

# Hobbyist Drones

## Payload and Mission Capabilities

### Roger Clarke

Xamax Consultancy Pty Ltd, Canberra

Visiting Professor in Computer Science, ANU, Canberra

Visiting Professor in Cyberspace Law & Policy, UNSW, Sydney

### Adam Molnar

Lecturer, Criminology, Deakin University, Melbourne

Principal, Block G Security and Privacy Consulting

## IEEE SSIT RPAV Workshop

29 September 2014

Copyright  
2013-14



1

# Hobbyist Drones

## Payload and Mission Capabilities

- Introductory Presentation
  - Scope of the Session 2
  - Use Contexts 5
  - Public Safety 4 + 3
  - Surveillance and Privacy 6
  - Regulatory Framework 2
- Regulatory Options
  - Public Safety 12
  - Surveillance and Privacy 8

Copyright  
2013-14



2

## What Does 'Hobbyist' Mean?

- 'Private / Personal / Sport / Recreational'  
Not 'Air Work / Commercial tasks (hire and reward)'  
incl. demos, training, R&D, company-internal purposes

Copyright  
2013-14



3

## What Does 'Hobbyist' Mean?

- 'Private / Personal / Sport / Recreational'  
Not 'Air Work / Commercial tasks (hire and reward)'  
incl. demos, training, R&D, company-internal purposes
- **But where are the boundaries?**
  - Rental for private or personal use?
  - Vicarious Joy-Rides (for the view)?
  - Competitions / Professional Sport?
  - Journalism / Voyeurism, if unpaid?
  - Uninc'd / Inc'd Enterprises / Associations?  
e.g. Human and Animal Search, Mustering,  
Hunting, Anti-Hunting, Trespass Surveillance

Copyright  
2013-14



4

## Hobbyist Drones Payload and Mission Capabilities

- Introductory Presentation
  - Scope of the Session
  - **Use Contexts**
  - Public Safety
  - Surveillance and Privacy
  - Regulatory Framework
- Regulatory Options
  - Public Safety
  - Surveillance and Privacy

## Types of Hobbyist 'Missions'

- Observation
  - Location
  - Pursuit
- Recording
- Search (person, article, animal, wreckage)
- Comms Relay (bushwalking, on-property)
- Survey (vegetation)
- Goods Delivery (water)

## Observation and Recording Motivations

- Scenic Appreciation
- Sousveillance ('police watch')
- Voyeurism / Peeping Toms
- Voyeurnalism / Paparazzi Aloft
- Journalism
- Community Policing / Vigilantism
- Moral Minority Policing

## Modes of Use

- **VLOS (Visual Line of Sight)**
- **FPV (First Person View)**
  - **As an Aid**
  - Exclusive (Goggles)
- Instrument-Based Ops (IBO)
- Single-Device
- Team / Squadron
- Swarm / Flock

## Use-Related Challenges

- **Physical Congestion**
  - Indoors, Forests, Buildings, Pole-Strung Cables, Airport, Emergency Scene (ghoul factor), Celebs/Notorieties (fan/parapazzi factor)
- **Electronic Congestion**
- **Contention**
  - Scheduled Aircraft, Emergency Ops (Search, Fire, Accident, Hostage, Stake-Out)
- **Criminal Uses**
  - Delivery, Diversion, as a Weapon, Jamming
- **Sociopathic Uses**
  - Interference, Weapon-Carriage, Kamikaze

## Use-Related Challenges The Pilots and Facilities Operators

- Education ==>> Understanding
- Training ==>> Expertise
- Concentration ==>> Performance
- Task Design ==>> Avoidance of Cognitive Overload
- Risks of Error  
Mis-Judgement  
Dehumanisation

## Hobbyist Drones Payload and Mission Capabilities

- Introductory Presentation
  - Scope of the Session
  - Use Contexts
  - **Public Safety**
  - Surveillance and Privacy
  - Regulatory Framework
- Regulatory Options
  - Public Safety
  - Surveillance and Privacy

## The Prescott Case – Sydney, 2 Oct 2013



<http://www.smh.com.au/technology/sci-tech/i-dont-know-whether-its-a-bomb-or-not-train-driver-flummoxed-after-drone-hits-sydney-harbour-bridge-20131126-2y76m.html>  
[http://www.liveleak.com/view?f=dccca42c2905&ajax=1&player\\_width=512&player\\_height=384&iframe=true&width=550&height=420](http://www.liveleak.com/view?f=dccca42c2905&ajax=1&player_width=512&player_height=384&iframe=true&width=550&height=420)

## Sydney, 2 Oct 2013

- Rihanna video-tech, Edward Prescott, flies his drone from a wharf West of Circular Quay
- The drone control malfunctions
- **It auto-redirects back to its point-of-origin**
- **It hits two Sydney Harbour Bridge girders, lurches across 6 lanes, a few metres above traffic, hits another girder, crashes on a railway line**
- The next train-driver stops and picks it up
- A Naval event is in progress
- Prince Harry is in town
- International coverage follows (London, Milan)

Copyright  
2013-14



<http://www.smh.com.au/nsw/mystery-drone-collides-with-sydney-harbour-bridge-20131004-2uzks.html>  
[http://www.liveleak.com/view?i=661\\_1385456831](http://www.liveleak.com/view?i=661_1385456831)

13

## The Prescott Case – Sydney, 2 Oct 2013

- **The Police gave him back his damaged drone**
- He posted the video it had captured on the Web

CASA provided some quotes to the media:

- "There are regulations and fines attached ... hundreds of dollars"
- "[Drone pilots] must keep them at least 30m away from any people, buildings or structures"
- "Airspace around the Harbour Bridge is restricted"
- **"Check with local council where they can be used"**

Long after Prescott left, CASA levied an \$800 fine

Copyright  
2013-14



<http://www.smh.com.au/nsw/mystery-drone-collides-with-sydney-harbour-bridge-20131004-2uzks.html>  
<http://www.theage.com.au/technology/technology-news/river-of-blood-after-drone-hits-australian-athlete-20140407-zqruh.html>

14

## Some Failures

- **First UK law enforcement use**  
Lost in the Mersey River off Liverpool (BBC 2011)
- **First Australian media use**  
Lost off Christmas Island (Corcoran 2012)
- **First US police-owned drone, in Texas**  
Crashed into a police vehicle (Biddle 2012)
- **In South Korea, a drone crashed into its control truck, killing 1, and injuring 2 'remote' pilots (Marks 2012)**
- **Micro-drone crashes in CBDs**  
Auckland (Mortimer 2012), Sydney (Kontominas 2013)

Copyright  
2013-14



15

## 'Failure Modes'

### Artefact Failure

- Mechanical
- Electrical
- Power
- Programming
- 'Fail-Secure' Misdesign

### Pilot Failure

- Education / U'stnding
- Training / Skill
- Concentration / Timing
- Contextual Appreciation

### Environmental Factors

- Physical Congestion
- Turbulence
- Lightning
- Communications
  - Interruption
  - Data Corruption

### 'Fail-Secure'?

- Remain in Place
- Land Immediately
- Auto-Return to Origin

Copyright  
2013-14



16



## Harm to Public Safety

### Impact Factors

- Aircraft Velocity
- Propellor Velocity
- Mass
- The Object that's hit

### Consequential Harm

- Explosion / Fire
- Surprise / Diversion

### Physical Interference

- Air Ops
- Ground Ops

### Comms Interference

- Congestion
- Jamming

## Deliberate Harm Motivations

- Thrill-Seeking
- Revenge
- Aid to Crime
- Terrorism

## Hobbyist Drones Payload and Mission Capabilities

- Introductory Presentation
  - Scope of the Session
  - Use Contexts
  - Public Safety
  - **Surveillance and Privacy**
  - Regulatory Framework
- Regulatory Options
  - Public Safety
  - Surveillance and Privacy





## The Privacy of Personal Behaviour

- The interest that individuals have to behave as they wish, without undue observation and interference by others
- Behaviour encompasses activities, movements, associations and preferences
- Sexual, Religious, Political ...
- Private places, Public places
- Surveillance – Visual, Electronic, Transactional, ...



"Kate Middleton and many other people besides can rest assured that their bare breasts are fair game, anywhere, any time," the Australian Privacy Foundation's Roger Clarke warned, in a week when snaps of the pregnant Duchess in a bikini made international headlines.

Last year a New South Wales resident filed a complaint after spotting a drone hovering outside their bedroom window, Australian Privacy Commissioner Timothy Pilgrim said.



THE civilian drone revolution in Australia has triggered calls from the Privacy Commissioner for a public debate about the "intrusive" technology as police investigate the potential of drones for crime fighting.

"... there needs to be public debate about the use of this technology and whether current regulations are sufficient to deal with any misuse"



<http://investigatamidwest.org/2014/03/21/states-restrict-drone-use-because-of-privacy-concerns/>  
<https://www.aclu.org/blog/technology-and-liberty/status-2014-domestic-drone-legislation-states>

## Hobbyist Drones Payload and Mission Capabilities

- Introductory Presentation
  - Scope of the Session
  - Use Contexts
  - Public Safety
  - Surveillance and Privacy
  - **Regulatory Framework**
- Regulatory Options
  - Public Safety
  - Surveillance and Privacy

## Regulatory Framework

- **Natural Controls**  
Physical Danger, Economics, Reputation
- **Individual Self-Regulation**  
Self-Restraint, Social Responsibility
- **Industry / Social Self-Regulation**  
Declared Voluntary Codes
- **Co-Regulation**  
Negotiated Statutory Codes
- **Formal Regulation / Law**  
Imposed Statutory Codes, Enforcement

## How to Recognise An Effective Regulatory Scheme

| Process                               | Product                                  | Outcomes         |
|---------------------------------------|--|------------------|
| • Clarity of Aims, Requirements       | • Comprehensiveness                      | • Oversight      |
| • Transparency                        | • Parsimony                              | • Enforceability |
| • Participation                       | • Articulation                           | • Enforcement    |
| • Reflection of Stakeholder Interests | • Educative Value                        | • Review         |
|                                       | • Appropriate Generality and Specificity |                  |

## Hobbyist Drones Payload and Mission Capabilities

- Introductory Presentation
  - Scope of the Session
  - Use Contexts
  - Public Safety
  - Surveillance and Privacy
  - Regulatory Framework
- Regulatory Options
  - Public Safety
  - Surveillance and Privacy

## Public Safety The Realities

- Little Understanding
- Little Training
- Little Responsibility Taken
- Not Easily Identified and Located
- Not Easily Proven Responsible
- No Insurance
- No Assets

## A Victim-Pays System

## Public Safety Social Controls

- Model Aircraft Clubs
  - Isolated Location
  - Constraints
  - Acculturation
  - Insurance
- No Powers, No Enforcement
- No Incentives to Drone Users to Join

## The Current Regulatory Framework

### International

- Small Drones are declared out-of-scope

### National

- Air Navigation Act  
Air Navigation Regulations
- Civil Aviation Safety Authority (CASA)
- Civil Aviation Safety Regulations (CASR)
- CASR 101-1 (UAVs) since 1998/2002
- CASR-101-3 (Model Aircraft) since 1998/2002

## The CASA Regulatory Regimes

| DETERMINATIVE FACTORS                     |   |   |   |   |     |     |
|---|---|---|---|---|-----|-----|
| Controlled Airspace                       | ✓ | – | X | X | X   | X   |
| > 150kg Fixed-Wing / 100kg Rotorcraft     | – | ✓ | X | X | X   | X   |
| < 150kg Fixed-Wing / 100kg Rotorcraft     | – | X | ✓ | ✓ | ✓   | ✓   |
| Commercial Use                            | – | – | ✓ | X | X   | X   |
| 2-7 kg                                    | – | X | X | X | ✓   | X   |
| < 2kg                                     | – | X | X | X | X   | ✓   |
|   |   |   |   |   |     |     |
| APPLICABLE REGULATORY REGIME              |   |   |   |   |     |     |
| Full Regulatory Framework (CASR)          | ✓ | ✓ | – | – | –   | –   |
| Limited Regulatory Framework (CASR 101-1) | – | – | ✓ | – | –   | –   |
| Model Aircraft Framework (CASR-101-3)     | – | – | – | ✓ | ✓   | ✓   |
| (Emergent light regulatory scheme)        | – | – | – | – | (✓) | –   |
| (Emergent even-lighter regulatory scheme) | – | – | – | – | –   | (✓) |
| Damage by Aircraft Act                    | ✓ | ✓ | ✓ | – | –   | –   |



Civil Aviation Authority  
**INFORMATION NOTICE**  
Number: IN-2014/115



Issued: 17 July 2014

**Small Unmanned Aircraft: Special Operations - Future  
Requirement for a Safety Case Assessment**

"[Re] Small Unmanned Surveillance Aircraft (SUSA) within the weight category 7 - 20 kg ... there will be a future need for their aircraft to be assessed for airworthiness in relation to operating within 150 m of a congested area [competencies, tech specs, outcome mitigation; assessment fee Stg 134 p.hr.]

## Generic Risk Management Strategies

### • Proactive Strategies

- Avoidance
- Deterrence
- Prevention

### • Reactive Strategies

- Isolation
- Recovery
- Transference

### • Non-Reactive Strategies

- Tolerance
- Abandonment
- Dignified Demise
- Graceless Degradation

## Generic Risk Management Strategies

- **Proactive Strategies**
  - Avoidance
  - Deterrence  
**Reminders**  
**Fines**  
**Criminal Charges**
  - Prevention  
**Redundancy in**  
**Power, Comms**
- **Reactive Strategies**
  - Isolation
  - Recovery
  - Transference  
**Express Liabilities**  
**Compulsory Third-Party Insurance**

## Categories of Intervention

- Operator Professionalism
- Technical Features
- Extra Supplier Responsibilities
- Regulatory Mechanisms

## Operator Professionalism Can Military Norms be Scaled?

- Highly-Articulated Structures
- Highly-Articulated Processes
- Expensive / Pay-to-Play
- Rules of Engagement
- Monitoring
- Moral Suasion
- Threat of Licence Withdrawal
- Reviews

## Technical Features

- Dual Control Channels
- Redundant Comms Channels
- Collision Detection
- Collision Avoidance
- Autoland
- 'Fail-Secure' [means what??]
- Design Audit and Certification
- Device Inspection after Manufacture
- Periodic Device Re-Inspection



## Extra Supplier Responsibilities Manufacturer? Distributor? Retailer?

- Information to Purchasers:
  - Risks
  - Procedures
  - Relevant Laws, Licensing
  - Public Liability Insurance
  - Club Directory
- Warranties
- Support and Maintenance Services

## Regulatory Mechanisms

- Minimum Feature Set (Licensing of Artefact)
- Minimum Training (Licensing of Pilot, Operator)
- Documented Procedures
- Contexts of Use Permitted / Banned
  - Missions
  - Payloads
  - Locations
  - Circumstances
- Legal Liability
- Insurability dependent on Compliance

## Hobbyist Drones Payload and Mission Capabilities

- Introductory Presentation
  - Scope of the Session
  - Use Contexts
  - Public Safety
  - Surveillance and Privacy
  - Regulatory Framework
- Regulatory Options
  - Public Safety
  - Surveillance and Privacy

## Contemporary Regulation of Surveillance

### Tort

- Interference with Real Estate (Trespass, Nuisance)
- Interference with the Person (Trespass, Obstruction, False Imprisonment, Assault, AVOs / PSIOs)
- Interference with Emotional State (Stalking, Negligence)
- Deceitful Behaviour (Misrepresentation, Deceit, Passing-Off)

### Surveillance Statutes

- Telecomms (postal, TIAA, computer offences)
- Aural/Visual Surv Devices (Clth, State, Territory)
- Pornography, Anti-Voyeurism

**Other Statutes** (Copyright, Trademarks, Media Law, Human Rights, Privacy)

**Media Codes** (APC, ACMA)

**Direct Action** (protecting the public, and the media)

## State Surveillance and Listening Devices Acts

Vic, WA, NT (1998-2000)

& NSW (2007), Qld

### Surveillance Devices Acts

Prohibition of surveillance only of a 'private activity', except:

- by someone who is a party to the activity
- if the activity is happening outside the building; or
- if the circumstances indicate that the parties do not care if they are seen

SA, Tas, ACT

1971, 1972, 1990

Prohibition of aural surveillance of a private activity, except ...

### Workplace (NSW, ACT)

- Must be merely declared
- Covert only with a magistrate's approval

*Anti-Voyeurism laws may put toilets, bathrooms, change-rooms off-limits*

Copyright  
2013-14



<http://www.privacy.org.au/Resources/PLawsST.html>

45

## The Regulation of Surveillance General Principles

1. Justification
2. Proportionality
3. Openness
4. Access Security
5. Controlled Use
6. Controlled Disclosure
7. Controlled Publication
8. Non-Retention and Rapid Destruction
9. Review
10. Withdrawal

Copyright  
2013-14



<http://www.privacy.org.au/Papers/PS-CCTV.html>

46

## The Policy Response

- **Technology Assessment?**
  - Only Europe has TA Agencies
  - Only Norway has published anything
- **Risk Assessment?**
  - Little sign of corporate RA
  - No sign of society-level RA
- **Law Reform Commissions?**
  - Mention in an ALRC Privacy Study

What Policy Response??

Copyright  
2013-14



47

## APF's Policy Statement on What's Needed

1. **Comprehensive laws regulating surveillance activities**, by all organisations and individuals
2. Provisions that relate to **private places**, but also provisions that relate to **private space in public places**
3. Provisions relating specifically to **visual surveillance**
4. Provisions relating to **aerial surveillance**, reflecting the additional vulnerabilities that arise from it
5. To the extent necessary, provisions relating to **surveillance by means of drones**
6. Provision of **responsibilities, authority and resources** to an appropriate agency ...

Copyright  
2013-14



<http://www.privacy.org.au/Papers/PS-Drones.html>

48

## Privacy as a Strategic Factor

- Privacy is a potentially severe impediment
- 'Privacy doesn't matter until it does' means that media breakouts will be uncontrollable
- Privacy-Sensitivity in Design and Operation has the potential to be a Differentiator
- Privacy-Sensitivity doesn't just happen
- A Privacy Strategy involves a proactive stance, an express strategy, an articulated plan, resourcing, monitoring against the plan

## Forms of Privacy Project

- Privacy Strategy Formulation
- **Privacy Issues Analysis**
- Deeper Privacy Impact Evaluation Methods:
  - Privacy Law Compliance Assessment
  - Data Privacy Impact Assessment (PIA)
  - Internal Cost/Benefit Analysis
  - Internal Risk Assessment
  - Privacy Impact Statement
  - **Privacy Impact Assessment (PIA)**
- Privacy Management Planning and Control
- Privacy Policy Statement (PPS) Prep, Review
- Privacy Audit

## Privacy Impact Assessment Key Considerations

1. Purpose
2. Responsibility
3. Timing
4. Scope (Dimensions, Stakeholders, Reference-Pts)
5. Stakeholder Engagement
6. Orientation (Process not Product; Solutions not Problems)
7. The PIA Process
8. Outcomes

## Hobbyist Drones Payload and Mission Capabilities

### Roger Clarke

Xamax Consultancy Pty Ltd, Canberra  
Visiting Professor in Computer Science, ANU, Canberra  
Visiting Professor in Cyberspace Law & Policy, UNSW, Sydney

### Adam Molnar

Lecturer, Criminology, Deakin University, Melbourne  
Principal, Block G Security and Privacy Consulting

### IEEE SSIT RPAV Workshop

29 September 2014