Drone Journalism: Newsgathering applications of Unmanned Aerial Vehicles (UAVs) in covering conflict, civil unrest and disaster.

Introductory Paper – January 2014

By Mark Corcoran
International Correspondent – Australian Broadcasting Corporation

Author's Note

This introductory report focuses on the potential use of unmanned aircraft technology on hazardous news gathering assignments, classed in three broad categories;

A. **Major conflict**; the military 'embed' and the implications of deploying media drones over civil communities during conflict.
B. **Civil unrest.** 'Drone journalism' in a hostile urban environment.
C. Disaster coverage. Floods, fires, earthquakes, where a small 'eye in the sky' can make a difference.

This is not a complex policy or technical document, but an introductory paper written as a primer for media executives, correspondents and news production teams. This paper does not specifically examine the complex range of domestic safety and privacy issues that need to be resolved before 'drone journalism' can become a reality within Australia. These issues are being explored by the author in another study, for inclusion in a research degree thesis at the University of Technology, Sydney.

The report features expert analysis from Michael Cox, formerly a senior ABC-TV cameraman with extensive conflict newsgathering experience and now ABC-TV Acting Production Resources Manager NSW, responsible for the assessment and acquisition of new newsgathering technology and; retired Lieutenant Colonel Philip Swinsburg, who was instrumental in the introduction of the small 'tactical UAV' surveillance capability for the Australian Defence Force in Iraq and Afghanistan and now works in the commercial sector as managing director of Unmanned Systems Australia.

The paper also draws on research from *'Remotely Piloted Aircraft Systems and Journalism'*, Oxford University, June 2013, a report co-authored with Dr David Goldberg and Professor Robert Picard, Reuters Institute for the Study of Journalism, Department of Politics and International Relations, Oxford University (Goldberg, Corcoran & Picard 2013).

Also included are the author's personal observations from 15 years working as a reporter and producer for ABC-TV's *Foreign Correspondent* program in numerous conflict and disaster zones (ABC 2013b).

Introduction

There's nothing quite like the sensation of being stalked by a drone. Real or imagined, it's a very personal experience.

The author's first drone or Unmanned Aerial Vehicle (UAV) encounter came amid the bomb-ravaged apartment blocks of south Beirut in 2006 while reporting for ABC-TV Australia's *Foreign Correspondent* program. Israel and Hezbollah were locked in a 34 day war and Israeli military drones were an omnipresent force over Lebanon, with 20 UAVs in the skies at any one time (Lambeth 2011). From an unseen point high in the sky emanated a faint, distant whine: part lawnmower, part chainsaw. There was a hint of panic as the otherwise disciplined Hezbollah gunmen; our escorts as we filmed the rubble of their South Beirut stronghold, suddenly vanished, leaving us alone and very exposed. Even without firing a shot, the drone is the perfect weapon of intimidation.

The Israeli fixed-wing UAV above us that day carried no weapons, but high-resolution cameras and sensors, hunting targets for fighter aircraft flying circuits out above the Mediterranean Sea, sitting on a deadly, supersonic cab rank. I imagined a bored young Israeli soldier of the PlayStation generation slumped over a console in a darkened corner hundreds of kilometres away, peering into the pixelated image of the live feed, determining if we were carrying cameras or missile launchers. Were we to be obliterated or ignored? Thankfully the latter. The all-seeing drone buzzed off, the militiamen reappeared, and we got on with our job. Hezbollah officials boasted that they too had drones; a claim confirmed when Israel shot down two Iranian-supplied UAVs during the war, while a third crashed in Lebanon. This was the first time in history a non-state entity had launched drones in a conflict. Another highly relevant precedent had been set a year earlier in April 2005, when a Hezbollah UAV successfully penetrated Israeli airspace and returned with on-board video of the mission, which was subsequently posted on a Hezbollah website (Shadid 2006).

Standing in the rubble-strewn Beirut street I had a Eureka moment, that with the benefit of several years hindsight, now appears blindingly obvious: If combatants were able to deploy these 'eyes in the sky', could media adopt this technology for news gathering, both improving the coverage and lowering our exposure to risk in a chaotic, highly dangerous environment? The answer in 2006 was no. The cost of drones designed for military use was prohibitive and their large size and complexity made them impractical for media teams to deploy on assignments such as the Israel/Hezbollah War. But seven years on, the concept of drone journalism in hostile environments is finally taking off (Corcoran 2012b).

The Research Questions

The controversial deployment of drones as a new form of remote warfare has been extensively analysed, but what of the concept of journalists deploying the technology on high-risk assignments such as wars, civil unrest and natural disasters? Can drones be deployed by journalists to supplement newsgathering where ground-based access is deemed too hazardous? Is the small drone suitable for use as a safety or reconnaissance tool by news teams operating in high-threat environments such as Afghanistan? Can journalists exploit the technology as soldiers do, to scout ahead for insurgents planting improvised explosive devices or provide warning of imminent attack? What potential cultural and privacy issues are raised by media drone operations in such an environment? What are the potential benefits of deploying a drone for disaster coverage?

'The use of aerial platforms for newsgathering is not new. In the 19th century intrepid correspondents and photographers ascended in hot air balloons to cover the American Civil War and other major events. In the mid-20th century media organisations began using fixed wing aircraft and later helicopters to cover wars, fires, protests, and a myriad of other high risk assignments' (Goldberg, Corcoran & Picard 2013).

Deploying drones for newsgathering during conflict is a complex and difficult proposition, but one that demands thorough examination given the increasing numbers of media workers killed and injured covering conflict.

According to the International Federation of Journalists (IFJ), in the past 20 years more than 2,000 journalists and media staff were killed in the line of duty. In 2012, 121 workers from all sectors of the media industry lost their lives in violent incidents; 33 Syrian and international media were killed covering Syria's civil war. 18 died in Somalia, 10 in Pakistan (IFJ 2013b).

Background - International

Unmanned Aerial Vehicles (UAVs) or drones will soon be an increasingly common sight in our skies and become an indispensable item in the news crews' road case or the freelancer's backpack. Journalists have been among the pioneers of civilian adaptation of this technology which offers many compelling advantages for news gathering; however the introduction of drone journalism must be carefully balanced with the critical issues of air safety and privacy. Government regulators in Australia, the US and elsewhere continue to wrestle with the complexities of controlling the technology. In the US, several deadlines on progress for the greater integration of UAVs in civil airspace have been missed. The take home message: It is much harder than it looks.

So, why has the concept of 'drone journalism' emerged now? Two key factors have converged to drive the domestic drone boom;

As the United States wound down its ground based interventions in Iraq and Afghanistan spending on military drone projects has been reduced. 'American aerospace manufacturers, who exclusively supplied drones to the US military responded to these cutbacks by working to create a lucrative new civilian market' (Chiles 2013; Goldberg, Corcoran & Picard 2013) .

In 2012, the US Congress responded to UAV industry lobbying by overturning a domestic ban on civil and commercial UAVs, directing the Federal Aviation Administration to develop a plan to integrate civil drones in the national airspace by 2015. The FAA estimated 30,000

civil and commercial UAVs could be flying by 2030 (FAA 2010). In March 2013, AUVSI forecast a combined military/civil global UAV market of US$140 billion, generated over ten years (AUVSI brief, Melbourne February 2013).

'How the United States manages its domestic drone roll out is highly relevant to the rest of the world as the US aerospace industry dominates the sector, generating two thirds of global production and development. Manufacturers in Europe, China and many other countries have introduced remotely piloted aircraft of their own to compete for shares of the civilian market.

While the Americans and 'Europeans offered a highly engineered product for the emerging media market, it is China with its vast manufacturing base, cheap labour and economies of scale that has the potential to dominate this sector. In 2013 many small Chinese UAVs already (sold) for about 25-50% of the price of European and American competitors, although there was intense debate over the quality of the Chinese product' (Goldberg, Corcoran & Picard 2013).

These classic market-driven policies have converged with another factor, the rise of cheap, highly capable consumer electronics, championed by those now seeking to 'democratise technology'.

'The suits of corporate America now find themselves sharing airspace with the jeans and t-shirts of the 'personal drone' movement. Chris Anderson is a self-declared 'drone evangelist'. A physicist-turned-journalist, Anderson was Hong Kong and New York correspondent for *The Economist*, then (2001-12) editor-in-chief of influential technology magazine *Wired'*(Goldberg, Corcoran & Picard 2013).

In 2012 Anderson told ABC-TV that:

> "Thanks to Smartphones, and Wii controllers and other consumer electronics, we have all the necessary elements to create a drone. Sensors, wireless, GPS, processors, cameras, everything that's the Smartphone revolution has basically made the technologies cheap and available and this has just happened over the past four or five years" (Corcoran 2012b).

'This technological emergence led to the creation of online 'personal drone' communities, dedicated to open-source drone research and development. Many of these hobby forums have evolved into commercial businesses, as crowd sourcing accelerates the already dynamic pace of innovation. In 2007, Anderson founded the online group DIY Drones, which (in 2013) boasted more than 36,000 members worldwide. Volunteering their expertise online were IT experts from Google, Apple, IBM, bankers in Japan, advertising agents in Brazil, hobbyists from Australia, grocery store managers in the US. Anderson said:

> "I was blown away by what people in our community were doing with sensors from mobile phones and chips that cost less than a cup of coffee. Feature by feature, they were matching – or besting – aerospace electronics that had cost tens or hundreds of thousands of dollars just a decade earlier. It felt like the future of aviation… Autopilot electronics look just like smartphone electronics, simply running different software. The technical and economic advantages of coat-tailing on the economies of scale of the trillion-dollar mobile-phone industry are astounding" (Anderson 2012).

'Anderson claimed to have accidently kick-started the domestic drone boom in the United States and, while some disputed his assertion, Anderson is a highly influential figure in the emerging 'personal drone' movement. In late 2012 Anderson resigned from *Wired* to focus on his drone manufacturing start-up 3D Robotics, (by 2013) the company had expanded from

building US$175 open source drone autopilots to manufacturing more than 1,000 small multi-rotor and fixed wing drones and autopilots a month, of which half were sold in the United States. Anderson aimed to sell his drones for US$500 each (Goldberg, Corcoran & Picard 2013).

> "Today there're more drones out there being flown by hobbyists than there are by the military…military-grade technology at toy prices" (Corcoran 2012b).

And it is this global 'Personal Drone' movement, rather than the established defence-aerospace industry that may initially offer the most affordable and immediate options for news gathering in hazardous locations.

Background- Australia

Australia has an international reputation for innovation and application of civil UAV technology, introducing the world's first civil UAV operating regulations in 2002 (CASA 2002). By 2013, the Civil Aviation Safety Authority (CASA) acknowledged that the phenomenal speed of technological evolution and application had rendered those regulations largely obsolete, and the rapid proliferation of drone technology meant that CASA was largely ineffective in enforcing the rules (Corcoran 2013). CASA announced that new regulations on UAV operation and certification were being drafted to better reflect realities; a new weight based classification system would, at one end of the scale, effectively de-regulate the smallest category (craft with a take-off weight of 2kg and under), while the largest craft would be controlled by regulations comparable to those governing the operation of manned aircraft. As the majority of potential news-gathering tasks could be undertaken by the smaller craft, the regulations, when enacted, would have far reaching consequences for drone journalism (Corcoran 2013). Unofficial deadlines for rolling out this ambitious restructure have come and gone as CASA officials wrestle with the regulatory complexities of a technology that by definition encompasses everything from hobby shop toys through to multi-million dollar military intelligence gathering platforms.

By December 2013, there were 66 CASA-approved commercial UAV operators in Australia (up from 14 in 2012), specialising in aerial mapping and mine surveying, power line inspection, aerospace research, agricultural research, real estate photography, aerial filming of sports events. No media organisations had approval to operate drones in Australia; but several had hired CASA-approved operators for aerial filming, in much the same way that freelance news camera crews were engaged for assignments. Current CASA restrictions on operating in high density urban populations i.e. filming directly over people, effectively prohibited newsgathering, with most media assignments more accurately described as current affairs or documentary film-making, requiring pre-planning and conducted in a controlled environment.

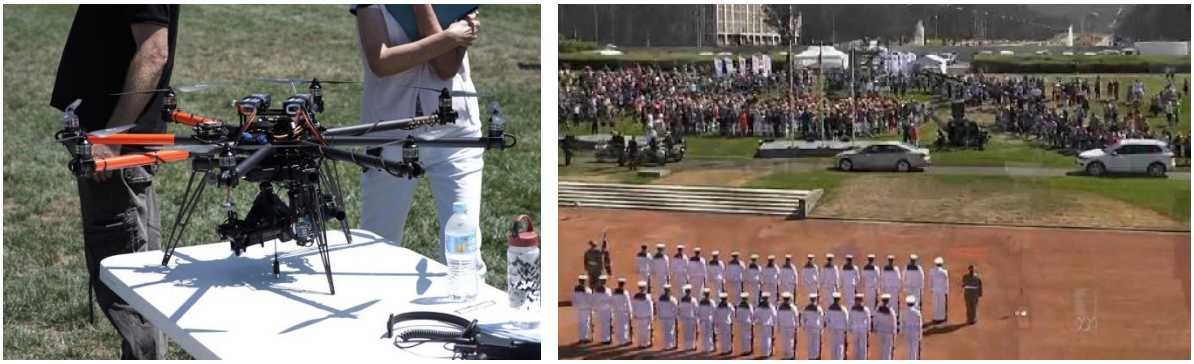
While restrictions were maintained on commercial UAV activity, there was a rapid proliferation of cheap, small high-performance hobby craft, with enthusiasts launching craft, defined as Model Aircraft (MA) that matched and often exceeded the capabilities of approved commercial UAV operators. MA flyers were not required to undergo any form of certification or airworthiness process and were permitted to fly on the condition they operated less than 400 feet, in daylight, within line of sight, and well clear of airports and people and did not fly for profit or reward – a restriction that included newsgathering. These rules appeared to be increasingly ignored, with CASA publicly acknowledging that it was unable

to effectively police the growing numbers of illegal flyers (CASA 2002, 2013a, 2013b, 2013c; Corcoran 2013).

In 2013, Australian media organisations had already incrementally – and legally - adopted drone technology. ABC-TV's *Four Corners* engaged a CASA approved operator to film sequences for a September 2013 report *In Google We Trust* which examined social media technology and privacy, and in January 2013 a member of the public provided 'amateur' drone imagery of the Tasmanian Bushfires aftermath for the ABC Tasmania's 7pm News bulletin (Gould 2013; Wood 2013).

In January 2014, ABC-TV Sport and Events contracted a CASA-approved commercial operator to fly a multi-rotor craft over the Australia Day Flag Raising Ceremony in Canberra, providing aerial shots of the ABC's one hour live national broadcast of the event. The drone camera was integral to the multi-camera coverage. This was a significant 'proof of concept', underscoring the ABC's confidence in both the reliability of the technology for in covering an important national Outside Broadcast (OB), and also safety: as the craft operated to within 30 metres of a large audience of VIPs including the Prime Minister and Governor General. ABC Events Executive Producer David Spencer said;

"Whilst a lot of what we wanted could have been achieved by a helicopter the noise and visual impact would have been completely unacceptable for the program – let alone the cost… The result was an exponential leap in the look and visual impact for the program. A UAV was the only option for the shots we wanted. Prior to the availability of UAV's with live broadcast quality links, we could only dream of getting these shots". (Waite 2014).



Australia Day 2014: (L) The custom-built 8 rotor UAV operated by 'Coptercam' for ABC-TV and (R) a screenshot from the live broadcast

Eye in the sky: the ABC/*Coptercam* UAV can be seen above/to the right of the police boat on Canberra's Lake Burley Griffin.
Images Source: David Spencer- ABC-TV

The BBC and CNN also launched UAVs on international news and current affairs assignments, while Australian commercial TV Networks Seven and Nine, facing restrictions domestically also began deploying small drones overseas. A Seven Network video journalist won the 2013 Walkley Award for Camerawork for a series of reports that included compelling drone imagery of the perils of the beach ship-breaking industry in Bangladesh, sequences that would have been extremely difficult, and possibly dangerous, to obtain by conventional filming methods (Russell 2013).

'Graveyard for Giants' - screenshot.
Image Source: *Sunday Night/High Alpha Media*.

Two major advantages offered by drones are convenience and cost, particularly when compared to news helicopters operating in an urban environment. Drone technology offers a convenient low cost aerial filming capability. A small multi-rotor, depending on configuration, performance and camera, costs A$1,000 - $20,000. By comparison, the capital acquisition cost of a news helicopter is about A$3.5M. Similarly, hourly operating costs of a CASA-approved, small UAV operated by a commercial company range around A$300-$500, compared to A$2,000 an hour for a crewed news helicopter (Author presentation to the *Drone Power Conference*, Canberra, July 2013).

While UAVs have much to offer news gatherers, it should be emphasised that this technology is still maturing, particularly when making a helicopter vs. drone comparison.

'Current UAV technology still lacked that human element, what pilots call the *Eyeball Mark I.* This is the ability of a news helicopter pilot and media crew to observe and instantly react to a safety threat, or to anticipate a breaking development on a story that is unfolding beyond the narrow field of view of the camera. Helicopters also have an additional logistical capability lacking in UAVs; the ability to land in inaccessible locations and drop off equipment and news teams, or to immediately rescue individuals in distress' (Goldberg, Corcoran & Picard 2013).

The Definition Dogfight

Time magazine's controversial cover story February 11, 2103. A composite image of an armed *Predator* flying 'low and slow' over unsuspecting American suburbia.
Image Source: Photo-illustration by Dan Winters for *Time*.

What exactly is a drone? It is a deceptively simple question with a highly contentious answer that requires examination before exploring the complexities and potential applications of 'drone journalism' in hazardous environments.

The 'drone' of the 24 hour news cycle invokes images of menacingly-named *Predators* and *Reapers* prowling the skies of Afghanistan and Pakistan, launching missile strikes, inflicting indiscriminate civilian casualties, triggering a surge of international anger over the ethics and legality of this new form of warfare. But the same label also describes a small, flying HD camera-equipped toy; the *Parrot AR Drone*, just A$350 from the local hobby shop. More than 500,000 *AR Drones* have been sold worldwide since the wheelie-bin lid sized craft first took to suburban skies in 2010 (Méchaly 2012; Mortimer 2013; Parrot 2013).

'If the job is too dirty, dull or dangerous, get a UAV to do it', has become the mantra of the aerospace industry lobby.

A curious 'definition dogfight' has developed over the terminology used to describe this technology. This name game underscores a battle for public opinion that will ultimately influence where, when and how these 'eyes in the sky' may be used in a myriad of potential civil applications: from the upbeat, such as scientific research, agriculture, mine surveys, and beach patrols, to the far more contentious, like newsgathering, police work and broad area surveillance.

So what's in a name? Decades ago, a drone was originally defined as a pilotless, radio-controlled military target-towing aircraft. Today 'drone' is the popular description for any craft that flies without a pilot at the controls, whether it is controlled directly by an operator

on the ground or is capable of autonomous or automated flight with no direct human intervention.

For most journalists, the technological marvel now flying into the realm of newsgathering possibilities is simply a ‘drone’. However, aviation professionals and government regulators have an almost visceral opposition to the drone word, preferring a complex array of more technically precise terminology:

- There is UAV (Unmanned Aerial Vehicle), also UAS (Unmanned Aerial System), which is a UAV, plus the ground-based control systems.
- Many military forces, including those of the UK, US and Australia, insist on using the terms RPA (Remotely Piloted Aircraft) and RPAS (Remotely Piloted Aircraft System).
- Military pilots hate the drone word because they feel it diminishes their expertise and direct involvement in controlling the craft in the air. As a Royal Australian Air Force RPA unit commander freshly returned from Afghanistan said last year: "People like to see the word 'pilot' in there" (Corcoran 2012c).
- International and national civil aviation regulators – Australia’s CASA included - also can't quite settle on a label. What started as a UAV became a UAS, and now RPA/RPAS has been added to the civilian lexicon, at the direction of the International Civil Aviation Organisation (ICAO). CASA has adopted RPA/RPAS as the official bureaucratic descriptor.

In addition, there is a growing array of subcategories that for the uninitiated can appear as a bewildering alphabet soup of TLR’s (Three Letter Acronyms). Use the ‘D’ word in a broadcast or article, and the offending journalist risks a volley of indignant emails and calls from the experts. In a 2013 *Time* cover story, ‘Drone Home’ on the civilian UAV phenomenon, journalist Lev Grossman observed that he had “…been corrected, even upbraided for failing to use terms like unmanned aerial vehicle or unmanned aircraft system (UAS) or remotely piloted vehicle. While literally accurate, those terms have a clumsy, euphemistic feel*”* (Grossman 2013). *Time* also provoked the ire of the aerospace community with its composite cover image of an armed *Predator* flying ‘low and slow’ over unsuspecting American suburbia.

This debate is about more than a ‘train-spotting’ fixation with arcane terminology. It underscores a deep-seated fear by governments and the aerospace industry, in Australia, the US and elsewhere, over the emotionally charged connotations of the drone label
The aerospace industry, through government lobbying in the United States and Australia, has helped stimulate the growing civil market. In 2013, industry was frustrated in attempts to seek a smooth, politically-trouble free transition of the technology to civil skies. Aerospace manufacturers were banking on the civilian market eclipsing military demand with global UAV/drone expenditure is forecast to exceed $US89 billion in the next decade.

This lucrative future was threatened by an image problem. The ‘drone’ had become embedded in the zeitgeist and largely due to military operations in the Middle East and South Asia, the connotations are overwhelmingly negative. Despite a rebranding campaign launched by industry lobby group AUVSI, both industry and regulators were losing the definition dogfight.

One senior CASA official tasked with integrating the technology in civil skies told an aviation conference that he abhorred the drone label "because drones kill people", a statement unlikely to endear him to military colleagues (Corcoran 2012c).

The 'D word' has increasingly dominated public discourse, from political debate (America's President refers to drones), US Congressional reporting, and academic research, through to cover stories in influential specialist publications and global media outlets such as *Time* magazine.

It is the author's view that if this technology is to be successfully demilitarised, de-mystified and widely deployed on a range of peaceful, civil applications - including news gathering - valid privacy concerns need to be addressed and safe examples of the many applications need to be demonstrated. Only then will public acceptance follow, regardless of what label is used.

In the interests of clarity this paper uses two terms; the colloquial 'drone' label and what was in 2013, still the most popular industry description, UAV.

Kicking The Tyres – Four broad categories of drones suitable for newsgathering

UAV capabilities are seemingly only limited by budget and imagination. The largest UAV flying operationally in 2013 was the US$200M US Air Force Northrop Grumman RQ-4 Global Hawk. With the wingspan of a 737 airliner, this unarmed intelligence gatherer can soar to 65,000 feet as it crosses the globe on non-stop 35 hour missions. Global Hawk is the ultimate UAV camera platform. While exact capabilities remain secret, we do know it can film targets in North Korea, obliquely, from a distance of 140 kilometres (Corcoran 2012a). But the vast cost and complexity of the unmanned aircraft – which is served by a 45 member technical ground crew – means it will remain a capability editors and news directors can only dream of.

Taking to the skies in 2013 were 'hundreds of different types of small, cheap multi-rotor and fixed wing UAVs that resembled radio-controlled model aircraft. The toylike appearances were deceptive as these craft concealed impressive capabilities; automated flight, GPS guidance, live video streaming cameras (connected to First Person View FPV goggles, enabling the craft to be flown via camera, out of sight, over the horizon), all sold in a compact flying package, available online in components or assembled, or from the local hobby shop for the price of a smart phone' (Goldberg, Corcoran & Picard 2013).

News organisations considering adding drones to their array of technologies were confronted by a bewildering array of options. In North America alone, there were 146 small UAV models weighing less than 11.2kg, being produced by 69 companies. This figure excluded manufacturers of hundreds of custom-built platforms and the 'personal drone' hobbyist movement (AUVSI chairman Peter Bale, Avalon International Air Show, 26 February 2013).

In 2012-13 ABC-TV's *Foreign Correspondent* program explored the booming international drone bazaar and defined four categories of UAV suitable for news gathering tasks. These groupings broadly reflected the new category system proposed by Australia's CASA (Corcoran 2012b; Corcoran 2012d, 2013).

1. Small, helicopter-like ‘multi-rotors’ weighing less than 2kg, on-board Wi-Fi-controlled by smart phone or tablet device. Cheap A$700-$1,500. Easy to operate with a range of a few hundred metres. “Go Pro’ standard camera quality. Suitable as a ‘back pack’ option where immediacy takes precedence over picture quality.

DJI *Phantom* with Go-Pro
Image Source: DJI

2. Larger multi-rotor, 2-7kg, capable of lifting heavier, broadcast quality HD live streaming cameras. Typically an operating radius of about 2,000m, with ‘line of sight’, maximum operating height of 2,000m, maximum speed 70 km per hour. Endurance 12-20 minutes. Requires skilled UAV pilot, usually supported by a camera/systems operator. Majority of drone journalism in urban areas will initially use this type. A$2,000 - $20,000 depending on complexity.

A$20,000 MikroKopter *OktoKopter* XL ARF
Image source: MikroKopter DE

3. Small fixed wing craft. Resembles large model aircraft. Hand launched. Various types have 45-90 minutes endurance with a range of 10-45 kilometres. Can be operated beyond visual 'line of sight' of the operator. Requires set up of antenna for ground control station. Suitable for longer range regional or coastal assignments. A$2,000-$50,000, depending on complexity.

TBS *Ritewing Zephyr* II A$2,000, range 30-45km

Image Source: fpvlab.com/chicken sashimi

Raven RQ-11B with gimbal-mounted camera. In service with the US military. Approx.US$35,000 each.
Image source: *Aerovironment*

4. Long-range fixed-wing craft. 18-25kg. Operated by the military as ‘tactical’ surveillance/reconnaissance craft, current civil applications includes mining survey and fisheries patrol. Highly complex; can require a skilled crew of 3-4 to operate. Exceptional endurance 24+ hours day and night. Requires support infrastructure of launch catapult and recovery net or ‘skyhook’. Modified for newsgathering, this type could operate effectively in remote/rural Australia, extended disaster coverage, offshore assignments; Japanese whalers vs. environmentalists in the Southern Ocean or the unfolding asylum seeker boat crisis off northern Australia. Can carry sophisticated day/night camera systems in gimbal mounts. Two types in military service that are commercially available in Australia are the *Aerosonde* and *ScanEagle*. A basic *Scan Eagle* or *Aerosonde* platform costs approximately A$100,000. A high end day/night camera, with thermal imaging, suitable for news-gathering can add another A$100,000-$250,000 (DefenseIndustryDaily 2013; Goldberg, Corcoran & Picard 2013; Insitu 2013)(Author interview with Peter Smith, Aerosonde Chairman). UAVs in this class have become over-engineered to meet the demands of punishing military operating environments. Manufacturers are now developing ‘civilianised’ versions. In 2013 Aerosonde was developing a civil variant with a smaller engine and lighter airframe that would have 20% greater endurance, but only 60% of the price of the military version. The commercial variant was expected to have fully automated take off, landing and flight systems enabling a reduction in crew size from 4 to 2 (Author interview with Peter Smith, Aerosonde, Melbourne, February 2013).

Aerosonde Mark 4.7
Image Source: Aerosonde

Boeing-Insitu *Scan Eagle*
Image Source: Boeing-Insitu

A. Major Conflict and military embeds

Journalists covering the US-led interventions of western forces in Iraq and Afghanistan usually had a choice of operating independently and taking personal responsibility for their own security, or they could opt for a military 'embed' with western forces, where a formal or informal contract involved the military providing security, accommodation and transport for the journalist or news team usually in exchange for restrictions on movement and what could be reported.

An embed doesn't always offer a greater degree of personal safety, as the military units accompanied are often specifically targeted by insurgents. Many media workers have been killed or injured, alongside the soldiers they were reporting on.

Journalists, news production teams and their employers are acutely aware of the high level of personal risk associated with these assignments. In recent years media organisations have invested heavily in providing protective equipment, intensive first aid and 'hostile environment' training; as a way of at least partly mitigating that exposure to risk.

Operating a small media drone in this environment, by teams either embedded or working independently, may further reduce exposure to physical risk while enhancing the ability to 'get the story'. For ABC-TV teams on this type of assignment, all equipment is usually compact, lightweight and capable of being carried in a backpack, should there be an unforeseen requirement to leave the vehicles and continue on foot. Drone technology needs to fit with this approach.

Philip Swinsburg recommended a small multi-rotor system weighing 2-7kg with a 15-20 minutes flight time, which he assessed as offering greater versatility than the smaller fixed-wing craft which provide greater endurance (up to 90 minutes), but unlike multi-rotors, have difficulty navigating urban filming environments, such as narrow streets or around damaged structures.

> "You can come down a bit lower, you can hover, and you can get a lot more stability in the aircraft. Whereas if you go for a conventional aircraft (small fixed wing drone) you have a lot more space you have to operate in because you have to fly this thing, and you've got a lot more sophisticated gimbals in the camera that you then have to compensate for" (Swinsburg interview with author).

Technological advances and ever-tightening budgets of media organisations have resulted in a reduction of the number of people deployed in a typical international newsgathering team, resulting in a higher degree of multi-skilling. In the author's experience with ABC-TV, the optimum configuration for a TV team operating in a high risk environment, from a safety and security perspective, comprises a camera operator and journalist with both sharing the producer role. Multiskilling predominates; journalists are expected to acquire basic filming and editing skills and experienced camera operators often act as director/producer and conduct interviews independently of the reporter. A frequent addition to the team is a locally engaged 'fixer' for co-ordination, translation and transport duties, although this fixer usually lacked technical expertise or familiarity with electronic news gathering systems. Multi-skilling evolved to a new level in the 1990s with the emergence of the 'video journalist', a lone news-gatherer who conducted all of these tasks, although many Australian 'VJs' also employed a fixer when operating in hostile environments. Adding a small UAV to this multi-skilling mix could potentially overload an already busy team.

Swinsburg argued that this problem could be addressed by adopting a control system with a high level of automation, operated by smartphone or iPad, on which a series of way points, and pre-formatted flight plan can be loaded onto a GPS map.

"So you take the skill away of flight because what you don't want to be doing when you are trying to report, and capture information is worry about aircraft….and then you focus on getting the camera shot that you want and not worry about the aircraft. If you are looking at say, going a kilometre from where you are reporting, then you can do that with relatively small antenna systems. If you want to go beyond a kilometre, then you are starting to get into the use of dedicated antennas" (Swinsburg interview with author).

"You could fit all of this really into one Pelican case. You might need to have some spare batteries etc. in another bag. And in that one Pelican case it wouldn't be unreasonable to have your display or your notebook computer or your iPad, your cables and re-charging kits in that container" (Swinsburg interview with author).

Michael Cox assessed that drone newsgathering was more suited to assignments located in a relatively static location, where physical parameters were more clearly defined.

"I'm thinking Fallujah (Iraq) in 2004, we knew that city was under siege by the Americans, there were opportunities to go in and out of that city with the Americans…we know where the action is – for want of a better term –we know who we're travelling with and how we're going to get in and out, you could then say, OK, let's take this device in there and let's put it up" (Cox interview with author).

There is also a risk that a small drone, flying low and slow, would not survive for long in a hostile environment before being shot down. It is likely that opposing combatants would regard all drone activity as being military-related, making the craft, and potentially the operators, legitimate targets.

"If someone sees a drone go up they know that even if it's a small one, it's capable of being the eyes and ears for the opposing military, so they're going to try and knock it down so it's probably not going to stay up for very long" (Cox interview with author).

Reflecting on the Australian Defence Force (ADF) experience in operating small and medium sized tactical UAVs in Afghanistan and Iraq, Swinsburg noted that the biggest problem with detection of small drones was not immediate visual identification, but noise.

"Generally speaking, if you fly over a crowd, they'll only look up if they hear something…If you've got a system that's a couple of hundred metres away it would probably be undetectable from visual sight, but you'd probably be able to hear it...that is a challenge because of the way these systems are designed" (Swinsburg interview with author).

The 'Disposable Drone' Concept

Conflict newsgathering may provide a suitable application for the concept of the 'disposable drone', where there is an accepted risk the craft may be seized or destroyed. Another benefit of the 'disposable drone' is that if it is to be sacrificed, the range of the craft, with a HD streaming video link, may be effectively doubled, as there is no need to return to the launch point. Lives do not have to be risked in recovering a downed craft with on-board camera cards.

A simple multi-rotor fitted with a cheap camera, with an all up cost of A$2,000 fits this 'disposable drone' role concept. The current return to base range of this type of craft varies depending on exact configuration, but is approximately 1-2 kilometres.

While the cheap 'disposable drone' concept provides immediacy, low cost and small sizes results in a trade off in picture quality.

"A DSLR camera which is relatively cheap, being able to record relatively good quality vision, you'd probably take the punt and say 'well look let's fly that, we know that that street down there is where all the action is, let's fly it down there and fly it back and if it gets back well we've got some vision in the can' " (Cox interview with author).

"It is still going to give you that high, wide shot but in these small packages, you can't put a camera with a big enough lens to actually be able to zoom down and get the sort of specific shots of groups of troops or groups of militia or whatever and also the stability. Even if you could get a camera with that lens on it, the actual stability of the device, even though a lot of these cameras do have stabilisation, it wouldn't be sufficient. You would have very jittery shots" (Cox interview with author).

A lower cost option is to select from a growing range of smaller craft, marketed as toys, priced from A$300, that still offer basic HD streaming capabilities. Notable in this category was the ubiquitous *AR Drone 2.0*, manufactured by French company Parrot. Global sales of the *AR Drone* exceeded 500,000 units since 2010 and capability steadily improved since the release of the initial model with a 50 metre range and 12 minutes endurance. Tests using the new 4G mobile network ground control system, GPS, and upgraded high density batteries have extended the AR Drone 2.0 range to one kilometre, with a demonstration test flight across Istanbul's Bosporus Strait (Méchaly 2012; Mortimer 2013; Parrot 2013; sUASNews 2013). The *AR Drone 2.0* was easy to fly, however its small size and light weight made the craft unstable even in light winds and this adversely affected image stability. Despite these limitations, the *AR Drone 2.0* was potentially suitable for short range news-gathering on the periphery of street protests, where agility and immediacy take priority over picture quality. The lightweight construction also made it highly susceptible to damage, but equally, it was less likely to cause injury if colliding with people.

Parrot *AR Drone* – Smart phone control panel – including live video feed.
Images Credit: Parrot Company.

ABC-TV *Foreign Correspondent* - Informal Proof of Concept - Afghanistan

In 2010, a team from ABC-TV's *Foreign Correspondent* (the author and camera operator Craig Berkman), examined the potential for UAV newsgathering during an informal 'proof of concept' while embedded with the US Army in Afghanistan.

The assignment focussed on a small Forward Surgical Team (FST) and helicopter medical evacuation unit tasked with extracting casualties from the battlefield. This was a high risk environment covering what a US Army surgeon described as the 'busiest FST in either Afghanistan or Iraq'. In the preceding 10 months the unit had received 600 trauma cases (Corcoran 2010b). Coalition troops were subjected to frequent attacks and were routinely targeted by massive concealed roadside bombs or Improvised Explosive Devices (IEDs), capable of destroying large, heavily armoured vehicles. Four months prior to the ABC assignment, an American journalist working in the district, received life-saving treatment from the FST after being critically wounded in a vehicle/IED incident that killed an accompanying US soldier (Gray 2009).

While filming a helicopter mission to recover three wounded and two dead US soldiers from the aftermath of an IED explosion, the ABC team was offered UAV imagery of the event as a 'second unit' to supplement conventional coverage provided by a helmet mounted Go-Pro worn by a pilot and a camera positioned on the surgery helipad.

Launched and controlled from the Forward Operating Base, the task of the unarmed RQ-7 *Shadow* UAV was surveillance; to provide early warning of possible Taliban attacks on the casualty evacuation.

In this role, the *Shadow* operated at a relatively high altitude of 3,500-5000 feet above ground level, which resulted in distant images, suitable for surveillance, but too wide for optimal use in a TV news production. As a result, the vision was only briefly used in the final ABC-TV report, but the operation underscored several advantages – and some problems - for media considering using the technology.

Pilot ‘point of view’ of the casualty evacuation. Armed helicopter crewman stands guard in foreground. The pilots expressed fears that on the ground the helicopters were highly vulnerable to surprise attack due to limited field of vision.
Image Source: *Foreign Correspondent* ABC-TV

Casualties are carried towards the helicopter – as seen from the pilot’s position.
Image Source – *Foreign Correspondent* – ABC-TV.

Drone vision – The scene as recorded by the *Shadow* UAV overhead. In this screenshot casualties are being extracted from vehicle wreckage. The lead ‘camera’ helicopter on the mission is bottom left of frame.
Image Source – Foreign *Correspondent* ABC-TV

Drone vision –*Shadow* UAV live vision of the destroyed MRAP armoured vehicle in which two US soldiers were killed and three wounded.
Image Source: *Foreign Correspondent* ABC-TV

Case Study Lessons

A drone may substantially reduce exposure to physical risk of the news-gathering team; Real-time UAV imagery can assist in identifying potential threats, providing a wider field of vision than possible from the ground, where the view of journalist or camera operator view may be obscured by vehicles, buildings and terrain – at a time when the team is focussed on activity in their immediate vicinity.

Drone imagery can be relayed as a live broadcast or incorporated in a packaged report. A media drone may also be used for 'look out' or reconnaissance during road trips in hostile environments by being launched and controlled from a moving media vehicle. This task may assist in giving early warning of threats such as the planting of roadside Improvised Explosive Devices (IEDs), which account for more than 60% of all casualties in Afghanistan (Corcoran 2010a).

This 'proof of concept' was conducted with a larger RQ-7 *Shadow* fixed-wing tactical UAV, weighing about 170kg, with a wingspan of 4.3m, operated by a specialist team. The military operate "systems' of several UAVs each with a ground control station. The per-unit cost for the Shadow is about US$750,000. For media tasks, this same capability could be achieved using a much smaller, simpler, hand-launched craft controlled by a single operator, flying at a lower altitude (less than 400 feet above ground level), enabling much closer filming of on-ground activities.

This exercise also identified several disadvantages; even small UAV operations are highly labour intensive, potentially placing additional burdens on a busy, multi-skilling news team.

Distance reduces intimacy and context. The ideal objective for drone newsgathering is to supplement or enhance ground-based coverage – not replace it. A camera drone should not be viewed as an easy substitute for the immediacy of ground-based filming or reporting, nor considered as a replacement for direct interaction between reporter and subjects.

There is also a potential risk of collision with military aircraft and UAVs which frequently 'swarm' or 'stack' over an incident or ongoing military operation. There have been reports of near misses and at least one collision between military UAVs and manned aircraft in the skies of Afghanistan.

Controlling large numbers of (military) UAVs of all types, which share airspace with both civil and military manned aircraft, has proved a highly complex task - and the problems encountered may be indicative of what lies ahead in more peaceful skies of the US and Australia. A 2006 U.S/NATO report on airspace management highlighted the 'current inability to co-ordinate and de-conflict the operation of Unmanned Aerial Systems (UASs)'.

'The unprecedented proliferation of UASs in recent years, specifically within tactical-level units and sub-units has dramatically increased the risk to air operations…Airspace managers have no way of controlling UAS operations at the tactical level where hand-launched systems are often employed for localized reconnaissance' (Griffith 2006).

This concern was first realised in dramatic circumstances on 30th August 2004, when an Afghan-operated Airbus with 100 people on board, on approach to Kabul Airport, passed within 170 feet (51 metres) of a German Army *Luna* tactical UAV, with the near-miss recorded by the drone's camera.

Screenshot: A German Army UAV records a near miss with an airliner over Kabul, Afghanistan, 30th August 2004.
Image Source: Bundeswehr

In August 2011, the crew of a large US C-130 transport aircraft narrowly escaped catastrophe after a mid-air collision with an RQ7 *Shadow* UAV over Afghanistan. Despite sustaining extensive wing damage, the C-130 landed safely (Mortimer 2011).

The damaged C-130 following mid-air collision with RQ-7 *Shadow* drone over Afghanistan.
Image Source: sUAS News

In 2013, no commercially available anti-collision technology was readily available for small UAVs. 'Detect and Avoid' anti-collision transponders are now fitted to piloted aircraft, but developers still faced challenges in attempting to miniaturise the systems for UAVs. The US Government Accountability Office, after examining the progress of the FAA's integration of Unmanned Aerial Systems (UAS) into the domestic airspace, made a sombre assessment' (Goldberg, Corcoran & Picard 2013). In submission, the GAO's Gerald Dillingham told a Congressional panel that:

"To date, no suitable technology has been deployed that would provide UAS with the capability to sense and avoid other aircraft and airborne objects and to comply completely with FAA regulatory requirements of the national airspace"(GAO 2013).

Both document incidents in Afghanistan involved larger UAVs with a take-off weight in excess of 20kg. Australia's CASA has argued that the risk posed by smaller craft would be far less, a significant factor for 'drone journalism' as the majority of UAV newsgathering tasks would be conducted by much smaller UAVs (weighing less than 7kg) flying at a very low altitude (less than 500 feet above ground level).

CASA has conducted 'kinetic energy' tests to determine the threat of injury or damage to people and other aircraft, posed by UAVs of varying sizes. Senior CASA officer Jim Coyne, stated that being struck by a small UAV weighing 2kg or less, would be comparable to sitting in the outer areas of the Melbourne Cricket Ground and being hit by a cricket ball;

"A cricket ball weighs about 160 grams, but at 100 kilometres per hour (with a) kinetic energy of about 62 joules…there's been no recorded incident of anyone being killed by a cricket ball in the stand. The potential for harm and the consequence is very low.

We talk about a harmless UAS, causing minimal harm to a person. If it hits them on the head it will give them a headache. If it hits them in the back it will give them a bit of a bruise, but it is not going to kill you" (Corcoran 2013).

Coyne's 'kinetic energy' assessment contradicted widely stated fears in the US and Australia that being struck by a larger drone (in the 2-7 kg weight category) would be comparable to being hit by a 'low flying lawnmower' (Corcoran 2012d). "Potential for harm goes up, still

it's not going to do a lot of damage…that's seven kilograms, about the weight of a six month-old baby, at 14 knots, or 26 kilometres an hour" noted Coyne (Corcoran 2013).

Implications of deploying media drones over civil communities during conflict

Pakistanis protesting against US drone strikes.
Image Source: Getty Images

Reporting on military activity from an 'embed' is only one element of news-gathering in conflict. An equally important component is the impact of the conflict on the civil population; investigating and reporting on issues including aid distribution, medical treatment, refugee welfare and allegations of human rights abuses. Such assignments require the journalist or news-gathering team to display a high degree of sensitivity and tact. There is a high risk that a media drone flight may be mistaken for military activity (author interviews with Cox & Swinsburg), particularly on assignments in Afghanistan and the tribal areas of Pakistan where there is already a high level of military drone activity resulting in extensive civilian casualties.

Data compiled in 2012 indicated that 'drone strikes killed 2,562-3,325 people in Pakistan, of whom 474-881 were civilians, including 176 children' (NYU 2012). CNN national security analyst Peter Bergen and associate Megan Braun calculated that "the number of high level targets killed as a percentage of total casualties is extremely low –estimated at just 2%" (Bergen 2012).

In an extensive investigation, *Living Under Drones* by Stanford Law School and New York University School of Law, examined the psychological damage caused by the permanent presence of US drones over communities in northwest Pakistan and found that;

> "Their presence terrorizes men, women, and children, giving rise to anxiety and psychological trauma among civilian communities. Those living under drones have to face the constant worry that a deadly strike may be fired at any moment, and the knowledge that they are powerless to protect themselves. These fears have affected behaviour. The US practice of striking one area multiple times, and evidence that it has killed rescuers, makes both community members and humanitarian workers afraid or unwilling to assist injured victims. Some community members shy away from gathering in groups, including important tribal dispute-resolution bodies, out of fear that they may attract the attention of drone operators. Some parents choose to keep their children home, and children injured or traumatized by strikes have dropped out of school" (NYU 2012).

Such deep-seated trauma and anger would have significant consequences for drone newsgathering. With the proliferation of satellite TV in the remotest rural communities of Afghanistan and Pakistan, it has been the author's experience that most communities now have a basic understanding of the role of a news-gathering team and the equipment carried. However the unannounced arrival of a TV crew with a piece of kit of quasi-military appearance will invariably raise suspicions.

"These things are still seen as military devices and given the experience on the Pakistan border over the last couple of years, no matter what size the drone is, any sort of device floating over a compound is going to be seen as military… Some people might recognise it as not being big enough to carry weapons but they would see it as surveillance device or possibly another drone or for troops who are in the area" (Cox interview with author).

In Afghanistan or Pakistan it is unlikely that a village community would immediately make the distinction between media and military drone flights – despite very different methods of operation.

"The little quad copters…they often travel very low to the ground, whereas most of the military systems are probably sitting at about a thousand feet, so they would be outside the field of their immediate awareness zone, so they can operate and not necessarily be all that intrusive. So if you do have a small system and its right down low in the crowd, trying to get the imagery which is what TV would like, high definition, high quality video, then you are going to be a lot more intimate to that crowd and in itself could cause some problems, so that's what I say, it is a matter of determining what your requirement is and then start at that point and work towards your ultimate goal" (Swinsburg interview with author).

In addition, cultural and religious considerations need to be addressed. For example, in rural Afghanistan and Pakistan, traditional communities live in walled compounds and engage in the practice of 'purdah', with strict rules on gender segregation and public movement.

"Putting a drone up over those compounds, there would be an extremely hostile reaction from the locals and you would be undermining your own coverage plan because a lot of the way we go about covering things we seek to engage the locals as much as possible, as much as we can, and we rely on it. We hope to engage with locals because not only do they give us intelligence on where we can go and how, hopefully they, we can bring them into the story and film with them, maybe film with their family and get a sense of what this story's about to them. So anything that is detrimental, that is a huge negative" (Cox interview with author).

Other risks for media drone operations in conflict

Media coverage of other conflicts, such as Syria's ongoing civil war, may present additional problems for potential drone news-gatherers.

In 2013, western media coverage of the Syrian civil war was conducted predominately from the side of the fractious, poorly trained and ill-disciplined militia groups that opposed the technologically well-equipped state army of the Assad regime. In 2012, 33 Syrian and international media were killed covering the conflict, the hazards heightened by frequent Government attempts to specifically target media workers (IFJ 2013a). The Committee to Protect Journalists (CPJ) reported that the deaths of at least two journalists may be attributed to the interception and location of their satellite phone transmissions by Syrian regime forces (Rayner 2012; Smyth 2012).

Small UAVs are particularly vulnerable to this threat, as the craft require radio links for control and separate channels for video streaming. These control channels broadcast on well-

known model aircraft frequencies. Once airborne, a small drone emits signals omni-directionally – going in all directions. The ground based control station receives these signals and also transmits omni-directional signals back to the drone. These emissions would be relatively easy to intercept and locate using basic military signals intelligence equipment.

Drone newsgathering is still possible in this high threat environment; however Swinsburg cautioned against flying larger, complex drones that require a stand-alone radio control network, instead, he suggested deploying a cheaper simpler craft that can be operated by smart phone and on-board Wi-Fi.

> "Even the commercial mobile phone network can be used to control this so it would be difficult to target in on a mobile phone, if there are thousands of those about the place. So it depends on that communications network you are using, if one stands out, that's easy to detect that's going to be a military communications device or its going to be something else, then that can easily be detected but if you blend into the background it's a little bit more difficult". (Swinsburg interview with author).

Swinsburg suggested basic countermeasures, such as establishing a re-transmission point some distance from the journalist/controller's location.

> "That way if there was any risk of being shot at, then it would hit your relay and obviously that's just a communications antenna or box on the ground. You don't get injured. And your aircraft would have a failsafe so that if communications is lost it would come back to a known point which you could then go and collect that" (Swinsburg interview with author).

The US Government Accountability Office (GAO) in investigating the integration of civil drones in US domestic airspace also highlighted another problem; the potential for jamming of drone control signals. 'According to one industry expert, GPS jamming would become a larger problem if GPS is the only method for navigating a UAS'. The GAO's Dillingham testified to the US Congress that small drones were also vulnerable to spoofing, where a third party takes control of the navigation signal (Goldberg, Corcoran & Picard 2013).

> "This type of scenario was recently demonstrated by researchers at the University of Texas at Austin…During the demonstration at the White Sands Missile Range; researchers spoofed one element of the unencrypted GPS signal of a fairly sophisticated small UAS (mini helicopter) and induced it to plummet toward the desert floor. The research team found that it was straightforward to mount an intermediate-level spoofing attack, such as controlling the altitude of the UAS, but difficult and expensive to mount a more sophisticated attack"(GAO 2013).

In Iraq, insurgents were able to easily monitor unencrypted video feeds from patrolling US drones using cheap, off the shelf systems (Gorman 2009). In Syria, government forces have operated more sophisticated intercept systems. As a counter measure, Swinsburg recommended the installation of commercially available encryption software in the media craft (Swinsburg interview with author).

NATO defined Syria as a 'hostile electronic environment' and jamming of electronic signals by the Syrian regime has been both frequent and sophisticated. The regime has also deployed small drone technology for filming/reconnaissance purposes. In June 2013, the *Washington Post* reported that Syrian Government forces were operating Iranian supplied surveillance drones to locate opposition forces (Warrick 2013).

Potential Sovereignty Issues

While smaller UAVs are limited to a small operating radius of 2-50 kilometres, the larger, more sophisticated platforms now commercially available, such as the *ScanEagle* and *Aerosonde* are potentially capable of ranging thousands of kilometres. A CASA official working on UAV regulations noted that a *Scan Eagle* based in Australia "could fly to New Zealand" (Corcoran 2013).

The newsgathering capability of this 'tactical' class of UAV is enormous, as the craft can also be launched and recovered from larger vessels. Potentially, such craft could be deployed on a variety news-gathering tasks that, to date, have largely defeated the logistical capabilities of media organisations; such as providing independent verification of Southern Ocean confrontations between Japan's whaling fleet and environmental activists, or bypassing the media restrictions on 'Operation Sovereign Borders', by independently locating and monitoring the fate of asylum seeker boats that depart Indonesia and head for Australia. Already there are indications that not all operators of high performance UAVs are prepared to abide by the rules. In November 2011, a Royal Australian Navy target-towing jet encountered an unidentified fixed wing drone, while flying at 3,000 feet, 65 nautical miles east of Jervis Bay in NSW. The mystery drone was not operated by the Australian, NZ or US military or any of the certified civil operators (Corcoran 2012c; Goldberg, Corcoran & Picard 2013).

The civil emergence of this medium altitude, long endurance capability may present unique sovereignty issues for news organisations.

There may be unintended consequences if the media UAV is launched across a national border into a country where foreign media access is banned or tightly controlled. Tim Robinson, Editor of *Aerospace International* raised highly plausible scenarios of the implications of the BBC, CNN or *Al Jazeera* launching a drone into Syria to document atrocities, or fly over Iran's hyper-sensitive nuclear research facilities.

> "To penetrate a denied area would suggest a long-range UAS, flown from outside the borders. Yet the news editor would most be interested in footage that was closer in, to emphasise the human aspect – like what a VTOL UAS carrying a HD camera might provide. Secondly, is that while journalists do smuggle themselves inside restricted areas – using a UAS might indicate a significant escalation and perhaps even an act of war. Would a 'news' UAS flown over a Iranian suspected nuclear facility be recognised as a) from the media and b) unarmed?" (Robinson 2012).

At a national level, regulations and restrictions on potential media use of UAVs in Australia, the US and Europe are clearly defined and evolving, but the regulatory and political consequences of launching media drones, particularly over conflict zones, where government authority may already be contested, is far more ambiguous.

Aviation's global regulatory body, the International Civil Aviation Organisation (ICAO), has been working with national regulators to formulate rules on how international and intercontinental UAV flights will be managed. As with many other aspects of this emerging technology, international regulation still lags behind capability (CASA briefing, attended by author, Avalon International Air Show, February 2013). Nor have regulators reached international agreement on the important issue of frequency spectrum – the radio channels that can be used for controlling UAVs. The issue was raised at the 2012 International Telecommunications and the World Radio Conference, but delegates deferred making any important decision until 2015 (Goldberg, Corcoran & Picard 2013).

Discussion

Drone technology offers great potential for news-gatherers covering conflict, but there are some important qualifications. Journalism is about people and personal contact and UAVs should not be seen as an easy substitute for the journalist or news team on the ground. The drone is a camera platform, a tool to be incorporated among all the other news-gathering technology and professional skills a journalist uses on hazardous assignments.

Conflict reporting is not just about military embeds. Equally important is the civil story; aid distribution, medical treatment, refugees, investigation of human rights abuses. In this environment media drones should only be deployed with great sensitivity. As detailed in Living *Under Drones* by Stanford Law School and New York University School of Law, communities subjected to frequent military drone attacks suffer high levels of trauma and psychological damage, so launching a media drone in such an environment could not only add to their suffering but potentially expose the news team to greater risk from a hostile population.

The ADF and other western military forces will need to acknowledge that UAVs and the airspace over a conflict zone is no longer their exclusive preserve. Defence officials may be forced to review the contentious subject of media management; embedding and reporting; as UAV technology may in some cases lessen media dependence on restrictive embeds. If a journalist wants to quickly confirm details on the activities of an Australian or U.S. Army unit 20 kilometres distant in the next valley in Afghanistan, why should that reporter be subjected to the limitations of an embed, when a small fixed-wing drone –can be swiftly launched to establish the facts?

As a former commanding officer of the Australian Army's UAV unit, 20th Surveillance and Acquisition Regiment, Philip Swinsburg supported the concept of embedded media crews operating small drones; however he opposed the idea of un-embedded 'unilateral' news teams operating a drone independently, in the vicinity of troops.

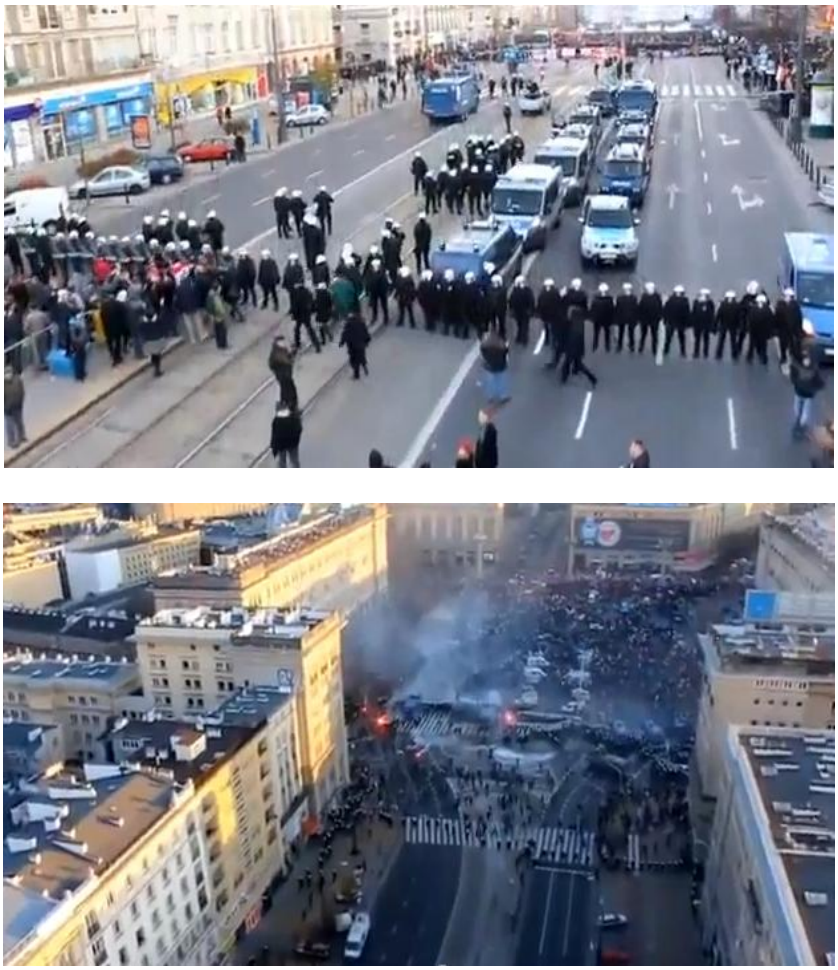
> "If on the other hand there was say, an undisclosed crew that is filming you as you are going through a building and doing operations that would be concerning because I don't know where that imagery is going, who is seeing that information, so potentially that could be giving my position away and putting my guys in danger" (Swinsburg interview with author).

Journalists will not be alone in launching small drones over conflicts. As detailed in the introduction to this paper, the Lebanese militia Hezbollah makes the claim to be the first non-state player to operate small, unarmed UAVs during its ongoing confrontation with Israel. (Shadid 2006). Such is the rate of proliferation of this technology, the low cost and simplicity of operation that it is likely that Taliban drones will soon appear in Afghanistan's skies.

B. Revolution and Civil Unrest: Drone Journalism in an urban environment.

Activist and opposition groups have already demonstrated the news-gathering potential of drones over urban protests in several countries. In December 2011, a multi-rotor was launched to take pictures of the scale of a crowd, protesting against election fraud, in Bolotnaya Square in Moscow (RTNews 2011). 'Citizen journalists' flew a drone over a large anti-government rally in Argentina that had gathered in opposition to rising inflation, violent crime and corruption (AlJazeera 2012).

Another early demonstration of the technology occurred in Warsaw Poland in November 2011 when an anonymous activist launched *Robokopter* a small multi-rotor to record rioting, then uploaded the vision to YouTube (Anon 2011a, 2011b). The videos illustrated the capability of a small drone in easily circumventing police barricades blocking media access to the centre of a protest.



Drone Over Warsaw – November 2011. Demonstrating the suitability of small multi-rotor drones for news gathering in confined urban environments.
Source: *YouTube* anonymous (Anon 2011a, 2011b).

Deploying a drone over a volatile urban assignment requires a high degree of tact on the part of the operator, and security concerns may limit the drone's effectiveness. Michael Cox worked extensively as an ABC camera operator covering the Israel/Palestine conflict in the streets of Gaza and the West Bank. If operating a small drone in this environment, he assessed his first priority as locating a secure launch and recovery point, preferably on the roof of a small five or six story building.

> "But even that far removed from the crowd, you're probably going to get spotted, given the size of the device, the limitations on how far aware you can be from the device to control it, and people are not going to be wildly excited. They're going to always assume the worst. They're going to assume that you are there as some sort of government surveillance or military surveillance or there to gather information which is detrimental to them so you're always going to come under suspicion. We're certainly not at the stage where they're so ubiquitous that people can walk in with their drone and fly it up and the protestors go 'oh terrific, we'll get some better coverage on the news tonight'" (Cox interview with author).

In 2011 the author spent two weeks with protestors in Cairo's Tahrir Square covering the 'Egyptian Revolution' for ABC-TV's *Foreign Correspondent* program and witnessed Egyptian and foreign media workers being systematically targeted by regime security officials and pro-regime vigilantes. On one occasion, the *Foreign Correspondent* team was attacked on Tahrir Square and the camera equipment damaged (Corcoran & Wilesmith 2011). During another incident, ABC producer Greg Wilesmith, camera operator Craig Berkman and translator/Egyptian producer Youssef Taha were detained by vigilantes at a roadblock, blindfolded, bound, and held in military detention for several hours, before ultimately being released unharmed (Wilesmith 2011).

Other Egyptian and foreign media workers fared much worse. One Egyptian journalist was shot dead by a sniper; dozens of international and Egyptian media workers were variously attacked, beaten, stabbed, sexually assaulted, detained, and in some cases tortured (IFJ 2011a, 2011b) .

One significant challenge during this assignment came in identifying the best way of illustrating the scale of the protests and conflict that ebbed and flowed in and around Tahrir Square. Filming at a fixed location at street level exposed the crew to the risk of assault or abduction and the ABC team spent many hours negotiating with residents and protestors for access to rooftops and balconies that provided a vista of the unfolding story. Would a drone have made a difference? *Foreign Correspondent* Egyptian producer, BBC journalist Youssef Taha concluded that deploying a UAV in such circumstances would have provoked an attack on the crew;

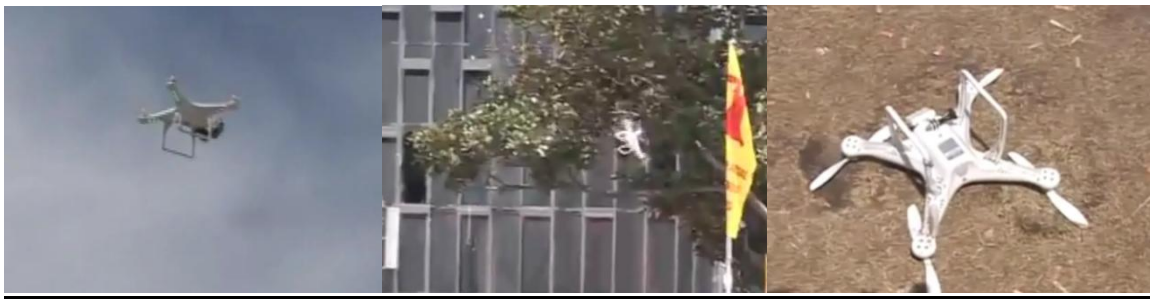
> "(A drone) would have put us on war path with the government and the protesters. The government has overall control on all aircraft, private jets and helicopters are not allowed. Camera drones - however small, are illegal. There was an incredible amount of suspicion from all sides. Had we used one the government would've shot it down in no time or the protesters would have brought it down. I was branded 'spy', 'traitor', without a camera drone. Imagine if we used one! (Author email correspondence with Taha).

Civilian UAVs remained banned in Egypt in 2013. Irrespective of this prohibition, Taha believed that community suspicion of the technology was an even greater obstacle. He said this suspicion was ingrained through decades of military rule and it would take several years before media drones were "culturally acceptable".

> "Rumours spread like wildfire in Egypt. Anything they don't know is immediately woven into foreign conspiracy theory. People are averse to being filmed or photographed secretly. Their immediate reaction is bring the kit down and destroy it" (Author email correspondence with Taha).

Elsewhere in the Middle East attitudes evolved rapidly. In June 2013 in Turkey, protestors in Istanbul's Taksim Square launched a small multi-rotor, a A$750 DJI *Phantom* equipped with a A$300 *Go Pro* camera, to illustrate the confrontation with police, with the vision broadcast by *CNN International*. Confirming Cox's observation on the vulnerability of the technology, the drone was ultimately shot down by police, but another craft soon appeared to take its place – an example of the 'disposable drone' concept where there was an accepted risk the craft may be seized or destroyed – then easily replaced by another small, simple, cheap but effective UAV. A decade ago this type of aerial filming capability would have required a much larger craft that according to aerospace engineers, would have cost more than A $100,000, many times the size of a *Phantom* with an operating complexity beyond the expertise of most journalists and activists (author presentation to the *Drone Power Conference*, Canberra, July 2013).

Drone vision over Taksim Square, Istanbul, Turkey – June 2013
Image Source: Twitter Jenk 1907/YouTube.



1. 2. 3.

2. Protestor *DJI Phantom* drone over Taksim Square.
3. Hit by police gunfire.
4. Aftermath.

In Egypt in August 2013, following the military ousting of President Mohamed Morsi, his Muslim Brotherhood (MB) supporters deployed a small DJI *Phantom* over mass protests in Cairo's Rabaa Adaweya Square. The MB drone monitored movements of the opposing security forces and was used to document the large size of the demonstrations, as a way of illustrating the level of support for the deposed President. The craft was openly operated by MB cadres, yet some elements of the crowd, reinforced Taha's observations, by telling journalists of what they incorrectly assumed to be 'a suspicious foreign drone' operating in the vicinity. After confirming that the craft was operated by the MB, Egyptian police reportedly shot down the drone (AlJazeera 2013; MuslimBrotherhood 2013).

C. Disaster Coverage.

Disaster coverage is one major application of drone technology where positive attributes overwhelmingly outweigh negative considerations. A small UAV operating over a large disaster area such as a tsunami aftermath, floods or bushfires can provide reasonably high quality pictures of a large area at low cost.

"I'm thinking now of the tsunami damage in Japan, there are places that a reporter and a cameraman could get to quite closely but because just of the mountain of debris and it being unsafe, they couldn't get pass that initial wall of debris. If they had a device like that they could launch it and they could actually get quite useful shots of the debris fields and whatever else was going on" (Cox interview with author).

Drones may also enhance the safety of the journalist operating in a disaster zone. For example, bushfire activity is notoriously difficult to predict and many casualties occur when wind changes suddenly alter the direction of the fire-front. Earthquake aftershocks also cause numerous casualties when people are struck by falling debris from damaged buildings. A small drone deployed in these locations could provide a stand-off capability enabling the news-gatherer to record the images from a safe distance. In the aftermath of the Christchurch earthquake in 2011, engineers deployed a small Parrot *AR Drone* (a hobby-level multi rotor craft that is operated from a smart phone or tablet device, and transmits live HD vision (Parrot 2013)) to inspect extensive damage inside the city's Catholic cathedral, after it was declared too dangerous for workers to enter.

'"Even if we lost it in the building 'cause we're never quite sure with the Wi-Fi range or the battery life, but if it turned out to be a suicide mission it's a $500 one not a far more serious one," said engineer Nicholas Dawe' (Hampton 2011).

Mobility for news-gatherers may also be enhanced by deploying a drone to reconnoitre damaged roads, enabling quicker movement around the disaster zone.

"It's all well and good to have a four wheel drive vehicle but on a lot of these stories the vehicles then become useless because the terrain, because of what's happened, isn't passable, so then you're on foot. That ability to see over the horizon, and sometimes the horizon can be literally ten meters in front of you, you just literally cannot see over what's in front of you and you can't get up, you physically can't get up high enough…It might be a case that you know a kilometre ahead there is nothing significant that you want to film, but a kilometre to the left or the right or behind you there is. So this gives you that bird's eye view that allows you to make decisions about the coverage" (Cox interview with author).

The Daily Drone

In 2010, Rupert Murdoch's News Corporation established *The Daily*, a tablet-based digital news service, promoted as the world's first iPad-only newspaper (Oremus 2012). *The Daily* soon acquired a small camera-equipped *MicroDrone* MD4-1000 multi-rotor, operated by a private contractor 'as part of its drive for more creative content' (UASVision 2011c). This example highlighted both the disaster coverage potential of the technology and the regulatory restraints of operating domestically in the United States. The tablet news service created a segment titled *The Daily Drone* and the *MicroDrone* was dispatched to cover natural disasters, providing dramatic coverage of tornado aftermath in Tuscaloosa, Alabama, and flooding on the Mississippi River. *The Daily Drone* provided a unique perspective, flying lower than a news helicopter, often just 2-5 metres above ground level as the craft recorded 'some stunning videos' of tracking shots of natural disaster aftermath, rescue and reconstruction (Maksel 2012). Edited with an accompanying scripted voice over, the news packages were highly professional in presentation.

At this time CNN also briefly launch a foray into drone journalism, with one CNN reporter 'experimenting' with a far less sophisticated *AR Parrot* hobby drone at the aftermath of the Tuscaloosa tornado. Shaky imagery of the destruction was posted on the CNN website, but the CNN vision was markedly inferior in quality to *The Daily Drone* production and the network soon abandoned the experiment (UASVision 2011a). In contrast, *The Daily* made a substantial investment in technology, expertise in operating the equipment and editorial post-production. *The Daily Drone* segments generated news stories and commentary on other US media, which praised the innovation and quality of the vision and concept, but also questioned the legality of the operation as under US FAA regulations, commercial operation of drones in domestic airspace was illegal. A subsequent FAA investigation resulted in a warning to *The Daily* (Francescani 2013). The FAA ultimately determined that *The Daily* had crossed the line into a commercial purpose, and *The Daily Drone* experiment was permanently grounded (Maksel 2012).

A *MicroDrone* MD4-1000
Image Source: Microdrones.com

Screenshot of a "*Daily Drone*" video report of tornado damage in Tuscaloosa, Alabama. The imagery was recorded from a *MicroDrone*.

Fukushima

Following Japan's devastating 2011 earthquake and tsunami, three different types of drone were successfully deployed as part of the emergency response to closely examine damage to the crippled Fukushima nuclear plant. A key problem for crisis managers during earlier nuclear incidents at the 1979 partial meltdown at the US Three Mile Island plant and the Soviet Chernobyl disaster in 1986 was a lack of detailed visual information. Extremely high radiation levels made even short term exposure for humans fatal (Madrigal 2011).

Immediately following the earthquake and subsequent tsunami, the US Government authorised 20 missions by US Air Force *Global Hawk*, over the damaged Fukushima Daiichi nuclear plant (UASvision 2011b). The US$200M *Global Hawk* was the largest, most sophisticated UAV in operational service, capable of cross the world on non-stop 35 hour missions. *Global Hawk* primarily a high altitude military intelligence, surveillance and reconnaissance platform, and TEPCO urgently needed a closer inspection, so smaller UAVs were soon dispatched to the site. First to be launched was a small fixed wing UAV, operated by Air Photo Service (APS), a private commercial aerial photography venture (AirPhotoService 2012).

The *Air Photo Service* team prepare the APS UAV for the second mission over the crippled Fukushima Dai-ichi nuclear plant on March 24, 2011.
Image Credit: AP/Air Photo Service.

APS - UAV	
wingspan	2.8m
endurance	4.5 hours
take-off weight	35kg
range	500 kilometres
Crew	3

In the days leading up to the earthquake and tsunami, APS had, on contract to local government, conducted aerial surveying of potential disaster locations near a volcano in Kagoshima, southern Japan. Following a direct request from a Japanese cabinet minister, APS immediately redeployed to a location 70 kilometres from the Fukushima Daiichi plant, believed to be outside the radiation zone, and launched two 90 minute missions over the

stricken facility, recording 300 images on each flight (E-mail and phone correspondence with the author via interpreter).

A radiation expert was on standby for decontamination after each mission, but APS Chief Executive Yamazaki claimed there was no detectable contamination, despite the craft's multiple low-level passes just 300 metres above the damaged reactors. The APS drone was not fully autonomous and the missions had to be pre-planned with calculations of direction, route and airspeed programmed into the drone prior to launch. Once airborne, progress of the craft was monitored via computer. The operators were unable to directly control the camera or transmit images from the craft back to the control point in real-time. All 600 images were sent to TEPCO, but only 10 were approved for public release.

This March 20, 2011 image taken by the *Air Photo Service* UAV shows a wide shot of the crippled Fukushima Daiichi nuclear power plant, from left; Unit 1 (partially seen), Unit 2, Unit 3 and Unit 4.
Image source: AP/Air Photo Service

March 20, 2011, Damaged Unit 4 (left) and damaged unit 3 (right) from the Air Photo Service UAV.
Image Source: AP/Air Photo Service.

March 24, 2011. The *Air Photo Service* UAV image shows the damaged Unit 4 of the crippled Fukushima Dai-ichi nuclear plant.
Image Credit: AP/Air Photo Service.

By the fourth week of the crisis, TEPCO required closer examination of the damage than the APS UAV could provide, so a different UAV type, the US Honeywell *T-Hawk*, was called into service. Dubbed 'the flying beer keg', the *T-Hawk* has a 'hover and stare' capability, enabling extremely close access to the target for on-board cameras (Honeywell 2013; Madrigal 2011). *T-Hawk* had been extensively deployed by US forces in Iraq searching for roadside bombs (ArmyTechnology 2012). Four *T-Hawks* were sent to Fukushima, two flying operationally, and two held in reserve. The drones were operated by an American civilian crew wearing full-body radiation protective gear. TEPCO restricted information on the exact nature of the missions. However the civilian Honeywell crew told the *Wall Street Journal* that the *T Hawks* were unaffected by radiation, but that rain and heavy winds prevented the drones from getting airborne on some days (Pasztor 2011).

Honeywell *T-Hawk* Unmanned Aerial Vehicle
Image source: Honeywell Aerospace.

Honeywell *T-Hawk*	Rotary Ducted MAV (Micro Air Vehicle)
Take-off weight	8 kg
Endurance	50 minutes
Operating radius	10 kilometres
Power plant	Petrol engine

T-Hawk image -seashore-side of the reactor building.

T-Hawk image of operation floor of a reactor building

Images source: TEPCO

On June 24, a *T-Hawk* lost control while collecting dust samples around the complex and was forced to make 'an emergency landing' on the roof of the No.2 reactor. Japanese and western media reported that the 'landing' appeared to be a crash. Due to the small size and weight of the craft, TEPCO stated that it was unlikely that the drone had pierced the damaged reactor roof, and announced that the drone would be recovered by a long crane (HeraldSun 2011; Inajima 2011). Flight restrictions caused by high wind and rain, and the accident underscored the limitations of current small UAV technology. Despite this mishap, Japanese and US sources indicated that the drone operations provided valuable visual data for emergency co-ordinators (Madrigal 2011; Pasztor 2011).

A *T-Hawk (centre of picture)* lies on its side after 'crash landing' on the roof of Fukushima Reactor No.2
Image source: Japan News Today.

Japan's atomic energy authority and the Aerospace Exploration Agency later announced a joint project to develop a specialist drone to measure environmental radioactivity (AFP 2012). James Acton, Associate of the Nuclear Policy Program at the Carnegie Endowment for International Peace told *International Business Times* that;

> "Fukushima is not the worst nuclear accident ever but it is the most complicated and the most dramatic. This was a crisis that played out real-time on TV, Chernobyl did not" (InternationalBusinessTimes 2011).

The Fukushima drone missions closely matched tasks that would have been set had the UAVs been specifically operated by news organisations. This was a major story of international significance, but restrictions imposed by Fukushima's operator TEPCO, and the Japanese Government resulted in very little of the drone imagery being publicly disseminated. Kathleen Culver in '*Ethics Aloft'* theorised that drone journalism could have provided a way of validating the accuracy of Government statements on this crisis;

> "News organizations suspected the government of hiding the extent of the damage and the release of radiation but were powerless to challenge official figures. A drone with cameras and radiation sensors would have provided a fast and cheap check on the official story and represented citizens' interests" (Culver 2012).

The Fukushima drone missions raised public awareness of the news-gathering capabilities of the technology. Aerial Photo Service was subsequently commissioned by a commercial TV network to once more fly over the stricken Fukushima plant to film a documentary. This flight had TEPCO approval. Air Photo Service CEO Kenzo Yamazaki said one unintended response to his high profile Fukushima missions came from police, who subsequently made periodic visits to the APS offices and expressed a concern that the APS drone could be stolen by terrorists and used to spread deadly sarin gas. Yamazaki said the Japanese Government did not impose restrictions on his operations, and by April 2013 APS was operating two fixed wing and two rotary UAVs (E-mail and phone correspondence with the author via interpreter).

The Lithgow-Blue Mountains Bushfire

Drone vision of the NSW Blue Mountains bushfires. October 2013
Image Source: YouTube/Cividrones.

In October 2013, an anonymous drone operator *Cividrones*, posted a YouTube video of the aftermath of the Blue Mountains bushfires that had caused widespread destruction in NSW (Youtube 2013). The video clip, which appeared to have been recorded from a small multi-

rotor, showcased the extraordinary capabilities of the technology as the craft tracked through a burnt out building, over fire-fighters and what appeared to be a back-burning operation.

The clip was widely broadcast by several major media groups including the ABC, Fairfax, News Corporation and the BBC. The Civil Aviation Safety Authority (CASA) subsequently warned that such flights were illegal, that operating a remotely piloted aircraft in the same airspace as helicopter and planes fighting fires 'created a real risk of a mid-air collision' (ABC 2013a). CASA's concerns may be warranted as small multi-rotor drones would be difficult to control in the high winds generated by bushfires and the smoke would make the craft difficult to spot from the ground or low flying fire-fighting aircraft.

Another factor that may potentially discourage the use of small multi rotor drones for newsgathering at bushfires, is the inherent fire risk posed by the craft. Most consumer-grade small multi-rotor UAVs are powered by volatile lithium-polymer batteries that have a history of exploding or catching fire following heavy impact with the ground or a tree branch (Kim, Tredeau & Salameh 2008; Sanchez 2012).

January 2013: *ABC News* the Tasmanian Bushfires

In January 2013, ABC-TV News broadcast its first drone 'user generated content' on the 7pm Tasmanian state new bulletin, with aerial vision of the aftermath of the devastating bushfires in the township of Dunalley. The drone vision was recorded by local enthusiast Rian Taylor on a small homemade craft;

> "My brother, who is in the fire brigade, had been in chopper above devastated area earlier in the day. I was passing through helping with generators, thought I'd put up a drone. I've always got one in the back of the car. Got about 20 of them… I posted the vision on my *YouTube* page and was contacted by …ABC News. It went on the news and I was contacted by people from around the world". (Author communication with Taylor).

Current CASA regulations were obeyed, as Taylor operated as a hobbyist and recorded the vision for the sole purpose of posting on his *YouTube* page. ABC news producers offered no payment or reward, when requesting permission to broadcast the online material (Taylor 2013). The vision was broadcast, only after ABC editorial staff were satisfied that the images were authentic, had been recorded under ethical circumstances and that Taylor had not broken any laws. The ABC had recently introduced editorial guidelines for the use of smart phone camera vision/stills offered for broadcast by members of the public. These regulations on 'user generated content' could be easily adapted to incorporate amateur 'drone vision' contributions.

Drone Images of the Dunalley bushfire devastation – broadcast by ABC TV News January 2013.
Images Source: ABC-TV News /*RianRex* YouTube Rian Taylor.

Drone enthusiast and User Generated Content Provider - Rian Taylor.
Image Source: *7.30 Tasmania, ABC-TV.*

Taylor, who was subsequently profiled in a story on ABC-TV's *7:30 Tasmania*, stated that he operated under CASA-approved 'safe conditions' insisting that he would never launch over an active fire due to low visibility caused by smoke, and the hazards of fire-generated winds that can gust to 150 km per hour, making the drone dangerously uncontrollable. Taylor invested A$2,000 in his custom built craft which he said had a 'safe' range of 650-700 metres.

Taylor claimed to be also developing a disposable A$160 micro drone for the local fire brigade (Wood 2013). Employed as a private investigator, Taylor stated that he did not deploy drones on investigations as he lacked the appropriate CASA UAV certification and regarded the craft as "too noisy" for surveillance work (Author telephone communication with Taylor).

Screenshot – ABC Emergency webpage –
http://www.abc.net.au/news/emergency/plan-for-an-emergency/
Image source: Australian Broadcasting Corporation

ABC – Emergency Broadcaster

The Australian Broadcasting Corporation serves as Australia's Emergency Broadcaster during natural disasters such as bushfires, cyclones and floods. The mainstay of this service is the ABC's network of 60 Local Radio stations around the country which broadcast localised warnings and alerts to residents during a crisis. ABC TV and Online services also provide support during emergencies and updates are immediately posted on Twitter (ABCEmergency 2013; Mannix 2012).

Could a large ABC drone enhance this capability, when local communications infrastructure may be damaged or destroyed?

In 2010, NSW Rural Fire Service Group Manager Tim Anderson published a comprehensive Churchill Fellowship study; *Improving Bushfire Intelligence Through The Use Of Unmanned Aerial Vehicles.* While acknowledging limitations imposed by current technology, cost and regulation, Anderson concluded that Unmanned Aerial Systems (UAS) could provide effective 24 hour fire surveillance capability 'UASs can provide improved local fire information, especially at night when current aircraft are not available'. He also noted that UASs could provide "…better decision making and more accurate public warnings' (Anderson 2010).

Ian Mannix, the ABC's Manager of Emergency Broadcasting assessed that a drone could simultaneously provide immediate news coverage while also aiding emergency authorities with timely intelligence to assist in countering the disaster. However Mannix stressed that privacy considerations would need to be factored into drone operations, particularly during coverage of bushfires.

> "Increasingly emergency agencies are preventing the electronic media from accessing fire grounds until residents have been allowed to view their burnt out properties. The aim is to reduce trauma from seeing a destroyed home" (Author e-mail correspondence with Mannix).

Mannix said a media-operated drone may also be suitable in a dual-use role during floods.

"Rapid flooding, or high level riverine flooding frequently knocks out the telemetry that gives BoM (Bureau of Meteorology) or water authorities their intelligence. (Nogoa River, Emerald, Qld, 2008) Real time images of flooding can be used to develop better warnings. Ideally some sort of measuring device would be useful, but if a drone was sent "up river" before the floods arrived, the images would then give base information to compare river heights, and flood levels. This is both a BoM and media activity. Being able to send cheap, cost effective drones up and down the same river for the duration of the flood would provide high level accuracy" (author email correspondence with Mannix), (ABC 2008).

In a related development, the US military introduced the concept of UAVs as flying cell-phone towers to provide 3G smart phone/internet coverage over parts of Afghanistan where terrain degrades reception for the conventional ground-based network (Ackerman 2010; Sternstein 2013; Textron 2012).

Larger, fixed-wing drones such as the *Aerosonde/ScanEagle* type could be deployed by media, above firefighting aircraft, flying in a pre-determined racetrack pattern for more than 24 hours at a time, recording vision day and night, using conventional and thermal imaging cameras.

Summary

Small drones offer considerable advantages for news staff deployed on high risk assignments such as wars, civil unrest and natural disasters.

When embracing this technology and its many benefits journalists should be mindful not to be completely removed from the story they are covering. Direct personal contact remains an essential element; gathering information and gauging mood, context and accuracy, and this is difficult to achieve remotely. But there are applications where it may be too dangerous or difficult to have a journalist 'on the ground' where the 'lone drone' could be extremely beneficial to the safety of news gatherers in the field.

While this is in many ways a transformative technology, it is unlikely that drone news-gathering will radically alter the practise of journalism, in terms of influencing editorial decisions or changing storytelling methods. The development of the internet, smart phones, cheaper smaller cameras, more powerful telephoto lenses, laptop editing systems and the availability of commercial satellite imagery have all contributed to a technological revolution in news-gathering. Drones will add another extremely powerful element to this already impressive array, but it is the author's belief that the craft will ultimately bolster a technological shift already in motion, rather than creating a distinct media genre.

It is clear that the phenomenal pace of UAV development and the rapid proliferation of this technology has caught government regulators, the aerospace industry, and potential civilian 'adaptors', including media, by surprise. No-one really knows how 'The Drone Age' will ultimately evolve. As Dr. Peter W. Singer, US Brookings Institution robotics and technology expert noted;

"This is a technology that's a game changer. It's been so on the military side, it will be the same on the civilian side, it's real, and it's coming. No amount of hand-wringing is going to stop it" (Corcoran 2012d).

The challenge now for journalists and media organisations is to ensure that the technology is adopted within a clearly defined operational framework where safety, ethics and privacy are paramount

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