. the UAV was on a one-way journey with no need to return to its point of origin). This innovation represented major headway in the genesis of UAVs and positioned the US at the forefront of technological development in the area. However, concern throughout Western nations over the potential monopolization of UAV technology by the US prompted other nations to begin to successfully utilize the technology in the years following World War I, but it was not until the resurgence in weapons demand initiated by Word War II that UAVs would command prominent status in combat – having been adopted by both Axis and Allied countries by the end of the War.

Although UAVs had thus been established as a relatively permanent device during times of war, after WWII, they moved in a new direction that helped establish contemporary definitions of the technology. UAVs were increasingly differentiated from ballistic missiles, characterized not only by their ability to return to their point of origin, but also by their association with their surveillance capabilities, particularly tactical understandings of battle spaces. This definitional shift saw UAVs transition from singular craft to 'a weapon system or sensor that feeds information through an extensive and complex system of networks which gets the right information to the right person at the right time.'[10] The culmination of this shift highlights the surveillant capacities of the technology, a quality that has been particularly relevant in the historical trajectory of UAVs in Canada.

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[9] Kenneth Hough, "Aerial Torpedoes, Buzz Bombs, and Predators: The Long Cultural History of Drones." *Origins* 6 11 (2013), http://origins.osu.edu/article/aerial-torpedoes-buzz-bombs-and-predators-long-cultural-history-drones; Thomas P. Hughes, *American Genesis: A Century of Innovation and Technological Enthusiasm, 1870-1970* (University of Chicago Press: Chicago, 1989). Rear Admiral Delmer S. Fahrney and Robert Strobell, "America's First Pilotless Aircraft," *Aero Digest* 66(1) (1954): 28.

[10] Emphasis added Steven Zaloga, *Unmanned Aerial Vehicles: Robotic Air Warfare 1917-2007* (Oxford: Osprey Publishing, 2008) 4; Canadian Forces Experimentation Centre, *Experiment Report IICE - 001/2002: Uninhabited Aerial Vehicle Concept Development and Experimentation* (Department of National Defence Canada: Ottawa, 2003).

1.2 A Canadian history of UAV technology

Canadian contributions to the development of UAV technology became noteworthy following the end of WWII. A partnership between the Canadian government and the Canadair Corporation produced the first UAV to be used exclusively for surveillance purposes in the British Commonwealth in the late 1950s. However, the Canadair Corporation was only one of two major UAV developers operating in Canada at the time, the other being the Boeing Canada Company. Although the two companies' overall orientations towards UAV devices were somewhat divergent, with Canadair developing UAVs for surveillance purposes and Boeing creating 'target drones' for training pilots and gunners, these companies would distinguish Canadian UAV conceptualization and development, positioning Canada as a global leader for over two decades, beginning with the introduction of the CL-89 surveillance UAV in 1959 (see Figure 1.0).[11]

Figure 1.0: CL-89

The CL-89 was a product of the Canadair Corporation and was the first in what would become a series of CL UAVs. This first rendition was 'aimed at meeting the requirements of the British and Canadian Armies by means of a simple, lightweight, relatively low-cost unmanned aerial vehicle.'[12] As a device primarily engaged for surveillance purposes, the CL-89 carried a series of cameras and transmission equipment, the range of which extended 70 kilometres, making it the only reconnaissance focused UAV in the British commonwealth at the time.[13] In addition, the CL-89 was a re-usable craft, capable of returning to its point of origin. However, manufacturing a prototype of the craft, let alone putting the device into full production, would take considerable time.

[11] *Flight International*, "Canadair CL-89," 25th June (1964).
[12] British Minister of Defence Peter Thorneycroft cited in *Flight International*, "Canadair CL-89," 25th June (1964).
[13] *Flight International*, "Canadair CL-89," 25th June (1964).

1.2.1 Review of major UAV milestones in Canada

Due to a need for UAVs that were capable of vertical take-offs and landings, the Canadair Corporation began producing the CL-227 Sentinel (a helicopter like UAV) in 1994.[14] The craft was conceptualized as early as 1968 but the first prototype to capture what would take on the CL-227's distinctive 'peanut' design was unveiled in 1984.[15] The Peanut was characterized by the unique placement of the UAV's rotor blades at the craft's centre of gravity, but, much more importantly, this craft was now capable of the vertical take-offs and landings required of some missions (see Figure 1.1). While this technical feat represents one stream of Canadian aviation advancements, a divergent emphasis centred on the development of target drones, specifically in the Canadian Forces.

Figure 1.1: The CL-227 adopted an innovative 'peanut' design which placed its rotors at its center of gravity, its motors and exhaust at the top of the UAV, and its cameras and sensors at the bottom of the craft.

The success of the CL series was marked by technical advancements in reconnaissance, surveillance and target acquisition.[16] From the late 1980s onwards

[14] *Flight International*, "Boeing Wins Sole UAV Contract" (1994); *Flight International* (1998); M. Pelletier, A. Sahmoto, C. Teder, and G. Salntonge, "Autonomous Navigation and Control Functions of the CL-327 VTOL UAV," Paper presented at the AGARD MSP Symposium on "System Design Considerations for Unmanned Tactical Aircraft (UTA)," Athens, Greece, 7-9 October (1997).
[15] *Flight International*, "Staying Power," 25th April (1995).
[16] M. Pelletier, A. Sahmoto, C. Teder, and G. Salntonge, "Autonomous Navigation and Control Functions of the CL-327 VTOL UAV," Paper presented at the AGARD MSP Symposium on "System Design Considerations for Unmanned Tactical Aircraft (UTA)," Athens, Greece, 7-9 October (1997): 184.

Canada's contributions to UAV design and development slowed considerably largely due to a lack of government support.[17]

1.2.2 A shift in military focus in Canadian UAV development and use

The Canadian government (the Canadian Forces) maintained an interest in researching the capabilities of UAVs even while the development of UAV technology slowed. An emphasis on surveillance and attack capacities in particular formed the basis of the Joint UAV Surveillance and Target Acquisition project. This joint initiative comprising personnel from the Army, Navy and Air Forces took up the task of testing UAV technologies as an 'Intelligence, Surveillance and Reconnaissance (ISR) platform within a network centric environment' in the Canadian environment in 2001.[18] The primary objective of these experiments was to facilitate a transition away from the conceptualization and use of UAV technology as singular craft to Network Enabled Operations (NEO).[19]

1.2.3 Live use of UAVs by Canadian Forces

The first time that an UAV was used during a live operation by the Canadian Forces in Canada was June 2002 in a mission dubbed Operation GRIZZLY associated with the Kananaskis, Alberta G8 summit of that year.[20] A similar event, the third Summit of the Americas held in Québec city, had been met by public protests the year before and it was decided that a UAV would be useful in identifying ground threats around the conference location. In preparation for this first operational mission a number of agencies collaborated, including the Canadian Forces, the Royal Canadian Mounted Police and various private security forces. The I-Gnat UAV was selected after a series of tests had been successfully conducted in an operation named 'Robust Ram.'

As a surveillance tool, the I-Gnat's specific task was to identify the presence of any persons within 80 nautical miles of the event site. During a series of flights the UAV was successful in locating various vehicles and persons, as well as using Electro Optical (EO) Zoom camera technology to specifically investigate and identify protestors.[21] For this operation the UAV was used for surveillance, providing key data that produced a digital construct of the event space. As was noted in the operation report: 'in many cases the I-Gnat became the 'eyes' of the commander… the ability of the I-Gnat to provide high quality, near real time, uninterrupted motion imagery to the ISR Commander located at the Kananaskis Valley was excellent.'[22] As

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[17] Andrew Carryer, *A History of Unmanned Aviation in Canada* (MacDonald, Dettwiler and Associates, 2008), http://www.uavs.ca/outreach/HistoryUAVs.pdf.
[18] Canadian Forces Experimentation Centre (2003): ii.
[19] NEOps; Sandy Babcock, "Canadian Network Enabled Operations Initiatives," Department of National Defence, Ottawa Directorate of Defence Analysis, (2004), Accession Number : ADA466127, http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA466127: 1.
[20] Canadian Forces Experimentation Centre (2003): 113.
[21] Canadian Forces Experimentation Centre (2003): 139.
[22] Canadian Forces Experimentation Centre (2003): 140.

such, the mission was deemed successful, prompting recommendations by Defence staff that 'further concept development and experimentation for the use of UAVs to support Task Force Commanders and other government departments in domestic operations should be pursued.'[23] With this first operational success, UAV technology began to be integrated into other military and civilian endeavours.

The first time an Unmanned Aerial System (UAS) was made operational by the Canadian Forces outside of Canada was in October, 2003 for missions in Afghanistan. As opposed to a singular UAV, a UAS allows for multiple UAVs to be coordinated through various support equipment; in this case, four UAVs were initially purchased as part of the UAS but additional craft were purchased in 2005 due to losses in the field.[24] In addition, the Skylark-1 UAS was also deployed in Afghanistan in February 2006 following a decision by the Canadian government to award the contract for the mission to Thales Canada and Elbit Systems of Israel.[25] However, UAV and UAS technologies were not exclusively being employed in military operations; as domestic police forces also began to capitalize on the advantages of the craft.

1.2.4 Live UAV use by Canadian domestic police services

The first legal application of an UAV by a domestic police service to collect evidence that would ultimately be presented in court was by the Ontario Provincial Police (OPP) in 2007. Officer Marc Sharpe was able to obtain aerial photographs by modifying a simple Styrofoam and rod hobby plane.[26] This incident spawned considerable interest within the OPP regarding the use of UAVs, particularly due to their potential for cost savings when compared to the use of helicopters to obtain aerial photographs.[27] By 2013 the OPP was operating at least four separate UAVs out of at least three divisions in Northern Ontario alone. Furthermore, while the OPP were the first to utilize UAV technology, both national and region police services would follow suit. For instance, by 2012 the Royal Canadian Mounted Police (RCMP) had UAS technology in place for 'operational flights for forensic identification, major crimes, search and rescue, and their dive team.'[28] In addition, several municipal police services have experimented using UAV technologies. The Halton police department, for example, has used UAVs, for the purpose of marijuana grow operation identification.[29] Not surprisingly, the increased domestic presence of

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[23] Canadian Forces Experimentation Centre (2003): xi.
[24] D. Connolly, "UAV a Great Success," Canadian Department of National Defence (2004), www.forces.gc.ca/ad,,at/site/uav_e.asp.
[25] Department of National Defence/Canadian Forces News, "Canada Increases Air Capabilities in Afghanistan," (2012), http://archive.today/WxhBk.
[26] Sigrid Forberg, "Emerging Trends," *The Gazette* 74(1) (2012), http://www.rcmp-grc.gc.ca/gazette/vol74n1/trends-dernierestendances-eng.htm.
[27] Ibid.
[28] Ibid.
[29] *CBC News,* "OPP testing Unmanned Flying Drones," 9 May (2013).

UAVs has prompted the development of various regulations and laws regarding the purposes and uses of the craft, to be further discussed in section 4 of this report.

1.3 Market growth

Recently, a new trend is emerging where UAV uses have expanded from military and police operations into commercial, industry, civilian and public safety sectors. The global market for UAVs has been called 'the most dynamic growth sector of the world aerospace industry' and is currently around $6.6Bn US per annum, expected to almost double to $11.4Bn US over the next decade.[30] Teal Group estimates spending of $89.1Bn by 2024.[31] In 20 years, the US Federal Aviation Authority (FAA) predicts that up to 30,000 UAVs will be operating in American skies.[32] This immense figure signals the extent to which both commercial and public authorities are interested in harnessing the technical capabilities of UAVs. The sizable number of technical systems that can attach to UAVs for surveillance, monitoring, and other information communication purposes continue to an expand in the range of tasks that UAVs perform for a broad range of public authorities, private organizations, but also for citizens alike.

Industry experts suggest that the increasing capabilities of UAVs will lead to further market growth. As one drone manufacturer commented in our interviews[33] UAVs 'are going to become more prevalent and so companies are going to market those capabilities because there are compelling business reasons why those automated technologies have a future in the marketplace.'[34] Hinting at the future growth of the market, this individual further listed a number of reasons why UAVs make sense in business terms: 'they're highly portable. They're substantially more accessible. They're less expensive. Flying in (an Aurora helicopter) for $10,000 - $14,000 an hour is a lot more expensive than flying a small, medium-altitude, long-endurance UAV for $1,500 - $2,000 an hour with the equivalent sensors on board.'[35] All of these aspects of UAVs will aid in market growth.

1.4 UAV applications

While there is a great deal of the growth within the military sector, UAVs are now finding increasing application within the civilian context. In Canada, drones have

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[30] Teal Group, http://tealgroup.com/index.php/about-teal/teal-group-in-the-media/3/79-teal-group-predicts-worldwide-uav-market-will-total-89-billion-in-its-2012-uav-market-profile-and-forecast.
[31] Ibid.
[32] Federal Aviation Association, "FAA Aerospace Forecast Fiscal Years 2010-2030," *Federal Aviation Authority* (2010), http://www.faa.gov/data_research/aviation/aerospace_forecasts/2010-2030/media/2010%20Forecast%20Doc.pdf.
[33] Interviews were conducted in 2013 with thirteen UAV stakeholders, including: government, industry, law enforcement and academia. See note 4.
[34] Quotation from interview data.
[35] Ibid., Aurora is a brand of helicopter.

been used for a number of activities in the public domain, including: locating missing persons in search and rescue operations, tracking and monitoring of animal populations,[36] and crime scene and highway accident imagery.[37] Elsewhere, UAVs have been used to monitor for environmental abuses by private corporations,[38] and deployed by forestry trusts, environmental researchers and private corporations to survey and assess otherwise inaccessible areas.[39] As one interviewee suggested, past and future applications of UAVs 'for mining companies and hydroelectric companies and companies that monitor power lines and the like, companies that monitor forestry, forest fires, crop health; these technologies are out there and they are being marketed where they can be used, and highly effectively. I think the applications are almost limitless.'

The possible applications for UAVs seem endless. The primary Transport Canada website on UAVs lists 20 possible uses for the technology, while the Transport Canada UAV working group lists various applications for UAV usage across six categories including sensor/surveillance, payload delivery, orbiting, transport, flight training and test flights, totaling 27 possible applications (See Figure 1.2). As such, it can be presumed that most marketing of UAVs domestically will fall within these (permitted/ recommended) categories.

Figure 1.2: Word cloud compiled from various Transport Canada web pages outlining potential and approved uses of UAVs in Canada.

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[36] *CBC.ca,* "Commercial uses 'endless' under Canada's drone laws," *Huffington Post*, July 15 (2013), http://www.huffingtonpost.ca/2013/07/15/drone-use-canada_n_3597277.html.
[37]Jennifer Quinn, "Police drones sparks debates over privacy," *thestar.com*, February 5 (2013), http://www.thestar.com/news/world/2013/02/05/privacy_vs_security_when_does_the_use_of_drones_cross_the_line.html.
[38] Alexandra Gibb, "A drone field guide," *opencanada.org* May 31 (2012), http://www.opencanada.org/features/the-think-tank/a-drone-field-guide/.
[39] Julia Hortman,"Attack of the drones to fight tree rot in Scotland," *The Scotsman*, October 28 (2012), http://www.scotsman.com/news/environment/attack-of-the-drones-to-fight-tree-rot-in-scotland-1-2602637.

1.4.1 UAV use by the public sector

In the public sector, a range of federal, provincial, and municipal authorities use UAVs. Law enforcement agencies represent the largest group that employ small drones domestically, primarily justified as a cost-effective strategy.[40] For public authorities, the vehicles are used for reconnaissance, intelligence-gathering, object targeting, and encompass public safety operations, law enforcement, customs and border patrol, first responder and emergency services, and commercial aerial imaging.[41] [42] More particularly, an RCMP review of the 'operational feasibility [of UAVs] within the Lower Mainland District,' suggests a range of applications of UAVs for Canadian authorities.[43] Such applications include:

- Identifying hazardous materials
- Conducting search and rescue
- Taking aerial photos of concealed or shadowed/darkened areas within housing complexes in the service of crime prevention
- Supporting tactical situations and performing reconnaissance before putting officers into potentially harmful situation
- Perching UAVs on top of buildings to observe crowds and for videotaping troops in training
- Observing crowd behaviour, the flow of persons/traffic, and for planning associated with major events
- Examining structural integrity and locating survivors during disaster response operations
- Photographing crime scenes to locate evidence
- Providing reconnaissance of suspected explosive devices prior to disposal
- Assessing fire-related damage (such as the extent of fire spread) as well as determining the origin of fires
- Videotaping training exercises for assessment/feedback purposes
- Reconnoitering vessels before boarding them as well as for water-based search and rescue operations
- Taking aerial photographs to overlay with scale diagram software to better understand crime scenes
- Assessing environments following chemical, biological, radiological, nuclear, and explosive events, as well as to facilitate subsequent triage and direct responder actions[44]

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[40] Government Accountability Office. *Unmanned Aircraft Systems: Measuring Progress and Addressing Potential Privacy Concerns Would Facilitate Integration into the National Airspace System*. United States Government Accountability Office, Report to the Congressional Requestors, GAO-12-981, September (2012).
[41] Richard M. Thompson II, "Drones in Domestic Surveillance Operations: Fourth Amendment Implications and Legislative Responses," *Congressional Research Service*. Published April 3 (2013): 3.
[42] Chris Parsons and Adam Molnar, "Watching Below: Dimensions of Surveillance by UAVs in Canada," Block G Privacy & Security Consulting (2013).
[43] Ibid.
[44] ibid.

1.4.2 UAV use by the private sector

Many of the applications identified by the RCMP for public authorities are also being taken up in the private sector. UAV use by private organizations support information gathering initiatives across a range of sectors, from mineral exploration companies, private media organizations, research organizations, telecommunication companies,[45] film and television production, as well as agricultural companies. In terms of specific applications, UAVs are increasingly being used in the private sector to conduct 'infrastructure inspection, communications and broadcast services, wireless communication relay and satellite augmentation systems, natural resources monitoring and digital mapping.'[46] And, as the proliferation of UAV technology continues, even more opportunities for intelligence-gathering initiatives are likely to expand beyond current predictions.

1.4.3 UAV use by citizens / individuals

Individuals are also increasingly using drones for recreational purposes, such as photography or political activism. In Australia, activists used a $17,000 (AUS) drone to gather video intelligence on an industrial livestock operation.[47] While Transport Canada is concentrating on creating a legislative framework for the operation of small drones, model aircraft may potentially be left unregulated,[48] opening the door for information collection by individuals and citizens on public authorities or private sector organization operations,[49] as well as through processes of *lateral* surveillance where citizens are collecting information on other citizens.[50]

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[45] A. Barr and R. Albergotti, "Google to Buy Titan Aerospace as Web Giants Battle for Air Superiority," *The Wall Street Journal*, April 14 (2014), http://online.wsj.com/news/articles/SB10001424052702304117904579501701702936522.

[46] Council of the European Union. *Towards a European Strategy for the development of civil applications of Remotely Piloted Aircraft Systems (RPAS)*, Working Paper (13438/12), September 6 (2012) as quoted in Office of the Privacy Commissioner of Canada, "Drones in Canada: Will the Proliferation of domestic drone use in Canada raise new concerns for privacy?," Report prepared by the Research Group of the Office of the Privacy Commissioner in Canada (2013): 6.

[47] Susan Bird, "Aussie Activists Deploy $17,000 Drone to Spy on Factory Farms," Care 2 (2013) http://www.care2.com/causes/aussie-activists-deploy-17000-drone-to-spy-on-factory-farms.html

[48] Office of the Privacy Commissioner of Canada, "Drones in Canada: Will the Proliferation of domestic drone use in Canada raise new concerns for privacy?," Report prepared by the Research Group of the Office of the Privacy Commissioner in Canada (2013): 7.

[49] Michael Condon, "Feedlots concerned about industrial espionage from drones," Australian Broadcast Corporation (ABC), February 4 (2013), http://www.abc.net.au/site-archive/rural/news/content/201304/s3727893.htm.

[50] Ibid.: 16. For further information, please see Mark Andrejevic, "The Work of Watching One Another: Lateral Surveillance, Risk, and Governance," *Surveillance & Society* 2(4) (2005): 479-497, http://www.surveillance-and-society.org/articles2%284%29/lateral.pdf.

1.5 UAV capabilities: Technological payloads and size

The range of surveillance technologies with which drones can be equipped is extensive. The capacity for UAVs to be outfitted with a range of additional visualization and sensor technologies make them both *flexible* in terms of the broad range of tasks they can perform, but also *specific* in terms of the purpose of their deployment. These features affect the *scope and type of data* that is collected through UAV operations. The devices also vary significantly according to size—which further affords the technological characteristic of persistent monitoring (and aerial manoeuvrability) in relation to their technological payloads. UAV technologies as a surveillance mechanism therefore harness their full effect at the nexus between size, aerial capabilities, application, and technological payloads, that when taken together, shape the type and detail of data that UAVs might collect. The possibilities for data collection by UAVs are incredibly extensive. Building on the OPC Research Report on Drones,[51] the range of advanced surveillance technologies that can be mounted on UAVs includes:

- **High-power zoom lenses:** collect real-time video and image capture from a distance that is imperceptible to the object or target being surveilled.
- **Night vision, infrared, ultraviolet, FLIR (Forward Looking Infrared Radar) otherwise known as thermal imaging, and LIDAR (light detection and ranging):** enable UAVs to detect and enhance detail, in particular, information such as heat emanations that is being created from inside a building, but can be detected on an external surface of a building.
- **Radar technologies:** penetrate surfaces such as buildings, walls, obstructions caused by poor weather conditions, and foliage, as a means to detect and track individuals or other processes.
- **Video analytics technology:** accompany UAV data collection to aggregate and define 'normal' patterns in urban or other environments as a way to algorithmically flag any deviations from 'normal' processes in these spaces. For example, the use of UAVs to recognize patterns and allocate resources based on data gathered from past crimes, as well as detected deviations in a 'real-time' setting.[52]
- **Distributed networked surveillance:** UAV technologies are integrated with other video surveillance networks, or digital technologies such as smartphones, or databases as a means to facilitate intelligence analysis through expanded surveillance operations.
- **Facial recognition or other 'soft biometric recognition'**: based on algorithmic calculations, allows the UAV to detect and identify biographical attributes such as height, age, gender, and skin colour.

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[51] Office of the Privacy Commissioner of Canada, "Drones in Canada: Will the Proliferation of domestic drone use in Canada raise new concerns for privacy?," Report prepared by the Research Group of the Office of the Privacy Commissioner in Canada, March (2013).
[52] Erica Goode, "Sending the Police Before There's a Crime," *The New York Times,* August 12 (2011), http://www.nytimes.com/2011/08/16/us/16police.html?_r=4&.

- **WiFi information communication technologies:** UAVs relay information communication signals.
- **Automated-license plate recognition (ALPR)** where UAVs utilize optical character recognition on images to read vehicle license plates.
- **Modular cyber attack hardware and software** which allows the UAV to operate as an airborne laptop to intercept and/or corrupt wireless network communications. Potential 'off-the-shelf' hacking technologies to accompany the UAV include IMSI catchers, mobile phone signal interception, decryption tools, and jamming capabilities.[53]

These technologies can be affixed to a broad range of classes of UAVs, the implications of which are contingent on the size of the UAV. UAVs can be broken down into three main groups in terms of size:[54] ***strategic***, ***tactical***, and ***micro*** and ***mini*** vehicles.[55] ***Strategic UAVs*** are the largest and refer to *large fixed-wing aircraft* that often reach altitudes of approximately 20,000 metres. The most globally recognized of these devices are the US military's use of the Northrop Grumman RQ-4 Global Hawk aircraft, and the Predator drone, which have become routine in overseas military operations to conduct persistent intelligence collection or to prosecute armed strikes at targets in overseas operations. Recently however, the US Department of Homeland Security (DHS) deploys devices such as the Global Hawk in domestic operations as a means to conduct persistent surveillance of domestic US borders, including the U.S.-Canada border.[56] ***Tactical UAVs***, while also fixed-wing aircraft, are slightly smaller in size than strategic UAVs, weighing up to 1,500 kilograms and are also used for military operations and persistent reconnaissance missions, increasingly by local law enforcement in the U.S.[57]

The private sector use of strategic UAVs is just getting off the ground. Google and Facebook Inc. are both looking to expand their proprietary networks through UAV capabilities, and these companies are in the early stages of deploying strategic UAVs that boast a wing-span larger than a Boeing 767. These devices rely on solar power capabilities to stay aloft for months, and eventually years, at a time.[58] [59] Titan Aerospace, Google's strategic UAV manufacturer, expects to have initial commercial

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[53] Clarence Robinson Jr., "Petite Cyber Drone Packs a Punch," Defense Media Network, September 24, (2011) http://www.defensemedianetwork.com/stories/petite-cyber-drone-packs-punch/.
[54] This is military terminology, civil terminology refers to them as small, medium and large.
[55] Anne Cavoukian, "Privacy and Drones: Unmanned Aerial Vehicles," Information and Privacy Commissioner, Toronto, Canada, Privacy by Design (August 2012), http://www.ipc.on.ca/images/Resources/pbd-drones.pdf.
[56] ibid.
[57] J. Stanley and D. Crump, "Protecting privacy from aerial surveillance: Recommendations for government use of drone aircraft," American Civil Liberties Union (ACLU) (2011): 4, https://www.aclu.org/files/assets/protectingprivacyfromaerialsurveillance.pdf.
[58] Ann Cavoukian, "Privacy and Drones: Unmanned Aerial Vehicles," Information and Privacy Commissioner, Ontario, Canada, August (2012): 6.
[59] A. Barr and R. Albergotti, "Google to Buy Titan Aerospace as Web Giants Battle for Air Superiority," *The Wall Street Journal*, April 14, (2014), http://online.wsj.com/news/articles/SB10001424052702304117904579501701702936522.

operations in place as early as 2015, however technical experts have indicated that this achievement could take three years.[60]

Both Google and Facebook Inc. are looking to incorporate UAV technology into a range of business applications, including leveraging their networks to communicate Internet and wireless bandwidth signals in parts of the world that are not already accessible by terrestrial-based information communication networks.[61] In addition, Google is interested in integrating image-capturing capabilities via the persistent systematic aerial surveillance capabilities afforded by strategic UAV use into their Project Loon and Google Maps initiatives. Given these developments, Google Street View is an instructive venue for policy analysts to examine how Google may interpret their UAV operations in relation to privacy requirements. As a beacon for private sector use of strategic-sized UAV technology, these companies stand as exemplars for how persistent systematic intelligence collection by private organizations will converge with Canadian privacy laws, and in particular with Canadian PIPEDA requirements (see section 4 of this report).

Micro and ***Mini*** UAVs, by contrast, are used for low-altitude flights and are designed to operate in more densely populated areas.[62] Micro UAVs are able to operate in areas that are sometimes difficult for humans to operate within, and can navigate tighter quarters, such as in cities, as well as within and around urban infrastructure and buildings. Many domestic law enforcement agencies are currently using mini UAVs that can stay aloft for only a few hours at most to provide information gathering on traffic collision reconstruction and public-order policing initiatives.[63]

In the private sector, Amazon Inc. is interested in mini-UAV technology to provide 'short-hop' delivery flights with its 'Prime Air' service. While Amazon appears to be pushing ahead in this area, they will have to face an ongoing engineering challenge regarding UAVs: to create a craft with enough power and energy in relation to payload weight. Any Amazon Inc. craft, for instance, will need to be able to travel 10 miles with up to 5 pounds of cargo, and the company will also have to face the hurdle of landing on private property.[64] And while the Amazon Inc. case is the most popularized example of the use of micro and mini UAVs, the full effect of this development rests not in the technical innovation, but instead, the marketing coverage afforded through this project has the capacity to redraw social norms

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[60] Ibid.
[61] The potential for Google to enter into mature telecommunication markets is also a possibility.
[62] Office of the Privacy Commissioner of Canada, "Drones in Canada: Will the Proliferation of domestic drone use in Canada raise new concerns for privacy?," Report prepared by the Research Group of the Office of the Privacy Commissioner in Canada, March (2013).
[63] Travis Dunlop, "We've Got Our Eyes on You: When Surveillance by Unmanned Aircraft Systems Constitutes a Fourth Amendment Search," *South Texas Law Review* 51(73) (2009): 180-1.
[64] Adi Robertson, "Amazon Already designing eight generation of delivery drones, says Jeff Bezos," *The Verge*, April 10 (2014)., http://www.theverge.com/2014/4/10/5601992/amazon-designing-eighth-generation-of-delivery-drones-says-jeff-bezos.

around the popular use of UAVs, thereby redrawing society's expectations about the regularity, appropriateness, and acceptability of UAVs in the sky.

By contrast, less popularized and more prevalent applications of UAVs in the private sector include lucrative opportunities for the energy sector. These technologies are expected to be used for 'monitoring power lines, inspecting oil and gas pipelines, checking wind turbines for defects and pinpointing malfunctioning solar panels.'[65] Other interested private sector organizations are news media representatives, spawning a new area of media termed 'drone journalism.' The use of drones by media organizations is expected to proliferate, and has even precipitated a 'Drone Journalism' program at the University of Missouri.[66] Recently, however, the FAA is considering legal action against drone journalists in Arkansas, which raises First Amendment concerns about the agency potentially infringing upon press freedoms in the absence of formal rules.[67]

1.6 Legislation and regulation of UAVs

The Convention on International Civil Aviation prompted the first international agreement regarding UAVs on December 07, 1944. Its regulations restricted UAV flights by mandating that craft receive authorization to fly (regulating airspace as well as individual flights). In particular, Section 8 of the document stated that '[n]o aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization.'[68] While this general regulation was established to govern UAV flights globally, Canada eventually created national regulation to address the domestic use of UAVs, some 50 years later.

The Canadian Aviation Regulation (CARs) began legislating UAV flights in 1995; however, it was not until 2003 that there was considerable regulation attention was dedicated to the craft. In part, this transition can be attributed to a shift in managerial responsibilities. Specifically, although Transport Canada became fully responsible for oversights regarding craft flights, Industry Canada was placed in charge of managing digital data transmissions associated with the craft. With these regulations came a specific operational definition of a UAV as 'a power-driven aircraft, other than a model aircraft, that is designed to fly without a human operator on board,' which require the obtainment of a Special Flight Operation

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[65] Todd Woody, "Drones are becoming energy's new Roustabouts," *New York Times*, April 21 (2014) http://www.nytimes.com/2014/04/22/business/energy-environment/drones-are-becoming-energys-new-roustabouts.html?_r=0.

[66] CBS/AP, "Missouri looks to revive journalism drones," *CBSNews.com*, April 25 (2014), http://www.cbsnews.com/news/missouri-looks-to-revive-journalism-drones/.

[67] Greg McNeal,"FAA 'Looking Into' Arkansas Tornado Drone Journalism, Raising First Amendment Questions," *Forbes Online*, April 29 (2014), http://www.forbes.com/sites/gregorymcneal/2014/04/29/faa-looking-into-arkansas-tornado-drone-journalism-raising-first-amendment-questions/.

[68] *Convention on International Civil Aviation* (1944).

Certificate (SFOC)[69] part of the rationale for which is grounded in the need to properly track the flight plans to ensure the safety of craft. All UAVs that fall within this definition now require that an SFOC be submitted to Transport Canada and be approved, restricting the time, space and purposes for which the UAV is approved to fly. However, these restrictions have prompted some special interest groups (such as Unmanned Systems Canada) to push for UAV development and usage to move in new directions.

Although the non-profit group to forward the UAV industry's interests in Canada was UVS Canada in 2003, AUVSI-Canada was a similar group founded in 2007, and the two groups joined together to form Unmanned Systems Canada / Systèm Télécomandes Canada in 2010. This non-profit organization is the current primary advocate of the UAV industry in Canada, intent on serving as 'a single voice for the Canadian unmanned systems community,' facilitating 'the growth of the Canadian unmanned vehicle systems community through education, advocacy and exchange of ideas' and assisting 'the Canadian unmanned vehicle systems community to achieve leadership in research and development, application and operation.'[70] In collaboration with Transport Canada, Unmanned Systems Canada has contributed to the development of recommendations for future Canadian legislation governing UAV usage in Canada.[71] These suggestions included extending the airspace allocated for UAVs as well as the duration and distance of UAV flights. In addition, the group has also sought out working partnerships with a variety of other organizations including the Canadian Trade Commission Service and Trade and Development Canada to promote UAV development and usage.[72] The influence of Unmanned Systems Canada on UAV usage in Canada may come to significantly influence the development of UAV regulation and legislation.

1.7 SFOCs in Canada

To corroborate anecdotal information that UAVs are quite literally on the rise in Canada, a content analysis of SFOCs approved between 2007 and 2012 provides statistical evidence that supports this trend. This information was gathered using Access to Information and Privacy (ATIP) requests to Transport Canada collected in October and November of 2013 for SFOC information for 2007-2012.[73] Specifically, information was provided that 618 SFOCs were approved between 2007 and

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[69] *Canadian Aviation Regulations* (2003) Sec. 602.41.
[70] Unmanned Systems Canada (2012).
[71] CARAC, the Canadian Aviation Regulation Advisory Council, is also consulted by Transport Canada in improving regulations. CARAC is a joint undertaking of government and the aviation community, with participation from a large number of organizations outside Transport Canada that also recommends regulatory changes through cooperative rulemaking activities. How this process unfolds is unclear. See http://www.tc.gc.ca/eng/civilaviation/regserv/affairs-carac-menu-755.htm.
[72] (2013): Sec. 121.16.
[73] Specific dates of ATIP requests were: October 28th 2013 - Request file number: A-2013-00588 / RB; October 29th 2013 - Request file number: A-2013-00586 /RB; October 29th 2013 - Request file number: A-2013-00817 /RB; November 12th 2013 - Request file number: AI-2013-00038/RB.

2012.[74] It is significant to point out that the number of issued SFOCs does not include the number of drone flights under each certificate.[75] Frequency distributions reveal that each year the number of SFOCs approved increased or remained consistent, respectively: 44 in 2007, 64 in 2008, 66 in 2009, 66 in 2010, 149 in 2011 and 229 in 2012. This revelation prompted us to consider other details that could be gleaned from the SFOCs associated with how use patterns of UAVs might have changed during this period, as well as details about the changing nature of the SFOC process. In particular, below we present descriptive statistics that shed light on UAV usage in terms of regional distribution, purpose of flight, institution type (public or private), most frequently cited institutions and vehicles, in addition to the SFOC process itself in terms of the length of time between SFOC submission and approval as well as overall SFOC duration.

SFOCs indicate the region in which the application was submitted, specifically the provinces of Ontario, British Columbia and Quebec constitute distinct categorical regions, while the Prairies (Alberta, Saskatchewan and Manitoba) and Atlantic (New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland) form regions collectively. A review of the breakdown of SFOC distribution between regions on a yearly basis reveals that the Prairies, Ontario and British Columbia have continually witnessed the highest rates of application; however, as with the overall rate of SFOCs, the number of applications within each region has grown dramatically over the years in high use regions (see Table 1.0).

Table 1.0: Region of SFOC application by year*

	Year					
	2007	2008	2009	2010	2011	2012
Region						
Prairies	20	31	25	25	39	98
Ontario	9	13	14	20	65	44
British Columbia	6	8	18	4	25	71
Quebec	5	7	3	8	12	7
Atlantic	4	5	6	9	8	9

*Total number of SFOCs for 2007-2012 = 618

Similar to the consistent pattern of high use regions throughout the SFOCs analyzed, the most frequently cited reasons for flight in SFOCs remained consistent as well. Altogether, 16 different types of purposes were listed across all of the SFOCs

[74] It has subsequently been reported that the number of SFOCs issued by Transport Canada rose to 945 in 2013. See Linda Nguyen, "From police work to inspecting farms, drones can be big business in Canada," *The Calgary Herald*, May 3 (2014), http://www.calgaryherald.com/business/From+police+work+inspecting+farms+drones+business+Canada/9800805/story.html.

[75] Transport Canada Annual reports detail the numbers of flights, specific companies and the number of passengers which fly within Canadian airspace for traditionally piloted aircraft. However these numbers in relation to UAV flights and the issueance of SFOCs are currently lacking from Transport Canada's annual reports, and as such, public understandings about the role that UAVs are now playing within Canadian civil aviation are clouded.

submitted (however, for simplicity some similar categories were collapsed[76]) but a few key purposes were predominantly cited (see Table 1.1; due to space limitations we do not list all of the cited purposes by each year but, instead, provide an overview). The top three purposes for flight in each year are listed, revealing that visual mediation tasks as well as research and development have consistently remained the priority of SFOC applicants (demonstrated through consistently high percentages of overall purposes in each year). Another noteworthy point is that citing the reason of 'multiple purposes'[77] has become increasingly popular since 2008. This trend suggests that applicants have perhaps come to better utilize the SFOC system by using one application to gain approval for purposes accomplished through multiple flights (a speculation that can be corroborated by the increasing length of SFOC durations, discussed below).

Table 1.1: Selected most common purposes of application by year*

	Year					
	2007	2008	2009	2010	2011	2012
Purpose						
Visual mediation**	20(45.5%)	19(29.7%)	31(47%)	28(42.4%)	53(35.6%)	133(58%)
Research and development	10(20.9%)	19(29.7%)	13(19.7%)	8(12.1%)	33(22.1%)	23(10%)
Multiple purposes			8(12.1%)	21(31.8%)	32(21.5%)	41(17.9%)
Advertising	5(11.6%)					
Agriculture		6(9.4%)				

*Total number of SFOCs for 2007-2012 = 618

**The visual mediation category includes: aerial photography, remote aerial inspection, aerial survey, geophysical research, wildlife management, and aerial surveillance and recognizance.

Analysis of the SFOCs was also able to cast light on 'who' SFOC applicants are (although the substantial presence of redacted information does not allow us to provide a complete overview in this regard). To begin, the distribution between publically and privately funded institutions applying for SFOCs is interesting (see Table 1.2). The pattern suggests that private institutions have always applied for SFOCs in greater numbers than public institutions. Furthermore, what appears to be an increasing tendency towards providing largely redacted materials to researchers exploring the use of UAVs in Canada is quite unfortunate. Redacting information makes it difficult to accurately grasp usage trends and patterns. For instance, while in 2007 less than half of institution names were redacted (20 of 44), allowing us to see that a minimum of 12 different institutions were responsible for the 44 applications based on the non-redacted information, by 2012 only one institution name was not redacted (likely accidentally), making it impossible to determine how many applicants are responsible for the 229 applications submitted that year.

[76] The visual mediation category includes: aerial photography, remote aerial inspection, aerial survey, geophysical research, wildlife management, and aerial surveillance and recognizance.
[77] The applicant simply intended to use the UAV for more than one purpose (e.g., for both visual mediation and advertising).

Table 1.2: Applicant type by year*

	Year					
	2007	2008	2009	2010	2011	2012
Applicant type						
Private	13	30	25	1	104	1
Public	11	8	13	4	36	0
Redacted	20	26	27	61	9	228

*Total number of SFOCs for 2007-2012 = 618

Conversely, the distribution of specific UAVs used has remained consistently transparent; however, the large number of different crafts cited (over 100 across all five years) makes a comprehensive review here impossible. Furthermore, the most commonly cited vehicles have fluctuated each year. Possibly the most interesting statistical piece of information that can be gleaned from this variable is that the combined distribution of UAV types across all five years sees the Draganflyer (100 or 16.2%), Outlander (28 or 4.5%), and Cinestar (25 or 4%) as the most commonly cited vehicles and that the distribution of 2012 (the most recent year for which we had data) mirrors this, with the Draganflyer (39 or 17%) and Cinestar (4 or 1.7%) being amongst the most frequently cited.

Finally, analyzing the SFOCs also granted insight into the changing nature of the SFOC process, specifically changes in overall approval time and certificate duration. To provide an overview of these changes we provide descriptive statistics on these times for 2007 (the first year for which we have information) and contrast it against 2012 (the most recent year for which we have information). First, approval time refers to the average number of days it took an SFOC applicant to have their application approved from the time it was submitted. In 2007 for the 43 SFOCs[78] the range for approval time was 0[79] to 413 days, with an average wait time of 45 days. Despite the fact that SFOC applications increased substantially to 229 by 2012, the length of approval time decreased[80] with the range now being 0 to 330 days, with an average wait time of 22 days. Second, SFOC duration refers to the average number of days an SFOC applicant received approval to fly their craft. In 2007 the 44 SFOCs range for approval time was 1 to 378 days, with an average duration of 70 days. By 2012 the 224 SFOC[81] applicants were requesting, and receiving, SFOCs lasting substantially longer with the range now being 1 to 541 days, with an average wait time of 109 days.

[78] One case was removed from the analysis in 2007 because no submission date was listed in the application in this case.
[79] Submitted and approved on the same day.
[80] It should be noted that the 'mean' (described as average wait time here) is a statistic sensitive to 'outliers' (values in the distribution that are substantially lower or higher than most) and, as such, the few instances in which applications took exceptionally long to process (e.g., 413 days) inflate the overall average somewhat.
[81] Five cases were removes from the analysis in 2012 because the listed date for which the SFOC was issued followed the date for which it was valid until. This clerical error caused them to be excluded.

Reviewing these statistics suggests a few key points about trends in UAV usage and SFOC application in Canada. First, that it has continually increased; a fact demonstrated through the climbing number of SFOCs issued each year. However, and second, that increase (and the use of UAVs generally) appears fragmented; it is much more common in particular regions of the country, used most commonly for a host of visual mediation tasks than anything else, and predominantly pursued by private, as opposed to public, institutions. Third, although the number of SFOCs sought each year has greatly increased, the approval process seems to have been streamlined (taking substantially less time on average in 2012 than 2007). Finally, the considerable increase in average SFOC duration between 2007 and 2012 suggests that applicants are also gaining a better grasp of the SFOC process, perhaps increasing the requested length of their SFOCs and increasingly citing 'multiple purposes' to accomplish as much as possible with a single SFOC.

1.8 Conclusion

The modern day Canadian unmanned aerial vehicles' history can be dated back to the turn of the 20th century and the advent of the key technologies of radio controls, wireless communications, and internal navigation. Significant early advancements in the development of UAV technology were made by a number of Western nations, primarily in the context of military warfare during the First and Second World Wars, however, the expansion of the role of these craft from a singular craft to integrated technologies of battlefield surveillance came within the post-war period. Canada primarily entered the scene in the late 1950s, and research produced in the country focused more on surveillance and intelligence recognizance than unpiloted 'Aerial Torpedoes' and target practice drones that more generally dominated this historical period. This era also saw a separation of UAV and ballistic missile design leading to an expansion of UAV applications. The major models that have dominated cutting edge Canadian drone development have largely followed a linear trajectory in development – primarily making minor adjustments between subsequent renditions of previous models.

As a result of these advancements as well as diminishing costs associated with the technology, UAV usage has expanded since the turn of the 21st century, shifting them from technologies on the fringes of applicability, to central players in the network-centric environments of current intelligence, surveillance and reconnaissance practices. Overall, the surveillance ramifications and privacy considerations of UAVs vary according to their size and flight capabilities (such as their capacity to stay airborne for considerable periods of time, aerial maneuverability, the myriad technologies that can be affixed to the devices) all make a difference for the kinds of monitoring, intelligence collection, data linking, and analytical potential afforded by UASs. Given the historical improvement and growth trajectory of UAV technology, which has evolved into a present-day manifold aerial surveillance technology, the questions remain 'what are the implications for these technologies in relation to privacy in Canada' and 'what does the future hold?'

2.0 Marketing drones: Understanding how manufacturers and technical experts work with others to develop and promote drone use

There is a disconnect between how UAVs are perceived by the public and their actual and intended applications in Canada. The Canadian public is unaware of a number of areas where UAVs are already being deployed and many have negative impressions of their use.[82] For instance, in a recent news article, a marketing and communications manager at Aeryon[83] stated that the negative connotation of the word 'drone' distracts from the intended applications of UAVs. This manager claimed that the negativity surrounding the use of unmanned aerial systems needs to be addressed 'by educating people on their use, like search and rescue, and hydro-line inspection.'[84] An examination of marketing material of UAVs in Canada as well as an investigation into their marketed versus actual applications will demonstrate whether negative perceptions of drones are well founded or merely misconceptions. This section will address the market literature, experiences cited from interviews with industry stakeholders, market presence, effectiveness, accelerators, obstacles to growth and the UAV working group mandate. This analysis will also account for the implications of advertised capabilities for privacy, civil liberties and human rights.

2.1 Marketing literature

An analysis of marketing material of Canadian UAV manufacturers[85] was completed in order to determine whether or not the uses of these technologies are being advertised in a way contrary to Transport Canada's UAV working group recommendations or to PIPEDA. After gathering marketing data online from Canadian UAV manufacturer websites and from literature gathered at the Unmanned Systems Canada Conference[86] we performed a content analysis of the various materials to determine the manifest content of communications used to market UAVs. One outcome of our content analysis, representing the most frequent words in the materials, is visualized in the word cloud seen in Figure 2.0, below. Thus, according to our analysis of these marketing materials the most prominent

[82] This will be discussed more in the public opinion section of this report, drawing on Vision Critical survey results.
[83] Nicolas Pollock, "Send in the drones," *Capital News Online*, April 5 (2013), http://www.capitalnews.ca/index.php/news/Send-in-the-drones.
[84] Ibid.
[85] The list of Canadian UAV manufacturers was compiled in part from the Unmanned Systems Canada website, and supplemented through information collected at the Unmanned Systems Canada 2013 Annual Conference.
[86] 12-14 November 2013, Unmanned Systems Canada 2013 Annual Conference, Vancouver BC.

words used to market UAVs are SUAS (small unmanned aircraft system), aerial, video, news, systems, fire and monitoring.

The analysis of the key words showed that manufacturers focus primarily on the technologies themselves and then on the possible applications. The terms used are innocuous and open-ended in that they name the systems and use broad terms to describe their capabilities and possible applications. This observation was further noted by our interviewees, as seen in the quotation in section 2.1.3, which states that marketing materials tend to highlight the technological capabilities of the SUAS as opposed to specific applications.

Figure 2.0: Word cloud compiled from various marketing materials of Canada UAV manufacturers, collected from their websites or collated from brochures collected at a Canadian industry conference.

2.1.1 Experience of marketing/ being marketed to

Drawing on interview data collected at the Unmanned Systems Canada Annual Conference, we asked interviewees about their experiences of marketing and being marketing to.[87] Most individuals said that the information about UAV technologies comes in the form (or is delivered in the form) of brochures, pamphlets, and videos when they receive (or send) marketing material on UAVs. They also cite the internet, through searches and manufacturer websites as being one of the best sources for marketing materials. Industry conferences and trade shows are cited as ideal locations to meet individuals and talk about the technologies and perhaps see them in action. Because the industry is a fairly small one, one-to-one marketing is the most effective.

[87] For more details on methodology see note 4.

2.1.2 Market presence

The companies listed as having the largest market presence in Canada varied across interviews. However, the most cited companies were Aeryon Labs Inc. and General Atomics, followed by CAE, DJI Innovations, and Northrup Grumman.

2.1.3 Effectiveness of marketing

The interviews with industry and non-industry professionals alike highlight that the effectiveness of marketing materials is two-fold; it is based on: 1) the cost effectiveness of these technologies, in monetary and risk terms, and 2) the detail and technological capacities of the technologies as listed in the marketing material. Where the marketing materials seem to be lacking is in their explanation of where and what the various UAVs can be used for. As the UAV market is still in the early stages of development, manufacturers may not be aware of all the possible applications and limitations of their technologies. On this point, one interviewee said, 'What I find in the marketing material is that usually they talk about the product rather than the outcome. Every company tries to advertise for everything because they're testing the market rather than targeting areas that they are successful in, realizing this is what I'm good in, how about we go for that market?'[88]

2.1.4 Market accelerators

Documents acquired through ATIP requests highlight market accelerators for civil UAVs in Canada as outlined by industry professionals to the National Research Council.[89] The primary paths of action highlighted to grow opportunities for civil UAVs in Canada were: establishing a business model, marking Canada as a UAV development destination, and defining the distinct UAV markets.

The business model discussed refers to multi agency and multi functional platforms, where 'commercial companies might serve multiple agencies and multiple application needs with a consolidated fleet of one or more types of vehicles, assuming the platforms allowed rapid modular customization for anticipated uses.'[90] This model would rely on private-public partnerships with specific arrangements of UAV centres stationed geographically across the country to provide contract UAV service capabilities that could meet a number of application needs.

Canada can be distinguished as a UAV development destination, according to these documents, because Transport Canada has approved numerous experimental flight certificates to industry, whereas the Federal Aviation Administration (FAA) in the United States has been much more restrictive in granting these certificates.

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[88] Quotation from interview data.
[89] Access to Information and Privacy (ATIP), request file number: A2013-0025.
[90] ATIP, request file number: A2013-0025; "Civil Opportunities for UAS in Canada: Final Report," May (2008), Conclusions and Observations: 73/101.

Therefore, the report proposes that 'Canadian companies offer facilities and airspace access for overseas manufacturers and operators to design, develop, and test their civil UAVs here.'[91]

Different challenges exist for small UAVs versus larger UAV systems, as well as for smaller companies versus larger companies. Another market accelerator as outlined in the report is a need to differentiate amongst companies, between the different market applications, challenges, and opportunities as they vary across different types of UAVs.[92]

Some UAV industry professionals also highlight the cost effectiveness and reach that UAV technologies offer as opposed to manned aerial vehicles. UAVs can be offered as an alternate to manned aerial vehicles because of 'the promise of lower cost to these things that are already done. The promise to increase the safety of individuals who need and use new information because unmanned aircraft can collect all the information. The classic scenario is that unmanned aircraft is best suited to do things that were either dull, dirty, or dangerous. So it's an improvement over manned aircraft needs.'[93]

2.1.5 Market obstacles

Issues of regulation and infrastructure as well as public opinion[94] have affected the development of the UAV industry in Canada. Therefore, a regulatory framework is necessary to ensure public safety and to allow for development of the UAV sector. Introducing UAVs to the public in terms of how they can help with the dull, dirty, and dangerous work, and their effectiveness in assisting with jobs in remote areas (such as oil and gas pipeline surveying, as well as hydro line surveillance) could help shift public opinion to a more positive light.

Other barriers to the UAV market outside of the military context include: air space regulations that do not adequately address UAV systems, liability issues for civil operations, lack of secure non-military frequencies, negative public perception of technologies, limited payload capacity and operating restrictions.[95]

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[91] Ibid.
[92] All information in this section is taken from the ATIP material, as per previous notes.
[93] Quotation from interview data.
[94] This was echoed in our interview data, and further analysis of public opinion is covered in section 3 of this report.
[95] List initially retrieved from report by the Office of the Information and Privacy Commissioner of Ontario, edited and supplemented with information obtained during interviews conducted at the Unmanned Systems Canada Conference in Vancouver, November 2013 http://www.ipc.on.ca/images/Resources/pbd-drones.pdf.

2.2 Implication of advertised capabilities for privacy, civil liberties and human rights

One of the questions that we wanted to address in this report with regard to marketing material of Canadian UAV manufacturers was whether their advertised capabilities had implications for privacy, civil liberties and human rights. From the analysis of the marketing material, there are no key words that stand out (as negative) on their own. The terms imaging, and monitoring are quite neutral on their own and can be linked to any number of applications. As the material primarily advertises the technological capabilities of the UAVs and broad applications that could be applicable across a number of fields, there is no clear problem with the way they are being marketed.

However, as UAVs proliferate in Canada, the possible applications and locations for use of these technologies is likely to grow as well. As noted in other reports, such as the OPC Research Report 'Drones in Canada,' 'the magnitude of the impact on privacy, including the extent and type of personal information that may be captured on UAVs, will depend largely on the purpose for which drones are used, the context and location of their use, as well as the type of technology mounted on them.'[96] Many of these concerns will be addressed later in the report, dealing with the privacy implication of UAVs.

What is interesting to note here are some particular instances of advertising that raise concerns about the implications of UAV use. While UAVs are often compared to CCTV for their image or video recording capabilities, or to helicopters for their aerial features, UAVs differ in that they are mobile and unobtrusive. Additionally, as seen in the variation of UAVs on the market, there is any number of variations in technology that you can add to the flying system, whether digital recording devices or sensory readers. Therefore, in addition to UAVs possibly going unnoticed compared to other technologies of surveillance, they have more ways to collect and gather data.

The images below are taken from the Aeryon Labs Inc. website. These show two possible applications that could be quite intrusive with respect to privacy and civil liberties. Because the technologies attached to each UAV may differ, the implications vary across situations. It is not unreasonable to assume that individuals may be less likely to exercise their right to peaceful assembly if UAVs are being used by law enforcement agencies (LEAs) or a private company to scan the perimeter of their property. This brings up further questions regarding individual's expectation to privacy in public as has also been noted in the 'Drones in Canada' report.[97] The

[96] Office of the Privacy Commissioner of Canada, "Drones in Canada: Will the proliferation of domestic drone use in Canada raise new concerns for privacy?," Prepared by the Research Team of the Office of the Privacy Commissioner of Canada, March (2013): 12.
[97] Ibid.

significance of the Aeryon Labs case is highlighted again in section 2.3.1 as these particular craft have been recommended for exemption from the SFOC process.

Figure 2.1: Images of possible applications for Aeryon SUAS as advertised on the Aeryon Labs Inc. website

Crowd Control

Crowds can get out of control; sometimes quite quickly. Constant surveillance of a crowd as it moves is critical to providing public safety officers a visual of the situation and how it evolves. With the Aeryon platform, surveillance/crowd control teams have the ability to constantly monitor the movement and behavior of the crowd. The pre-planned flight path capabilities along with the ability to control multiple flyers simultaneously allow for non-stop monitoring of any situation.

Private Security

Perhaps the challenge is to secure an open-pit mine? Or oversee a significant sporting or political event? Or monitor a safe house? In all cases whether you're securing people, property or equipment – constant monitoring of all activities in the area surrounding your asset is an absolute necessity. Multiple Aeryon sUAS constantly following a pre-planned route, such as the perimeter of a site, will provide you non-stop aerial intelligence keeping your assets as safe as possible.

2.3 UAV stakeholders: Enabling UAV development and growing the market

Transport Canada's UAV working group has identified a number of government agencies and departments that are vital to the development and growth of Canadian UAV technologies. The UAV working group highlights the importance of Industry Canada's role in supporting the UAV sector when it is seeking funds through programs such as the Strategic Aerospace and Defence Initiative (SADI) and Industrial and Regional Benefits (IRB).[98] The UAV working group states that UAV industry associations will be able to facilitate effective growth of the Canadian UAV sector if it is appropriately funded by such programs as listed above, as this would help the industry to 'become a strong economic engine in Canada, both as a national solution provider and as a high tech exporter to the world.'[99]

[98]Transport Canada, "UAV working group – Final report," (2011): 12.5, http://www.tc.gc.ca/eng/civilaviation/standards/general-recavi-uavworkinggroup-2266.htm.
[99] ibid.

The UAV working group also concluded that, 'government agencies from the National Research Council to Public Safety and Emergency Preparedness Canada to Human Resources and Social Development Canada to Natural Resources Canada, need to be apprised of unmanned aircraft systems and the requisite enabling technologies to ensure that they use them to further their individual mandates in a coherent fashion that will benefit the optimum number of Government departments whilst growing a profitable national high tech sector.'[100] Thus, the working group suggests marketing the various uses of drones to government departments will promote market growth.

2.3.1 UAV working group mandate

At the Unmanned Systems Canada Conference, it was made known that the role of Transport Canada and the UAV Working Group was to mandate safety. However, in section 2.3 the excerpts from the UAV Working Group webpage show that the group does far more than mandate UAV safety. In fact, the UAV working group primarily seems to deal with lobbying the government and industry to find increasing applications and acceptance of UAVs. Some well-known UAVs such as the Aeryon Scout fall into the category of low energy Remotely Piloted Aircraft Systems (RPAS) which have been recommended for exemption from the SFOC process by the UAV Working Group at Transport Canada.[101] The Aeryon Scout is advertised for its application in crowd control and the ability to monitor crowds.[102] If this vehicle is employed in such cases without an SFOC, the repercussions for individuals are not just centered on safety but on their chartered civil rights, privacy and security.

2.4 Conclusions on marketing

The marketing of UAVs is not to the general public at large but largely takes place within the UAV industry sector, targeting government funding and buyers. The perception of UAVs in their target market is very positive and is facilitated by various lobby groups such as the UAV Working Group at Transport Canada. Industry marketing and media portrayal of technologies of not align, especially regarding the naming of these technologies as unmanned aircraft or drones, respectively. Most marketing occurs between industry and government, with both realms overlapping in the world of research and development. However, in order for UAVs to expand successfully within the civil realm, the public must be convinced of their uses and their safety and privacy standards.

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[100] ibid.
[101] Shayna Gersher, "Canada's domestic regulatory framework for RPAS: A call for public deliberation," *Journal of Unmanned Vehicle Systems* 2(1-4) (2014): 2.
[102] "Aeryon Public Safety Applications," Aeryon Labs Inc., (2014), http://www.aeryon.com/applications/public-safety.html.

3.0 Drone Awareness: Probing public opinion to discover how Canadians perceive and access the use of drones in varying contexts

Many UAV applications are welcomed by, and gain approval from, the Canadian public. For example, a January 2013 poll of Canadians by Phoenix Strategic Perspectives for the Office of the Privacy Commissioner of Canada (OPC) found that people were very comfortable with UAVs being used for search and rescue, border patrol, and law enforcement investigations while they were less supportive of uses for public monitoring and surveillance.[103] However, the widespread use and rapid proliferation of UAVs in Canada raises questions and public concerns for civil liberties and privacy. In considering these issues, public awareness and public opinion of UAVs in Canada must be discussed in order to inform public policy as it is being developed.

This section of the report deals with the topic of public awareness and public opinion regarding UAVs in Canada by drawing on two unique sets of data gathered for the purposes of this report. Key stakeholder interviews with individuals in the UAV industry,[104] as well as a large-scale survey with members of the general public[105] were conducted to shed light on public opinion and awareness of UAVs in Canada. The survey data collected for this report by Vision Critical (2014) demonstrates the complexity of public opinion and awareness of UAV usage by the general public by asking more specifically about the capacity of data collection, and the reasons why various institutions would be using UAVs. These findings will be useful to legislators and regulators in developing policy on UAVs.

[103] Phoenix Strategic Perspectives Inc., "Survey of Canadians on Privacy Related Issues: Final Report," Prepared for the Office of the Privacy Commissioner of Canada. Ottawa (2013).

[104] Thirteen interviews were completed in November 2013 with representatives of the various stakeholders involved in UAV development and use in Canada at the Unmanned Systems Canada Conference, including government, industry, law enforcement, and academia. Thirteen questions dealing with historical development, public opinion, marketing, and future directions of UAVs in Canada were covered. Informed consent was obtained from all participants and the process was approved by Queen's General Research Ethics Board (GREB).

[105] The research team developed a set of questions for the survey that was carried out by the polling company, Vision Critical in January 2014. The survey aimed to understand awareness and perceptions surrounding the use of drones to identify and collect information in Canada. The questions asked individuals whether they had basic awareness of various UAV applications in Canada, as well as assessed support for how they are being used and in what scenarios. The poll included responses from 3,045 individuals across Canada in an online environment sourcing from the Angus Reid Forum. English and French speaking individuals were polled and samples were balanced by age, gender and region. For a copy of the questionnaire, please contact the Surveillance Studies Centre.

3.1 Key stakeholders on public opinion

As part of the investigation into public opinion on UAV use in Canada, key stakeholders - such as leaders in the UAV industry - were interviewed and asked about their perceptions of public opinion by individuals in Canada not involved in the UAV industry. In general, they reported that they believe public perceptions are dominated by skepticism, a lack of understanding, and misinformation about domestic UAV use and capabilities. In particular, these stakeholders claim that uneasiness regarding UAV use in Canada by the general public is misplaced, and that public opinion in Canada is adversely shaped by negative media portrayals of the technology. For many of those interviewed, it is the dominance of news coverage on the weaponization of UAVs and military strikes conducted by the United States that were to blame for this negative perception in Canadian public opinion.

To illustrate this, the industry stakeholders often argued that the dominance of media portrayals of weaponized drones ultimately resulted in a situation in Canada in which 'all [the public] see on the news are the drones, as they call them, that are bombing the wrong places or doing wrong in foreign countries because journalists want something that's going to grab people's attention.'[106] One interviewee, however, did concede that 'there have been some spectacular applications of force that have gone horribly wrong overseas,' noting that these actions 'have provided some very high profile stories that have very negatively impacted public opinion.'[107] Many stakeholders believe that these negative media portrayals of weaponized UAVs are being carried outside of the context of military applications, as *all* UAVs are now being widely portrayed in the same negative light by the Canadian and US media. It was generally asserted that this framing has, in turn, led to the overlooking of what stakeholders felt were the 'positive' domestic applications of UAV technologies. As one interviewee expressed, 'there's a big emphasis, more of an emphasis in the media, on bad things associated with drones as opposed to good.'[108] As a result of this perceived unequal media representation, there was a shared impression expressed by those interviewed that the public lacks an accurate understanding, or appreciation, of the variety of UAV applications in Canada.

Although sensitive to Canadian public opinion of UAV use, the industry stakeholders interviewed generally characterized these perceptions as 'uneducated,' and any concerns regarding the technology were perceived as unfounded and/or misplaced. In order to change this negative public opinion, many agreed that the best approach would be to initiate a campaign of awareness and education – pointing to the need for the industry to engage actively in a dialogue between the Canadian UAV industry, government, and the general public. For this reason, those interviewed stressed the need for public outreach and education. However, this understanding of

[106]Quotation from interview data.
[107]Quotation from interview data.
[108]Quotation from interview data.

public opinion also led to a notable downplaying of both public concerns regarding UAV applications as well as the usefulness, or validity, of consulting public opinion in regards to the development of additional government legislation to regulate new or existing UAV technology.

The need for further public education on the multiple uses of UAV technology and applications within Canada is clear. However, that the current exclusion of public involvement seems to promote and environment where industry 'experts' should dominate the development of legislation, regulators and policy, is somewhat problematic as this would represent only the favourable promotion of the industry. Furthermore, in contrast to the perception of blanket negative, media-shaped public opinion of UAV technologies that is portrayed in the stakeholder interviews, the survey data research collected by Vision Critical for this report demonstrates that public opinion regarding the adoption of UAV technology sophisticated, and cannot be explained with a single, or simple, blanket statement of 'support' or 'opposition.' The public opinion survey findings show that the intended use and the institutional affiliation of the UAV matter deeply to Canadians. As such, the question of *why* they are used and *by whom* provide the basis for understanding the public opinion poll findings concerning the application of this rapidly expanding technology and the importance of public involvement in policy development, which will be turned to next.

3.2 Awareness of UAV applications and usage in Canada

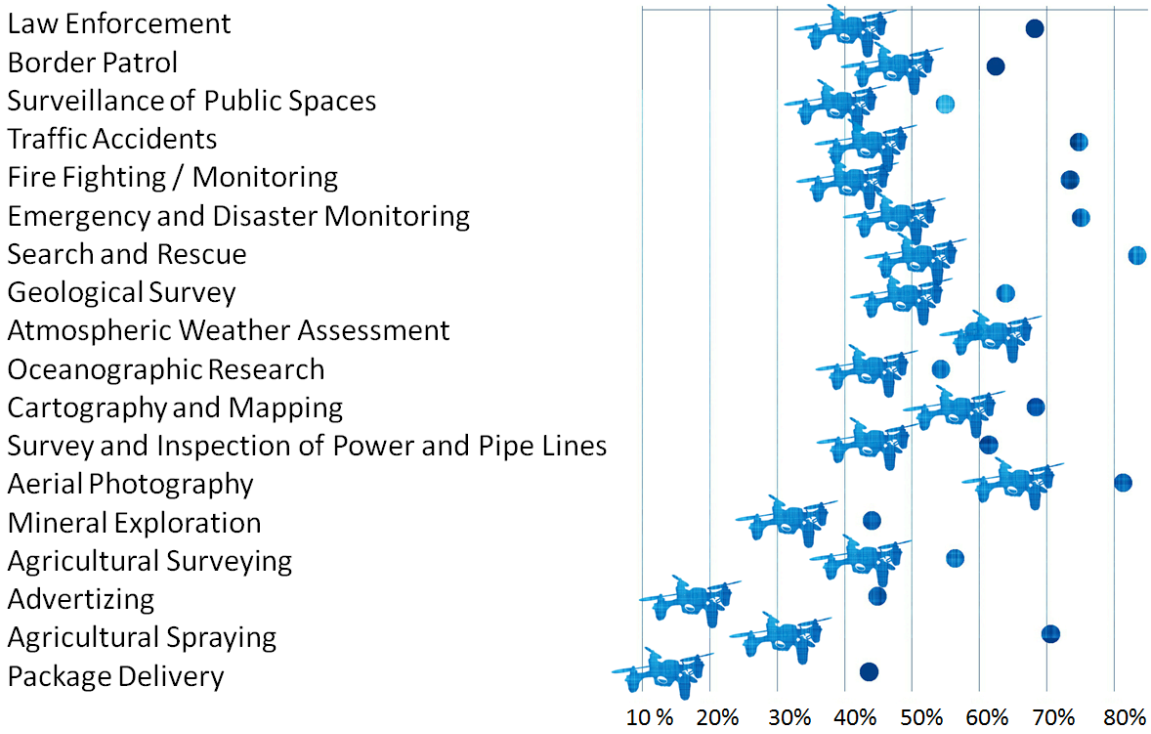
In laying the groundwork for understanding public opinion regarding UAV use in Canada, the first series of questions of the Vision Critical survey conducted for this report was designed to establish a baseline of general public knowledge, or awareness, regarding current or proposed UAV applications within Canadian airspace. In brief, it was found that public awareness of UAV use in Canada was fairly low, with a marked decrease of awareness when compared to the use of traditionally piloted craft for the same applications.

Within this section of the survey, current and proposed uses of UAVs in Canada were drawn from the 'Uses for unmanned air vehicles' presented by Transport Canada within the *Unmanned Air Vehicles Special Flight Certificates* section of its web page – ranging from 'aerial photography' to 'police surveillance.'[109] These listed uses were then amalgamated or slightly modified to fit the needs of the public opinion survey. Ultimately, those interviewed were asked if they were aware of thirteen specific applications regarding UAV flights, while these questions were also tested against public awareness of traditionally piloted aircraft for these same purposes.

[109] Transport Canada: Unmanned Air Vehicle (UAV) https://www.tc.gc.ca/eng/civilaviation/standards/general-recavi-brochures-uav-2270.htm.

Public awareness of the use of traditionally piloted aerial vehicles for many of the tested applications was relatively high, and only two uses were found to have an awareness of less than 50% of those polled ('mineral exploration' and 'package delivery'). In each of the thirteen measured uses, fewer people responded that they were aware of UAVs performing the measured tasks within Canadian airspace when compared to traditionally piloted vehicles – with the exception of 'Atmospheric Weather Assessment' (see Figure 3.0). The largest disparity in awareness came in relation to 'Agricultural Spraying' where 71% of individuals surveyed were aware of traditionally piloted craft being deployed for this purpose, but only 31% were aware of this use of UAV technologies.

Figure 3.0: Public awareness of traditionally piloted and UAV applications in Canada



Data Source: Vision Critical 2014

The survey also found that the applications of 'Aerial Photography,' 'Atmospheric Weather Assessment,' 'Cartography,' and 'Search and Rescue,' were the only measured applications in which the majority of those polled were aware of UAV being used in this way in Canada. For the remaining ten cases the degree of public awareness ranged from 14% to 49%, though the application of 'package delivery' was the lowest of those polled within this survey. This lack of awareness within the general public was somewhat surprising due to the amount of press generated by Amazon.com and Lakemaid Beer corporations in their claims that they were able to

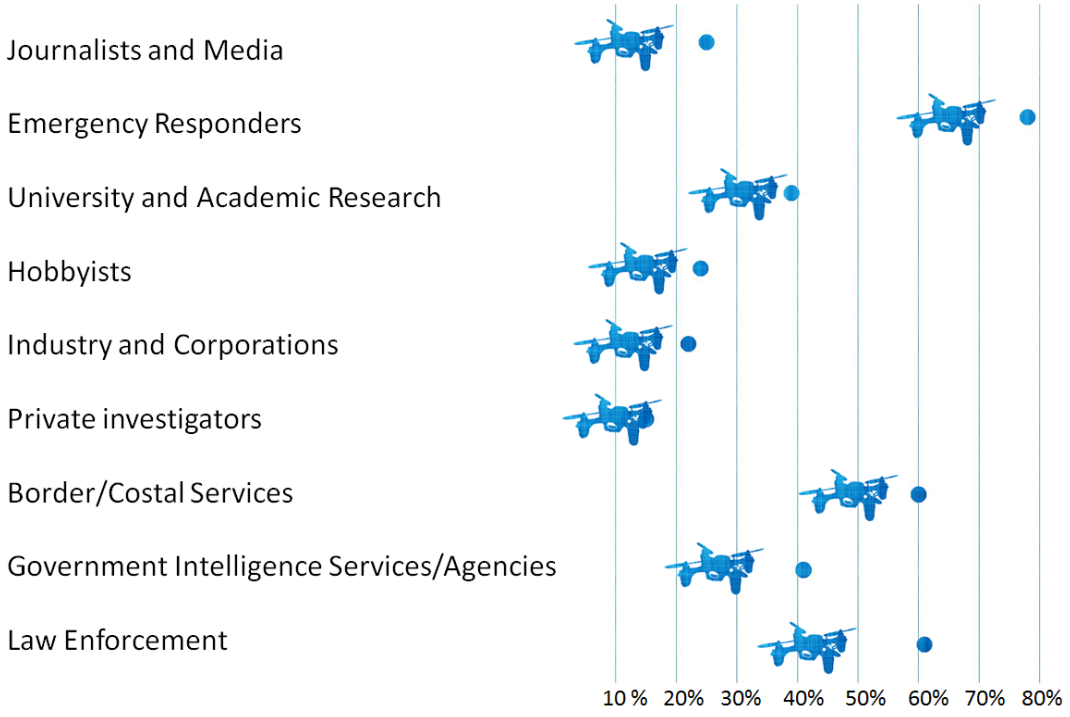
deliver small packages, and that they would be doing so commercially within the United States by 2015.[110]

Ultimately, the data demonstrates a low degree of awareness (within the Canadian population) of the various current uses of UAVs in Canada. This is likely linked to the newness of many of these applications and the relatively small number of flights that have been conducted in many of these areas before 2007.

3.3 Support for UAV use in Canada by group

After collecting data regarding general awareness within the Canadian general public, the survey questions turned to an investigation of public support for UAV use by particular institutions. This set of questions produced significant results, as the responses of those polled demonstrate a trend within Canadian public opinion that support for data collection by government and private groups dropped in nearly every case where UAV technology was proposed to be adopted. Additionally, this support was also found to be almost universally lower when the use of an UAV technology was proposed as opposed to a traditionally piloted aircraft, while public support was found to be even lower still when the UAV's piloting was explained as being fully automated (see Figure 3.1).

Figure 3.1: Support of use by group



Data Source: Vision Critical 2014

[110] Amazon.com: Amazon Prime Air, http://www.amazon.com/b?node=8037720011; Lakemaid Beer: Drone Delivery, http://lakemaidbeer.com/.

The survey data, as demonstrated in the above figure, show that there is a distinct lack of support for UAVs used by 'private investigators' (11%), 'industry and corporations' (12%), 'journalists and media' (12%), and 'individuals/ hobbyists' (14%). The only group that found support for the collection of data through the use of UAVs by the majority of those polled was that of 'Emergency Responders'–a category that refers to fire services, as well as search and rescue, and other similar practices. In this case, 65% of individuals responding to the survey were found to be in support of the use of UAVs by this group. Although 'Emergency Services' groups did find support by a majority of those polled: it is also important to note that support for this same group increased significantly when the technology in question was shifted to a traditionally piloted craft.

These polling data demonstrate that the act of introducing an UAV to the practice of data collection works to lower the support found in the general public for these practices, regardless of what group was behind the proposed UAV flight. As noted above, in some of the measured cases, this impact was significant enough to cause applications which had previously found support within the general public to be opposed if UAV technologies were adopted to complete a data collection task.[111] In particular, the use of UAV technology by 'law enforcement agencies' and 'government border/ coastal security organizations' demonstrate the critical importance of this technological choice in regard to either gaining the support or opposition of the general public. In both of these groups, there was originally approximately 60% support, however, as a result of the proposed adoption of UAV technology the reported public opinion fell below 50% support and shifted from a position of majority to one of opposition.

3.4 Support for use: Law enforcement and industry

This section investigates Canadian public opinion in relation to the two main groups of law enforcement and private sector corporations. As was noted in the introduction of this section, public opinion regarding UAV use in Canada is variable and cannot be explained by a simple blanket statement of support or opposition. The results in this section draw out the sophistication and application of UAV technology further, by asking those polled not only about a specific organizations use of UAVs, but also about the specific uses that that organization has adopted, or may take up UAVs to perform tasks. In both the cases of law enforcement and private sector applications, specific uses for UAVs varied from nearly complete support within the general public to nearly complete opposition.

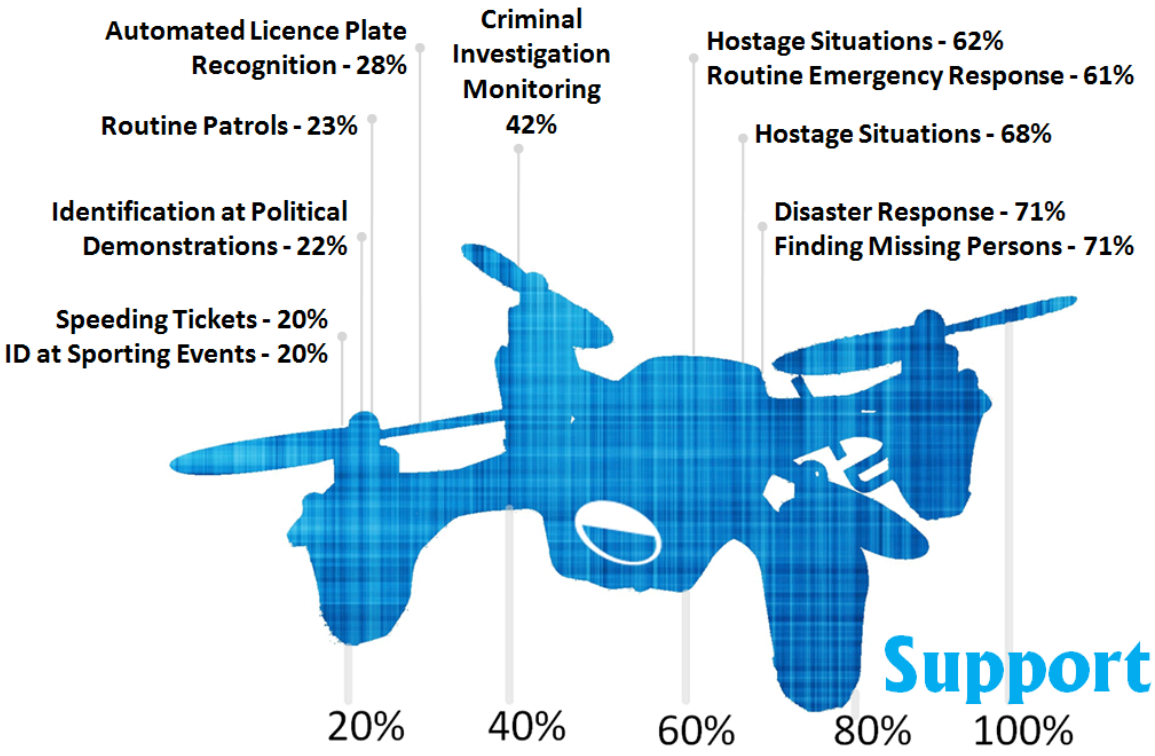
3.4.1 Law enforcement use

It should be noted that, as with other data, the proposed use of an UAV by law enforcement groups did result in a decline in support when compared to

[111]Vision Critical., Ibid.

traditionally piloted craft. However, a more specific general pattern did develop in relation to the support of UAV technology by this group. Applications related to definite tasks that required an emergency response, such as the rescue of a person in trouble or the resolution of a dangerous situation, find support within the majority of those polled. In particular, law enforcement applications such as 'finding missing persons' or 'disaster rescue' were found to have the highest levels of support, both being at 71% (see Figure 3.2).

Figure 3.2: Law enforcement applications



Data Source: Vision Critical 2014

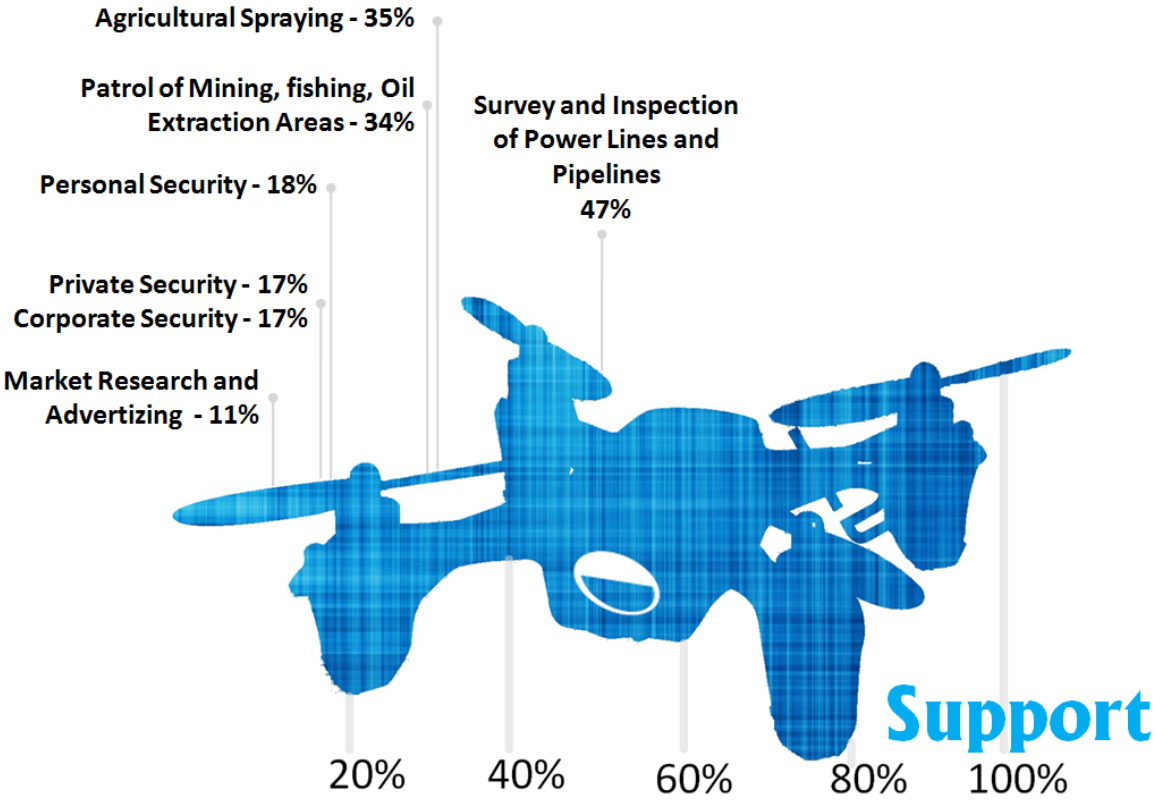
Where support waned and turned to opposition, however, was with the adoption of UAV technology for routine acts of policing, such as the 'issuing of tickets.' In addition, public support dropped significantly for UAV technology if it was to be adopted for tasks of individual identification, such as the identification of citizens at 'public events' or 'political demonstrations' – these applications receiving the lowest levels of support from those polled at only 20% and 22% respectively.

3.4.2 Industry and private companies

Private industry use of UAVs also found less support with the general public than the use of traditionally piloted aircraft. While there was significant variation in individual responses to UAV applications for the measured private sector purposes, no industry application found support within the majority of the polled population.

In general, a trend developed which showed greater support for industry and private sector company applications when UAV data collection was directed towards the oversight, maintenance, and management of private property, such as the inspection of oil pipelines (see Figure 3.3).

Figure 3.3: Private applications



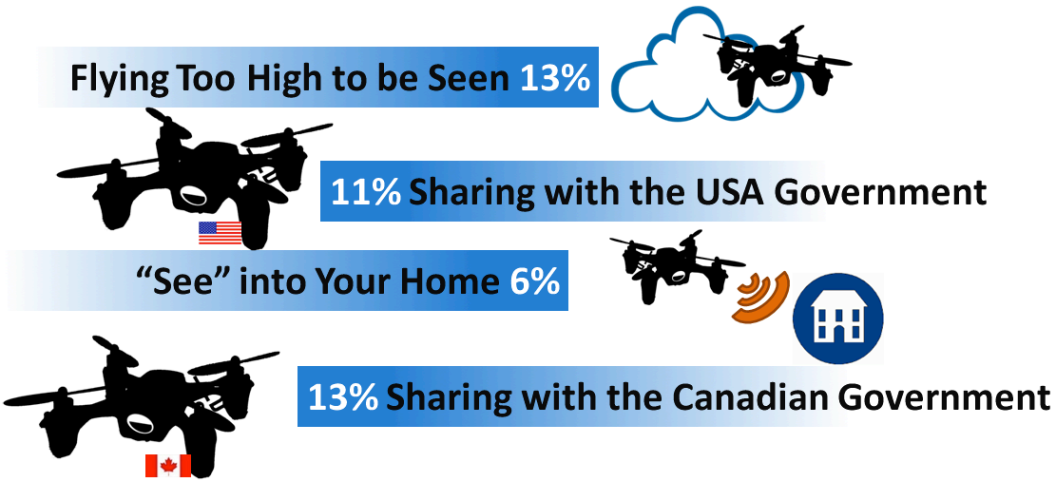
Data Source: Vision Critical 2014

In this sector, the industry and private company application of the 'survey and inspection of remote power lines and pipelines' received the greatest support from the polled population (47%), while 'agricultural surveying' was the next most supported application (35%). In both of these cases, the management of personal or private property was the target of the UAV data collection. It is important, however, to note that the support for these two applications also lag behind the similar application of traditionally piloted craft. The applications to receive the lowest levels of support were those in which an UAV was proposed to perform 'market research and advertising' (11%), followed by 'private security purposes' (17%). Here a second trend emerges in Canadian public opinion regarding UAV use by industry and private companies, demonstrating the loss of support for applications, which push the target of the UAV application outside of a corporation or individual's private property, and into public spaces.

3.5 Data sharing and visibility

Several questions were included within the survey in order to develop an understanding of public support (in Canada) for the sharing of collected UAV data and the importance of the visibility of the aircraft to individuals on the ground. Overall, this study found that Canadians are not in support of their information being shared with governments, nor do they support the use of craft that can collect data while flying too high to be seen (see Figure 3.4).

Figure 3.4: Data sharing and visibility (numbers indicate support for associated scenario)



Data Source: Vision Critical 2014

In particular, only 13% of the polled population reported being in support of all UAV data being shared with the Canadian government, while this number dropped further, to only 11%, when the question involved the sharing of such data with the government of the United States.

The capabilities of the technologies employed by UAVs also affect public support, such as the capacity to collect data from a height at which the UAV could not be seen from the ground. The Canadian Forces Experimentation Centre reported in 2003 that it was not only possible to collect data from a height at which the UAV could not be seen form the ground, but that they had successfully photographed and identified protesters from a height of 12,000 feet during the G8 Summit in Kananaskis as part of Operation GRIZZLY.[112] This report also noted that this capacity of the UAV deployed would be extended to 50,000 feet in the subsequent camera model.[113] At this height, the craft would not be readily visible to people on the ground, and only 13% of those polled were in support of allowing UAV to collect data under these conditions. With regard to the collection of data from people's homes, it was reported that in 2013 it was reported that the city police of Halton, Ontario, had initiated a UAV surveillance program which used heat sensing cameras to locate

[112]Canadian Forces Experimentation Centre (2003): 138-140.
[113]Canadian Forces Experimentation Centre (2003): 140.

potential marijuana growing operations.[114] When polled, only 6% of Canadians were in support of enabling UAV technologies to 'see' into their homes using these types of infrared sensors – demonstrating a considerable lack of support for the use of both of these types of technologies within a Canadian context.

3.6 Conclusions on public opinion

As the survey data shows, the interviewed stakeholders were correct in saying that many Canadians currently lack an accurate awareness of UAV operation, applications, and capabilities in Canada today. The opinion that is held by many of the interviewed stakeholders regarding the negative and undifferentiated nature of public opinion regarding the use of UAVs in Canada is, however, misplaced. The overwhelming outcome of this survey data is that, for the Canadian public, the intended use of an UAV matters, and who is using the UAV matters as well. As opposed to the blanket negative opinion suggested by industry stakeholders, the data from this study demonstrates that Canadian public opinion regarding UAV use is highly nuanced, where support exists for specific applications and groups, but not for others. Although public opinion is highly case specific, there are some generalizations that can be made from the survey data.

In every area of awareness and support, the use of UAVs rather than piloted craft, changed public opinion about information collection. In nearly every category, support is lower when an UAV is deployed. The implications of this are that if an institution or organization starts using an UAV for routine practices, activities that the public formerly deemed acceptable are now seen as unacceptable if an UAV is used. Generally speaking, the data shows that private sector use of UAVs lack support, especially regarding security focused applications rather than aerial surveying-type applications. This indicates that individuals want their property and privacy rights to be protected when UAVs operate in the airspace above, at both a personal and private level. Visibility was also shown to be important for individuals, as they do not wish to be viewed by UAVs that they cannot see, or have data collected about them while in spaces they deem to be private, such as their homes. Transparency is an issue as well, as individuals want to know what, when and where they are being surveilled, and they also oppose data sharing with foreign governments. UAVs have the capabilities to do all of these things and with such low levels of support from the public, these matters should be strongly considered when shaping policy on approved and future applications.

Overall, express following, targeting, and monitoring of individuals receives less support regardless of the vehicle used. As seen in section 3.3 regarding law enforcement usage and industry and private company applications, regulators should be cautious and specific about which applications they choose to approve for

[114]CBC News, "OPP testing Unmanned Flying Drones," 9 May (2013), http://www.cbc.ca/m/touch/news/story/1.1405733.

UAVs use in Canada. In general, support wanes whenever a UAV is deployed, and it should be stressed that public approval for the use of UAVs for applications such as 'search and rescue' does not equate to blanket public approval for all law enforcement agency applications. While the Canadian public may not be aware of all of the currently approved applications of UAVs, there are some very clear distinctions between what they are and are not in support of, and this should be taken into consideration in the development of future legislation, policy, and regulation.

4.0 Drones and Privacy: How drone development challenges existing regulations and law and what are the key questions confronting us

This section will examine the surveillance ramifications of this manifold aerial technology and more clearly draw out the associated privacy implications in domestic deployments of UAVs. First, keeping in mind the distinct the attributes of UAVs, in terms of their size, modes of technologically facilitated surveillance, and the current applications that UAVs are being used for which were discussed in section one of this report, the following section discusses the surveillance ramifications and emerging privacy considerations surrounding the use of UAVs in domestic contexts. The final part of this section considers the regulatory landscape of UAV policy-development in Canada to show how the distinct attributes of UAV-driven data collection schemes run up against already existing legislation. Considering the emerging technology of UAVs in relation to the Privacy Act, but also, significantly, in relation to PIPEDA, introduces novel considerations for privacy regulators coming to terms with the increasing use of the technology, and particularly by those in the private sector.

4.1 Surveillance ramifications

Gathering benchmark data on individuals and groups within a normalized social environment carries a dual inflection as a surveillance practice. On the one hand, individuals and groups are targeted as a discrete focus for tracking by UAV-enhanced monitoring. On the other, however, the capture of the broader environment that such objects or targets are situated within inevitably occurs. Consequently, surveillance is made both highly specific *and* diffuse. Specific since the visualization technologies are trained on particular targets (who may or may not be aware they are being monitored), and diffuse since a large body of ambient data is simultaneously collected on otherwise innocent or 'non-deviant' groups, individuals, as well as a wide range of attributes situated within terrestrial environments. And often, terrestrial environments are the subject of surveillance as a data collection strategy that establishes a normalizing benchmark to determine acceptable risk thresholds between normal patterns and certain environments and to detect subsequent deviations from that environment. Detecting 'abnormal' deviations are intended to prompt further action by an organization, whether for crime control or traffic control.[115]

[115] Chris Parsons and Adam Molnar, "Watching Below: Dimensions of Surveillance-by-UAVs in Canada," Block G Privacy and Security Report (2013): 15 (hereafter referred to as "Watching Below").

Tensions between *pro-active* and *post-event* uses of UAV for surveillance also frame the debates about the intrusive use of UAVs in Canada.[116] At the 2012 Unmanned Aerial Systems Canada Conference, the national chair of the RCMP UAV working group on drones stated that UAVs were *not* for 'proactive surveillance—gathering info on subjects, crowds or riots,' 'grow operation searchers,' 'radar/Lidar,' nor are they to be 'weaponized.'[117] The RCMP insists that 'police use of UAVs for surveillance purposes is strongly discouraged by all stakeholders' and that operating UAV programs in Canada demands that 'public support…remain favourable.'[118] This statement indicates the extent to which the RCMP, at least publicly, communicates their use of UAVs as a public safety and/or forensics tool, and not as a surveillance technology that is used to target and collect intelligence on specific groups and individuals. Contrary to this public discourse, internal documents from the RCMP affirm a different position. For instance, RCMP documents note that 'stealth' has been identified as a positive attribute in a criteria designed for evaluating and contrasting the merits of various UAV technologies.[119] In addition, the RCMP has not provided any record of privacy impact assessments when they have been requested through access to information legislation. Targeted surveillance however, continues to be of operational interest by law enforcement in Canada. Recent uses of UAVs for targeted public-order surveillance by law enforcement in Canada involves Ontario Provincial Police (OPP) surveillance of a Tyendinaga Mohawk protest on First Nations Territory in early 2014.[120]

Mass data collection afforded through the persistent data capture capabilities of UAVs can both target and track specific individuals and groups, but also collect a wealth of 'ambient' information across a wide range of terrestrial environments, including the people, objects, and behaviours that are occurring within them.[121] Such mass collection possibilities indicate that UAVs are also likely to be integrated into public-private 'smart-city' arrangements. The collection of large swathes of data by UAVs will also help public and private organizations constitute and analyze patterns of 'normality,' to detect when deviations from normal patterns occur as a means to further direct resources.[122] However, in addition to the data-driven algorithmic implications of drone surveillance, the potential to recognize familial, political, professional, religious, and sexual associations, as well as potential health ailments are also a significant ramification of surveillance by UAVs.[123] These

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[116] "Watching Below": 14.
[117] Dave Jewers, "Unmanned Aerial Systems (UAS): Operational Feasibility within the Lower Mainland District," RCMP Policy Report, November (2010).
[118] Ibid.
[119] Dave Domoney, "F Div UAV Project: Collision Reconstruction Program Handout Material,' RCMP, Presentation (2012).
[120] J. Bowman, "Ontario police defend use of drones over protests," *CBC News*, March 5 (2014), http://www.cbc.ca/newsblogs/yourcommunity/2014/03/ontario-police-defend-use-of-drone-cameras-over-protests.html.
[121] "Watching Below": 14-15.
[122] B. Schneier, "Surveillance by Algorithm," *Schneier on Security*, March 5 (2014), https://www.schneier.com/blog/archives/2014/03/surveillance_by.html.
[123] "Watching Below."

invasive characteristics of UAV surveillance remain salient in spite of Canadian authorities (and potentially private sector actors) defining their own use of the technology as a tool for public safety, or another organizational purpose, and not explicitly as an intrusive surveillance technology.

4.2 Privacy considerations

The manifold technological capabilities afforded through UAVs, and their associated surveillance ramifications, reach across both public and private sectors, therefore the privacy considerations are many. The use of UAVs aligns with the precepts of categorical suspicion and social sorting, which rely on conducting surveillance according to a range of organizationally defined classificatory criteria.[124] [125] In the context of how organizations define their use of UAV technology, three main privacy considerations emerge.

First, when focusing on the nature of UAV-specific surveillance a primary issue concerns whether the collected information relates to 'core' or 'extraneous' information about a given person.[126] Monitoring populations through UAV surveillance from aerial vantage points poses a challenge for determining exactly how much of a person's 'biographical core' is necessarily captured in the monitoring of populations, groups, and/or individuals, even when such individuals are situated within broader contexts. Most notably, what might be considered 'extraneous' to an individual is still 'core' to a community that the individual is (or has been) associated with.[127] Therefore, in uses of UAVs that rely upon justifications for situational awareness or 'non-targeted' mass surveillance operations, the capture of personal characteristics that relate to the temporary or long term associations in groups or communities raise serious concerns for association, speech, and further relates directly to the formation of public opinion concerning what is an appropriate intrusion by authorities or, an inappropriate 'over-collection' of information.

Related to this point is how public authorities and private organizations currently define their own uses of the technology. Law enforcement Agencies have already deployed terrestrial-based optical sensor-based surveillance systems (more specifically aerial public video surveillance from higher aerial vantage points such as on top of buildings), for *situational awareness* or other public safety purposes. These systems rely on mass surveillance as a public safety initiative, and are prone to capturing large amounts of environmental data. Because these programs are premised on the notion of public safety operations, law enforcement insists that any data that is captured is not revealing of a person's personal activities. This

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[124] Tyler Wall and Torin Mohahan, "Surveillance and violence from afar: The politics of drones and liminal security-scapes," *Theoretical Criminology* 15(3) (2011): 239-254.
[125] Kevin D. Haggerty and Richard V. Ericson, 'The New Politics of Surveillance and Visibility," in *The New Politics of Surveillance and Visibility*, edited by Kevin D. Haggerty and Richard V. Ericson (Toronto: University of Toronto Press, 2007): 2.
[126] "Watching Below."
[127] "Watching Below."

justification is intended to limit concerns about invasive surveillance. However, these same systems have been used in *operational* terms to capture, retain, and potentially share personally sensitive information.[128] As such, the language of 'situational awareness' or 'environmental monitoring' could be used as a policy shield by both the public and private sectors, which would obfuscate the relative ease of misuse of UAV technology at the operational level.[129] Similarly, many private sector organizations are also likely to adhere to the claim that UAVs are no different from a range of devices that are already in use which perform similar monitoring functions. For instance, the use of video-surveillance by private security organizations, or Google Street View for that matter, are comparable cases to anticipate future uses of UAVs in contexts where similar precedent are likely to be invoked in cases where UAV surveillance is involved.

Second, the notion of 'place' or the location where UAV-specific data collection occurs raises further privacy considerations. Location and boundaries of data collection are important since reasonable expectations of privacy often hinge on a community's acceptability of context or location where the monitoring takes place. The public survey data contained in this report raises early considerations about the boundaries and reasonableness of UAV surveillance.[130] However, as the proliferation of UAV technology continues, the potential for public acceptance of the technology could also grow, thereby reconditioning the legal benchmark of the 'reasonable expectation of privacy' as it relates to UAV applications.

Third, the particular capabilities of UAVs mean that most individuals will be unaware that their information is being captured. This attribute of UAV surveillance raises both legal considerations (bypass of consent and signage laws) and could also foster concerns from a public that becomes aware of their monitoring post facto. Overall, these surveillance ramifications and privacy considerations play out in novel ways in the context of the Canadian legal regulatory framework. A brief outline of these surveillance ramifications and privacy considerations—specific to the emerging technology of UAVs—under the Privacy Act and PIPEDA are included in the following section.

4.3 Governance and regulatory landscape

While civilian use of UAVs at the federal level is regulated by Transport Canada and the SFOC process, the Department of National Defense (DND) is excluded from civilian regulation of UAV use. The unrestricted use of domestic UAVs by the DND

[128] Rob Wipond, "Vancouver's closed-circuit TV public-surveillance system guidelines contradict privacy pledge," *Straight.com*, May 2 (2012), http://www.straight.com/news/vancouvers-closed-circuit-tv-public-surveillance-system-guidelines-contradict-privacy-pledge. See also: Adam Molnar, "In the shadow of the spectacle: Security and policing legacies of the Vancouver 2010 Olympics," Doctoral dissertation, University of Victoria (2014), and "Watching Below."
[129] Ibid.

presents opportunities to skirt domestic regulatory requirements. For instance, having the Canadian Forces engage in domestic surveillance operations, as they did during the G8 in Kananaskis, potentially excludes the DND from being subject to requirements under the Privacy Act. In addition, the use of the technology by DND organizations further opens the door for UAV-specific data collection to potentially occur outside the scope of the Privacy Act, and yet still also facilitate information-sharing arrangements premised on UAV-specific collection between the DND and other domestic public authorities.[131]

However, behind the safety-specific regulatory standards linger questions about data collection, use, and management. The transformations in aerial monitoring capabilities afforded by UAVs and the attendant privacy considerations run up against a range of existing privacy laws and data regulation instruments in Canada. In what follows, we briefly explore how UAVs intersect with currently existing privacy laws, both in terms of the Privacy Act, but also in relation to PIPEDA, to detail what is qualitatively different about the emergence of UAV surveillance in relation to these statutes.

4.4 The Canadian Privacy Act and UAV use

At the public level, the Privacy Act applies to approximately 250 departments, agencies and Crown corporations. The Act obliges government institutions to adhere to rules governing the collection, use, disclosure, retention, and disposal of any recorded information 'about an identifiable individual.'[132] Recalling discussions about the boundaries of UAV-specific data collection, and specifically the boundaries of what constitutes personally identifiable information in this practice, the key tension of UAV surveillance rests at the boundaries of what constitutes core biographical information, versus 'extraneous' information.

4.4.1 The role privacy impact assessments

A key requirement for Federal organizations' collection and handling of personal information under the Privacy Act are Privacy Impact Assessments (PIAs). PIAs must be completed by any Canadian government institution wishing to collect, amend, or alter the use of personal information for bureaucratic or administrative purposes.[133] Given the blurred boundaries about what constitutes 'core' biographical information in relation to 'extraneous' information regarding collection of data by UAVs public authorities are avoiding key elements of the Privacy Act. To date, PIAs have not been obtained by the RCMP for their UAV operations. When an access-to-information request was submitted to the RCMP to disclose PIAs

[131] Adam Molnar, "Drones Need Privacy Rules," *The Ottawa Ciitzen*, OpEd, April 8 (2014), http://www.ottawacitizen.com/opinion/op-ed/Canada+needs+privacy+rules+drones/9710176/story.html.
[132] *Privacy Act*, RSC 1985, c. P-21, http://laws-lois.justice.gc.ca/eng/acts/P-21/.
[133] *Privacy Act*, RSC 1985, c. P-21 at s 8(2)(f).

regarding any of their UAV operations, no records were found or provided. This indicates that public authorities are considering the collection of data from (mini-size) UAVs to *not* constitute collection of personally identifiable information, a categorical trend that could similarly be pursued by private sector organizations. This establishes a disconcerting precedent that potentially allows Federal authorities to avoid the identification of privacy issues associated with UAV use, which altogether sidesteps the limitation of any privacy risks therein.

4.4.2 The courts

While the Supreme Court of Canada has identified privacy as 'an essential component of what it means to be free' and has further established the Privacy Act of Canada as a quasi-constitutional document, court rulings are still significant for guiding interpretations of the Privacy Act and associated Charter issues. Supreme Court ruling *R v Tessling* exists as the most significant guide from the Court regarding aerial surveillance. In this ruling, a key 'place-based' boundary issue that relates to the Privacy Act and Charter has been addressed. In *Tessling*, the Supreme Court 'examined the constitutionality of the police conducting warrantless searches of private dwelling houses using infra red technology during the course of criminal investigations.'[134] The Court ruled that any heat escaping from the defendant's home, which was detected by aerial surveillance, was meaningless and did not reveal core biographical details. The defendant therefore had no reasonable expectation of privacy concerning the heat emanations that were captured from public space outside of the home. What is central to this ruling however, is that the detectable heat emanations were not revealing of the defendant' private life, and therefore did not disclose personal or core biographical detail. As such, the search did not affect the dignity, integrity, and autonomy of the individual, and therefore, no unwarranted search occurred.[135] [136] As a result of this ruling, it is clear that UAVs that surveil more detailed personal information than heat emanations will constitute a government search for constitutional purposes. For example, an UAV that scans an individual's backyard and records a person's activities would constitute a search that is subject to Charter protections under the Constitution. UAV searches have potentially far more intrusive aspects than the RCMP's use of Forward Looking Infra-Red Radar in the Tessling case.

4.4.3 Lawful access disclosures

Exceptions in the Privacy Act on lawful access disclosure do exist and this is particularly relevant for UAV surveillance. Section 8(2)(c) extends authority to an institution head to disclose information without consent in compliance with a court

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[134] Canadian Civil Liberties Association, "R. V. Tessling: Police Searches with Infra-red Cameras," *Canadian Civil Liberties Association.* March 24 (2004), http://ccla.org/2004/03/24/r-v-tessling-police-searches-with-infra-red-camras/.
[135] *R v. Tessling*. (2004). SCC 67 at 55.
[136] "Watching Below": 24.

ordered subpoena or warrant.[137] If personal information is lawfully collected, meaning it directly relates to a government program, then Section 8 of the Privacy Act reveals that there is very little to prevent the government as an entity from utilizing this information at their sole discretion, for any purpose they deem legitimate including, but not limited to, the sharing of this information internationally.

4.5 PIPEDA and UAV surveillance

Private organizations using UAVs for commercial purposes are regulated by the Personal Information Protection Electronic Documents Act (PIPEDA). PIPEDA was designed to provide a check against how new technologies are increasingly impinging on the privacy of Canadians. Section 3 of PIPEDA, in particular, sets forth a purpose 'to establish, in an era in which technology increasingly facilitates the circulation and exchange of information, rules to govern the collection, use and disclosure of personal information…'[138]

PIPEDA applies to private sector organizations with respect to personal information that an organization 'collects, uses or discloses in the course of its commercial activities.'[139] Similar to the Privacy Act, the term 'personal information' is broadly defined in subsection 2(1) as 'information about an identifiable individual.' In this definition resides the most significant tension concerning UAVs as an emerging technology in relation to PIPEDA requirements. However, as an emerging (and manifold) technology with diverse applications, UAV surveillance has the capacity to redraw complex privacy issues in the relation to PIPEDA on many fronts.

The following section outlines key themes in PIPEDA rulings that run up against the surveillance and privacy attributes of UAV technologies. Chiefly, these trends include tensions in the definition of personal information, the authority of appropriate collection of data in surveillance-specific circumstances, and the scope of limits placed on the collection of certain types of information.

4.5.1 PIPEDA, UAV surveillance, and the boundaries of 'personal information'

In the context of UAS systems and their associated privacy considerations, the boundary of what constitutes personally identified information varies with the capabilities and application of the technology. The persistent collection of aerial data by UAVs may not specifically always collect core biographical information about an individual, but could contribute toward circumstances where information that is collected makes it possible to identify an individual. The Federal Court's definition of identifiable information as:

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[137] *Privacy Act*, RSC 1985, c. P-21 at s 8(2)(c).
[138] PIPEDA as s 3(1).
[139] Personal Information Protection and Electronic Documents Protection (PIPEDA) Act (S.C. 2000, c. 5).

> Information will be about an identifiable individual where there is a serious possibility that an individual could be identified through the use of that information, alone or in combination with other available information.[140]

In relation to this ruling, UAV surveillance can meet the definition of personal information since an individual can still be 'identifiable' or be 'capable of being identified,' particularly if data collected by UAV surveillance is amalgamated with other forms of data.[141] One conceivable example could involve the ongoing tracking of vehicular movements with persistent UAV video-surveillance that, over time, can reveal core characteristics about an individual as other address information or geo-locational information can be traced back to that person.

4.5.2 PIPEDA, UAV surveillance, and the appropriateness of collection

The surveillance ramifications of UAV technologies are also likely to hinge on definitions of appropriate purposes in the collection of data by private organizations. Subsection 5(3) of PIPEDA establishes the ground rules for organizations to collect, use, or disclose personal information 'only for purposes that a reasonable person would consider are appropriate in the circumstances.'[142] In addition to this requirement, consent must be sought. The relative 'invisibility' of UAV specific surveillance means that acquiring consent prior to the collection of personal information or personally identifiable information is a difficult task.

Instances where consent can be waived do exist, but only in limited circumstances. Exemptions to consent are predominantly awarded to organizations that are conducting surveillance in crime control operations. Notably, even if an organization is able to demonstrate that their use of UAV surveillance is allowable without consent, they must still prove that their data collection by UAV passes a reasonableness test. That is, under PIPEDA, that resorting to UAV surveillance without consent must still be considered reasonably appropriate under the circumstances within the meaning of subsection 5(3).

However, in addition to these requirements, if UAVs are to be used by the private sector for security and surveillance purposes, they must demonstrate that a reasonable person would find such surveillance to be appropriate in the circumstances. Determining appropriateness has found precedence through a four part legal test under section 5(3) of PIPEDA, which could find further application in the context of UAV operations.[143]

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[140] *Gordon v. Canada (Health),* (2008 FC 258 (CanLII), http://www.canlii.org/en/ca/fct/doc/2008/2008fc258/2008fc258.html.
[141] PIPEDA Case Summary #349, *supra* note 9.
[142] Personal Information Protection and Electronic Documents Protection (PIPEDA) Act (S.C. 2000, c. 5(3)).
[143] Office of the Privacy Commissioner of Canada, "PIPEDA: Leading by Example," OPC Guidance Document (2008), https://www.priv.gc.ca/information/pub/lbe_080523_e.asp.

Further, under PIPEDA, the OPC has created guidelines to regulate 'overt' video surveillance of the public by private sector actors, which carries some comparable insights when applied to UAV surveillance. While the 'covert' use of UAVs by private investigators for a range of organizations is a distinct possibility as a use of UAV technology, reviewing the guidelines for overt video surveillance in the private sector are revealing. Difficulties persist in making UAVs an explicitly 'overt' technology given their relative imperceptibility from the ground.

The guidelines for video surveillance in the private sector are instructive to review as a backdrop to UAV-specific surveillance capabilities.[144] When these guidelines are compared to UAV-specific video surveillance, a number of clearly transferable applications emerge, but the comparison also raises a number of challenges. For example, placing limitations on use and viewing range of mobile UAV technology with highly advanced sensors could prove difficult. In addition, PIPEDA mandates that the collection, use, and disclosure of personal information be premised on consent by the individual (Principle 4.3). Given the mobile and aerial nature of the technology, obtaining consent for the collection, use, and disclosure of personal information acquired through UAV technologies that operate over dynamic terrestrial environments could prove near impossible. Notifying the public that they might be subject to UAV surveillance could be difficult if not near impossible for the same reasons. And finally, establishing clear access and disclosure policies surrounding UAV data collection with the public could be challenging.

4.5.3 PIPEDA, UAV surveillance, and the problem of over-collection

PIPEDA also places limits on an organizations' collection and use of personal data. For instance, organizations must limit the collection of personal information in strict accordance with the purposes of the collection as identified by the organization (Principle 4.4). Given the broad range of surveillance functions that UAVs can perform, the prospect of manifold use of the technology could lead to non-compliance with Principle 4.4. In addition, as a check on over-collection, PIPEDA guards against the indiscriminate collection of information, also under Principle 4.4. Again, given the broad spatial expanses that UAVs can cover, in addition to the range

[144] Video Surveillance guidelines insist that private sector companies are responsible to: Determine whether a less-privacy invasive alternative to video surveillance would meet the needs of the organization; Establish a clear business reason for conducting video surveillance and use video surveillance only for that reason; Develop policy on the use of video surveillance; Limit the use and viewing range of cameras as much as possible; Inform the public that video surveillance is taking place; Store any recorded images in a secure location, with limited access, and destroy them when they are no longer required for business purposes; Be ready to answer questions from the public. Individuals have the right to know who is watching them and why, what information is being captured, and what is being done with recorded images; Give individuals access to information about themselves. This includes video images; Educate camera operators on the obligation to protect the privacy of individuals; Periodically evaluate the need for surveillance.

of technologies that can be affixed to the vehicles, the potential for indiscriminate collection is a significant possibility. Given these general checks on the amount and type of information that can be collected, the application to collection of data by UAVs raises some notable concerns. And finally, exceptions to consent and disclosure of data by organizations to third-party actors does exist in section 7 of PIPEDA. The most notable of these exceptions are lawful access provisions, and while there is no currently existing evidence that law enforcement is interested in private sector data acquired through UAV operations, the potential exists.

4.5.4 Difficulties in enforcing PIPEDA

It is not difficult to envision a scenario where an individual is unaware that personal information is extracted or derived from their 'personal self,' a community of association, and / or that such information is being recorded by an UAV. This presents a problem for enforcement since the enforcement provisions under PIPEDA rely on an individual to file a complaint and seek recourse in order to claim their rights under the legislation. In addition, an individual may encounter issues when requesting access to information about oneself that is held by an organization, especially in cases where access to the records containing personal information may reveal the nature of a third party organization.[145]

4.6 Conclusion

Both the Privacy Act and PIPEDA, while designed to provide a check against how emerging technologies might impinge on the privacy of Canadians, face a challenging (and increasingly familiar) circumstance when it comes to determining the scope and legitimacy regarding the collection of personal (or personally identifiable) information by UAVs. Similar to the use of surveillance technologies in other aspects (such as deep packet inspection), tensions persist regarding whether the capture of data by UAV surveillance constitutes a collection of 'core' biographical detail or otherwise 'extraneous' information.

However, what remains 'extraneous' to a particular individual could still translate into information that itself leads to 'personal identification.' Further, what might be considered 'extraneous' information captured by public or private organizations could still remain as a 'core' identifier to a community that the individual is (or has been) associated with, raising concerns for association, speech, and the potential for inappropriate 'over-collection' through UAV-specific surveillance.

Currently, public authorities such as the RCMP have exempt themselves from mandated requirements under the Privacy Act, instead preferring to interpret their use of the technology as a public safety tool that does not involve the capture of personal information. This avoidance of robust privacy assessment associated with

[145] PIPEDA at s 9(1).

UAV use deserves further consideration as to whether, and how, both public and private uses of UAVs meet the definitional requirements of the collection of personal or personally identifiable information to ensure that this trend is not being used to evade robust privacy oversight.

5.0 What to do next: Findings and questions to be addressed as the use of drones expands in Canada

This report examines a number of aspects of UAS use in Canada, primarily in relation to the private sector. We say 'primarily' because in many ways the lines are blurred between public and private use. Also, what applies in one area should also be considered for the other because the critical issues are so similar. The report welcomes many aspects of UAS use in Canada, recognizing their public benefit and their contribution to the common good, generally conceived. But the point of the study is to consider UAS applications that are intended to collect personal data of any kind, or to do so inadvertently. This is why we examine UAS use in Canada from the perspective of privacy and civil liberties – of human dignity and democratic practice – and thus, necessarily, the main focus is on areas where there is uncertainty, controversy, or shared concern about what people commonly call drones.

UASs have a long and distinguished history in Canada and there is every reason that the Canadian reputation for designing, manufacturing and using such vehicles would be enhanced through maintaining ongoing awareness of ethical and legal requirements expressed within regulation, compliance and agreed best practices. Given the international respect Canada has earned for upholding of human rights and civil liberties and for developing robust regimes for privacy protection it would seem appropriate that UASs would be developed here in ways that recognize from the beginning the need for appropriate rules that would govern their use. In the final recommendations that follow, therefore, some important proposals are made as to what are the key areas of concern and how they might be addressed. Dialogue between all parties concerned is vital if these recommendations are to be developed in a way that would genuinely make a difference.

5.1 Legislation

Focused legislation is necessary to address the unique privacy concerns raised by UAVs but complimenting existing regulations (such as PIPEDA). Legislation:

- Should be developed in collaboration with multiple stakeholders such as Transport Canada, UAV advocates/ industry and interested academics.

- Should acknowledge the varied forms UAVs take and, thereby, their different functions - some of which impact privacy concerns very little (i.e., not all UAVs should necessarily be governed by the same legislation and regulations).

5.2 Representation

Tasks for the Office of the Privacy Commissioner of Canada should be focused on increasing representation of various stakeholders and communities in developing more appropriate and comprehensive legislation for UAVs in Canada. Some suggestions are as follows:

- UAV Working Groups (such as those of Transport Canada and the RCMP) should include representatives from the OPC at a minimum, and preferably also representatives from civil liberties groups as well as academics who investigate the field.

- Current regulation standards for UAVs should include mandatory Privacy Impact Assessments and acknowledge an adherence to PIPEDA.

- The OPC should engage with current UAV Working Groups and the UAV industry association of Unmanned Systems Canada to engage in public consultation. There is a lack of knowledge that exists in the general public regarding the uses of UAVs in Canada. This is a barrier for the industry as noted in our interviews, and prevents the public from seeing the positive applications of UAVs. In association with the various stakeholders and communities, we suggest that the OPC launch a public engagement strategy through civil lotteries and citizen reference panels. This type of consultation will be beneficial to all parties and will work to juggle changing political contexts, fiscal constraints, and the competing interests of stakeholders and communities.

- The OPC should investigate the UAV Working Group as a lobbyist. Whereas Transport Canada's mandate is for safety, the UAV Working Group is primarily composed of private sector stakeholders and works to make connections with various government associations to spread the acceptance and application of UAVs in Canada. There are vast repercussions for citizens if they are not considered in this time of rapid proliferation.

5.3 Data collection and retention

- There needs to be an acknowledgment that not all types of data collected by UAVs yield the same sorts of privacy concerns.

- Data management and data creep with regards to UAVs need to be considered as central upcoming concerns for privacy. For example: how will concerns over the 'persistence' of UAV usage and information collection directly influence privacy concerns? How will distinctions be made between core data and extraneous data?

5.4 Accessibility and complaints

- Limitations in accessing UAV flight data through ATIP and FOIs due to proprietary information should be reviewed.

- An individual is required to submit a written request with the organization in question in order to access any of their personal information held by the organization. The individual may even be required to pay the cost for accessing the information (PIPEDA at section 8). In addition, access to information is prohibited when the record in question implicates or includes personal information about a third party (PIPEDA at section 9(1)). Since UAVs can collect personal information on many individuals on one record, it may be difficult for an individual to make a successful request for information.

- Transport Canada should be required to create an openly accessible electronic record of all UAV flights with approved SFOCs. This would be similar to flight data of manned aerial vehicles.

5.5 Enforcement

- A major issue pertaining to UAVs and privacy law is enforcement. Specifically, an individual may not be aware or may find it difficult to ascertain if their personal biographical, information and / or personal information has or is being recorded by a UAV in a surreptitious or covert manner. This poses a conundrum as enforcement provisions under PIPEDA can be construed as 'lax.' PIPEDA places the onus on the individual to demonstrate that someone has committed an action afoul or contrary to PIPEDA.

- Further, there is a general issue but one still relevant; 'line of sight' is becoming less of an issue with automated sensor-guiding drones and with improvements in this specific technology.

5.6 Future UAV regulation

In relation to UAV usage, regulation under PIPEDA may not be ideal. UAV usage is covert and a framework that places the onus on an observed individual to complain before action is taken may not be effective. Since UAV usage can go unnoticed, PIPEDA should hold companies to a higher threshold of accountability. Companies ought to be required to demonstrate that they, in reality, are not only demonstrating but also actively complying with PIPEDA provisions without having complaints lodged against them from individuals or the Privacy Commissioner.

Recommendations:

- Create a National Panel consisting of Privacy lawyers, representatives from the Surveillance community in Canada, a professor of Privacy law or Internet law that would quickly set up guidelines (and preside over proceedings) for UAVS on the basis of:
    - Context
    - Information gathered and the manner in which it was gathered.
    - Information, once extracted, must be vetted before a company sifts through it, and if it in any way captures individuals or individuals in their place of dwelling, the information must be made, at the very least, blurred and / or removed. Confirmation of this would be sent to the individual and the Privacy Commissioner notifying the individual that these steps took place.
    - Each organization must encrypt or use secure band spectrum wavelength for transmitting information and must be made accessible to the Privacy Commissioner.
    - Create strict rules of compliance with large fines.
    - Currently there are issues with the Privacy Act. UAV usage can collect vast amounts of data and information. A flight that is used to collect information for one specified and explicit purpose may have other uses as well. Section 8 of the Privacy Act allows greater breadth as to the threshold and high degree of disclosure between government institutions. This disclosure can result in UAV data being circulated to various government departments including foreign government. A recommendation would be to create additional robust regulation (for the Privacy Act) that controls UAV data flows in order to prevent excessive or greater than needed personal information traveling between governments.

5.7 Concluding statements

Our main conclusion, bearing in mind our discussions with persons associated with USC, the findings from public opinion, consideration of the current regulatory framework and past experiences of technological innovation, is that much more meaningful dialogue is required between all parties. The USC community is right to think that public misperceptions exist due to the association of 'drones' with remote assassinations and attacks, usually by American forces overseas. They are also correct in thinking that the public is under-informed about UAS uses in Canada and

that if the public understood better some of the search-and-rescue, wildlife conservation or even recreational photography and filming uses of UASs then the more negative perceptions would at least be balanced with more positive ones.

At the same time, the impression gained from some promoters of UASs is that concerns about 'privacy' and civil liberties are a distraction from the real issues of developing applications and finding markets for them. Yet given the advertising claims and the actual policing and security uses of UASs which may have public and private sector aspects, it is clear that such issues have to be confronted from the outset. The potential harms to individuals and groups from privacy breaches and the possible damage to democratic participation are too significant to be left until UASs are in routine use in areas such as crowd control or monitoring protests. This will become increasingly the case as other kinds of capabilities, such as video analytics, are added in the future.

Glossary

ALPR – Automated-License Plate Recognition

ATIP – Access to Information and Privacy

AUVSI-Canada – Association for Unmanned Vehicle Systems International

CARs – Canadian Aviation Regulation

CF – Canadian Forces

CL – series of UAVs that dominated the early Canadian UAV development and manufacturing market of the 1960s and 1970s.

Drone – aircraft that operate without an internal pilot, usually by remote operation through wireless signals. See also UAV.

FAA – Federal Aviation Administration, United States

FLIR – Forward Looking Infrared Radar

FOI – Freedom of Information

IC – Industry Canada

ISR – Intelligence, Surveillance and Reconnaissance

Lawful access – the lawful search and seizure of information and communication data with legal authority, such as a warrant or an authorization to intercept private communications, issued by a judge under specific circumstances.

LIDAR – Light Detection and Ranging

Micro and Mini UAVs – used for low-altitude flights and designed to operate in more densely populated areas, able to operate in tighter quarters and areas that are sometimes difficult for humans to operate within.

NEO – Network Enabled Operations

Payload – the carrying capacity of an aircraft or launch vehicle measured by weight.

PIA – Privacy Impact Assessment

PIPEDA – Personal Information Protection and Electronic Documents Act

Privacy Act - took effect on July 1, 1983. This Act imposes obligations on some 250 federal government departments and agencies to respect privacy rights by limiting the collection, use and disclosure of personal information. The *Privacy Act* also gives individuals the right to access and request correction of personal information about themselves held by these federal government organizations.

OPP – Ontario Provincial Police

RCMP – Royal Canadian Mounted Police

RPAS – Remotely Piloted Aircraft Systems

SFOC – Special Flight Operation Certificate

Strategic UAV – the largest UAV, refers to *large fixed-wing aircraft* that often reach altitudes of approximately 20,000 metres.

SUAS – Small Unmanned Aircraft System

Tactical UAV – fixed-wing aircraft, slightly smaller in size than strategic UAVs, weighing up to 1,500 kilograms.

TC – Transport Canada

UAS – Unmanned Aerial System, operate in wider technical networks and data management practices.

Unmanned Aerial Systems Canada Conference

UAV – Unmanned Aerial Vehicle – aircraft that operate without an internal pilot, usually by remote operation through wireless signals. See also drone.

UAV Working Group

USC – Unmanned Systems Canada

UVS – Unmanned Vehicle System – UAVs are recognized as a subset of these by military terminology.

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