

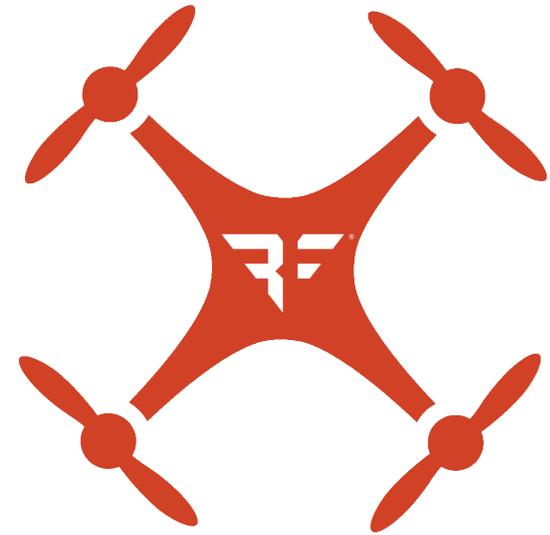
**BISHOP FOX**

# Highway to the Danger Drone

**BLACK HAT USA 2016 – LAS VEGAS, NV**



**August 03, 2016**



Presented by:

- Francis 'tastic' Brown
- David Latimer
- Dan 'altf4' Petro

Bishop Fox, LLC  
[www.bishopfox.com](http://www.bishopfox.com)

# Agenda

## OVERVIEW

1. The **Danger Drone** by Bishop Fox
2. Crazy State of **Drone Defenses**
3. Drone **Legal** Landscape
4. **IoT** = Target Rich Environment
5. **Future** Is Gonna Be Awesome



# No Such Thing as Drone Defense 'Best Practices'

## MOTIVATIONS BEHIND THIS TALK

- Companies are beginning to implement **1<sup>st</sup> generation drone defense** solutions / products
  - Previous proof of concepts have already demonstrated that the threat is real
- There **are no 'best practices'** or proven methods for defense against drones
- **Practical pentesting tools** are needed to test the effectiveness of these new 'drone defense' deployments
  - Separating real countermeasures from **snake oil**
  - Must be cheap, easy to build, and easy to learn how to use **for security professionals**

Why?

# Drone Threat Is Real

PAST **PROOF OF CONCEPTS** HAVE ALREADY DEMONSTRATED THIS

- Past proof of concepts have **already demonstrated the threat is real**. Now companies are deploying drone defenses and **need practical tools to test their effectiveness** and eliminate exposures.

CNN Money u.s. + Business Markets Tech Media Personal Finance Small Business

March 20, 2014: 8:10 AM ET



This drone can hack your phone

The next threat to your privacy could be hovering over head while you walk down the street.

Hackers have developed a drone that can steal the contents of your smartphone -- from your location data to your Amazon (AMZN) password -- and they've been testing it out in the skies of London. The research will be presented next week at the Black Hat Asia cybersecurity conference in Singapore.

The technology equipped on the drone, known as **Snoopy**, looks for mobile devices with Wi-Fi settings turned on.

GEEK APPLE ANDROID PS4 SCIENCE! GAMING

## WASP: The Linux-powered flying spy drone that cracks Wi-Fi & GSM networks

By Matthew Humphries Jul 29, 2011 10:15 am @mthgeek



The Black Hat Security Conference and DEFCON bring together the world's professional hackers, security researchers, government representatives, journalists, and just about anyone who thinks of themselves as a hacker. They listen to talks about security, show off the latest novel hacks, and generally share information about the state of computer security.

Every year there's a highlight to the conferences, and this year it looks like that highlight may be a flying drone, or unmanned aerial vehicle (UAV). This drone is called the **Wireless Aerial Surveillance Platform, or WASP**. It's an ex-U.S. Army spy drone measuring over 6-feet in length and wingspan that has been modified to make it more useful for hackers in our built-up, communication-heavy urban environments.

SkyJack

SkyJack is a drone engineered to autonomously seek out, hack, and wirelessly take over other drones within wifi distance, creating an army of zombie drones under your control.

by Samy Kamkar // [code@samy.pl](mailto:code@samy.pl) // Dec 2, 2013

Discover more of my technology at <https://samy.pl>

SkyJack - autonomous drone hacking w/Raspberry Pi, aircrack & Jvas...



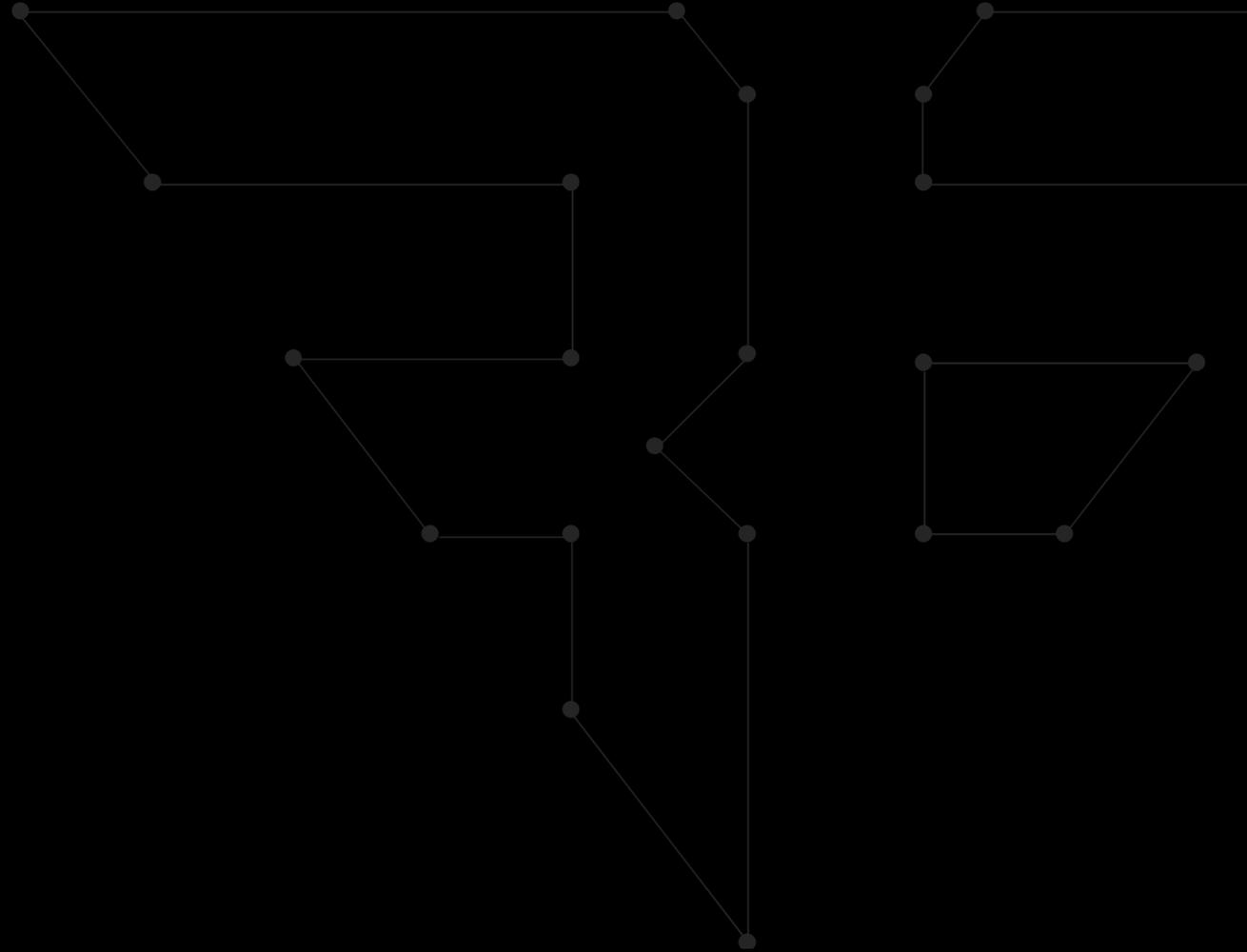
DEF CON 21 (2013) - Phantom Network Surveillance UAV / Drone - Hill - 03Aug2013

## Checked your Roof Lately?



# DANGER DRONE

FOR PENETRATION TESTERS





# Welcome to the Danger Drone

FREE PENTESTING DRONE FROM BISHOP FOX



- <https://www.bishopfox.com/resources/tools/drones-penetration-testers/>



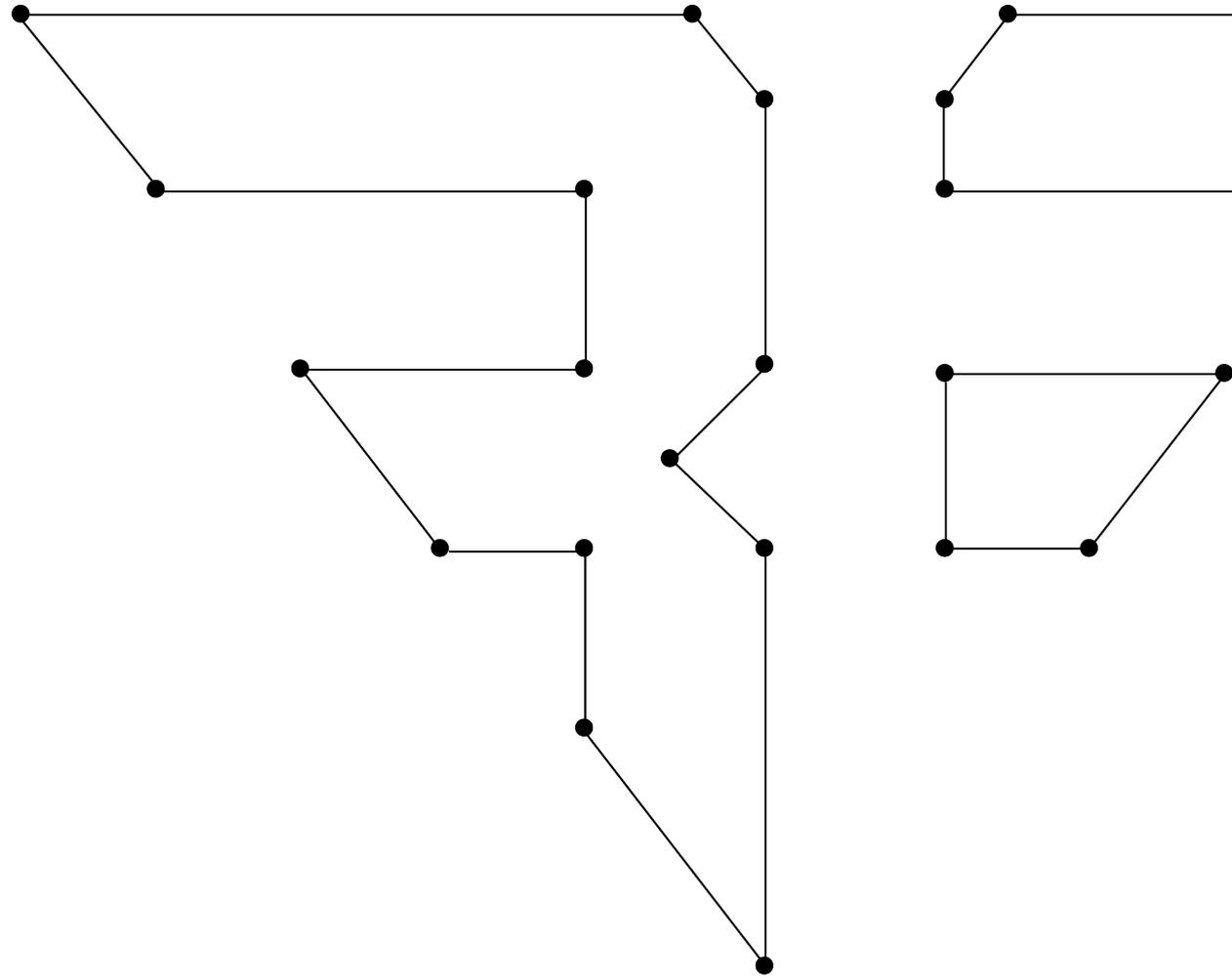
The Hacking Drone for Penetration Testers

© BISHOP FOX



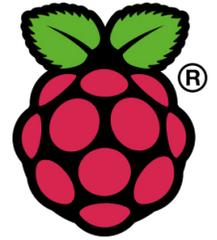


**DEMO**

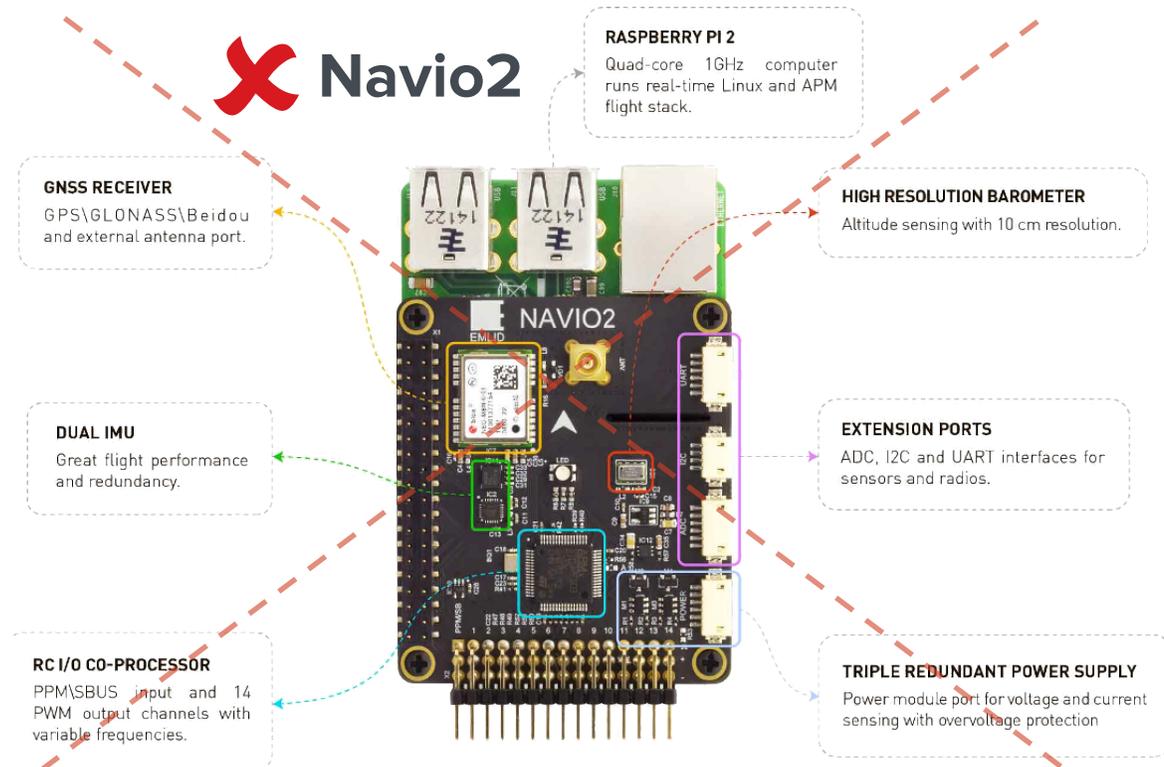
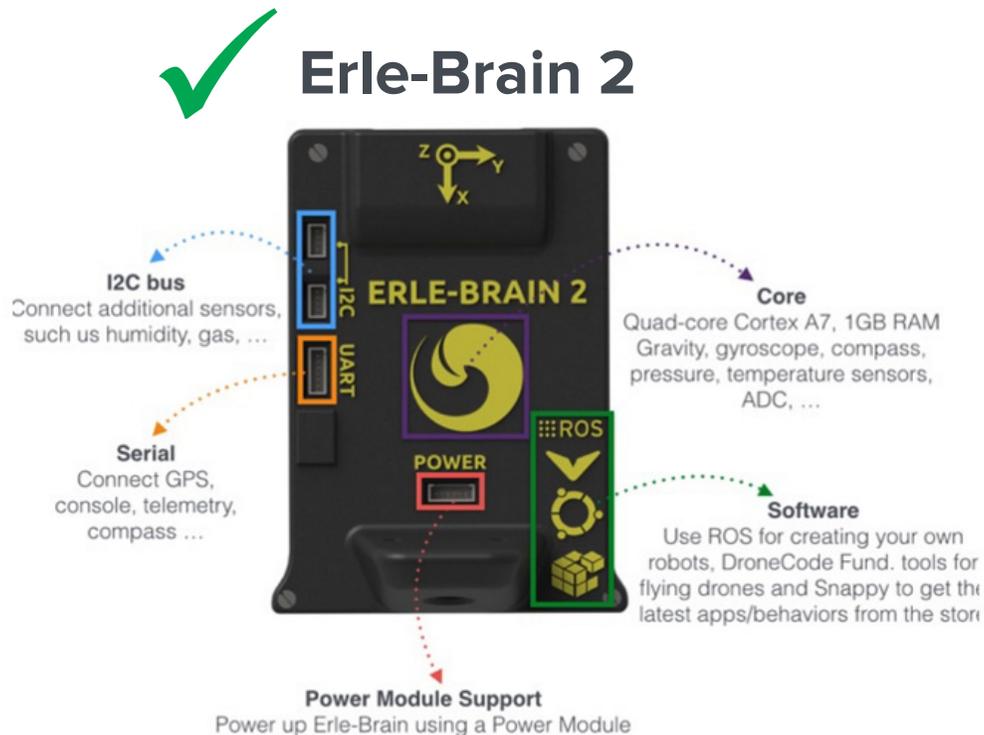


# Drone Brain = Raspberry Pi

HEAVILY SUPPORTED IN **DRONE** AND **HACKER** COMMUNITIES



- Raspberry Pi based copters have the obvious appeal of being heavily developed and supported by both the drone and hacker communities.
- The 2 most popular Raspberry Pi based flight controllers are the **Erle-Brain 2** and the **Navio 2**:



# Parts – Hacking ‘Over the Air’

HACKING PERIPHERALS – ADD-ON USB EXAMPLES



- Wi-Fi
- Bluetooth
- RFID / NFC
- ZigBee
- Software Defined Radio
- Wireless Keyboard Sniffers
- ...



SENA UD100 Bluetooth USB



Bluetooth 4.0 USB Micro Adapter (CSR 8510 Chipset)



Wi-Spy DBx Pro – USB Spectrum Analyzer



WiFi Pineapple Nano



TP-Link TL-WN722N

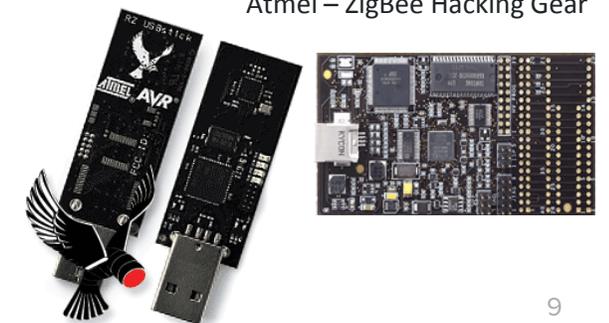


Asus USB-N53 (dual band)

Crazyradio 2.4Ghz nRF24LU1+ USB radio dongle with antenna



HackRF One: Software Defined Radio



Atmel – ZigBee Hacking Gear



# Parts – Hacking ‘Over the Air’

HACKING PERIPHERALS – ADD-ON USB EXAMPLES



- Custom 3D printed “3rd shelf” is convenient for attaching hacking USB peripherals:



3D Printed 3rd Shelf

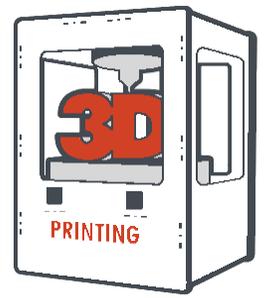


TP-Link TL-WN722N

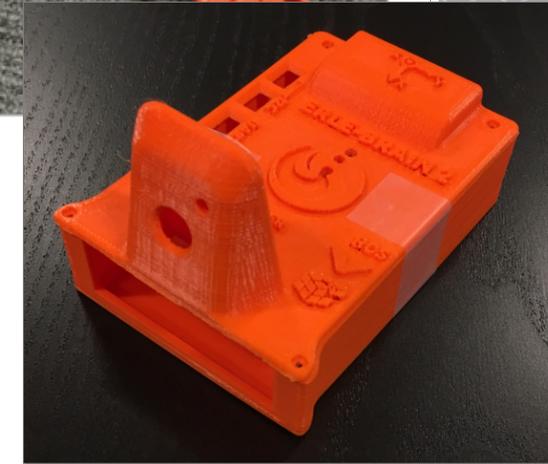
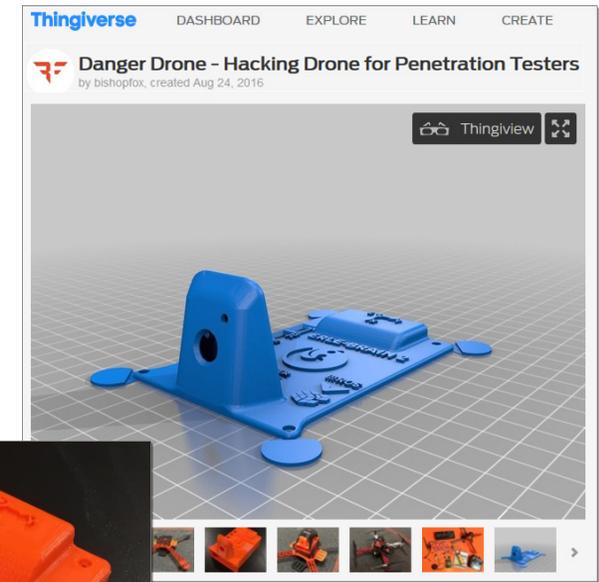
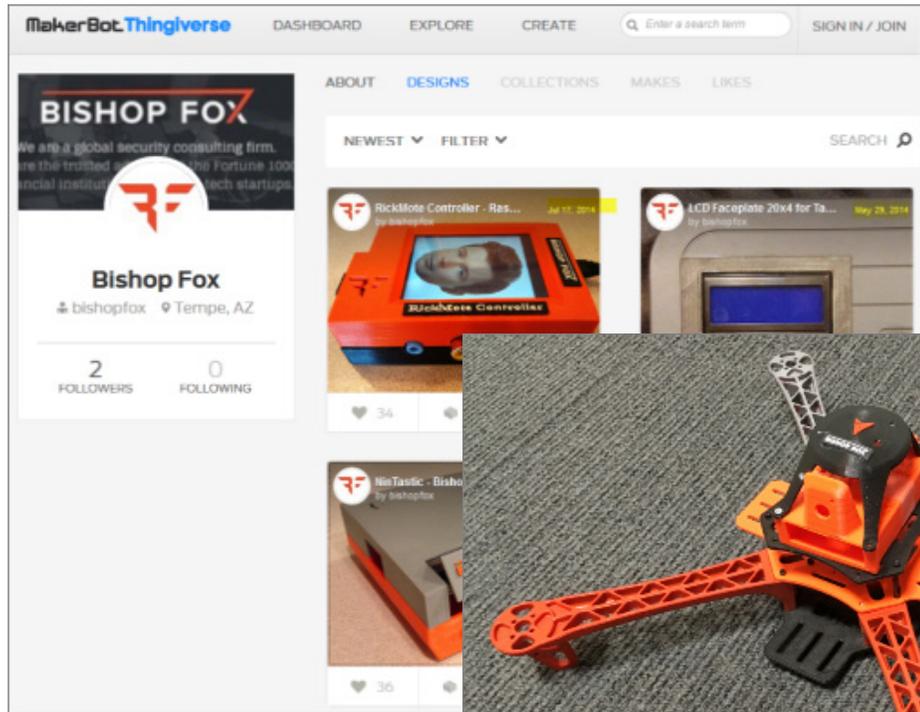
# 3D Designs

CHEAPER, LIGHTER, AND CUSTOMIZABLE (EXTRA SHELVES / SPACE)

MakerBot Thingiverse



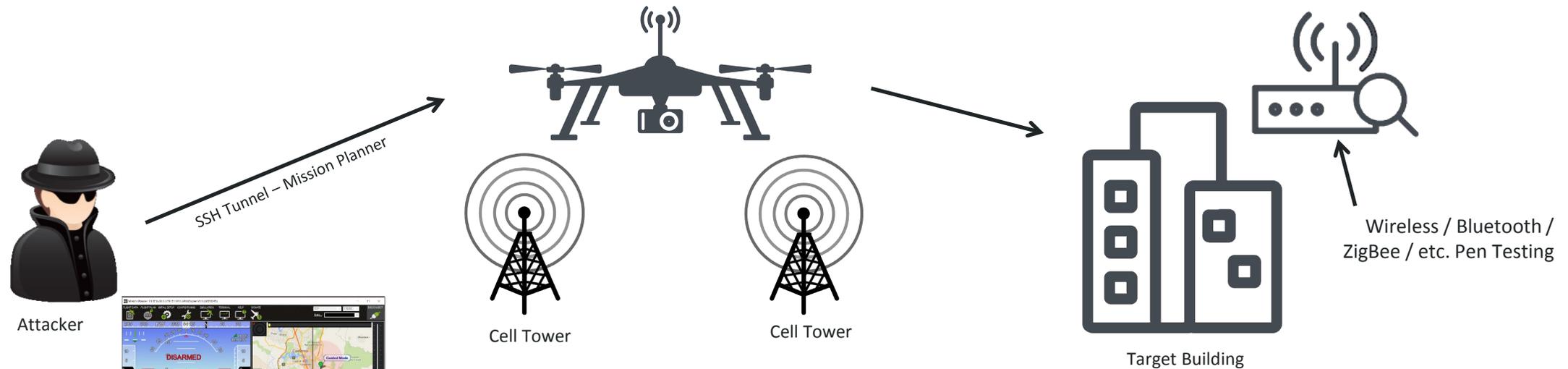
- <http://www.thingiverse.com/bishopfox/designs>



# Parts – Cellular 3G USB & GPS – Command & Control

## HACKING PERIPHERALS – ADD-ON EXAMPLES

- Remote control over SSH tunnel via 3G USB cell connection. GPS & Cellular signals are **illegal to jam** (see FCC regulations), making it **hard to defend against** this type of drone.
  - <https://transition.fcc.gov/eb/jammerenforcement/jamfaq.pdf>



Mission Planner



**7.2** Mbps  
**3G USB Modem**

For Android Tablets and Windows Laptops



\* **Note:** be sure to check **upcoming FCC regulations** about needing to keep drone within **line of sight** while flying.

# Parts and Pieces - Optional

EXPENSIVE, BUT SWEET ADD-ONS



- First Person View (FPV) Goggles
- GoPro Camera, Gimbal, & Legs

## Top 5 Best FPV Goggles: The Ultimate List

Published 10:00 am EDT, April 25, 2016 | Updated 11:01 am EDT, May 15, 2016 | 1 Comment | By Bobby Bernstein 7.9k

### Heavy

Two FPV goggles are shown. On the left is a black, rugged-looking pair. On the right is a white pair with 'FAY SHARK' branding and a black strap.

## Take pictures

Use the gimbal to take professional images\*.

\*Ere-Copter requires the Gimbal and the Legs to take professional images.



A white 'FAY SHARK' FPV goggles are shown next to a tablet. The tablet displays a first-person view of a rocky coastline with a stone archway. The goggles have a black antenna on top.

## First Person View (FPV)

Become Ere-Copter's eyes by using this amazing feature transmitted over WiFi using different frequencies.

## Tarot T-2D Gimbal

\$210.00

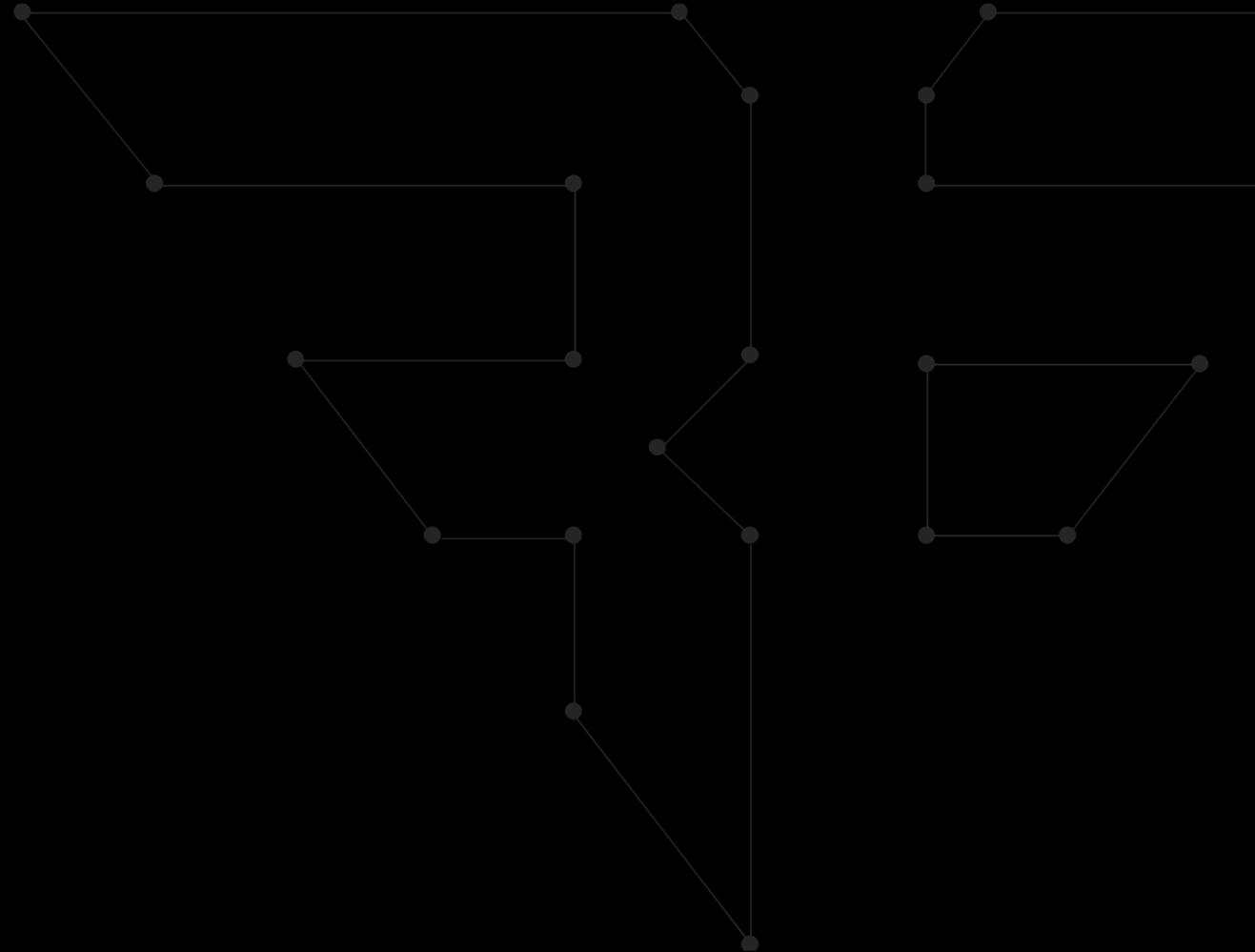
The two-axis Tarot Brushless Gimbal uses cutting-edge gyroscope technology to ensure you get crisp, stable images from your 3DR drone. The T-2D automatically compensates for the slightest movement, enabling you to capture rock steady video even in windy weather. Designed to accommodate the GoPro HERO 3, the T-2D Brushless Gimbal you get from 3DR is customized: pre-wired, pre-calibrated and configured to work with your 3DR copter.



Gimbal to Erle Brain 2

# CONSTRUCTION

EASIER TO MAKE SOMETHING THAT CAN **ALREADY FLY**  
ALSO **HACK** ... THAN VICE VERSA



# Erle Copter – Kit for Sale

EASIER TO SOMETHING THAT CAN FLY ALSO HACK... INSTEAD OF VICE VERSA



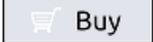
- **Erle-Copter – Hardware Kit** – get most parts for ~\$499. For an extra \$250 comes assembled.

- o <https://erlerobotics.com/blog/product/erle-copter-diy-kit/>
- o <https://erlerobotics.com/blog/product/erle-brain-v2/>
- o <https://erlerobotics.com/blog/erle-copter/>

**Erle-Copter**  
A Linux-based smart drone with support for the Robot Operating System



From **499.00 €**





HOME SERVICES PRODUCTS SUPPORT COMPANY  0

## ERLE-COPTER DRONE KIT

**499.00€**



- 1 + 

**KIT TYPE**  
The DIY kit gives you the opportunity to learn and assemble your own drone. The RTF kit comes assembled and Ready To Fly.

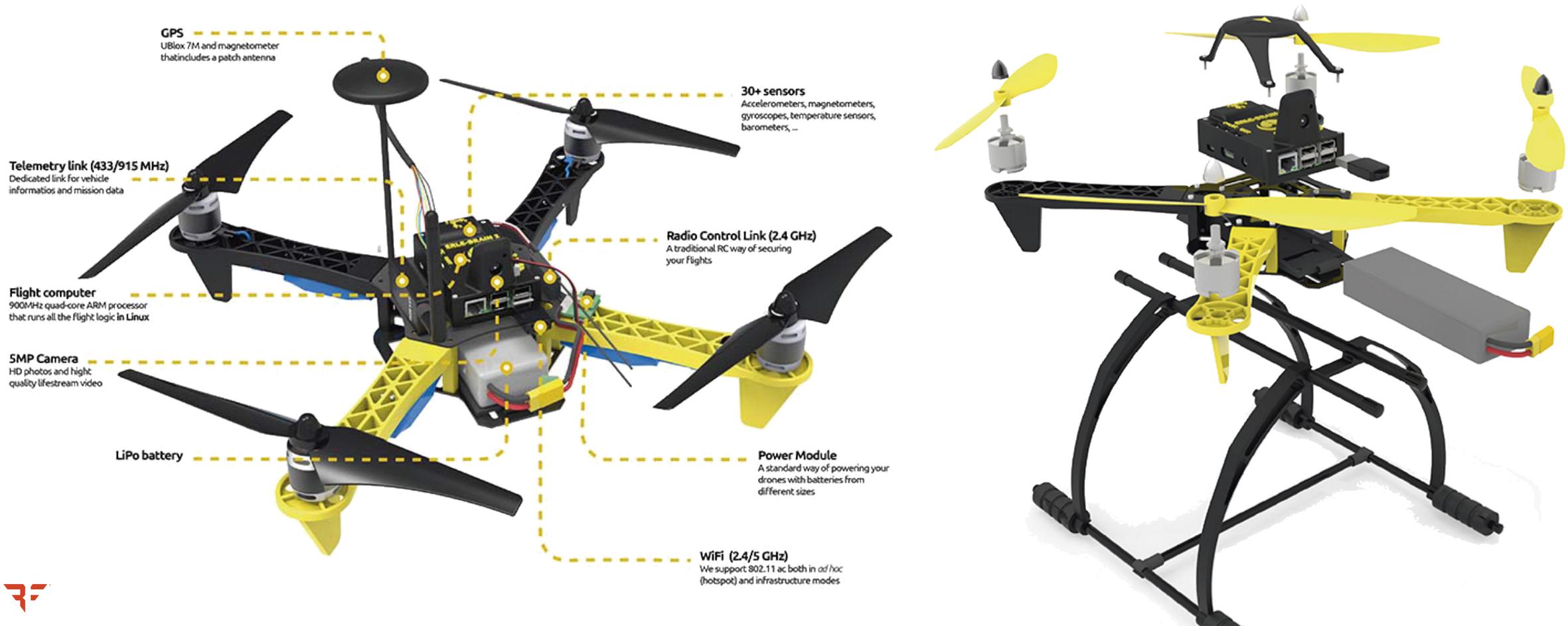
**Assembled** 250.00€

**CASE**  
Transport safely your flying robot and its components. Get it from [here](#). (+ 3980 grams/8.77 lb)

# Parts and Pieces - Assembly

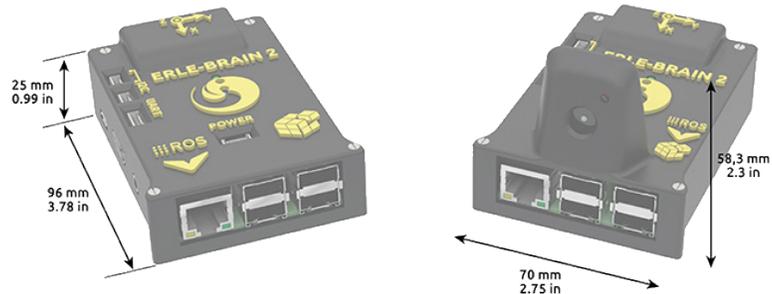
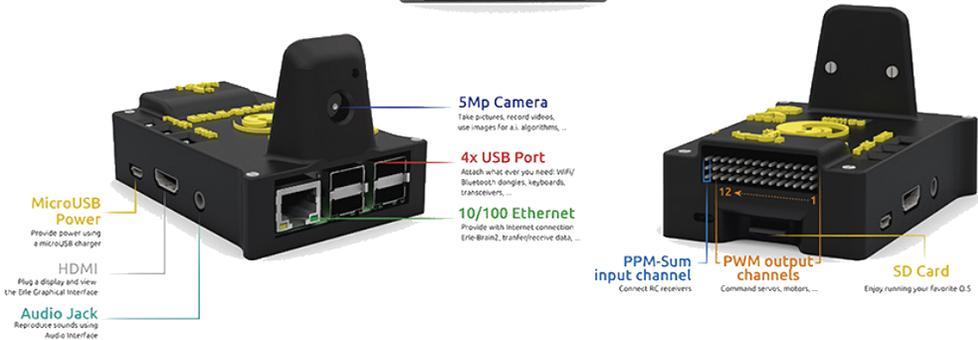
DISSECTING THE 'ERLE COPTER'

- [http://erlerobotics.com/docs/Robots/Erle-Copter/Assembly\\_|\\_Montaje/Erle-Brain\\_2/EN.html](http://erlerobotics.com/docs/Robots/Erle-Copter/Assembly_|_Montaje/Erle-Brain_2/EN.html)



# Parts and Pieces - Closer Look

## DISSECTING THE 'ERLE COPTER'



# Parts and Pieces – Piecemeal

CHEAPER TO BUILD YOURSELF - SLIGHTLY



- Essentially starting with **working / flying Erle-Copter** and then **adding hacking** capability (without breaking flying ability):
  - Adding Hardware – e.g. USB peripherals to Raspberry Pi, shelves
  - Adding Software – e.g. drivers, config changes, installs, etc.

\$490.53

#	Description	Cost	Product Link
1	Flight Controller	\$199.00	<a href="#">Erle Brain 2, a Linux brain for robots and drones</a>
2	GPS	\$50.68	<a href="#">Ublox Neo-M8N GPS with Compass</a>
3	RC Controller and Receiver	\$49.00	<a href="#">Turnigy TGY-i6 AFHDS Transmitter and 6CH Receiver (Mode 2)</a>
4	Motors x4	\$45.99	<a href="#">Tiger Motors 6th Anniversary Limited Edition 4x MN2213 Motors + 2 p</a>
5	Telemetry	\$40.88	<a href="#">HobbyKing - HKPilot Transceiver Telemetry Radio Set V2 (915Mhz)</a>
6	Battery (4 cell)	\$39.99	<a href="#">FLOUREON 4S 35C 14.8V 5500mAh Li-Polymer RC Battery Pack (5.98*</a>
7	ESCs x4	\$23.57	<a href="#">Amazon - Andoer 4Pcs Simonk 30AMP 30A SimonK Firmware Brushles</a>
8	Frame (F450)	\$19.99	<a href="#">Amazon.com - RipaFire F450 4-Axis Multi-Rotor Quadcopter Flame Air</a>
9	Power Module	\$14.29	<a href="#">Amazon - Ericoco Power Supply Module w/BEC APM2 2.5 APM Flight C</a>
10	PPM Encoder	\$7.14	<a href="#">HobbyKing - PPM Encoder Module HKPilot 32</a>
	Total:	<b>\$490.53</b>	



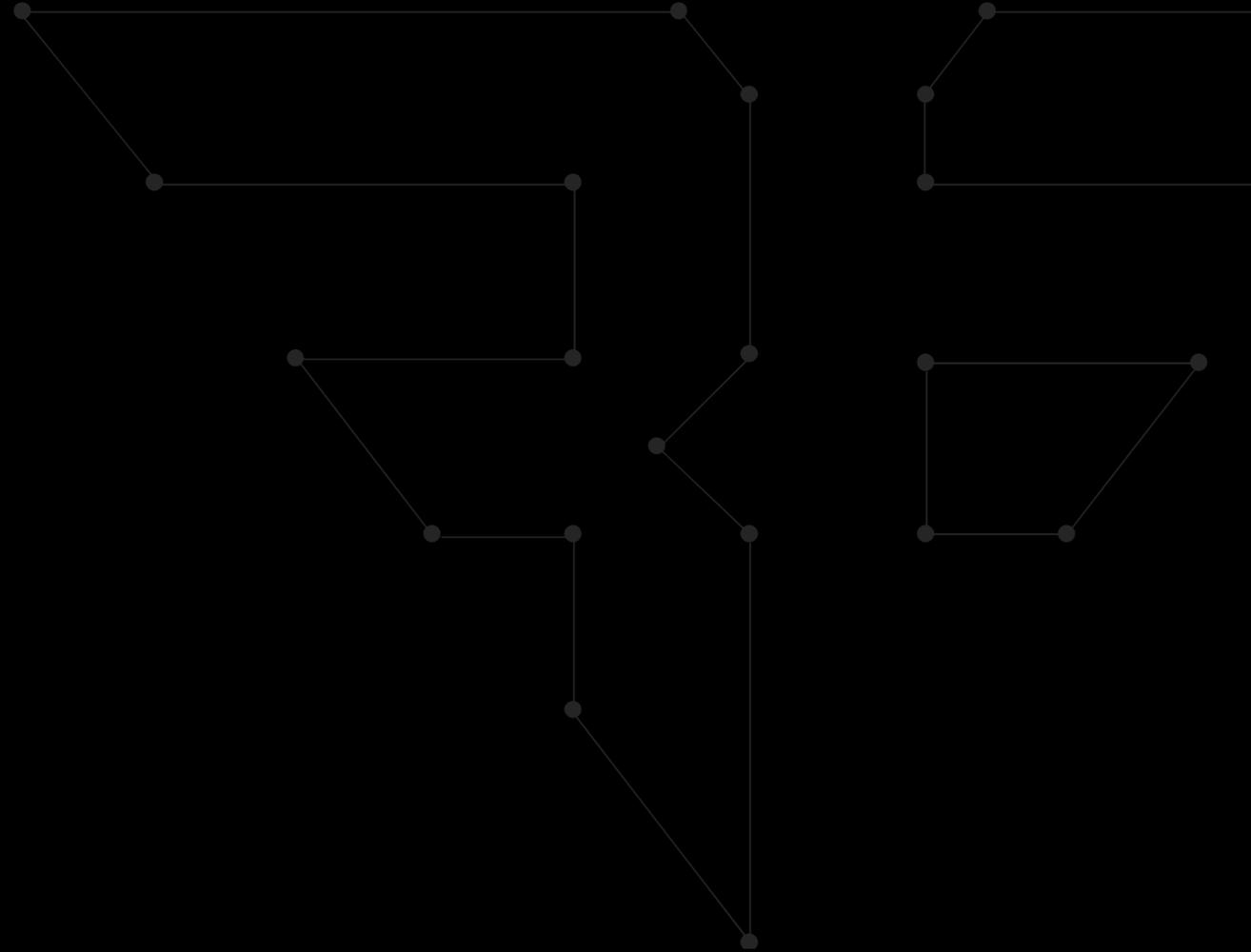
Bishop Fox – Danger Drone Research – Parts Lists, Assembly, and Config Guidance see:

- <https://www.bishopfox.com/resources/tools/drones-penetration-testers/>



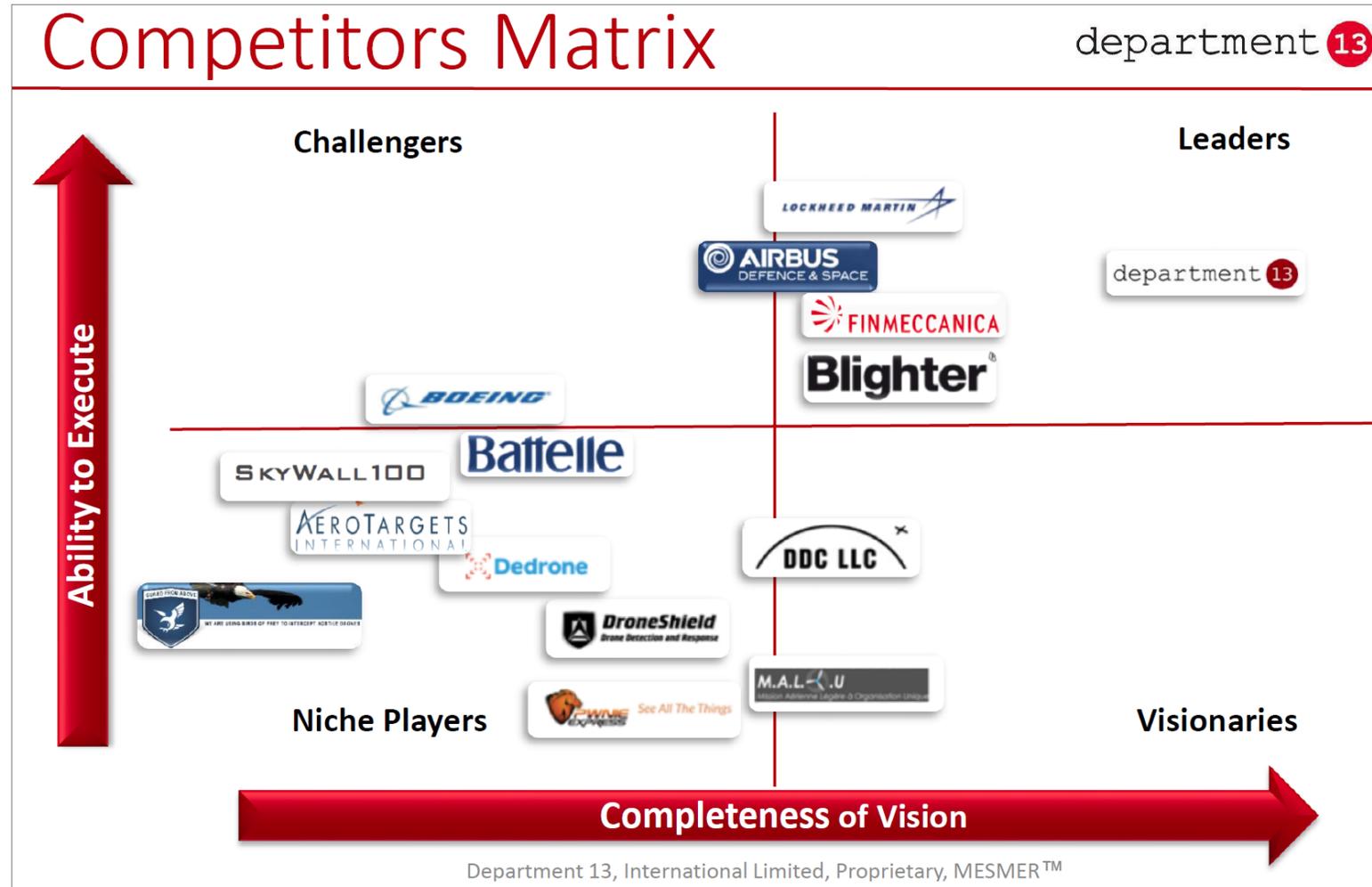
# DRONE DEFENSES

THERE ARE NO BEST PRACTICES ... YET



# Drone Defenses Gone Wild

INSIDE LOOK AT WHO ARE CONSIDERED EMERGING LEADERS IN 'ROGUE DRONE' DEFENSE



Department 13 - Mesmer - Counter Drone System - 04July2016 - Slide 9 - Competitor's Matrix

- <http://www.department13.com/wp-content/sharelink/20160704-mesmer---investor-presentation-a5824ff7cc200fd305fee33cbf73c5f1.pdf>

# Drone Defenses Gone Wild

FALCONS AND EAGLES TRAINED TO ATTACK DRONES



[The Washington Post - Terrorists are building drones. France is destroying them with eagles. - 21Feb2017](#)

[Fox News - Watch a police eagle take down a drone - 01Feb2016](#)



*"I'd like to spend my security training budget on **falconry** classes, please."* –

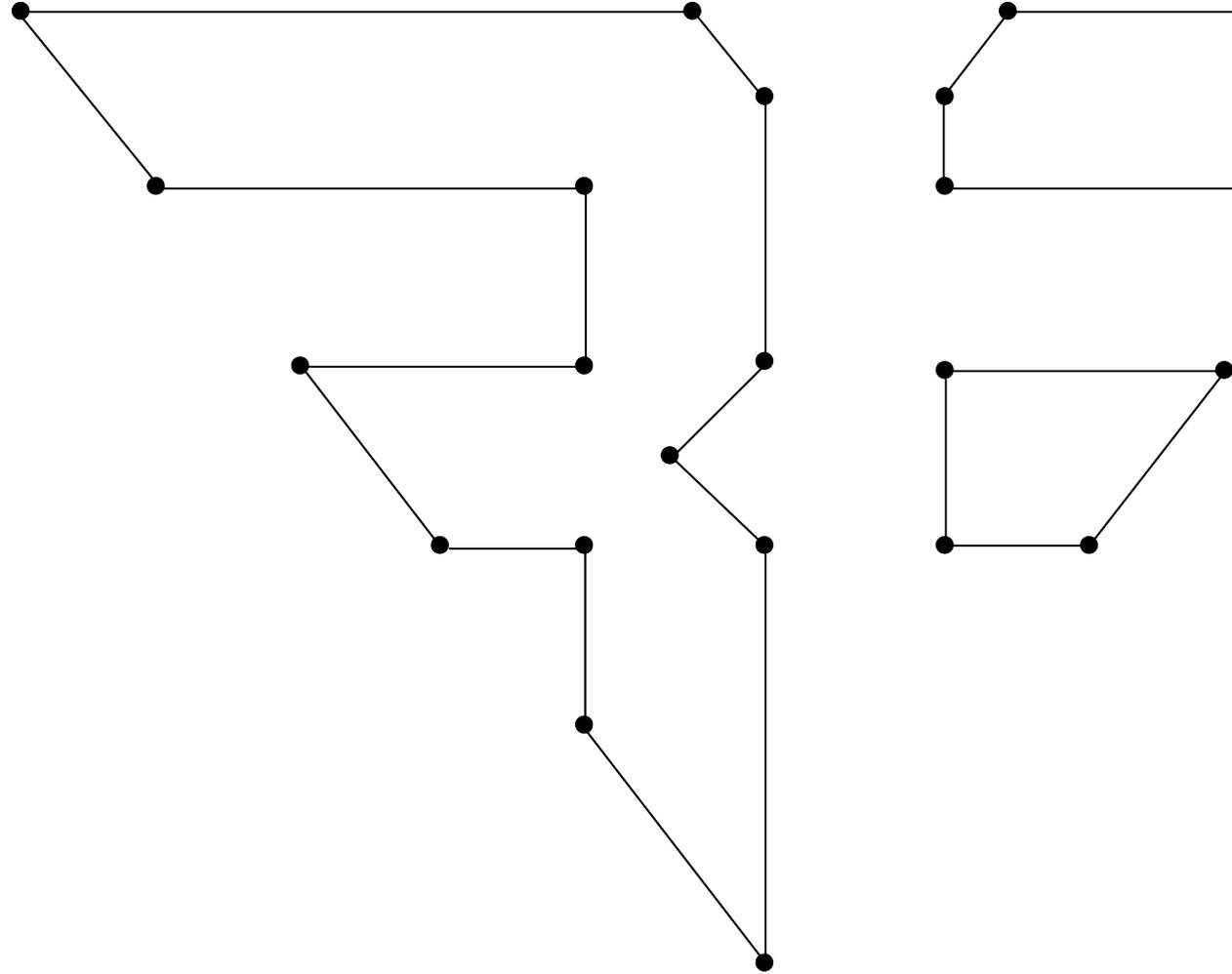
**Every Security Professional Next Year**



Guard From Above - Using birds of prey to intercept hostile drones

- <http://guardfromabove.com/>

# DRONE DETECTION & ALERTING SYSTEMS



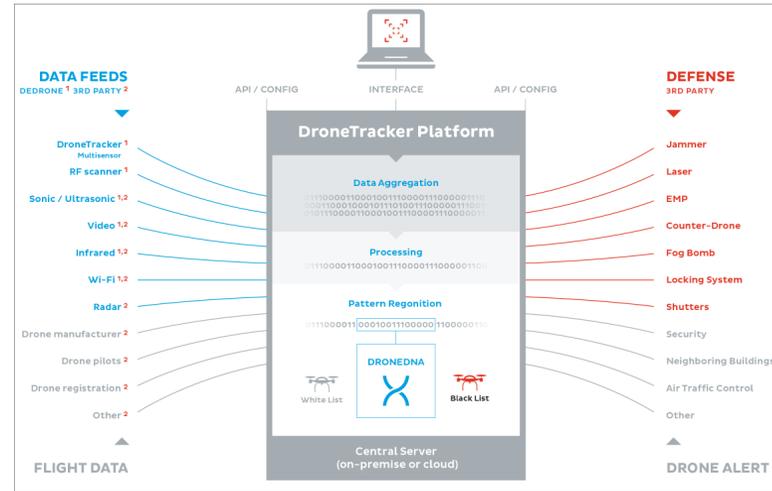
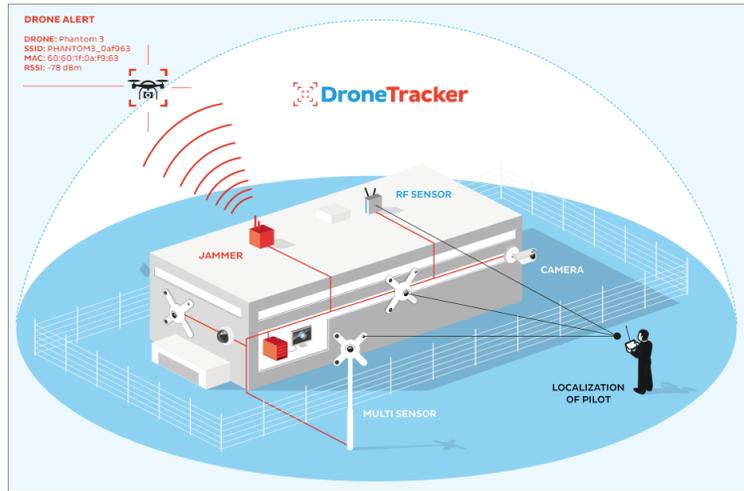
# Drone Defenses Gone Wild

NO BEST PRACTICES, SO PENTEST TOOLS NEEDED TO VALIDATE THESE ARE WORKING



[ZDNet- Cisco chairman backs drone security startup \(Dedrone\) in \\$15m Series B round - 14Feb2017](#)

[The Register - Airbus doesn't just make aircraft – now it designs drone killers - 27July2016](#)



### One Software – Many Devices

Scale it to your needs! [Learn more >](#)

Multi Sensor	RF Sensor	Explosion-Protected Camera	Panorama Camera
Pan-Tilt-Zoom Camera	Surveillance Camera	Jammer System	Radar System

### Automatic countermeasures

Depending on your individual security needs and legal preconditions, you can easily integrate third-party countermeasures into the DroneTracker platform and trigger them automatically via API.

Jammer, Laser, Block view, Counter-Drone, Fire Arms, Electromagnetic Pulse (EMP), Laser



• <http://www.dedrone.com>



# Drone Defenses Gone Wild

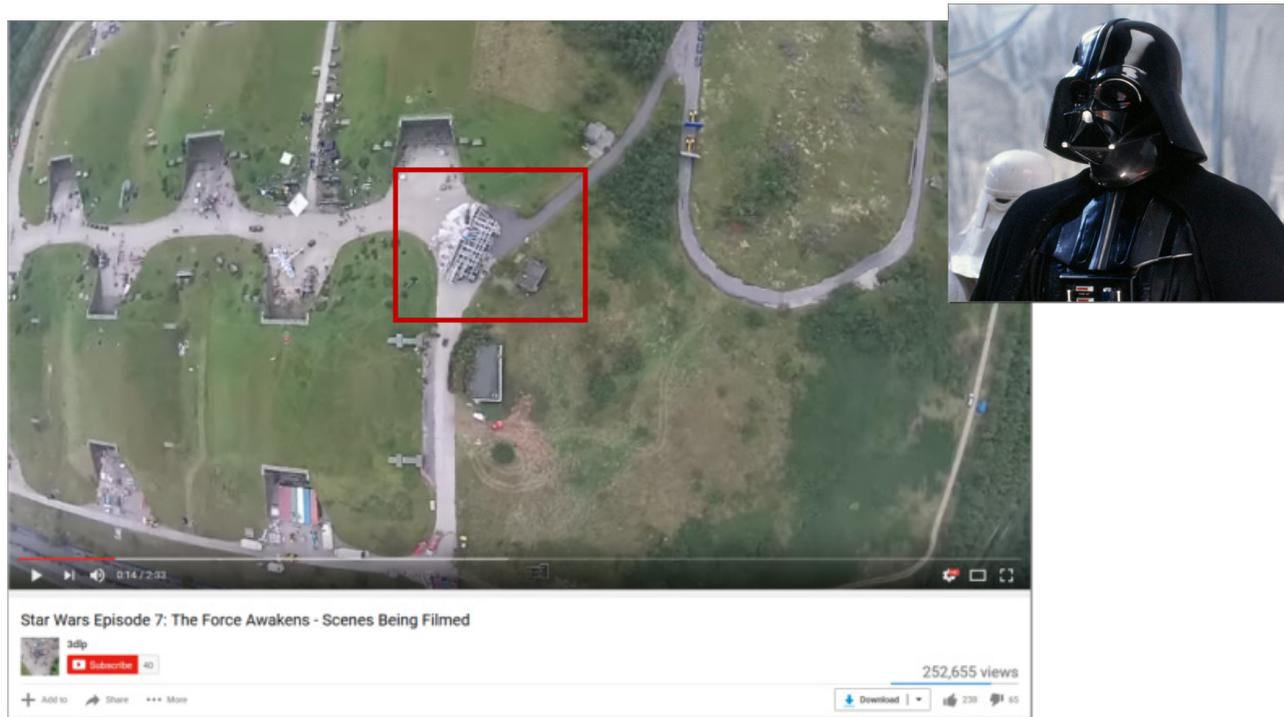
NO BEST PRACTICES, SO PENTEST TOOLS NEEDED TO VALIDATE THESE ARE WORKING



[Gizmodo - The Next Star Wars Movie Has Recruited a Team of Drones to Protect Its Secrets - 22Feb2016](#)

[Motherboard - Star Wars Ordered a 'DroneShield' to Prevent Leaks On Set - 10Sept2014](#)

- *Why monitor a problem if you don't do anything about it, though?*



PRODUCTS



 <p>WIDEALERT SENSOR Broad, Full-Range Drone Detection</p>	 <p>FARALERT SENSOR Far-Reaching Drone Detection</p>	 <p>DRONEGUN Highly effective drone countermeasure</p>
 <p>DRONESHIELD BASEPROCESSOR Drone Detection Without Internet Connection Requirement</p>	 <p>DRONESHIELD USER INTERFACE Continuous, Online Monitoring of Local Drone Activity</p>	 <p>DRONESHIELD ENTRY Autonomous Detection &amp; Countermeasure</p>

DroneShield – Drone Detection and Response Products

- <https://www.droneshield.com/products>



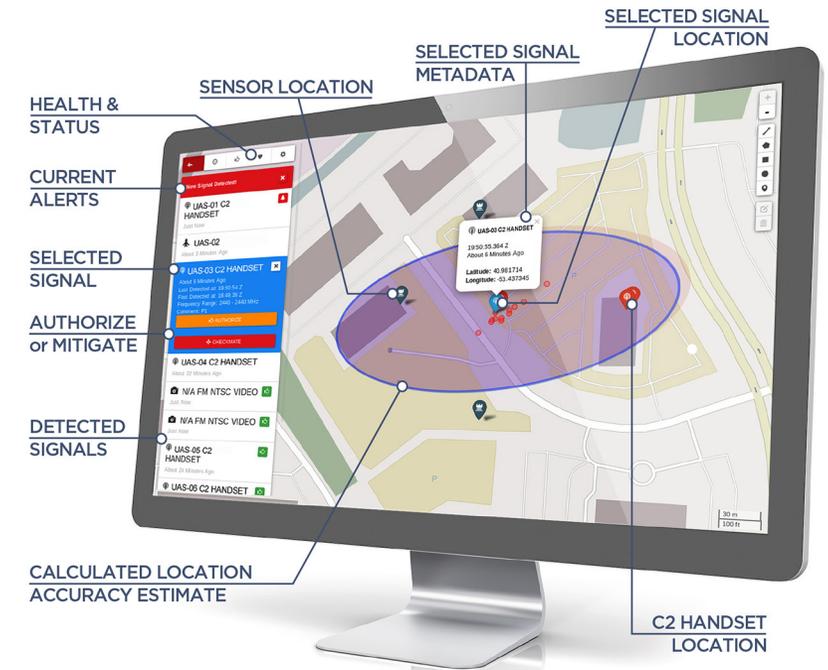
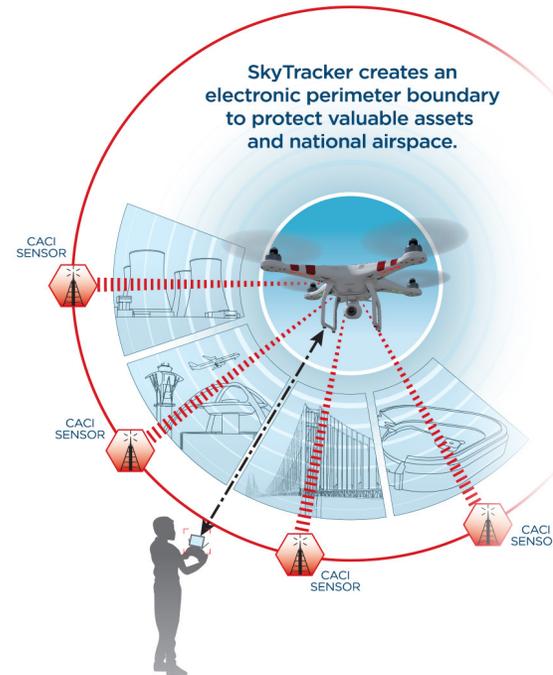
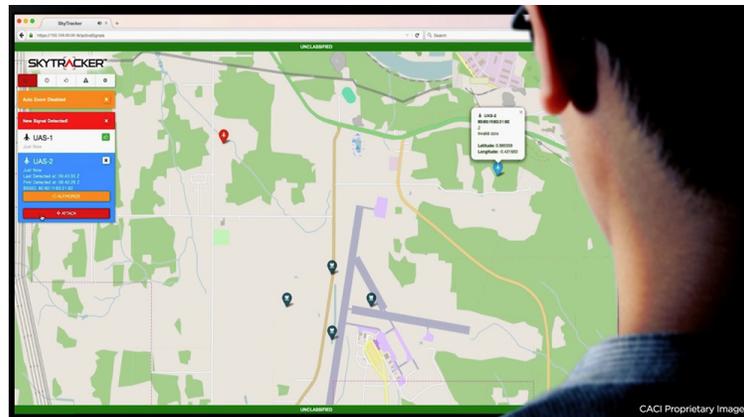
# Drone Defenses Gone Wild

DRONE DETECTION AND ALERTING SYSTEMS



## [DRONELIFE - What's So Secret About the FAA Contract with CACI? - 06Apr2016](#)

- *“The FAA announced a partnership with CACI, an information services company, and the Department of Homeland Security to create a drone detection system, according to a press release.”*



SkyTracker - by CACI - UAS Precision Tracking System

- <http://www.caci.com/skytracker/>



# Drone Defenses Gone Wild

DRONE DETECTION AND ALERTING SYSTEMS



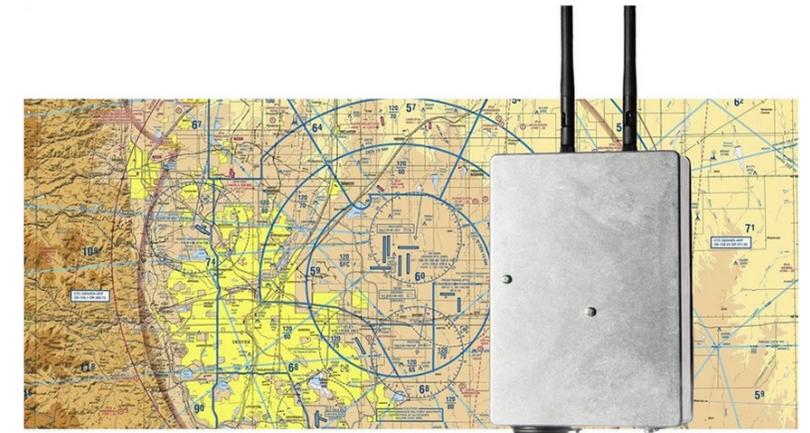
[AOPA.org](http://AOPA.org) - Sensofusion Airfence - Drone fence arriving in Denver - 03Nov2016



## DRONE FENCE ARRIVING IN DENVER

November 3, 2016 | By Jim Moore

Drones approaching sensitive facilities can be instantly identified and tracked; their operators located; and, if need be, the defense system developed by a company called **Sensofusion** can even force the offending drone to land at a location designated in advance—all without need for human intervention. The essential equipment is roughly the size of a wireless router commonly found in homes and offices, or a set-top cable television box. Add an antenna and a computer, and you're up and running. Soon there will be an **Airfence** at **Denver International Airport**.



The **Airfence** system by **Sensofusion** uses a small electronic device to detect and control drones that enter sensitive areas, and will soon be installed at Denver International Airport. Airfence device photo courtesy of Sensofusion.

Sensofusion – Airfence – Drone Detection and Tracking System

- <https://www.sensofusion.com/>



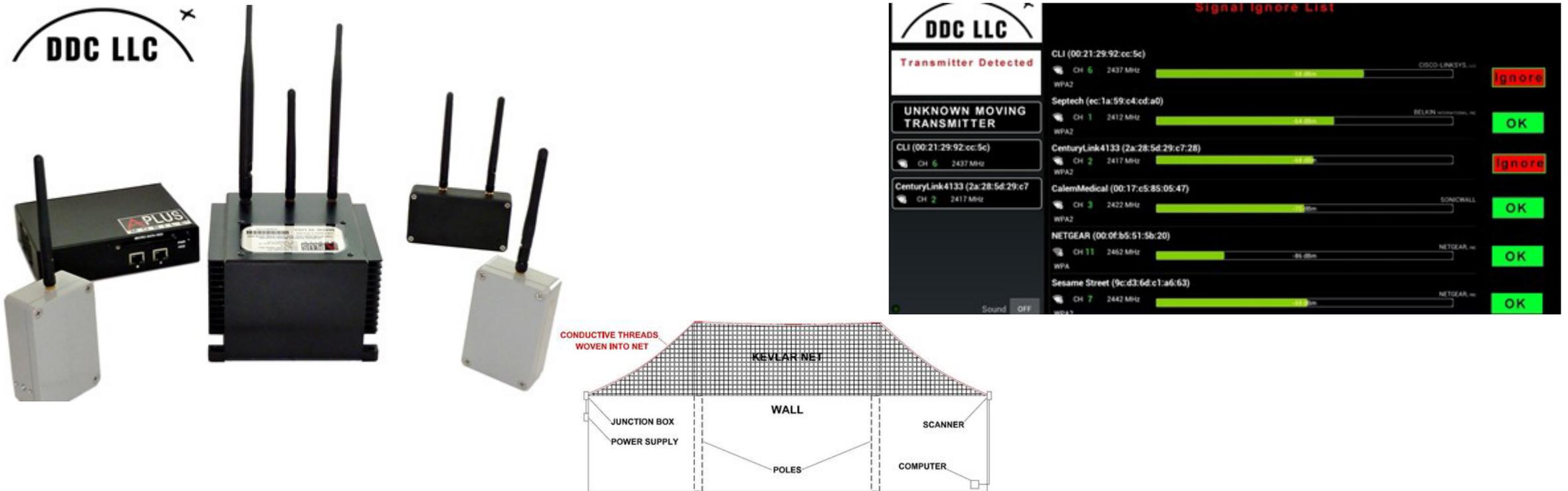
# Drone Defenses Gone Wild

DRONE DETECTION AND ALERTING SYSTEMS



## [DDC LLC - Domestic Drone Countermeasures - Drone Detection Systems](#)

- The Basic **Personal Drone Detection System** consists of three boxes: a Primary Command and Control Module and two Detection Sensor Nodes. These three boxes **create a mesh network** that can triangulate moving transmitters.



DDC LLC - Domestic Drone Countermeasures - Drone Detection Systems

- <https://www.sensofusion.com/>

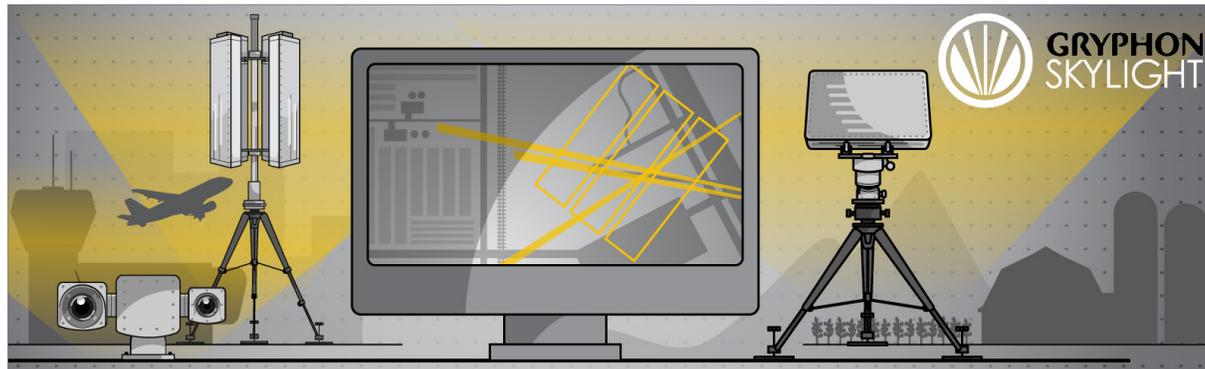
# Drone Defenses Gone Wild

## DRONE DETECTION AND ALERTING SYSTEMS



### [DDC LLC - Domestic Drone Countermeasures - Drone Detection Systems](#)

- The Basic **Personal Drone Detection System** consists of three boxes: a Primary Command and Control Module and two Detection Sensor Nodes. These three boxes **create a mesh network** that can triangulate moving transmitters.



### SAMI

SAMI (Skylight Airspace Monitor Interface) is the glue that brings our sensors together to give you a complete airspace picture.

### SKYLIGHT SYSTEM MULTISPECTRAL SENSORS



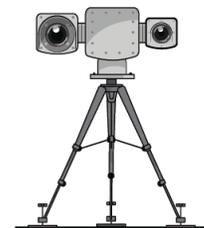
#### R1400\* - PRIMARY RADAR

- Large area, precision surveillance
- Drone security and Detect & Avoid applications
- 10km (sUAS), 27km (General Aviation)
- Low false alarm rate
- Low size, weight and power (SWaP); man transportable



#### SPECTRUM SENSING (S2)

- Fast target acquisition
- Strong positive confirmation for targets of interest
- Provides line of bearing
- Up to 5km detection range
- Up to 360° coverage



#### SLEW-TO-CUE CAMERA

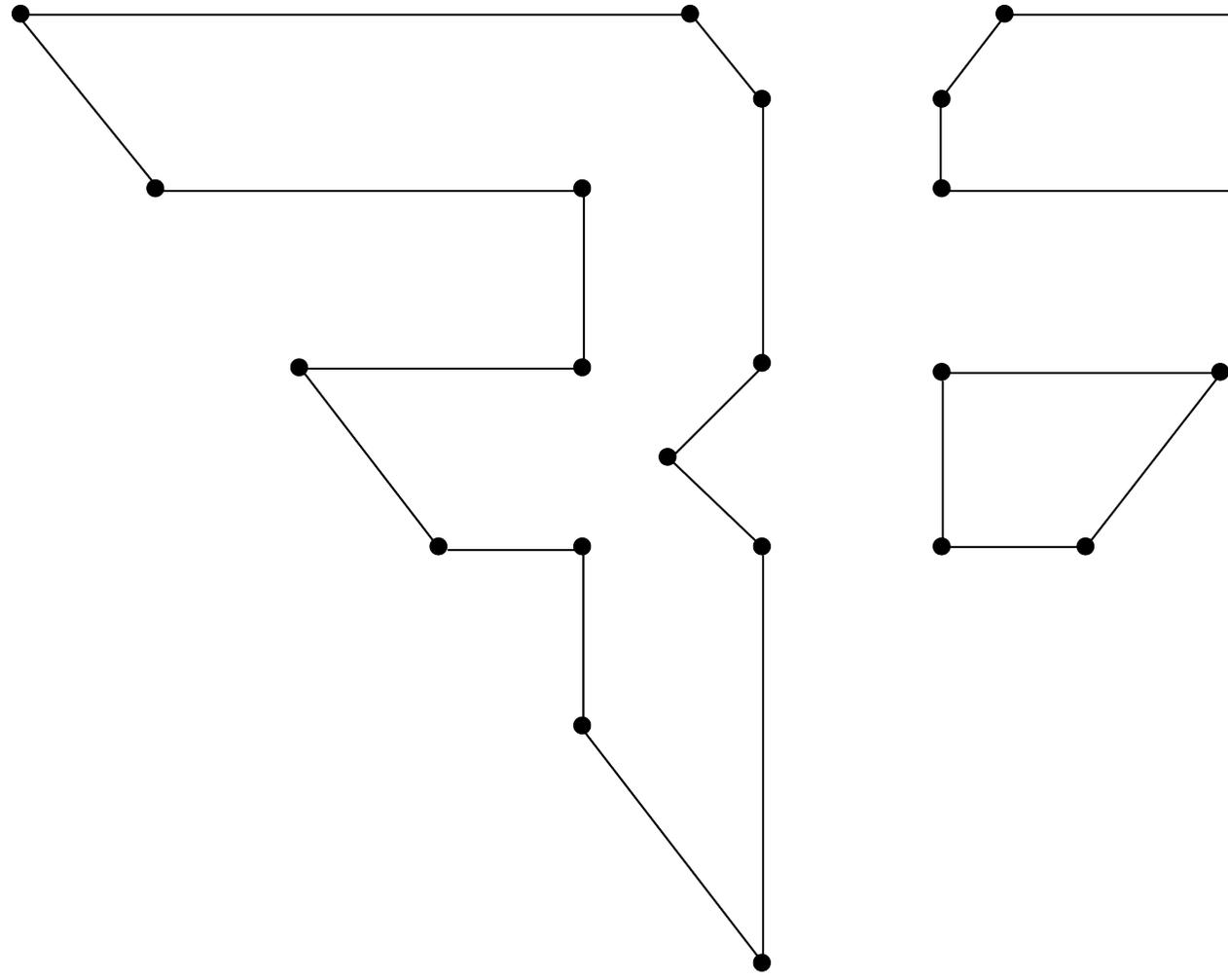
- Visual Target Identification
- Optical Tracking
- Thermal and EO lenses
- 3km detection range
- 360° Pan Rotation
- 180° Tilt Rotation



## Gryphon Sensors - Skylight - Drone Detection and Tracking

- <http://gryphonsensors.com/products/>

# DRONES SHOOTING NETS AT DRONES



# Drone Defenses Gone Wild

DRONES SHOOTING NETS AT OTHER DRONES



[DroneCatcher - Catching a Drone with a Drone - 19Aug2016 -YouTube](#)

[Security Affairs - The DroneCatcher evolves featuring a new improvement - 04April2016](#)



Specifications	
DroneCatcher	Flying system
Dimensions	775 x 755 x 350 mm
Speed	Currently up to 20 m/s 44.7 mph
Operating time	Up to 30 min.
Netgun range	Up to 20 meters 65.6 feet
Weight	< 6 kg



DroneCatcher - DelftDynamics

- <http://dronecatcher.nl/>



# Drone Defenses Gone Wild

DRONES SHOOTING NETS AT OTHER DRONES



[WSJ - Its Drone vs. Drone as Airspace Systems Takes Flight - 09Mar2017](#)

[Gizmodo - Watch a Drone-Hunting Quadcopter Attack Its Prey - 13Oct2016](#)

[Airspace Systems Inc One Touch Interceptor TI - 22Oct2016 - YouTube](#)

A screenshot of the Airspace Systems website homepage. The header includes the Airspace logo and navigation links for Technology, Customers, Careers, and Press. The main headline reads "THE WORLD'S FIRST COMPLETE DRONE SECURITY SYSTEM" with a "SEE IT IN ACTION" button. Below this is a section titled "TAKE CONTROL OF YOUR AIRSPACE" with a sub-headline: "Airspace is the only drone security solution capable of identifying, tracking, and autonomously removing rogue drones from the sky. Our hardware and software are purpose-built for this challenge—and get better with every mission—so that you can protect your airspace with the tap of a finger." Three key features are highlighted: "DETECT &amp; IDENTIFY" (using machine vision and deep learning), "TRACK &amp; FLY" (anticipating and reacting to drone movements in real-time), and "CATCH &amp; RETRIEVE" (safely disabling and retrieving drones to limit collateral damage).



American Airspace Systems - One-Touch Interceptor TI

- <http://airspace.co>

# Drone Defenses Gone Wild

DRONES SHOOTING NETS AT OTHER DRONES



[Popular Mechanics - Drone-Mounted Net Cannon Snags Other Drones with Ease - 12Jan2016](#)

[TheNextWeb - Watch Michigan Tech's 'Robotic Falcon' snatch this drone out of mid-air - 13Jan2016](#)



Michigan Tech - Robotic Falconry

- <http://me.sites.mtu.edu/rastgaar/hirolab/>

# Drone Defenses Gone Wild

DRONES SHOOTING NETS AT OTHER DRONES



## [Net Gun Drone - Excipio | Flite Test - 11Jan2016 - YouTube](#)

- *"Excipio"* is Latin for *"capture"*



### Excipio Aerial Netting System



Theiss UAV Solutions, LLC has released the EXCIPIO, a patent pending non-electronic, non-destructive Anti-Drone system. The EXCIPIO (Latin for "I Capture") is a unique Interception and neutralizing system that allows for surgical removal of a potential threat. Though the initial system concept was focused on intercepting and neutralizing an airborne UAS (or "Drone"), the conceptual applications have expanded to include manned aircraft, ground vehicles, people, and animals (whether airborne or on the ground).

The EXCIPIO Aerial Netting System can be mounted to a variety of fixed wing or rotorcraft platforms for use. The EXCIPIO is launched when a threat target has been identified and then flies to intercept the target. When the EXCIPIO has reached the threat target, it fires a net upon the target when commanded by the EXCIPIO System operator. Once the target has been "netted," the EXCIPIO can either release the net with the neutralized target ensnared (utilizing a small drag chute to slow the fall of the neutralized target) or keep the net tethered to the System for the purpose of relocating the net and neutralized target to a desired location before releasing them to the ground.

Please contact us via email for more information, or to order the EXCIPIO Aerial Netting System.

Excipio - Net Gun Drone - [thisisuv.com](http://thisisuv.com)

- <http://www.theissuav.com/researchanddevelopment/>





# Drone Defenses Gone Wild

DRONES WITH NETS SWOOPING IN AND SNAGGING DRONES



[Tokyo police drones use nets to catch illegally flown devices - 14Dec2015 - YouTube](#)

[Daily Mail Online - Tokyo police reveal bizarre 'UAV drone catcher' - 11Dec2015](#)



Tokyo Police - Drone Interceptor

# Drone Defenses Gone Wild

DRONES WITH NETS SWOOPING IN AND SNAGGING DRONES



[Popular Mechanics - This Drone Interceptor Captures Your Pathetic Puny Drone With a Net - 11Feb2015](#)

**M.A.L.O.U**  
Mission Aérienne Légère à Organisation Unique

Main page Store Articles Contact

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**Drone Interceptor MPI 200**  
The drone interceptor MPI 200 neutralizes the intruder with his net. It can capture up to 6 Kg drones. He can drop his net immediately without limit of weight or size of the captured drone. Handy, accurate, he can go to a top speed of over 100 km / h.

[See our offer >>](#)



**Drone MP 200**  
The recognition drone MP 200, is dedicated to surveillance, to detect intruder elements, with guided or fully autonomous manner, alone or in flying squadron.

[See our offer >>](#)

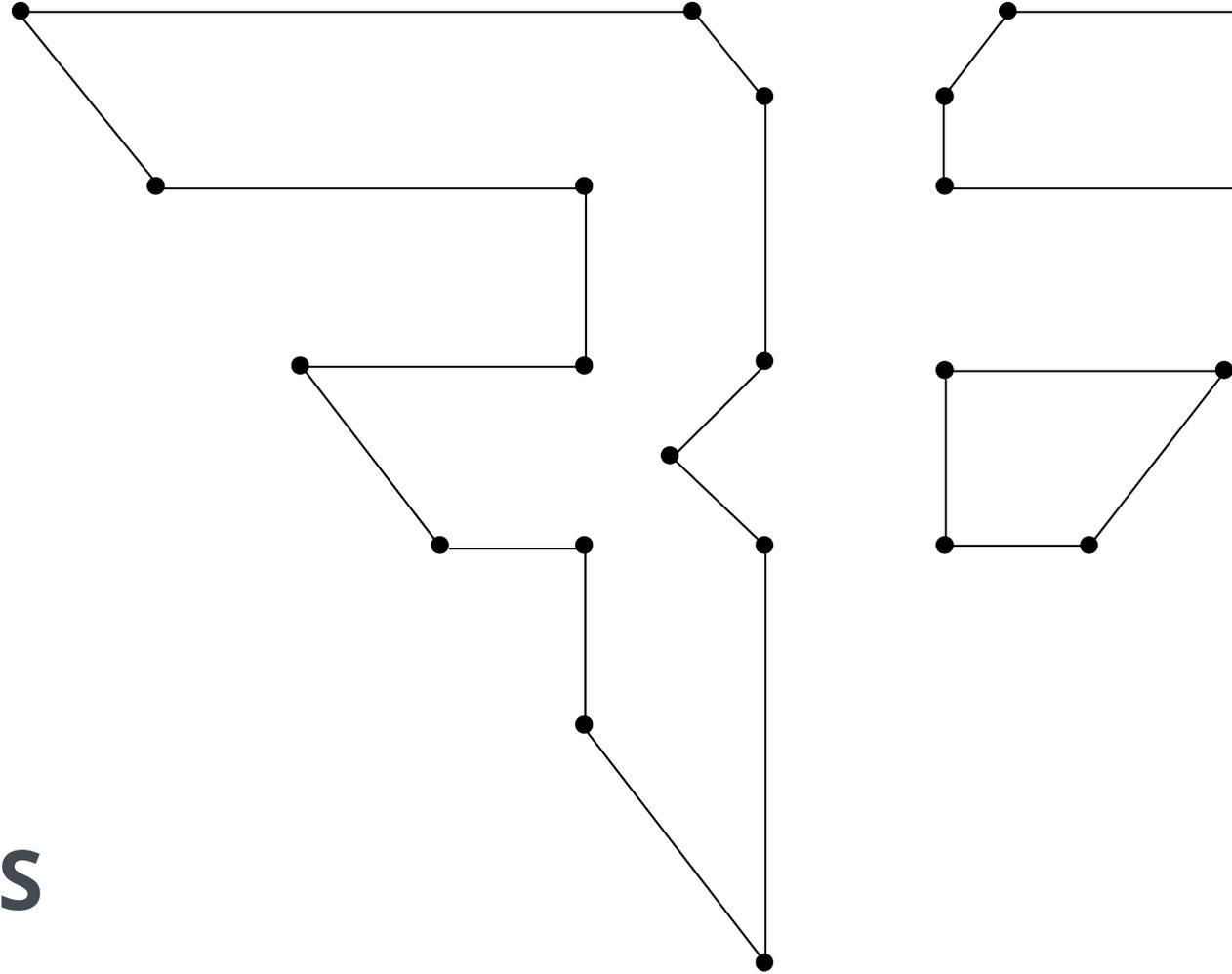
© M.A.L.O.U - Groupe assmann - all right reserved | Legal notes | contact



Malou Tech - Drone Interceptor MPI 200

- <http://www.malou-tech.fr/shopUS.php>

# SHOOTING NETS AT DRONES FROM THE GROUND



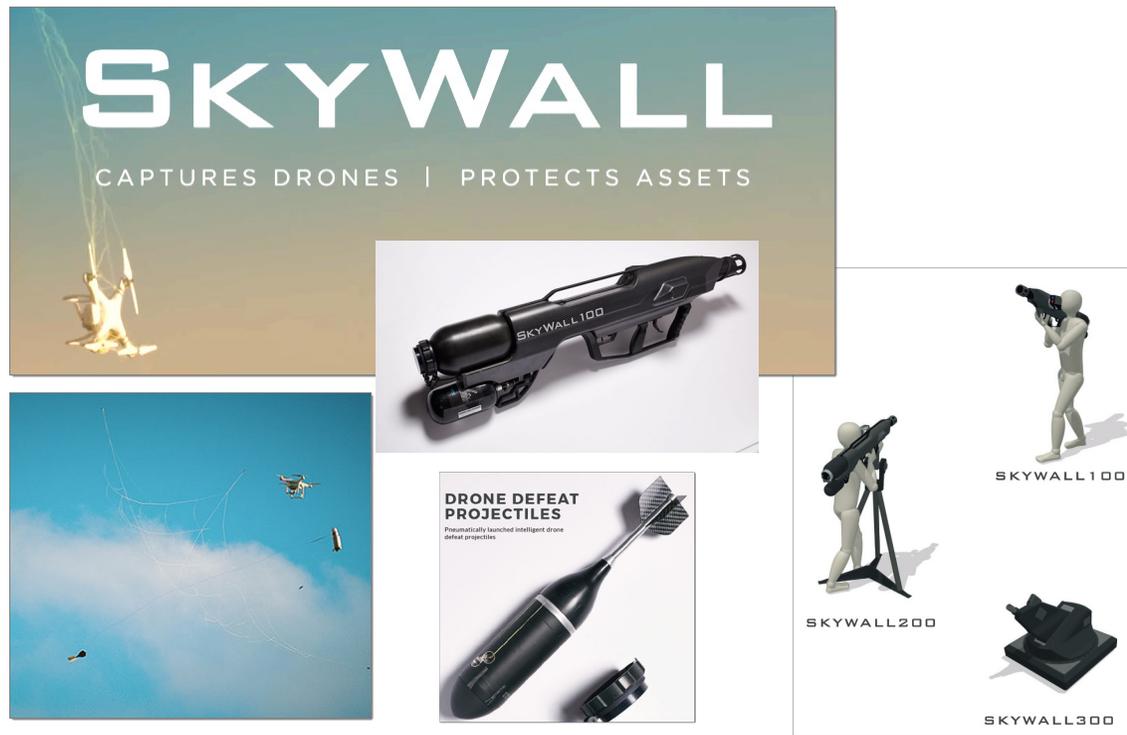
# Drone Defenses Gone Wild

BAZOOKA SHOOTING NETS WITH PARACHUTE AT DRONES



[Mashable - SkyWall gun stops drones dead with net, then gives a parachute landing - 05Mar2016](#)

[Popular Science - SkyWall Is A New Anti-Drone Net Bazooka For Police - 07Mar2016](#)



OpenWorks Engineering - SkyWall

- <https://openworksenineering.com/skywall>

# Drone Defenses Gone Wild

DRONE NET GUN - SMALL FLASHLIGHT SIZED



[DroneDefence.co.uk](http://DroneDefence.co.uk) - Net Gun X1



## Net Gun X1 Operation

The Drone Defence Net Gun X1 is a simple to use, versatile & economical device for Law Enforcement & Security Officers to tackle unwanted drone incursions. With two types of capture net the operator can select the appropriate configuration, dependent on the environment. The Type 1 capture net provides an protective barrier wall, which a drone cannot penetrate. Type 2 allows the operator to attempt the direct capture of a drone in flight.



Drone Defence - Net Gun X1

- <http://www.dronedefence.co.uk/net-gun-x1>

# Drone Defenses Gone Wild

DIY DRONE NET GUN



[LifeHacker - Build a Drone-Catching Net Gun Out of Basic Plumbing Parts - 24Feb2017](#)

Build a Drone-Catching Net Gun Out of Basic Plumbing Parts

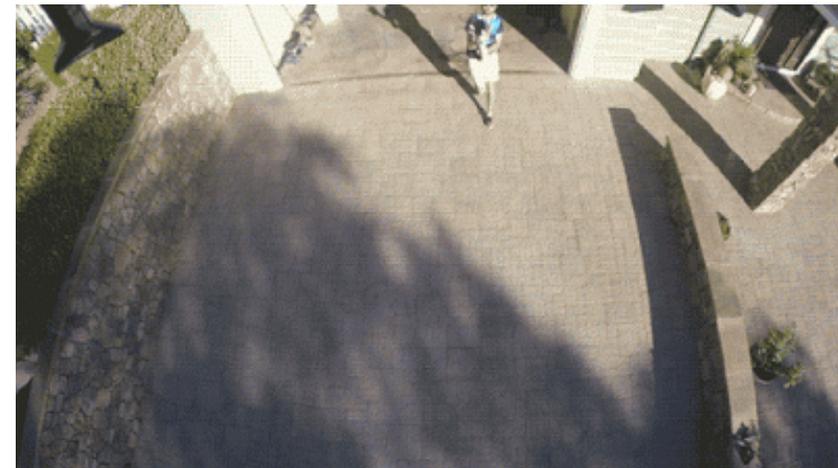
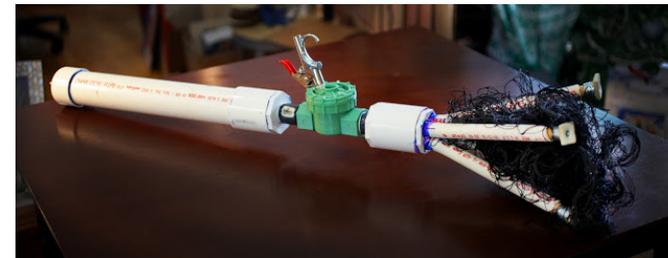
Patrick Allan  
2/24/17 4:02pm · Filed to: DIY

lifehacker

# NET GUN

A person's hand is shown holding a white drone that is caught in a net gun device. The device is made of white PVC pipes and a green valve. The net is black and is stretched across the end of the pipes. The background is a chain-link fence.

If you're looking for a way to shoot down snooping drones in the near dystopian future, or just want to pretend to be Batman, this fun DIY build is for you.



DIY Net Gun for Drones - William Osman

- <http://www.williamosman.com/2016/12/diy-net-gun.html>

# Drone Defenses Gone Wild

DRONE NET GUN SHOTGUN SHELLS



[Advanced Ballistics Concepts - Skynet™ Drone Defense](#)

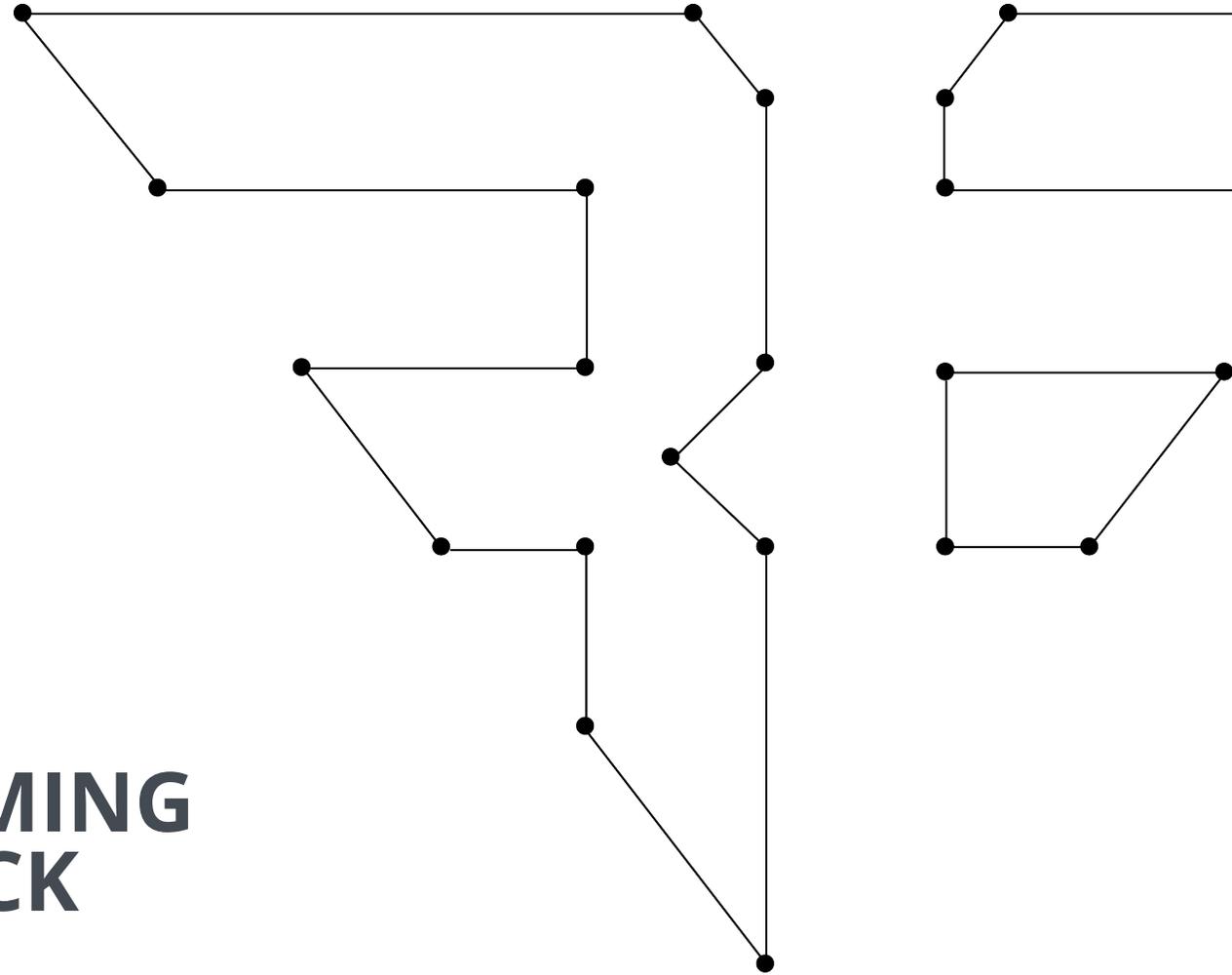


SKYNET – Drone Defense – Shotgun Net Shells

- <http://store.mibullet.com/skynetdronedefense.aspx>



**CANNONS SHOOTING JAMMING  
SIGNALS OR EMPS TO KNOCK  
DRONES OUT OF SKY**



# Drone Defenses Gone Wild

CANNONS SHOOTING JAMMING OR EMP SIGNALS TO KNOCK DRONES OUT OF SKY



[Mashable - DroneShield - DroneGun - Here is the anti-drone gun of your Rambo fantasies - 27Nov2016](#)

- *DroneGun may **not** be used or offered for sale in the U.S., other than to the government and its agencies. That's because the FCC "prohibits the operation, marketing, or sale of any type of jamming equipment."*



DroneGun – by DroneShield

- <https://www.droneshield.com/dronegun>

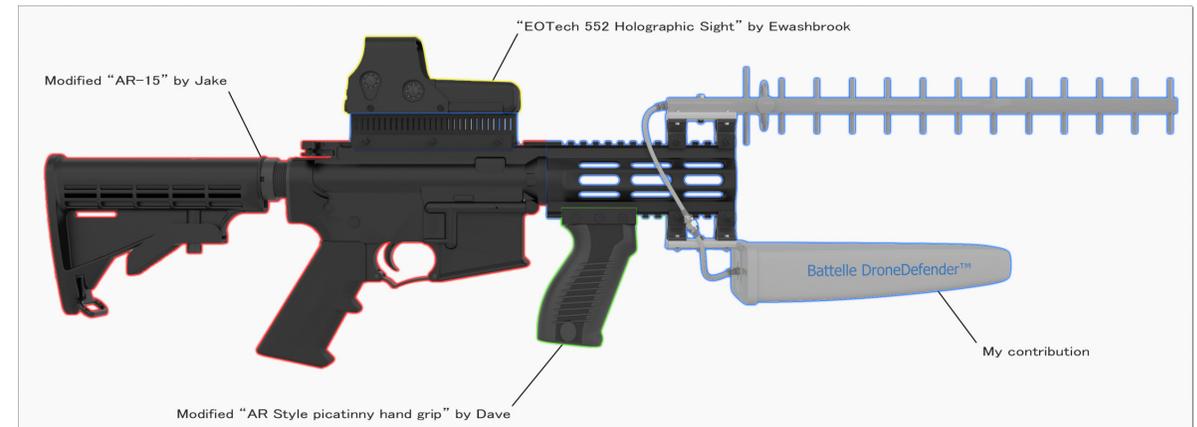
# Drone Defenses Gone Wild

CANNONS SHOOTING JAMMING OR EMP SIGNALS TO KNOCK DRONES OUT OF SKY



## [Security Affairs - DroneDefender, electromagnetic gun that shoot down drones - 16Oct2015](#)

- Only really work against Wi-Fi controlled drones, **ineffective** against those like the Danger Drone (i.e. **cellular/GPS control**)



DroneDefender – by Battelle

- <https://www.battelle.org/government-offerings/national-security/aerospace-systems/counter-UAS-technologies/dronedefender>

# Drone Defenses Gone Wild

DRONE PORTABLE JAMMERS



[DroneDefence.co.uk](http://DroneDefence.co.uk) - Dynopis Electronic Counter Measures (ECM)



### Dynopis E1000MP Operation

The E1000MP is the ultimate man portable anti-drone solution. It is a safe, simple to operate and can be carried effortlessly by law enforcement and security officers. The device uses focused electronic counter measures to block the drone's control, GPS and video signals while minimizing the impact on other local devices. With a range of up to 1km if you can see the drone then you can stop it.

\*Depending on power settings and environmental conditions.



Dynopis E1000MP	Dynopis E200BC
<b>Operating Frequencies</b> 433MHz   2.4GHz   GPS   5.8GHz	<b>Operating Frequencies</b> 433MHz   915Mhz   GPS   2.4GHz   5.8GHz
<b>Operational Range</b> Omni-Directional Antenna - 500m   Directional Antenna - 1km	<b>Operational Range</b> Up to 200m Omni-Directional
<b>Weight</b> 14.8kg without antennas	<b>Weight</b> 7kg including antennas
<b>Effect on Drone</b> Return to launch location or land immediately	<b>Effect on Drone</b> Return to launch location or land immediately



Drone Defense - Dynopis E1000MP - Man Portable Drone Jammer

• <http://www.dronedefence.co.uk/dynopis-ECM>

# Drone Defenses Gone Wild

DRONE PORTABLE JAMMERS



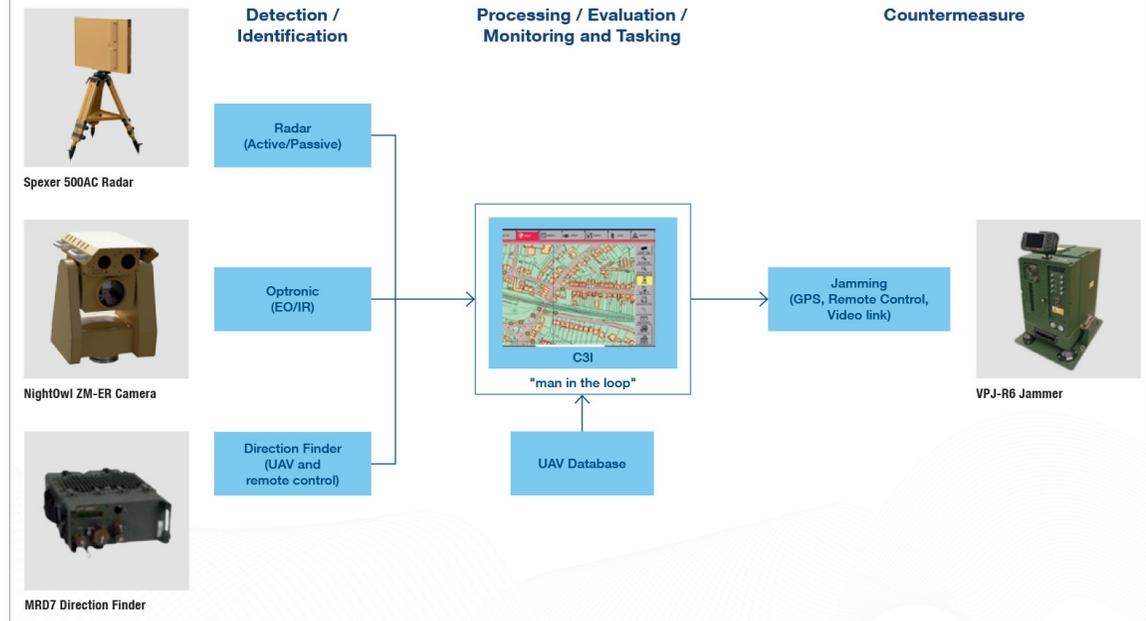
[c4isrnet.com](http://c4isrnet.com) - Airbus expands counter-drone line (acquired by Hensoldt - rebranded Xpeller) - 17Jan2017

[Airbus DS EBS Adds Portable Jammer to Its Innovative "Xpeller" Counter-UAV Product Family](#) - 03Jan2017

[Hensoldt.net - Xpeller - Counter UAV System Specsheat.pdf](#)



## HENSOLDT Sensors Core Approach



Hensoldt.net - Xpeller - Counter UAV System (formerly Airbus - Defense and Space - EBS)

- <https://www.hensoldt.net/solutions/land/electronic-warfare/xpeller-counter-uav-system/>



# Drone Defenses Gone Wild

CANNONS SHOOTING JAMMING OR EMP SIGNALS TO KNOCK DRONES OUT OF SKY



## [The Register - FAA to test Brit drone-busting kit \(Blighter\) - 01Jun2016](#)

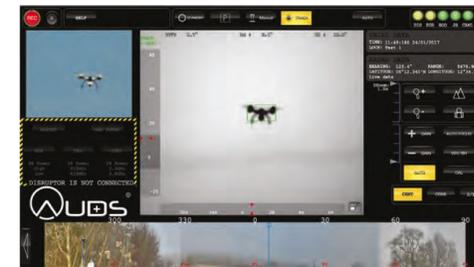
- “The **Blighter AUDS counter-UAV system** can detect a drone six miles (10km) away using electronic scanning radar, track it using precision infrared and daylight cameras and specialist video tracking software before disrupting the flight using an **inhibitor to block the radio signals that control it**. This detect, track, disrupt, defeat process is very quick and typically takes 8-15 secs.”



Blighter AUDS (shown with Blighter A422 radar with W20S antennas)



AUDS Radar GUI



AUDS EO/Inhibitor GUI

**Blighter**<sup>®</sup>  
Surveillance Systems



**LITEYE**

Blighter - AUDS (Anti-UAV Defence System) – Detect, Track, Disrupt, Defeat

- <http://www.blighter.com/products/auds-anti-uav-defence-system.html>

# Drone Defenses Gone Wild

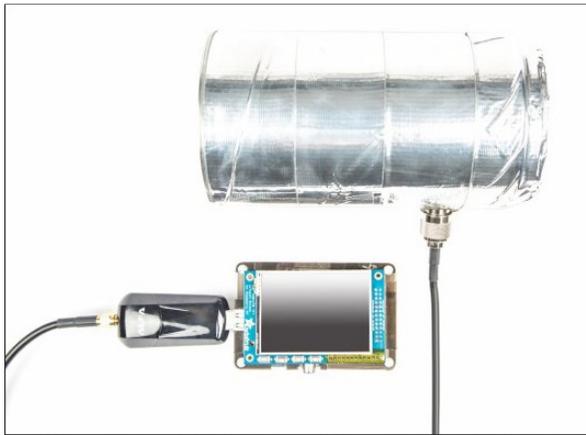
CANNONS SHOOTING JAMMING OR EMP SIGNALS TO KNOCK DRONES OUT OF SKY



## [DRONELIFE - Anti-Drone Gun Uses Raspberry Pi - 11 May 2016](#)

- Only really work against Wi-Fi controlled drones, **ineffective** against those like the Danger Drone (i.e. **cellular/GPS control**)

## Make:



MAKE: Build a Wi-Fi Drone Disabler with a Raspberry Pi – May 2016

- <http://makezine.com/projects/build-wi-fi-drone-disabler-with-raspberry-pi/>



# Drone Defenses Gone Wild

REMOTELY HACKING DRONES TO DEFEND AGAINST THEM



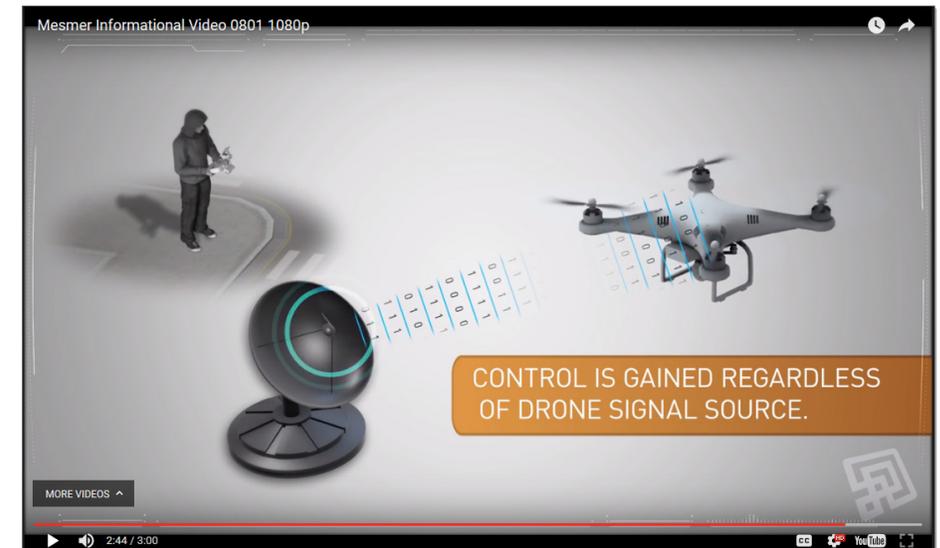
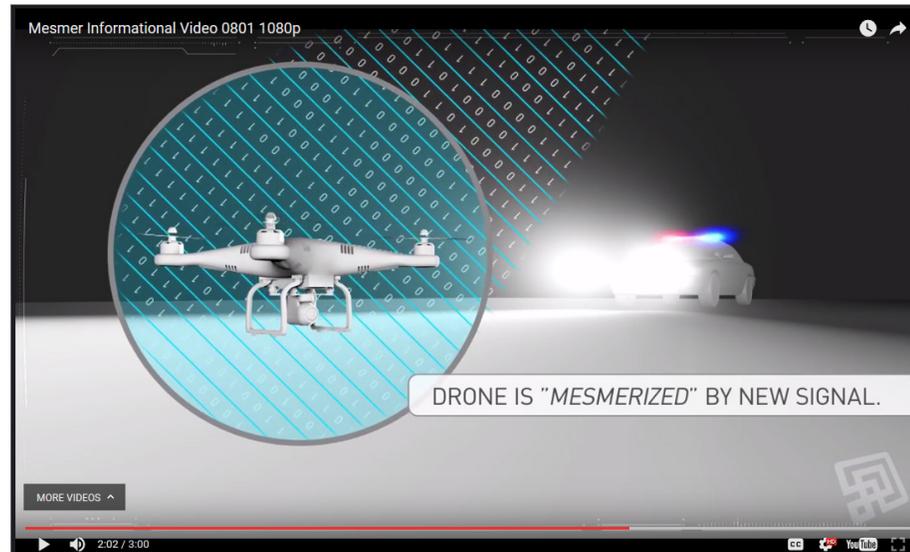
Hijacking command and control signal, or “*mesmerizing*” the drone (as they say)



**MESMER**  
COUNTER DRONE  
DEPARTMENT 13



Figure 1 Mesmer V1



Mesmer - Department 13 - Counter Drone System - Hijack Command and Control Signal

- <http://www.department13.com/products/>



# Drone Defenses Gone Wild

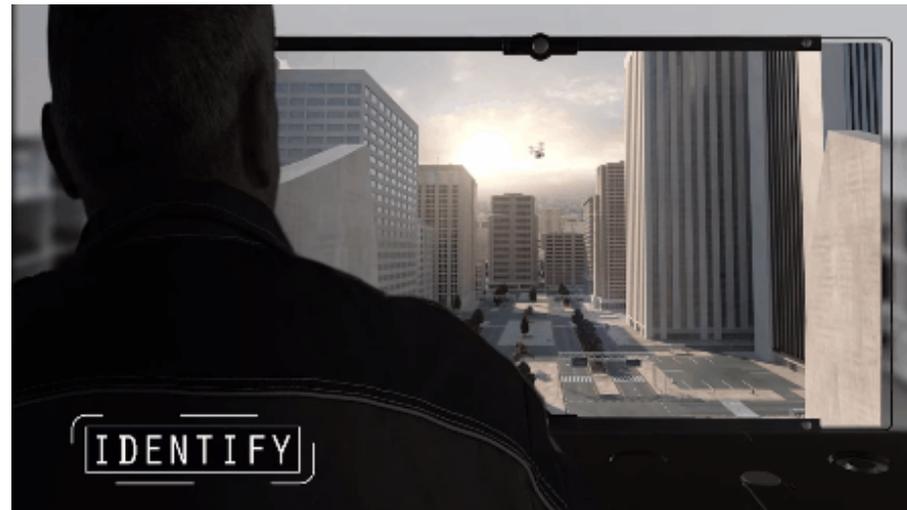
REMOTELY HACKING DRONES TO DEFEND AGAINST THEM



[Popular Science - Defense Company Unveils Anti-Drone System - 17Sept2015](#)

[Falcon Shield - 01Oct2015 - YouTube](#)

- “The material is vague on how exactly it stops small drones, but a video of the system shows the hypothetical threat: a quadcopter dropping a bomb in a stadium. The video then rewinds to show the same attack, foiled by Falcon Shield after mysterious beams take over the drone.”



Leonardo-Finmeccanica - Selex ES - Falcon Shield

- <http://www.leonardocompany.com/en/-/falcon-shield-launch>



# Drone Defenses Gone Wild

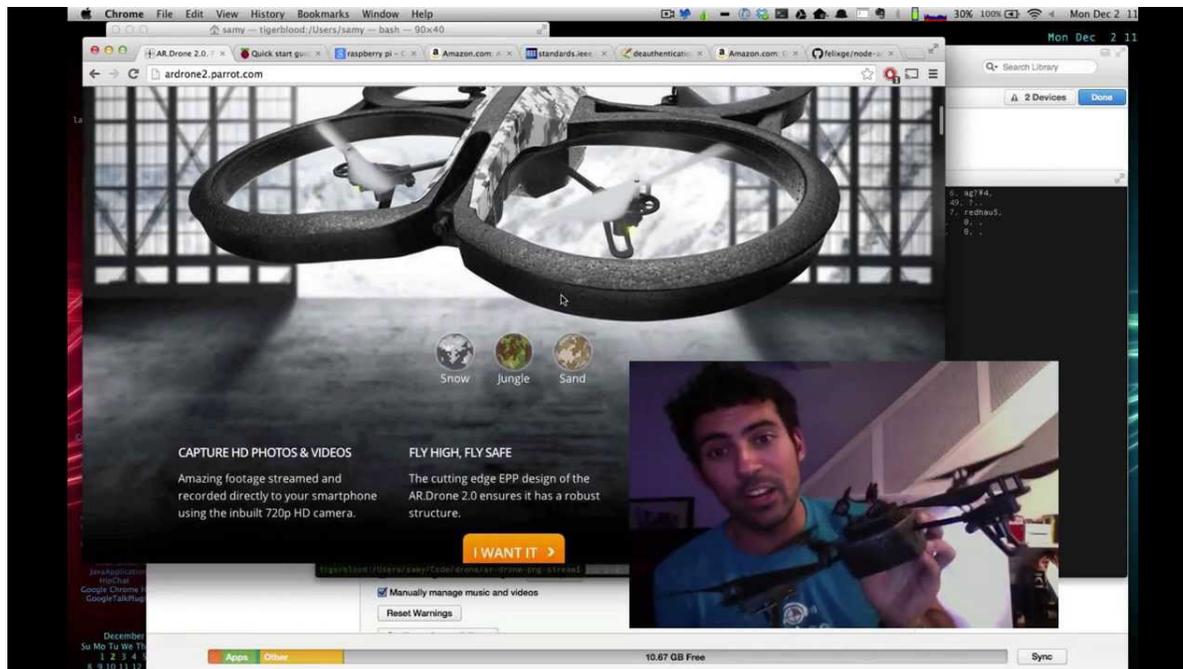
REMOTELY HACKING DRONES TO DEFEND AGAINST THEM



[Threatpost - How to Skyjack Drones for \\$400 - 03Dec2013](#)

[SkyJack - autonomous drone hacking w/Raspberry Pi, aircrack & Javascript - 03Dec2013 - YouTube](#)

- Raspberry Pi drone that autonomously seeks out, hacks, and takes remote control of other drones



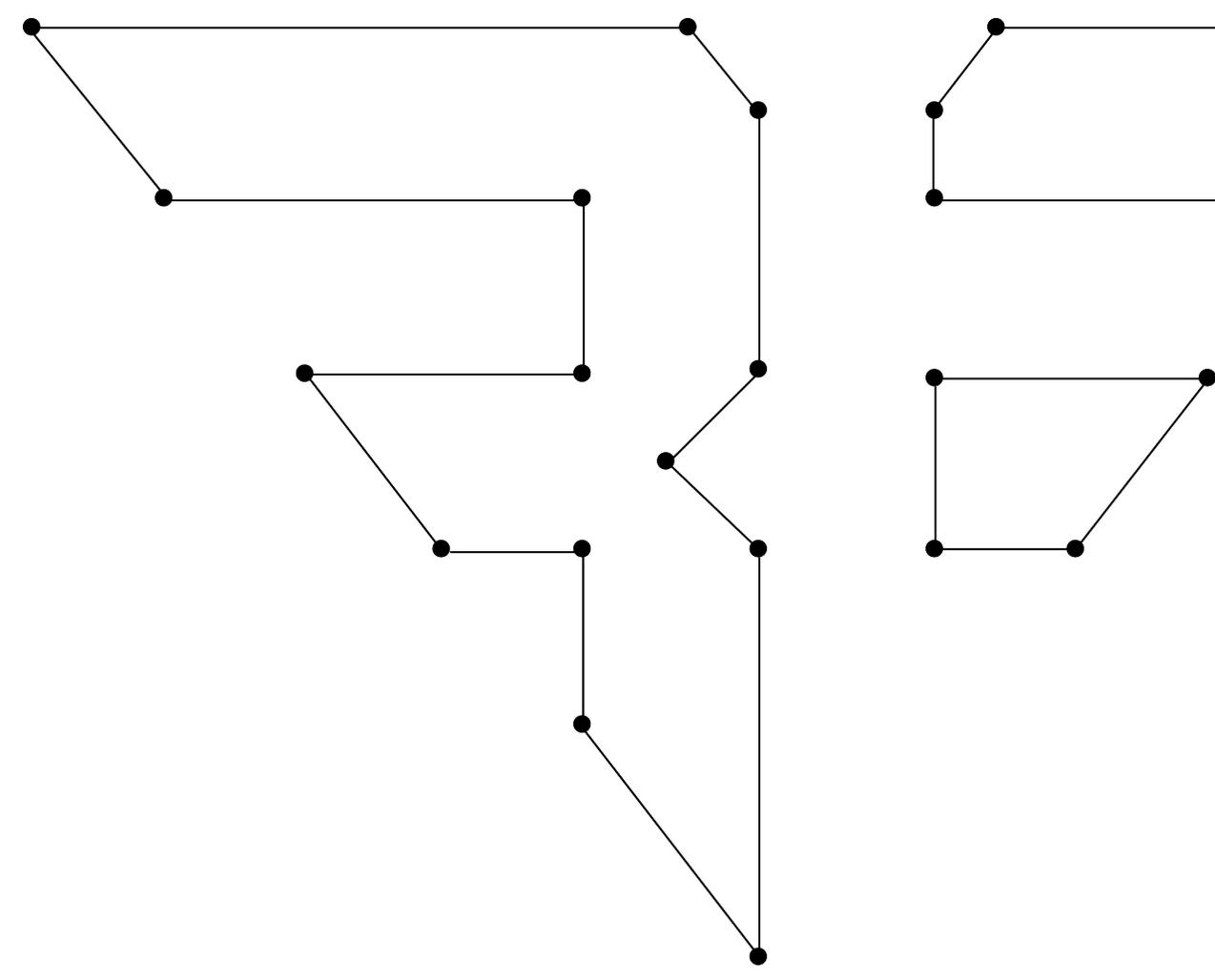
SkyJack - Samy.pl - Raspberry Pi hacking

- <http://samy.pl/skyjack/>





# SHOOTING DRONES WITH FRICKIN LASER BEAMS



# Drone Defenses Gone Wild

SHOOTING DRONES WITH FRICKIN LASER BEAMS



## [LA Times - To keep drones out of high-risk areas, companies try hijacking them and shooting them down - 07Oct2016](#)

- “Last year, **Boeing unveiled its compact laser weapons system**, which ignites targeted drones. At a demonstration in California, Boeing said it took only about 15 seconds for its **2-kilowatt laser to disable the drone.**”

## [Wired.com - Welcome to the World, Drone-Killing Laser Cannon - 27Aug2015](#)

- “The laser can take the 220 volts of power it needs from a generator or mobile battery pack and **is controlled with nothing more than a laptop and an Xbox 360 controller**, and the system will take over to track and fire on a drone itself once it's in range.

## [Boeing's Compact Laser Weapons System: Sets Up in Minutes, Directs Energy in Seconds - 27Aug2015 - YouTube](#)



## Boeing - Compact Laser Weapons System – “Directed Energy”

- <http://www.boeing.com/features/2015/08/bds-compact-laser-08-15.page>

# Drone Defenses Gone Wild

SHOOTING DRONES WITH FRICKIN LASER BEAMS



POPULAR SCIENCE

## The Navy Is Going To Test A Big Laser Soon

150 kilowatts of directed energy, pointed at an unknown date on a calendar.

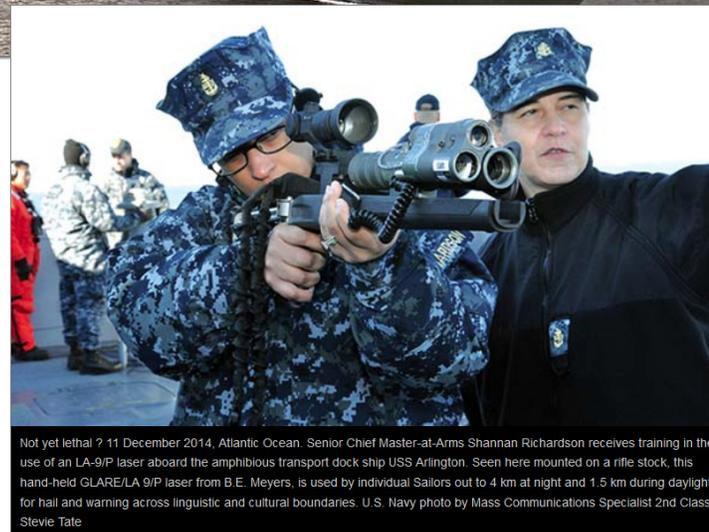
By Kelsey D. Atherton June 24, 2016



Laser Weapon System On The USS Ponce

US Naval Research, YouTube Screenshot

Damage done by laser weapons is a function of power and time. The longer a laser can stay on a target, like a drone or an incoming missile, the more damage it can do. The more powerful that laser is, the less time it needs to spend burning its target. The U.S. Navy already has a 30-kilowatt laser mounted on a ship. Yesterday, at a summit on directed energy weapons in Washington, D.C., the Navy announced it plans to go bigger: 150 kilowatts.



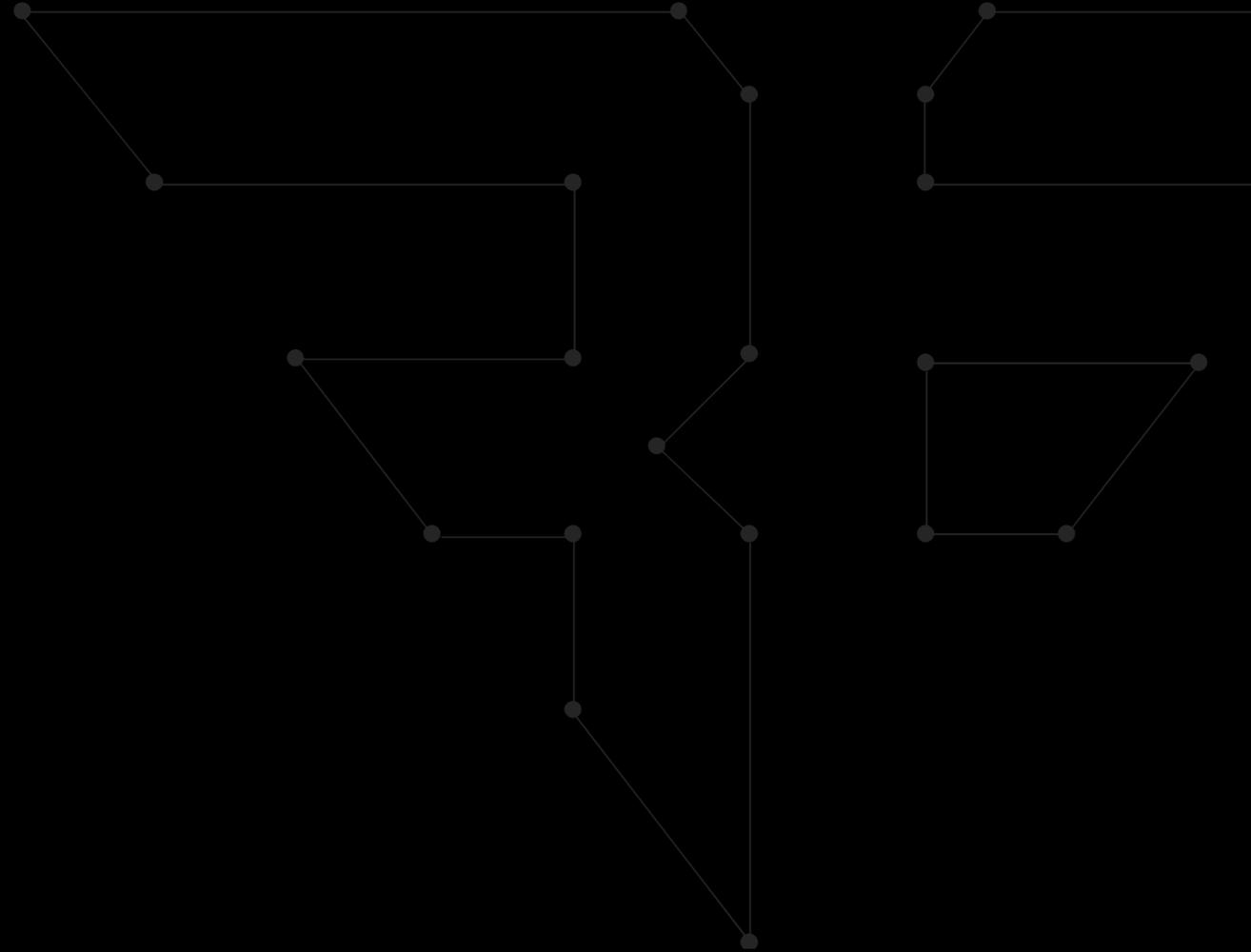
Not yet lethal ? 11 December 2014, Atlantic Ocean. Senior Chief Master-at-Arms Shannan Richardson receives training in the use of an LA-9/P laser aboard the amphibious transport dock ship USS Arlington. Seen here mounted on a rifle stock, this hand-held GLARE/LA 9/P laser from B.E. Meyers, is used by individual Sailors out to 4 km at night and 1.5 km during daylight for hail and warning across linguistic and cultural boundaries. U.S. Navy photo by Mass Communications Specialist 2nd Class Stevie Tate

U.S. Navy LaWS - AN/SEQ-3 Laser Weapon System or XN-1 LaWS

- [https://en.wikipedia.org/wiki/Laser\\_Weapon\\_System](https://en.wikipedia.org/wiki/Laser_Weapon_System)

# LEGAL ISSUES

YOU HAVE THE RIGHT TO REMAIN FRUSTRATED



# FAA Rule on Small Drones

CHANGING LEGAL LANDSCAPE



Effective: 29 Aug 2016

- <https://registermyuas.faa.gov/>

Federal Aviation Administration

Welcome to the Small Unmanned Aircraft System (sUAS) Registration Service

This site will allow you to register your small UAS with the FAA and update your registration.

REGISTER LEARN MORE

### Do I need to register my Unmanned Aircraft?

You need to register your aircraft if it weighs between **0.55 lbs.** (250 grams) and up to **55 lbs.** (25 kg)

You will be subject to civil and criminal penalties if you meet the criteria to register an unmanned aircraft and do not register.

The rules for operating an unmanned aircraft depend on why you want to fly.

	Fly for Fun	Fly for Work
<b>Pilot Requirements</b>	No pilot requirements	Must have Remote Pilot Airman Certificate Must be 16 years old Must pass TSA vetting
<b>Aircraft Requirements</b>	Must be registered if over 0.55 lbs.	Must be less than 55 lbs. Must be registered if over 0.55 lbs. (online) Must undergo pre-flight check to ensure UAS is in condition for safe operation
<b>Location Requirements</b>	5 miles from airports without prior notification to airport and air traffic control	Class G airspace*
<b>Operating Rules</b>	Must ALWAYS yield right of way to manned aircraft Must keep the aircraft in sight (visual line-of-sight) UAS must be under 55 lbs. Must follow community-based safety guidelines Must notify airport and air traffic control tower before flying within 5 miles of an airport	Must keep the aircraft in sight (visual line-of-sight)* Must fly under 400 feet* Must fly during the day* Must fly at or below 100 mph* Must yield right of way to manned aircraft* Must NOT fly over people* Must NOT fly from a moving vehicle*
<b>Example Applications</b>	Educational or recreational flying only	Flying for commercial use (e.g. providing aerial surveying or photography services) Flying incidental to a business (e.g. doing roof inspections or real estate photography)
<b>Legal or Regulatory Basis</b>	Public Law 112-95, Section 336 – <i>Special Rule for Model Aircraft</i> FAA Interpretation of the Special Rule for Model Aircraft	Title 14 of the Code of Federal Regulation (14 CFR) Part 107

**i** The **NEW** Small UAS Rule (Part 107), including all pilot and operating rules, will be effective on **August 29, 2016**. For more detailed information, please see:

- [Summary of the Small UAS Rule \(PDF\)](#)
- [Small UAS Advisory Circular – How to Use the Rule \(PDF\)](#)
- [Complete Text of the Small UAS Rule](#)
- [Sample Aeronautical Knowledge Test Questions \(PDF\)](#)

Need more information? [Read about how to fly a UAS for your work or business.](#)



# Taylor vs. FAA - Lawsuit Against Drone Rule

CHANGING LEGAL LANDSCAPE



[RC Groups - Taylor v. FAA Update - 04Mar2017](#)

[DRONELIFE - The Lawsuit Over Drone Registration: Taylor vs. Huerta & FAA - 14Jun2016](#)

[Hackaday - Don't Like the FAA's Drone Registration? Sue Them! - 26Sept2016](#)

- “My case challenging the FAA's model aircraft registration regulation, and the application of DC-area flight zones to model aircraft is scheduled for **oral argument** in the U.S. Court of Appeals for the D.C. Circuit on **March 14, 2017.**”

## How a little-known insurance lawyer became a symbol of (drone) liberty

*When the Federal Aviation Administration started enforcing new rules around model aircraft pilots, John Taylor went from drone hobbyist to crusader.*



*John Taylor and one of the drones he custom built.*

# Hard to Legally Defend Against Drones

IF YOU CAN'T JAM THE SIGNAL, AND YOU CAN'T BLAST WITH A SHOTGUN... THEN WHAT?



[The Register - Bloke cuffed for blowing low-flying camera drone to bits with shotgun - 20July2015](#)

[Digital Trends - Drone Shooting is a Federal Crime - 17Apr2016](#)

**The Register**  
Biting the hand that feeds IT

## Bloke cuffed for blowing low-flying camera drone to bits with shotgun

Sharpshooter exercises Second Amendment rights

Drone pwner ... William Merideth

30 Jul 2015 at 05:02, Iain Thomson

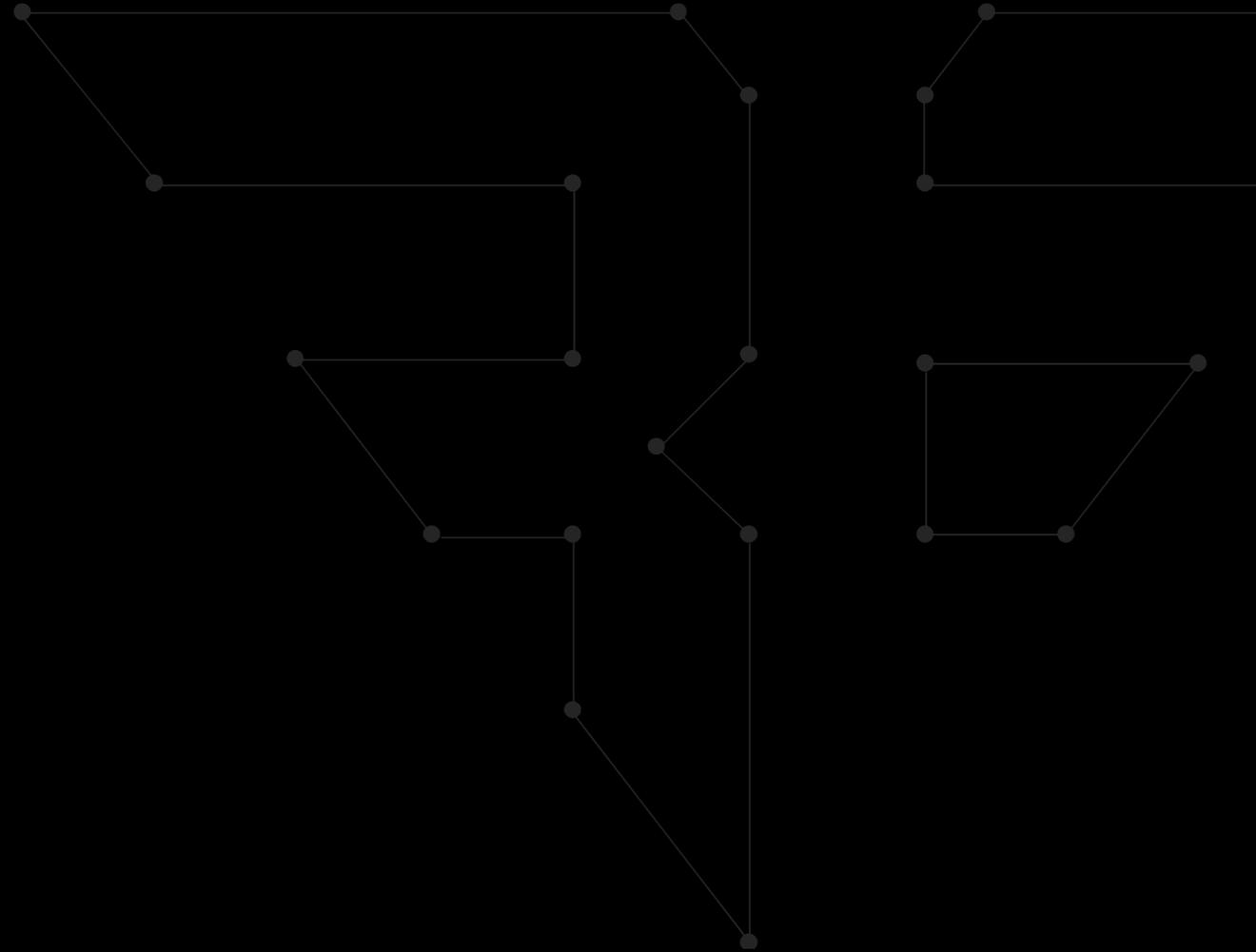
A father of two girls didn't take too kindly to a camera-equipped quadcopter hovering over his house and snooping on his kids – so he blasted it out of the sky.

Now he's facing charges of first-degree criminal mischief and wanton endangerment.

*“What the h\*\*\* are we supposed to use, man, harsh language?” – Aliens (1986)*

# IOT TARGETS

'OVER THE AIR' HACKING VIA DRONE



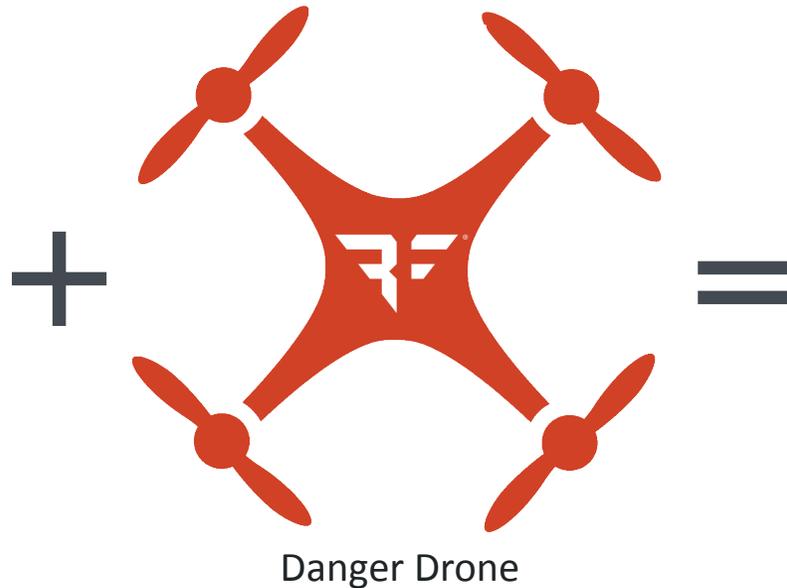
# IoT = Target Rich Environment

LOTS OF NEW TARGETS FOR 'OVER THE AIR' ATTACKS

- Ideal platform to launch 'over the air' attacks against new IoT products popping up in both the home & office
- Drone hacking threats need to be considered by consumers, security pros, and IoT product manufacturers



Internet of Things (IoT)



Danger Drone

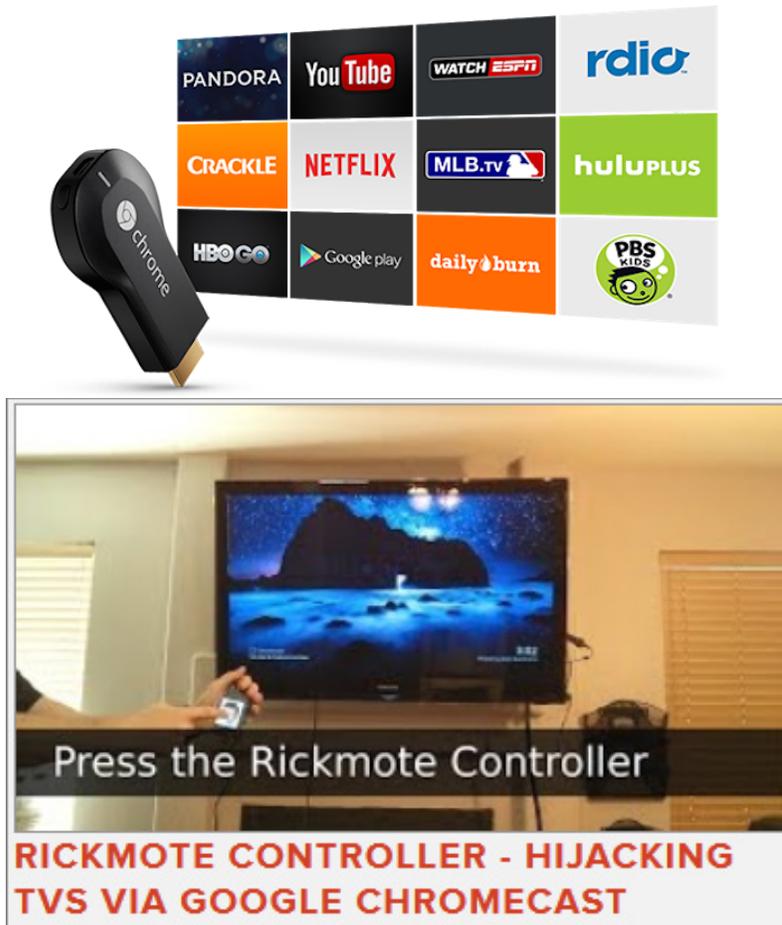


Target Rich Environment

# IoT - 'Over The Air' Attack - Examples

HACKING **SMART TV** AND **STREAMING** DEVICES - FROM DRONE

- <http://www.bishopfox.com/blog/2014/07/rickmote-controller-hacking-one-chromecast-time/>



# IoT – ‘Over The Air’ Attack - Examples

HACKING **SMART FRIDGES** – FROM DRONE



Aug 2015

- <http://securityaffairs.co/wordpress/39558/hacking/samsung-smart-fridge-hack.html>

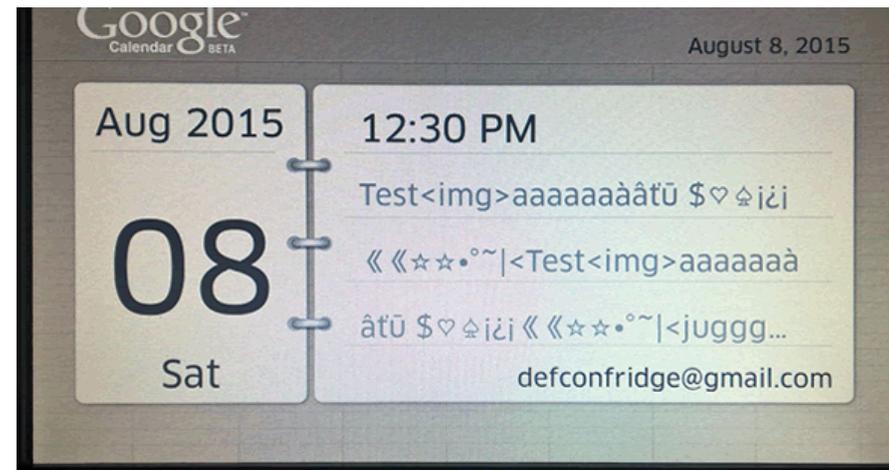
## Samsung smart fridge opens Gmail login to hack

August 25, 2015 By Pierluigi Paganini

At the recent DEF CON hacking conference penetration testers demonstrated that Samsung smart fridge leaves Gmail logins open to attack.

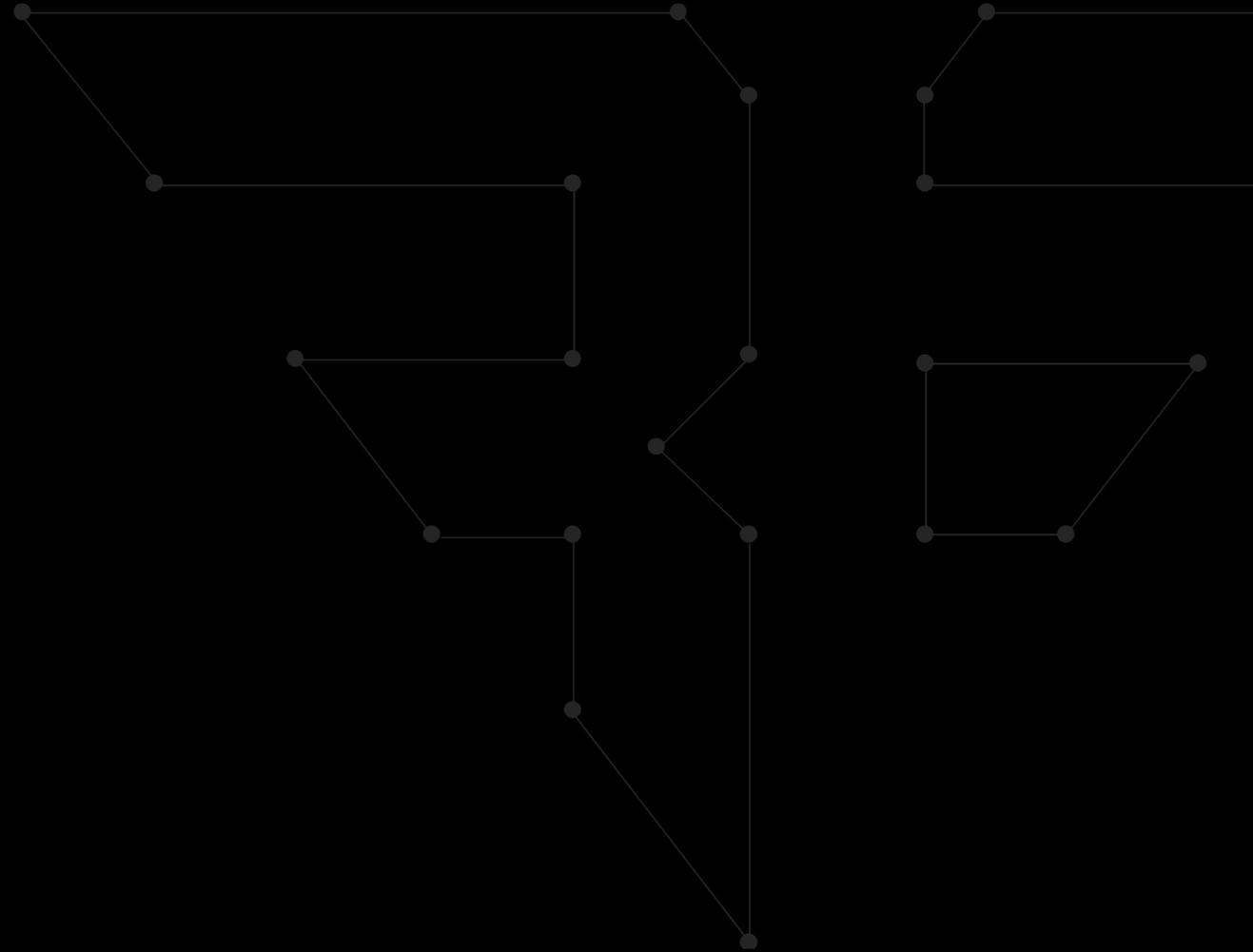


*"While SSL is in place, the fridge fails to validate the certificate. Hence, hackers who manage to access the network that the fridge is on (perhaps through a de-authentication and fake Wi-Fi access point attack) can Man-In-The-Middle the fridge calendar client and steal Google login credentials from their neighbours, for example."*



# FUTURE IS AWESOME

1980'S SCI-FI... FINALLY HAPPENING





# The Future was on TV in the Past

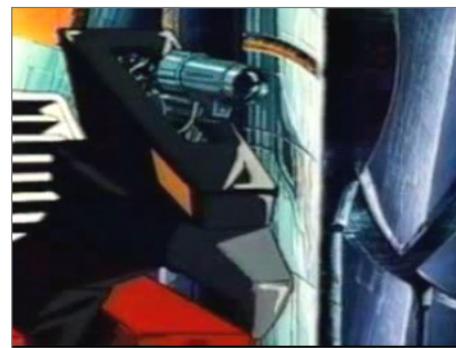
GADGETS - SMALLER **FLYING DEVICES** & DROPPING OFF **GROUND DEVICES**



"Bugs"



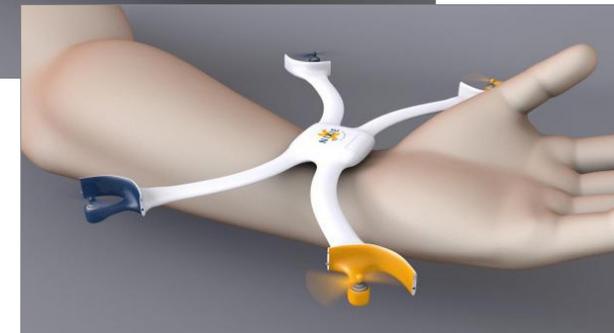
ProDrone - Robot Arms



Transformers - Laserbeak



Wearable drones



24 (TV) - Spy Bot



Call of Duty - RC-XD Remote Control Car (w Camera/Mic)



Sand Flea



Sand Flea - Jumping Infiltrating Robot





THANK YOU  
THANK YOU  
**THANK YOU**  
THANK YOU  
THANK YOU  
THANK YOU

**Have A Nice Day**

Bishop Fox – Danger Drone Research:

- <https://www.bishopfox.com/resources/tools/drones-penetration-testers/>



# Attributions (Images in Slides)

[Wi-Spy image](#)

[Adapter image](#)

[ASUS USB image](#)

[Wi-Fi Antenna image](#)

[Blue-Tooth USB adapter image](#)

[Roving Networks image](#)

[BlueSMiRF image](#)

[Arduino BlueTooth image](#)

[Raspberry Pi BlueTooth image](#)

[O'Reilly BlueTooth Book image](#)

[SENA Adapter image](#)

[Wi-Fi Pineapple image](#)

[Raspberry Pi image](#)

[BlueTooth Module Breakout image](#)

[BlueTooth Bee image](#)

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[WEB-DESIGN/Shutterstock](#)