TECHNOLOGY AGAINST CRIME, AFRICA

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THE DRONE BOOK

LAW ENFORCEMENT GUIDE

·· GLOBAL PERSPECTIVES FROM EXPERTS ··

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Executive Summary

In today's fluid security environment, certain emerging technologies that had their origins outside the law enforcement sphere are attracting growing interest from agencies and organizations seeking to achieve their mission more efficiently. For example, police departments across the globe are turning to social media platforms as a tool for both engaging their constituencies as well as trawling for suspicious or criminal activity, while cybersecurity tools developed for the commercial sector are increasingly finding a market among law enforcement agencies looing to fight crimes that occur in the virtual world.

Three technologies are particularly emblematic of this trend:
a. Unmanned aerial vehicles: These present myriad opportunities to address both law enforcement challenges that are as old as law enforcement itself.
b. Counter-drone technology: This addresses an emerging threat that has largely caught the security community off-guard i.e rogue Drone use.
c. The emerging sphere of autonomous and artificial intelligent (AI) systems.

All three technologies will play an important role in policing smart cities of the future. Much has been written about the potential benefits of all three of these technologies when used in a law enforcement context. And indeed, law enforcement organizations looking to remain on the leading edge of the technological curve would be remiss not to consider these tools. However, less ink has been spilled on the potential challenges involved in their adoption and effective use. To that end, this paper will enumerate both the opportunities and challenges associated with the adoption, use and integration of drones, counter-drone systems and Ai.

Law enforcement agencies looking to adopt these types of systems can use this paper as a resource to weigh these opportunities and challenges against each other in order to support an informed decision as to whether such systems make economic, tactical or legal sense within their own unique security environment.

Drone Benefits

- Drone can provide improved situational awareness
- Cheaper than traditional airborne imagery collection tools such as helicopters and fixed-wing aircraft
- Drones may be well suited for search and rescue operations.
- Drones could allow officers to collect intelligence at a safe standoff distance during potentially hazardous situations.
- Can be used to generate detailed 3D models of crime and accident scenes.

Challenges

- Drones have far less capabilities compared to manned aircraft
- As an emerging technology, drones may not be well-suited to every application that they are being used in, and there is a dearth of data about drone performance in law enforcement operations.
- Drone use may prompt civil liberties concerns and could face regulatory and public pushback if used in certain applications such as surveillance.

Counter-Drone Systems Benefits

- The malicious or improper use of drones presents a potentially serious public safety hazard, and counter-drone systems could effectively mitigate the threat.
- Counter-drone systems are designed specifically to identify and interdict drones, so they are likely to have a higher efficacy rate compared to other methods (for example, using visual observers).

Challenges

- There is no single silver-bullet solution for counter-drone systems technology; different detection and interdiction systems have its peculiar strengths and weaknesses.
- Kinetic interdiction systems may be impractical or unsafe for use at public events or in urban settings.
- Certain non-kinetic interdiction systems may be impractical in urban settings, as they may interfere with wireless communications.
- Counter-drone detection systems are ineffective at distinguishing drone use.

Artificial Intelligence (AI) Benefits

-AI Systems could improve efficiency and cut down on human labour needs by automating tasks such as hotspot analysis and imagery analysis.
- AI Systems can enable predictive policing tactics that potentially cut crime rates.
- Artificially intelligent unmanned systems could replace human officers in dull or dangerous roles.

Challenges

- AI systems can behave in unpredictable ways, and their use can yield unforeseen results.
- AI systems are complex, and errors that lead to harm may be difficult to trace.
- AI systems may amplify human bias in the law enforcement realm.
- AI systems remain unregulated and their misuse may be met with severe regulatory pushback that limits all use of these systems.

Criminal
Use of UAVs

"Education is the most powerful weapon in Law Enforcement. You can leverage technology, you can gain experience in solving crime.

Sharing that knowledge with others changes the balance of crime verses society in humanities favour."

Drone use in criminality includes:

Prison incursions - Drugs, Phones, Firearms & happy meals

Smuggling - Autonomous and use of daisy chaining

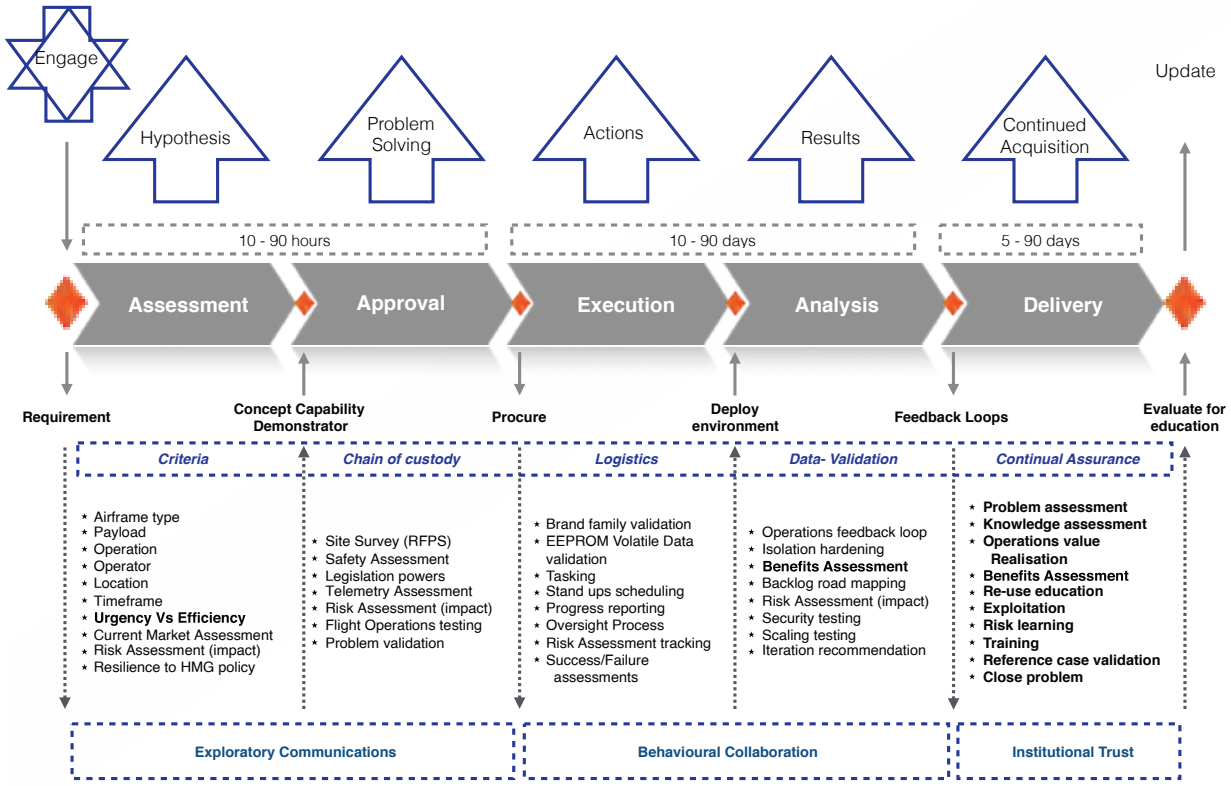
Trespass - Reconnaissance - Harassment

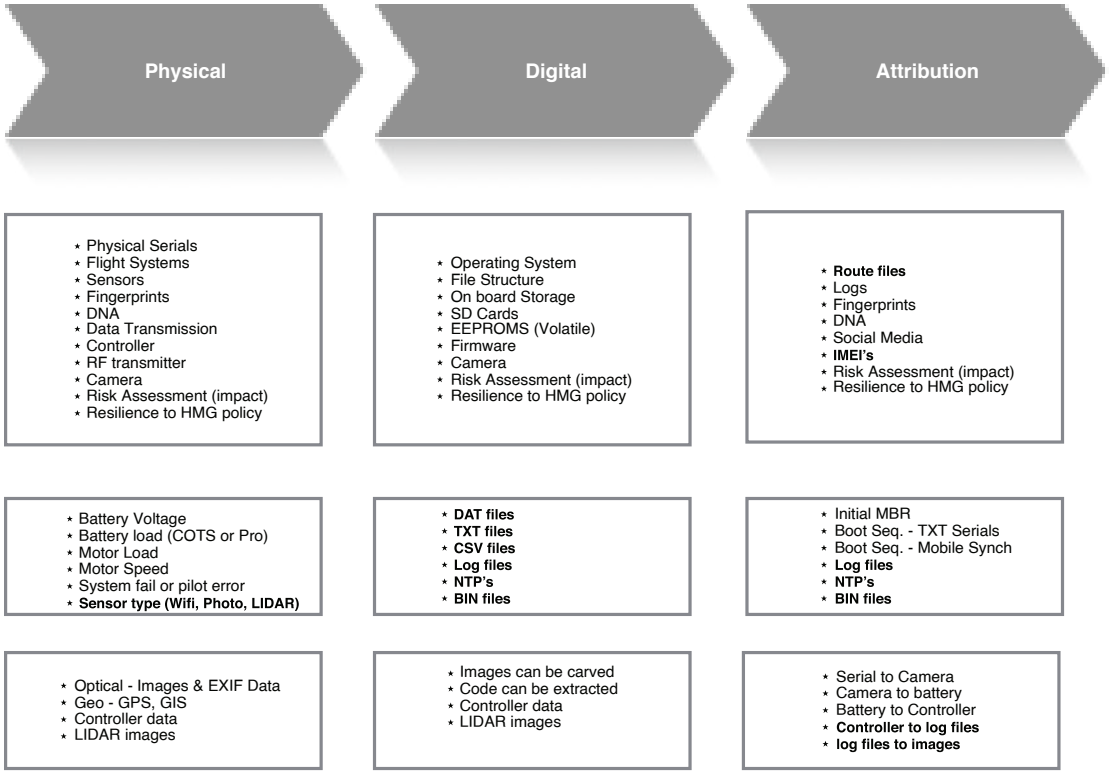
Surveillance - People and places

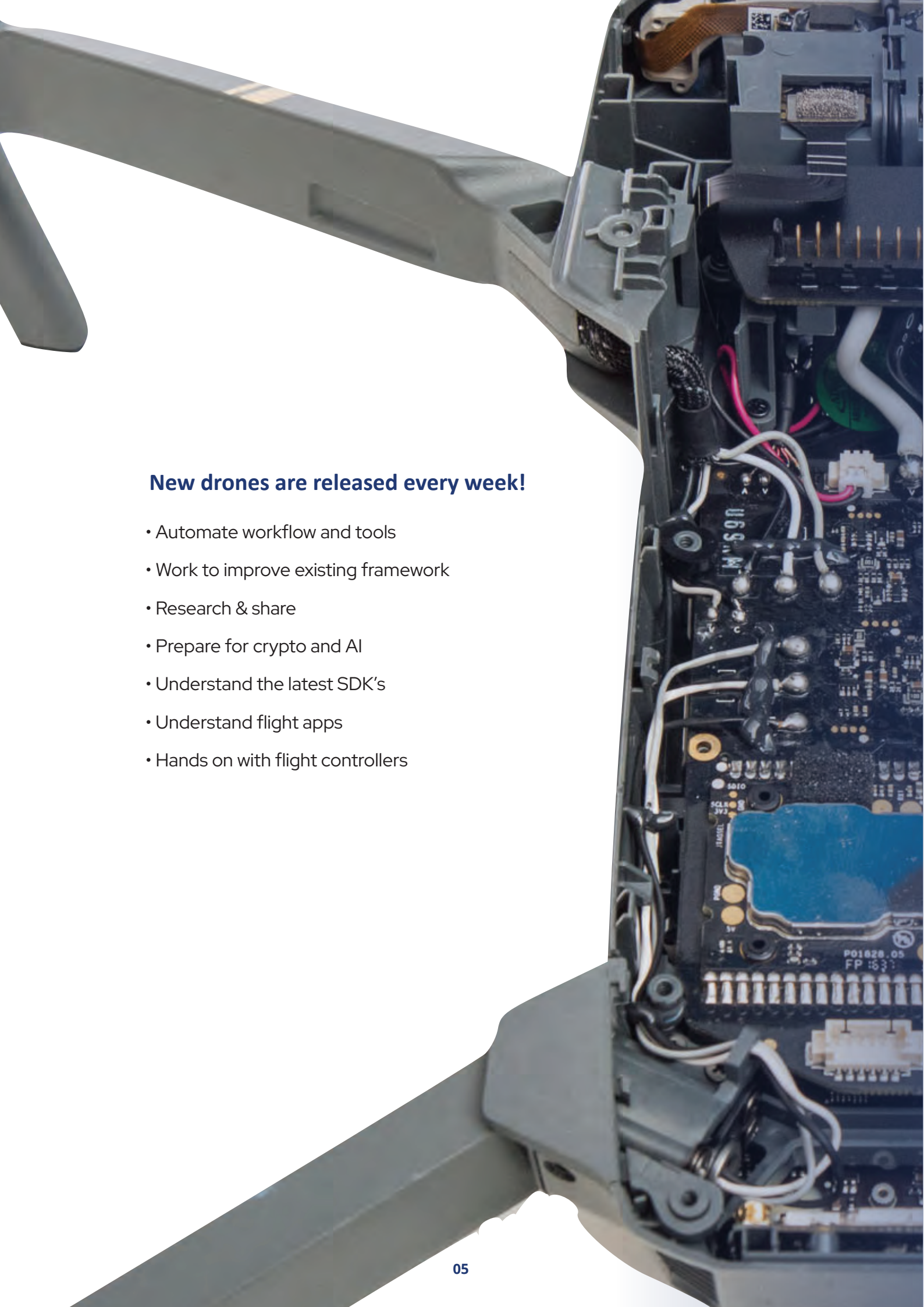
Cyber - Hacking of air gapped computers and spacial intercept

Terror - The use of Drones to incite fear through the unlawful use of violence and inDmidaDon of your perceived enemies

Drone Operating Model
Rapid Intelligence Acquisition

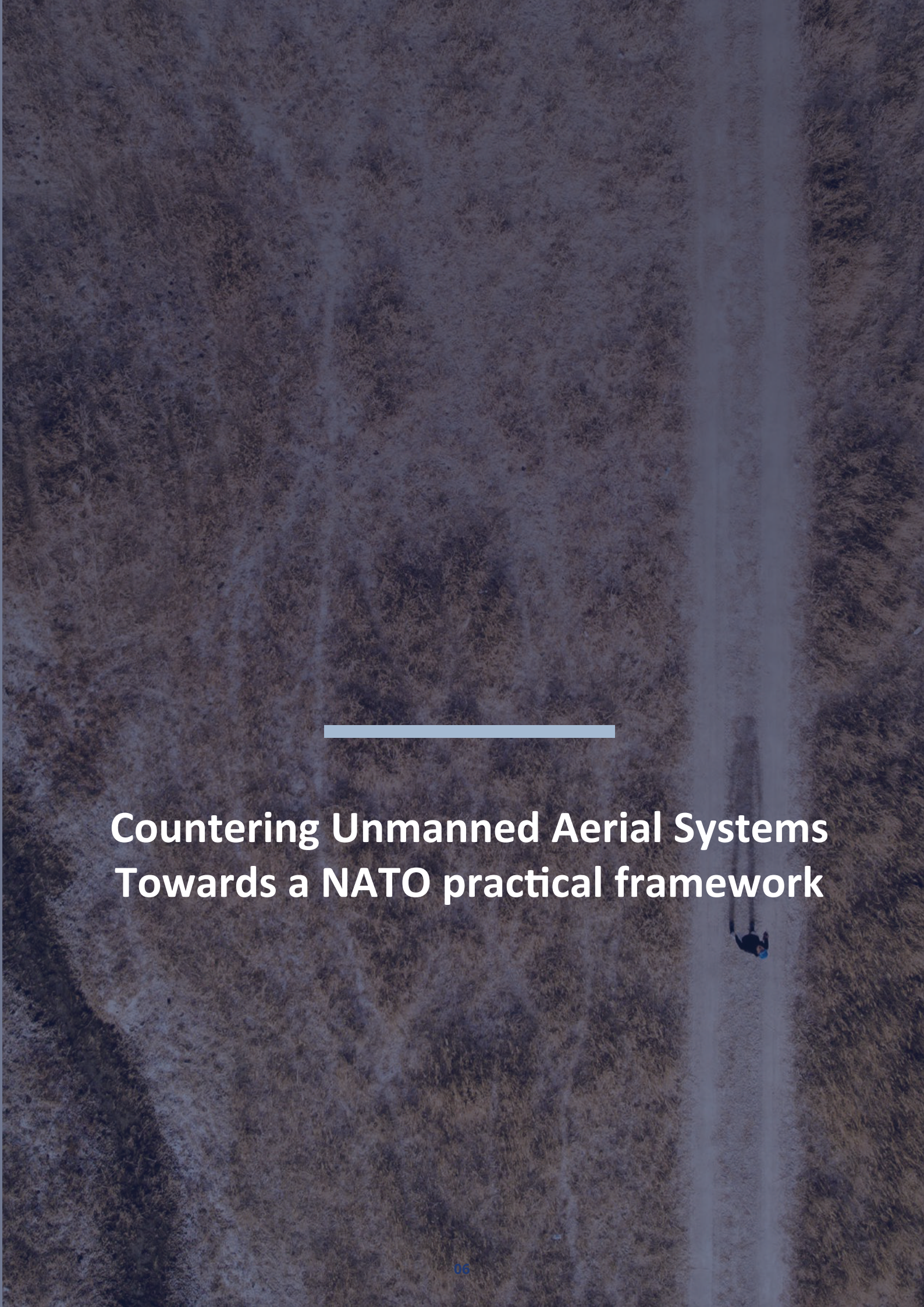






New drones are released every week!

- Automate workflow and tools
- Work to improve existing framework
- Research & share
- Prepare for crypto and AI
- Understand the latest SDK's
- Understand flight apps
- Hands on with flight controllers



Countering Unmanned Aerial Systems
Towards a NATO practical framework

Terrorist misuse of Unmanned Aerial Systems

As part of NATO's enhanced role in the fight against terrorism, NATO Emerging Security Challenges Division is exploring how to address within NATO the issue of countering terrorist misuse of technology and;

• Supporting Allies in development and deployment of capabilities for force protection

• Boost security at home

ATP-3.3.8.1

NATO UAS CLASSIFICATION

Class	Category	Normal Employment	Normal Operating Altitude	Normal Mission Radius	Primary Supported Commander	Example Platform
Class III (> 600 kg)	Strike/ Combat*	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre	Reaper
	HALE	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre	Global Hawk
	MALE	Operational/Theatre	Up to 45,000 ft MSL	Unlimited (BLOS)	JTF	Heron
Class II (150 kg - 600 kg)	Tactical	Tactical Formation	Up to 18,000 ft AGL	200 km (LOS)	Brigade	Hermes 450
Class I (< 150 kg)	Small (>15 kg)	Tactical Unit	Up to 5,000 ft AGL	50 km (LOS)	Battalion, Regiment	Scan Eagle
	Mini (<15 kg)	Tactical Subunit (manual or hand launch)	Up to 3,000 ft AGL	Up to 25 km (LOS)	Company, Platoon, Squad	Skylark
	Micro** (<66 J)	Tactical Subunit (manual or hand launch)	Up to 200 ft AGL	Up to 5 km (LOS)	Platoon, Squad	Black Widow

*Note: In the event the UAS is armed, the operator should comply with the applicable Joint Mission Qualifications in ATP-3.3.8.1 (STANAG 4670) and the system will need to comply with applicable air worthiness standards, regulations, policy, treaty, and legal considerations.

**Note: UAS that have a maximum energy state less than 66 Joules are not likely to cause significant damage to life or property, and do not need to be classified or regulated for airworthiness, training, etc. purposes unless they have the ability to handle hazardous payloads (explosive, toxins, chemical/ biological agents, etc.).

The pictures below are given only as an example; they do not intend to be comprehensive

Class I (<150 kg)

Class II (150 - 600 kg)

Class III (>600 kg)

Millitary







Consumer / Commercial




Recent events: ISIS

• Since 2014, ISIS has used UAS as part of its attacks

• Initial use of drone technology included filming Improvised Explosive device (IED) attacks for propaganda purposes, conducting reconnaissance and surveillance and spotting for indirect fire

• Lately, ISIS started to use weaponized UAS to deliver attacks

• ISIS demonstrated also expertise in fabricating its own weaponized drones and modifying Commercial Off The Shelf UAS

• ISIS demonstrated capabilities in using both fixed wings and multirotor
UAS

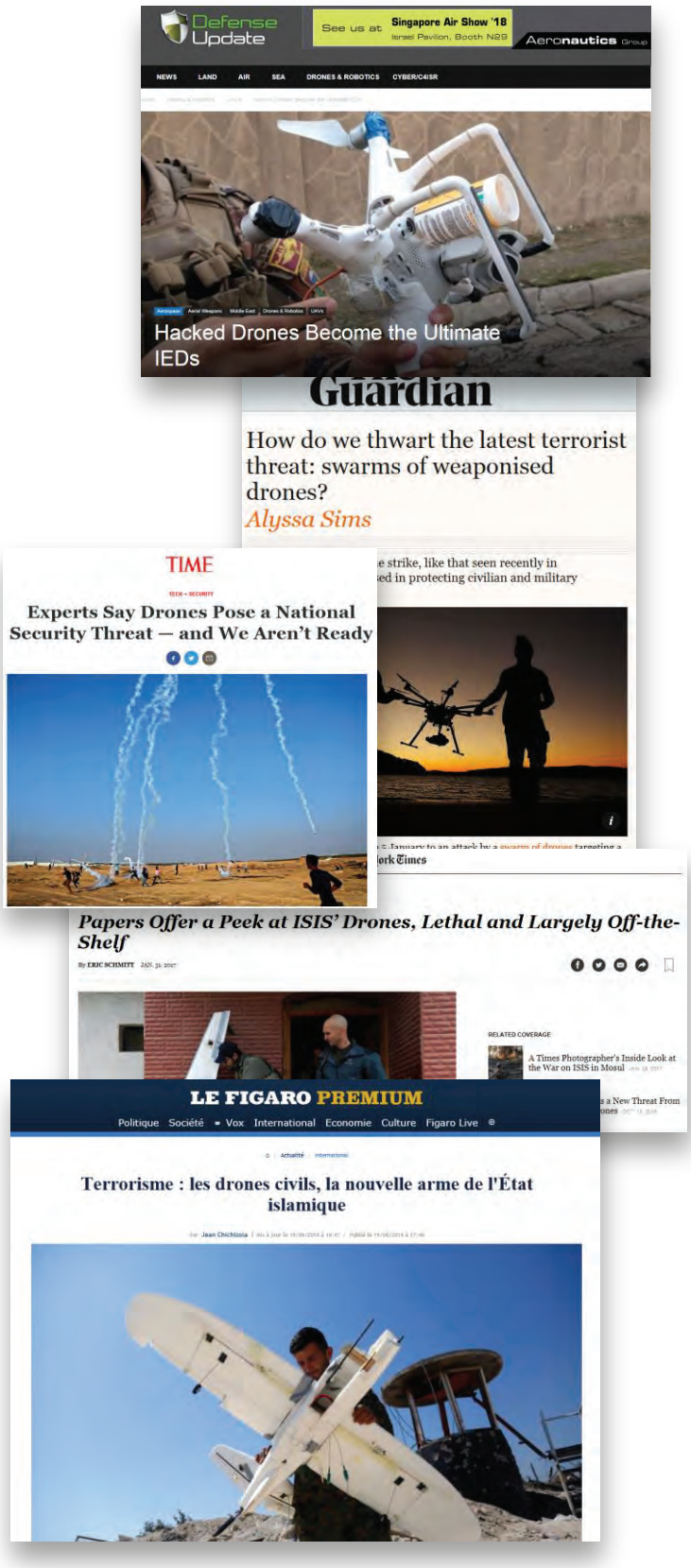
Terrorist misuse of UASs: some trends

- Class I UAS: Low Slow Small UAS
- Commercially available technology
- Increasing sophistication in line with technological advancements
- Some degree of autonomy
- Use of multiple UAS

Countermeasures: some lessons learnt from on-going activities

FULL CHAIN IS IMPORTANT
- Detection
- Tracking
- Identification
- Engagement
- Technical exploitation

NOT ONLY TECHNOLOGY
- Doctrine
- Organization
- Training
- Materiel
- Leadership
- Personnel
- Facilities
- Interoperability



Commercial usage of drones in private sectors “Blue Hat”

Commercial usage of drones in private sectors
“Blue Hat”

Hardware examples

• DJI / Albatross UAV / Parrot / Amazon

• DIY (Do It Yourself) – YouTube / Facebook / Forums / local knowledge, clubs

Software

• DJI / Pix4D / others

Applications

• 3D Modeling

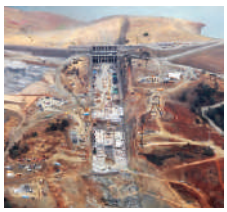
• Mapping

• Inspections / Monitoring

• Forensic documentation with mapping, stills and video

Dam infrastructure examples



Dam flood response / Shasta OroMoccasinville / Merced point cloud

Typical Workflow for 3D Mapping

Step 1: Acquire Data

- Aerial Images
- Drones with GPS
- Payloads
- Autonomous Flight

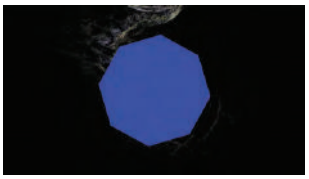
Step 1: Acquire Data

- Pix$D
- Resolution
- Formats
- Animation

Step 3: Acquire Data

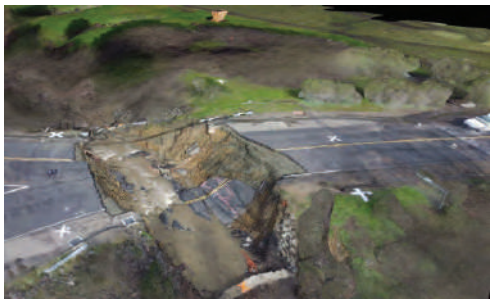
- Custom Maps
- Overlays with Google
- Earth
- Larg Data Sets

3D Point Cloud Renderings



3.2km of drone mapping at >2cm accuracy
+2000 imags in these stream bed animations

3D point mesh of road failure



Culvert failure causing collapse of road way,
Forensic data set to determine damages and repairs

Typical Workflow for Models

Step 1: Acquire Data

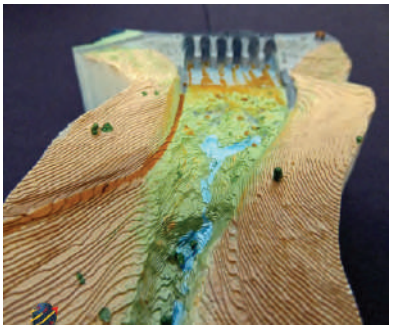
- Digital Images including hand-held drones with GPS
- Payloads
- Autonomous Flight

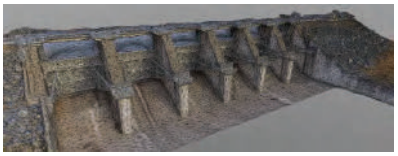
Step 2: Process Data

- Pix$D
- Resolution
- Output files for 3D printers (STL) and OBJ)

Step 3: Deliverables

- 3D printer set to match resolution
- Painted to match subject
- Durable and lasting





3D Model, Overlays Final Mesh Deliverables

Typical Workflow for Inspection & Monitoring

Step 1: Acquire Data	Step 2: Process Data	Step 3: Deliverables
- Digital Images and videos - Piloting Skills - Payloads - Autonomous and visual flights	- Adobe Light Room for processing of videos - Live feed to ground stations for immediate action	- Data sets captured over time, from the same location -Archival records for subjects of interest - Verifiable Data

30X zoom and 175mm payloads

2.5km comparison between m600 and insoire 2

Challenges Faced

LEGAL

- National / state / local laws
- Certified remote pilot vetting

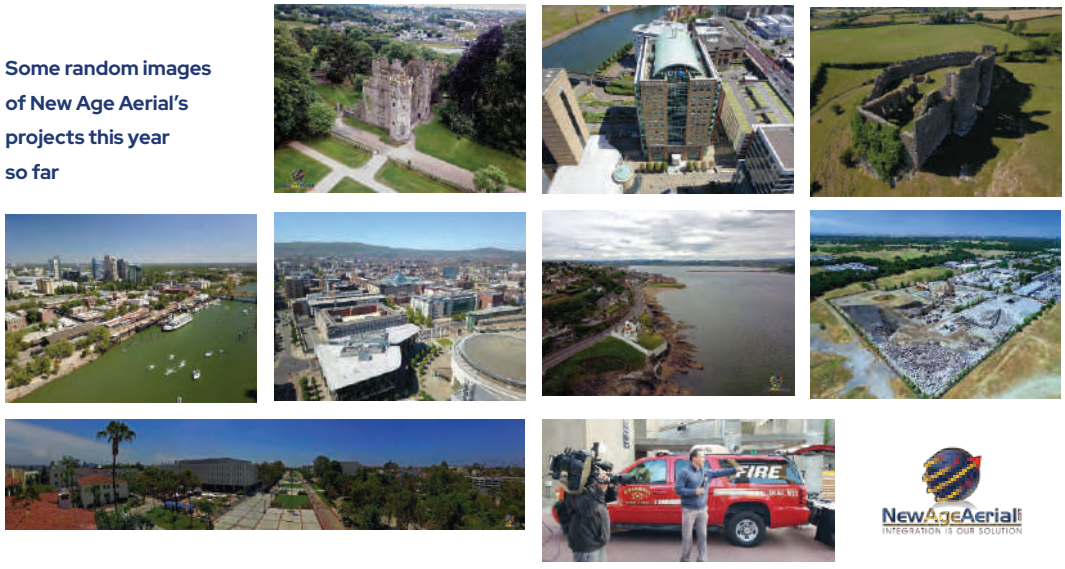
AIRSPACE

- Sharing, waivers
- Restrictions

SKILLS NEEDED

- Airmanship and piloting skills, GPS does fail
- Photography and software processing of hundreds of images
- Maintaining, building and or repairing of drones and related payloads

Some random images of New Age Aerial's projects this year so far



Recommended Readings

https://www.uasvision.com/2018/08/20/south-african-fight-against-rhino-poachers-helpedby-new-zealand-drone-firm/

https://www.uasvision.com/2018/08/20/drones-driven-by-ai-track-illegal-fishing-in-africa/

https://www.appliedaeronautics.com/ – commercial fixed wing drone company

http://pixhawk.org/ – open source drone flight controller

https://www.parrot.com/us/ – commercial drone company

www.DJI.com – commercial drone company

www.Pix4D.com – commercial image processing tools

https://www.linkedin.com/in/davidmccreary/ - my public profile and links to projects

www.NewAgeAerial.com/Interpol - this entire slide deck and full sized images

The use of UAV's in decostructing crime and incident scenes

Each year in the United States, over 33,000 traffic accidents result in at least one fatality. Additionally, in the U.K., more than 26,000 people are killed or seriously injured annually.

When an accident happens, particularly a fatal one, accident reconstructionists arrive on the scene. Using a combination of physics, vehicle dynamics, mathematics, photogrammetry, and computer applications, they paint a picture of what happened before, during, and after the incident.

In addition to traffic accidents, crime scenes present law enforcement professionals with a similar challenge, but more complex.

Evidence must be collected to capture the crime scene accurately, hopefully leading investigators to those who perpetrated the crime. Photos, measurements, and evidence needs to stand up in a court of law, so everything regarding the scene must be as accurate as possible.

UAV technology offers users the ability to revisit the site at any time, process the scene faster, and gather highly accurate information for use at any time.

Here's how drones put the pieces together for crime scene investigation & accident reconstruction.

Up, Up and Away

The past decade has seen the swift adoption of drones as a tool in the armoury of the police and other law enforcement agencies. Last year, the campaign group Drone Watch gathered information on police usage of drones in the UK. The responses to Freedom of Information requests sent to 48 police forces revealed the true extent of this phenomenon. 33 regional forces now directly own and use drones. Three others said they operate drones owned by other police or fire services. A number of police forces indicated they are using drones for covert surveillance operations. The Metropolitan Police Service (MPS) has over 20 drones in operation.

12 police forces confirmed that they deploy drones in operations involving protests and public order. Lincolnshire Police reported that drones were used to monitor a Black Lives Matter protest and a protest at an immigration centre.

The EA outlined the benefits of adopting the technology; drones offer EA inspectors unique perspectives, making otherwise inaccessible areas accessible. They have been deployed with enthusiasm by environmental crime teams to gather intelligence about illegal waste sites, avoiding the need for physical presence on site when collecting evidence used to bring criminal proceedings.

Flying High

Recently, the National Police Air Service (NPAS) has indicated its intention to take the application of this technology up a gear. NPAS is a police aviation service that provides centralised air support to police forces in England and Wales. It recently published a market engagement survey to determine what technical functionality currently exists for beyond visual line of sight (BVLOS) drones with infrared capability.

The market engagement survey asks for details of BVLOS drones that can operate for a minimum of 4 hours up to 50 kilometres away from the base station. NPAS is interested in obtaining information on drones capable of capturing facial features and clothing details for individuals, as well as make, model, colour and registration numbers for vehicles. It was reported in February 2022 that the MPS, West Midlands Police, Thames Valley Police and Norfolk Constabulary are participating in an NPAS research project to pilot drones up to 30 kilometres away. Devices could be controlled from police headquarters or other remote base stations.

Evidence gleaned by drone technology has already proven to be vital in a range of police activities, including searches for missing persons and dangerous offenders. However, the pace of change presents risks.

Adopting this technology too quickly may have unforeseen consequences for civil liberties, data protection and national security.

Ways these UAVs are Utilized

Crime Scene Investigation: Revisiting the Scene

Drones' abilities make them uniquely well suited for photogrammetry. More often than not, the specifics of an accident or crime scene are best documented with photos. While cameras have captured forensic evidence since the late 1800s, drones have only recently made capturing the entire scene practical and economically possible.

Instead of only collecting still photos, drones have the power to create digital twins of any accident or crime scene to review whenever necessary.

Being able to navigate a 3D model adds a whole new dimension to an investigation, and paints a much clearer picture than simple photos.

Drones Improve Accuracy of Crime Scene Investigation

Handwritten notes on the details of an accident scene are important, but pale in comparison to the accuracy of drone-based photogrammetry. Many of the optics used in drone payloads, from RGB cameras to LiDAR, produce highly detailed renderings and 3D models.

This level of precision allows professionals to take measurements and run data analysis, long after the scene is cleaned up.

Investigators can rely on centimeter-level accuracy to make calculations, ranging from determining the force of impact between two objects, to verifying the location of each item within an evidence field.

Faster Accident Reconstruction

Until UAV technology started spreading into law enforcement circles, ground-based photogrammetry was a time-consuming task.

Individual photos needed to be analyzed by a technician and pieced together during the investigation after the fact. Now, a number of programs, such as Pix4D, process and stitch images together while still on scene.

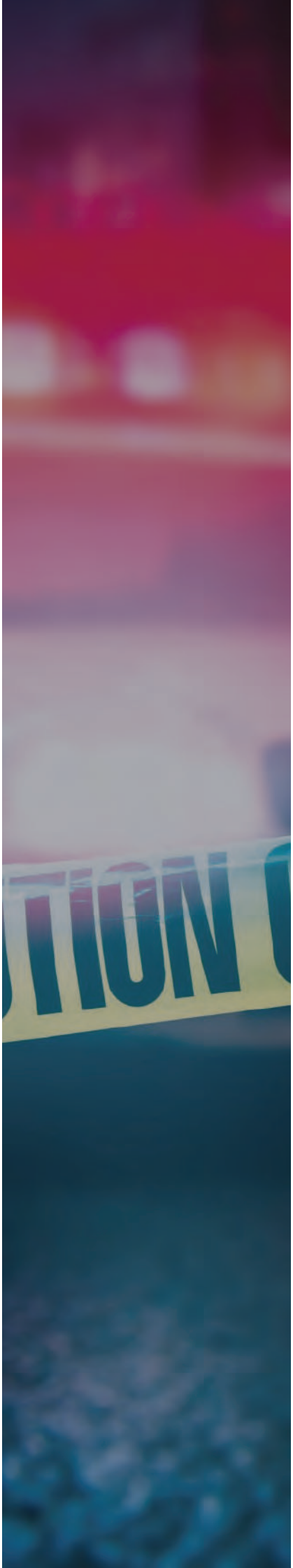
In a matter of minutes, law enforcement and accident reconstructionists can capture and review data from any site – all while still in the field.

As drones fly around the accident or crime scene, they can collect photos at different heights and angles, allowing for complete coverage of an area. Ground-based solutions simply are not as good for this task.

It takes tripod-mounted 3D scanners a far longer time period to complete the same job. Manually needing to set up, take down, move, and set up equipment over and over again takes an incredible amount of labor.

But, since drones move so quickly from place to place, and gather an uninterrupted stream of data, their speed is unmatched.

Thanks to UAVs, their optical payloads, and ever-improving software options, it's possible to have near-real-time duplication of almost any site.



Common Types of Drones used by Law Enforcement? > > > >

INSPIRE 1

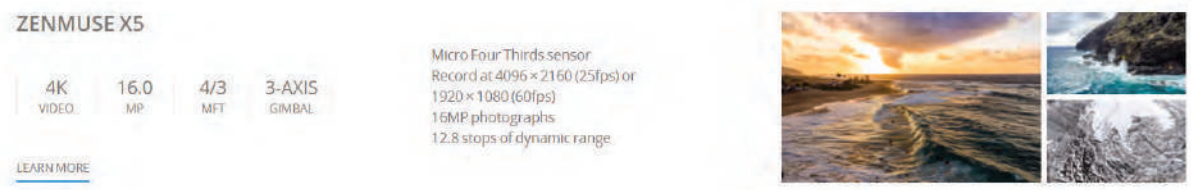
CREATIVITY UNLEASHED

AIRCRAFT
Transforming design
Powerful motors
Ready to Fly

CAMERA
ZENMUSE X3
ZENMUSE X5
ZENMUSE X5R
ZENMUSE XT
ZENMUSE Z3

REMOTE
Easy, intuitive control
Integrated DJI Lightbridge
Convenient controls

GO APP
Live HD view
Easy video editor
Worry-free autopilot
Built-in flight simulator for practice



MATRICE 200 SERIES

BUILT TO ENDURE.
ENGINEERED TO ADAPT.

Aircraft

Model	M200
Package Dimensions	31.1×15.4×11.4inch (790×390×290mm)
Dimensions (unfolded)	34.6×34.6×14.9 inch (887×880×378 mm)
Dimensions (folded)	28.2×8.7×9.3 inch (716×220×236 mm)
Folding Method	Folded Inward
Diagonal Wheelbase	25.3 inch (643 mm)
Number of Batteries	2
Weight (TB50)	Approx. 3.80 kg
Weight (TB55)	Approx. 4.33 kg
Max Takeoff Weight	6.14KG
Max Payload (2 TB50)	Approx. 2.34kg (with two standard batteries)
Max Payload (2 TB55)	Approx. 1.61kg (with two standard batteries)
Hovering Accuracy (P-mode with GPS)	Vertical: ±1.64 feet (0.5m) or ±0.33 feet (0.1m, Downward Vision System enabled) Horizontal: ±4.92 feet (1.5m) or ±0.98 feet (0.3m Downward Vision System enabled)
Max Angular Velocity	Pitch: 300°/s; Yaw: 150°/s
Max Pitch Angle	P Mode: 30° (Forward Vision System enabled: 25°) ; A Mode: 35°; S Mode: 35°
Max Ascent Speed	16.4ft/s (5 m/s)
Max Descent Speed	Vertical: 6.8 ft/s (3 m/s)
Max Speed	S Mode: 51.4mph (82.8kph) P Mode: 38mph (61.2kph) A Mode: 51.4mph (82.8kph)
Max Service Ceiling Above Sea Level	1.86mi (3000 m)
Max Wind Resistance	39.4ft/s (12 m/s)
Max Flight Time(No Payload, with TB50)	27min
Max Flight Time(No Payload, with TB55)	38min
Max Flight Time(Full Payload, with TB50)	13min
Max Flight Time(Full Payload, with TB55)	24min
Motor Model	DJI 3515
Propeller Model	1760S
Operating Temperature	-4° to 113° F (-20° to 45° C)
IP Rating	IP43

Gimbal Installation

Downward Gimbal Mount	Supported
Upward Gimbal Mount	Not Supported
Downward Dual Gimbal	Not Supported

Battery (Standard)

Model	TB50
Capacity	4280 mAh
Voltage	22.8V
Battery Type	LiPo 6S
Energy	97.58Wh
Net Weight	Approx. 520g
Operating Temperature	-4° to 113° F (-20° to 45° C)
Storage Temperature	Less than 3 months: -4° to 113° F (-20° to 45° C) More than 3 months: 72° to 82° F (22° to 28° C)

Gimbal

Compatible Gimbals	Zenmuse X4S Zenmuse X5S Zenmuse Z30 Zenmuse XT Zenmuse XT2 SLANTRANGE 3PX Sentera AGX710

Remote Controller

Model	GL6D10A
Operating Frequency	2.400-2.483 GHz 5.725-5.850 GHz
Max Transmitting Distance (unobstructed, free of interference)	2.4 GHz: 4.3 miles (7 km, FCC); 2.2 miles (3.5 km, CE); 2.5 miles (4 km, SRRC) 5.8 GHz: 4.3 miles (7 km, FCC); 1.2 miles (2km, CE); 2.1 miles (5 km, SRRC)
EIRP	2.4 GHz: 26 dBm (FCC); 17 dBm (CE); 20 dBm (SRRC) 5.8 GHz: 28 dBm (FCC); 14 dBm (CE); 20 dBm (SRRC)
Video Output Ports	USB, HDMI
Power Supply	Built-in battery
Charging	DJI charger
Dual User Capability	Host and Slave connection
Mobile Device Holder	Tablet or smart Phone
Max Mobile Device Width	170 mm
Output Power	9W (Without supplying power to smart device)
Operating Temperature	-4° to 104° F (-20° to 40° C)
Storage Temperature	Less than 3 months: -4° to 113° F (-20° to 45° C) More than 3 months: 72° to 82° F (22° to 28° C)
Charging Temperature	32° to 104° F (0° to 40° C)
Battery	6000mAh 2S LiPo
USB Supply Power	iOS: 1 A @ 5.2 V (Max); Android: 1.5 A @ 5.2 V (Max)

Battery (Optional)

Model	TB55
Capacity	7660 mAh
Voltage	22.8V
Battery Type	LiPo 6S
Energy	174.6Wh
Net Weight	Approx. 885g
Operating Temperature	-4° to 113° F (-20° to 45° C)
Storage Temperature	Less than 3 months: -20° C to 45° C More than 3 months: 22° C to 28° C
Charging Temperature	41° to 104° F (5° to 40° C)
Max Charging Power	174.6 W

DJI GO 4 APP

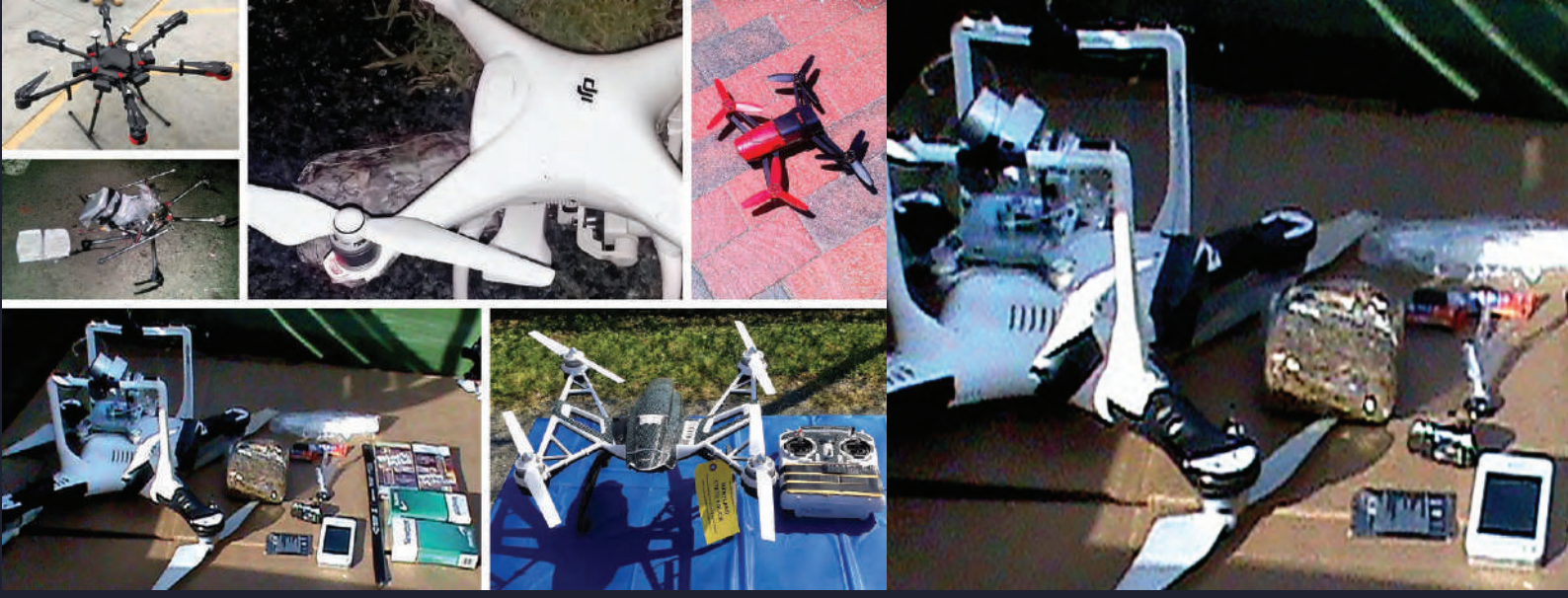
Name	DJI GO 4
Mobile Device System Requirements	iOS 9.0 or later, Android 4.4.0 or later
Supported Mobile Devices	iOS: iPhone SE, iPhone 6, iPhone 6 Plus, iPhone 6s, iPhone 6s Plus, iPhone 7, iPhone 7 Plus, iPad Air, iPad Air WI-FI + Cellular, iPad mini 2, iPad mini 2 WI-FI + Cellular, iPad Air 2, iPad Air 2 WI-FI + Cellular, iPad mini 3, iPad mini 3 WI-FI + Cellular, iPad mini 4 and iPad mini 4 WI-FI + Cellular. This app

The Intersection of Drone Technology with Law Enforcement and Government Agencies around the World.

How Long have drones been around?

Timeline.

- **1800's** – hydrogen filled remote control airships
- **1898** – first RC boat (Torpedo, Tesla)
- **1903** – first RC robot
- **1917** – first RC airship used as bomb
- **1932** – first military launched RC planes
- **1940** – RC boats made available to the public
- **1966** – RC cars available to consumers in Europe
- **1968** – first RC helicopter
- **1970's** – RC cars in UK and US
- **1980's** - offroad RC cars
- **2006** - Dà-Jiāng Innovations started
- **2013** – DJI Phantom 1 released



Drones Utilized for Threats

Locations.

Public gatherings

Government Locations

Military Bases

Prisons

Borders

Sensitive Locations

National Infrastructure

Threats

Terrorism

Destructive acts

Surveillance

Munitions Delivery

Assassination Attempts

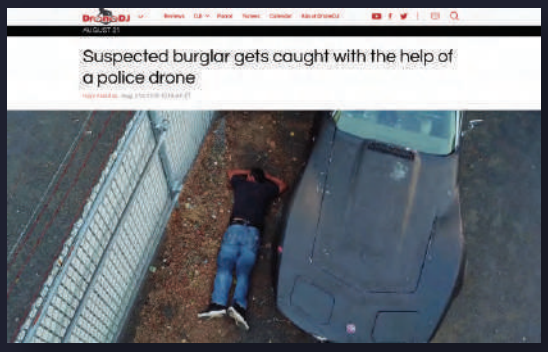
Disrupting Law Enforcement Activities

Contraband Delivery

Airspace Incidents

Military Operations

Law Enforcement / First Responder Use



Utilization

- Surveillance
- Traffic Control
- Accident Mapping
- Crime Scene Mapping
- Tactical Operations
- Urban Operations
- Wildfire Operations
- Missing Persons
- Recovering Deceased Victims
- Water Recovery

DJI Phantom 3
DJI Phantom 4
DJI Spark
DJI Inspire 1
Yuneec Typhoon
Parrot Disco
DJI Mavic Pro
Parrot Bebop 2
DJI Inspire 2
Yuneec Q500 4K
Yuneec H520
DJI Matrice 600
DJI Agras MG-1S
DJI S1000
SenseFly eBee
SenseFly Albris
DJI Mavic Air
Ryze Telo
DJI Phantom 4 Pro V. 2.0
Aion Robotics R1 Rover
Skydio R1
Handbuilt Ardupilot
Skyviper V2450 GPS
Drone Volt Hercules 20
Qysea FiFish
DJI Mavic Pro 2

Where are we headed?

Continued Evolution

Complex Regulatory Environment

Changes to Communications

Changes to Form Factor

Drone Swarms

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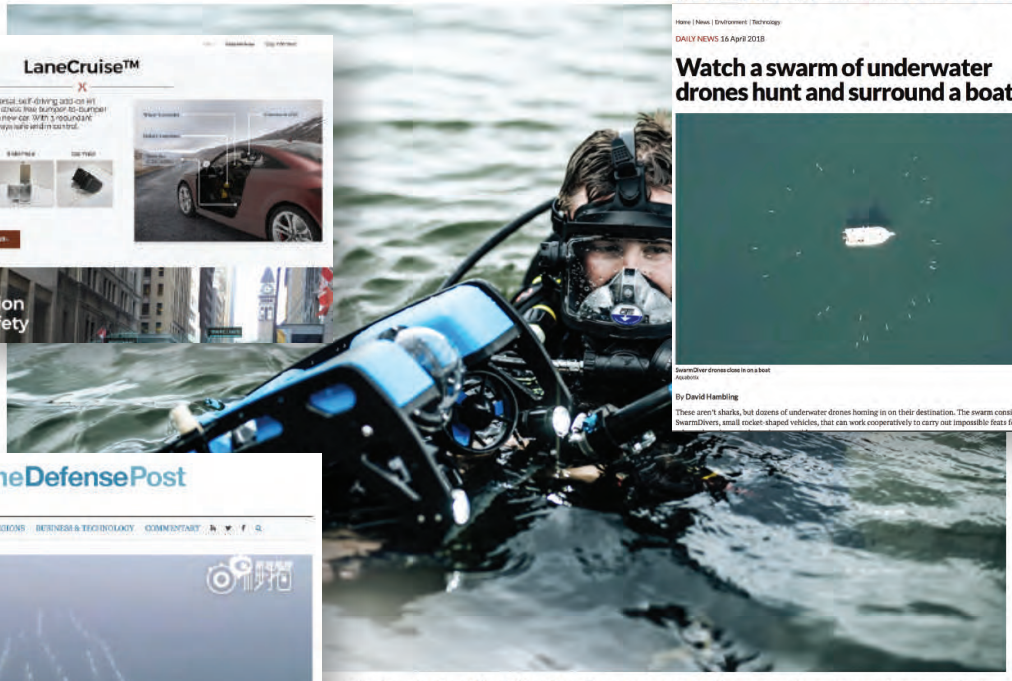
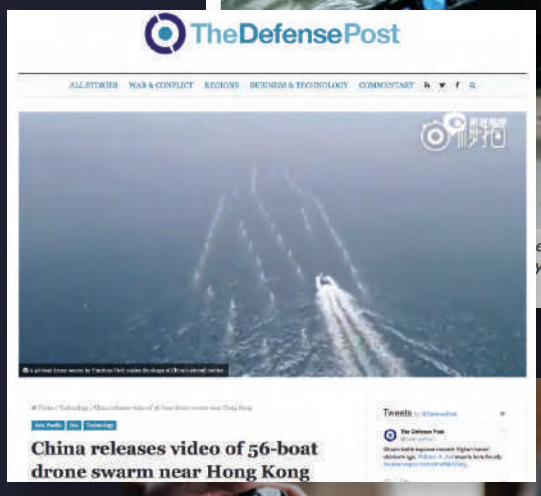
NEWS

Greenville County Sheriff's Office deploys high-tech robot to help with underwater searches

By **Andrew Moore** - Aug 23, 2018



enville County Sheriff's Office Dive Team, examines the agency's new remotely operated y donated by the ScanSource Charitable Foundation, a local nonprofit organization. Photo



Summary

Drones present opportunities and challenges in the three categories of THREATS, TOOLS, and EVIDENCE.

Good efforts are being made to use drones for LE and GOVT use.

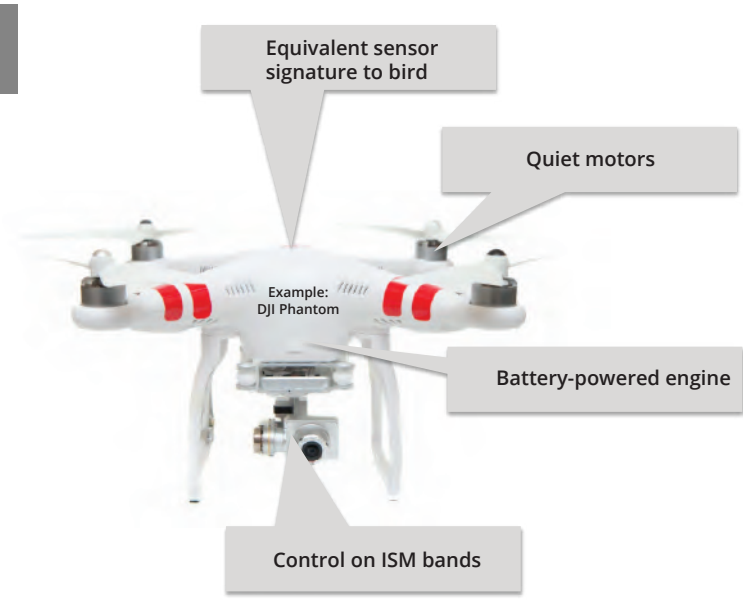
The digital forensics community is prepared to support your needs.

This ride will only get more exciting.

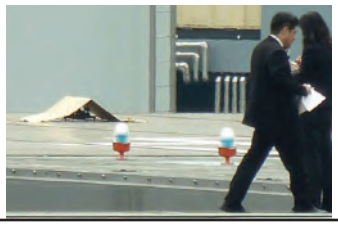
UAVs As Emerging Threats

SMALL UAV CHALLENGES

Growing Popularity
No blue force identification
Slow speeds
Low altitudes
Rapid launch capability
Small signatures



GLOBAL SMALL UAV SECURITY CONCERNS

Illegal Entry	Illicit Transport	Weapons Delivery
Airport/Airline Safety Heathrow GB, Jul. 2014 	Drug Trafficking Tijuana MX, Jan. 2015 	Critical Infrastructure Protection Tokyo, Apr. 15 
ISR of Sensitive Areas France, Oct - Nov. 2014 	Transport into prisons Maryland, Aug. 2015 	Special Security Events DresdenGE, Sept. 2013 

ISIS WEAPONIZED COMMERCIAL UAVS

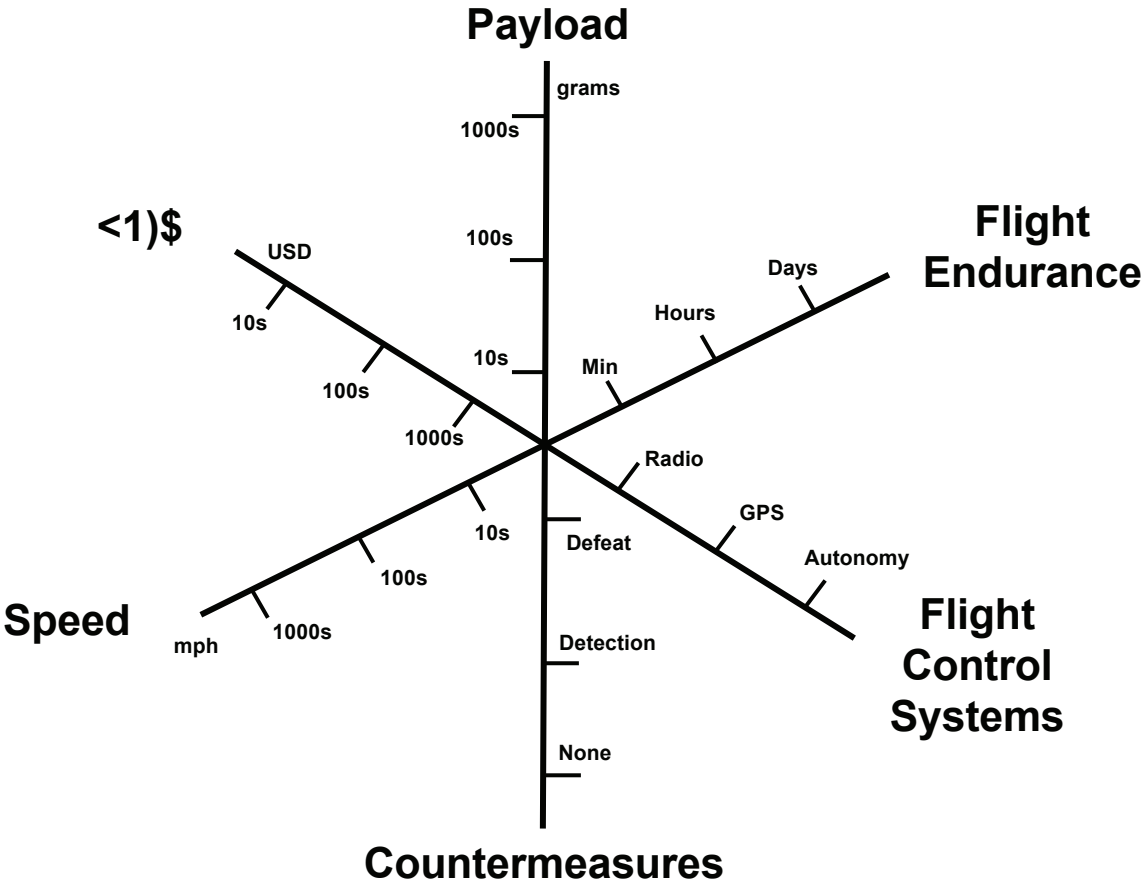
ISIS has used commercial UAVs for surveillance
• Recently, began UAV attacks with explosives
– 2 Kurdish soldiers killed by IED hidden in downed UAV Oct 2016
– Dropping small ammunitions (e.g. 40 mm rifle grenade) on crowds and vehicles in propaganda video

COUNTER TERRORISM CENTER: KEY TAKEAWAYS

Institutionalized UAV program

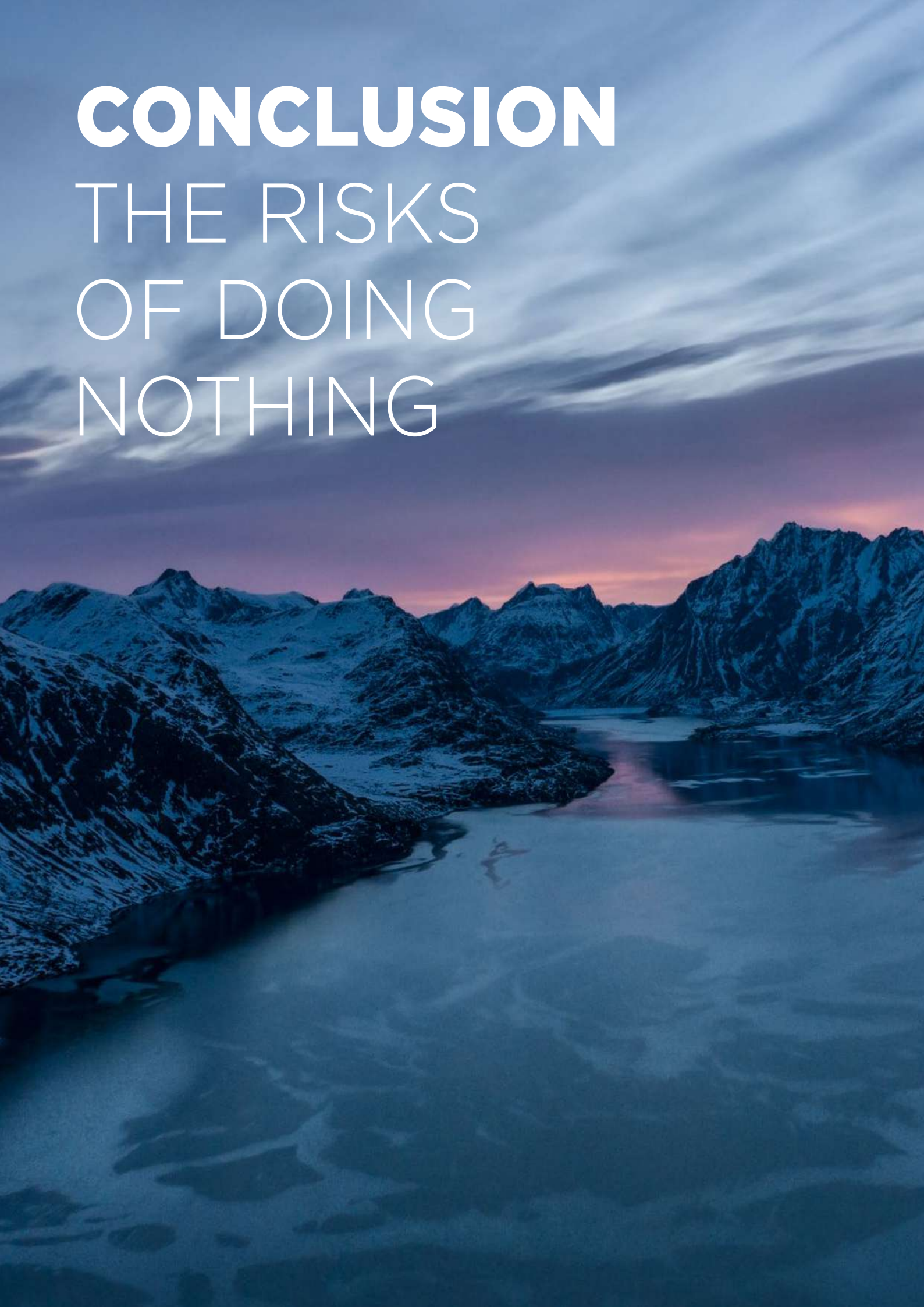
- **Not sophisticated but resourceful and innovative**
  - – Mostly commercial fixed wing (range), some rotor craft
  - – Some homemade UAVs and workshop in Ramadi discovered
- **Characteristic ISIS bureaucracy**
  - – Purchase requests, pre-flight checklist, flight plan forms

WHAT MAKES A THREAT A THREAT?



As UAVs advance, so will attributes that make them viable threats; performance trade space is highly dependent on goals

CONCLUSION
THE RISKS OF DOING NOTHING



CONCLUSION

Many substantive disagreements over how to regulate drone safety must still be resolved – even as rapid innovation threatens to leapfrog discussions already underway. But there is no other option.

People who care the most about drones must set forward-looking and evidence based expectations for safe flight, or else policies may be shaped by the uninformed opinions of people who care the least – or by what they fear the most. The chairman of the U.S. House Transportation and Infrastructure Committee recently warned that that one catastrophic incident involving a single drone could ignite a public demand to ground all drones.

Sensational news stories, knee-jerk political reactions, and policymaking by anecdote all pose a critical risk to the full flowering of drone technology and the benefits it brings. As others have noted, effective safety measures are based on "credible risks, rather than extraordinary anecdotes that incite fear."

It is crucial that everyone concerned with safe integration of drones in the airspace to make the most of this opportunity. Regulators and elected officials must develop rigorous standards for tracking real drone incidents and debunking false ones. Manufacturers must improve their voluntary technology and educational efforts. Experts need to commit to this and undertake substantive work to make their robust drone safety systems even stronger. Taking these actions will not be easy.

Ignoring them would be worse.

Drones are a net benefit for safety, and slowing their adoption for beneficial purposes would impose a real cost on society.

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