



# AIOLI - AI Open Lab Initiative

[mundt,weis]@ccc.cs.uni-frankfurt.de

December 6, 2017

Systems Engineering for Computer Vision

## **SciFi debunked - Slaugherbots**

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# Agenda

SciFi debunked - Slaugherbots

Slaugherbots

Drone technology background

Drone- and weapon-related science and projects

Live-demo

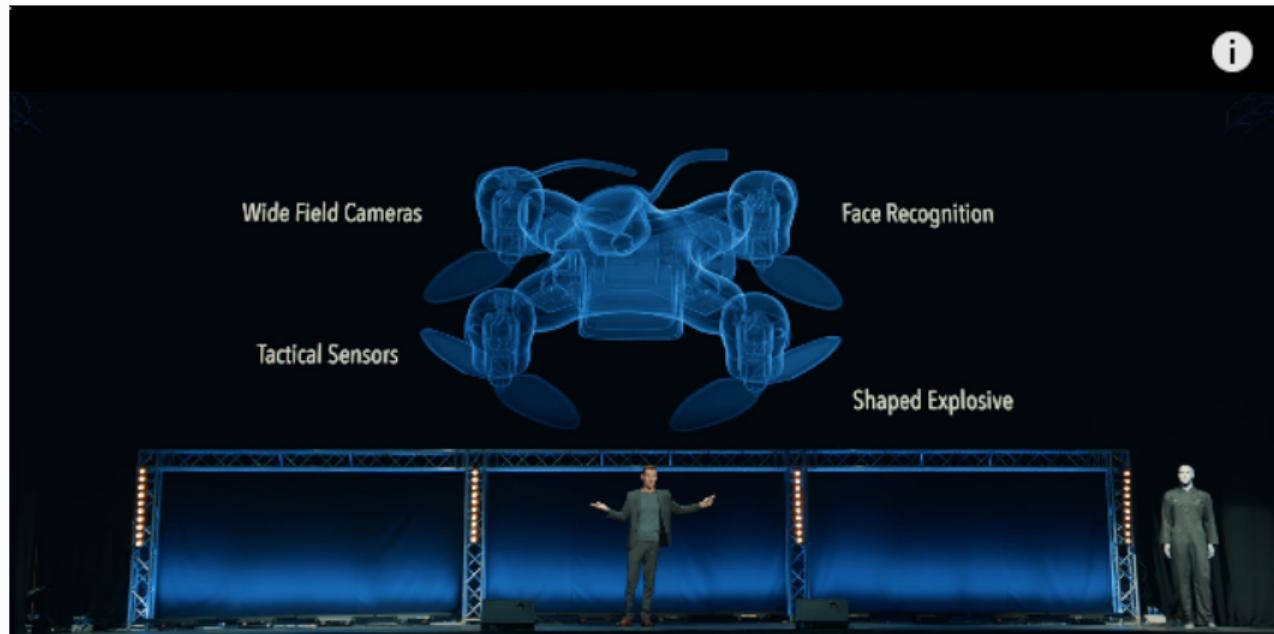
Assessment

## Slaughterbots

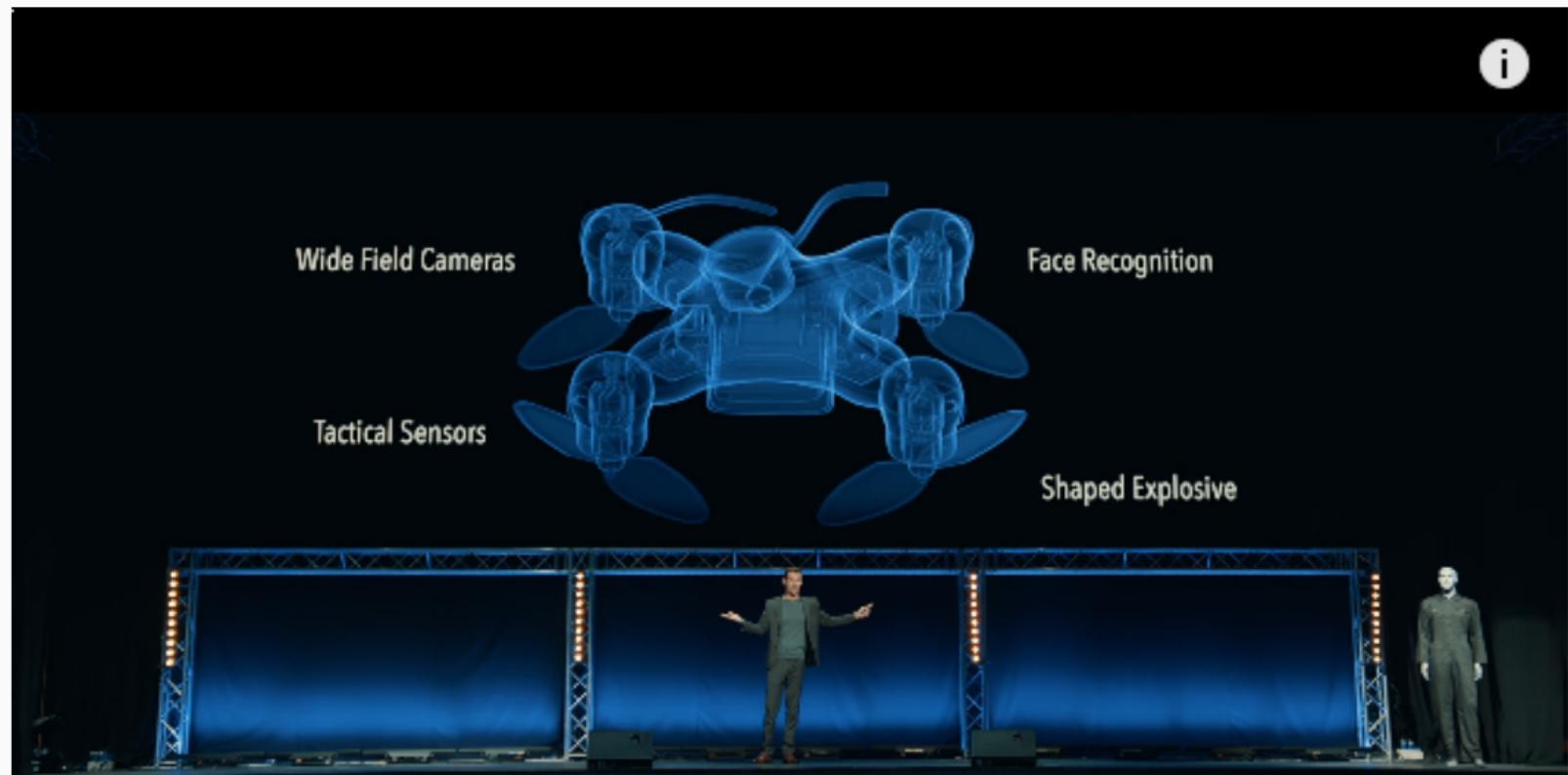
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## Video - Slaughterbots (7:47)

Video released by autonomousweapons.org, shall support the campaign(s) to pass laws against autonomous weapons (<https://www.stopkillerrobots.org/>) In the video: Prof. Stuart Russel (AI/CompSci, UC Berkeley)



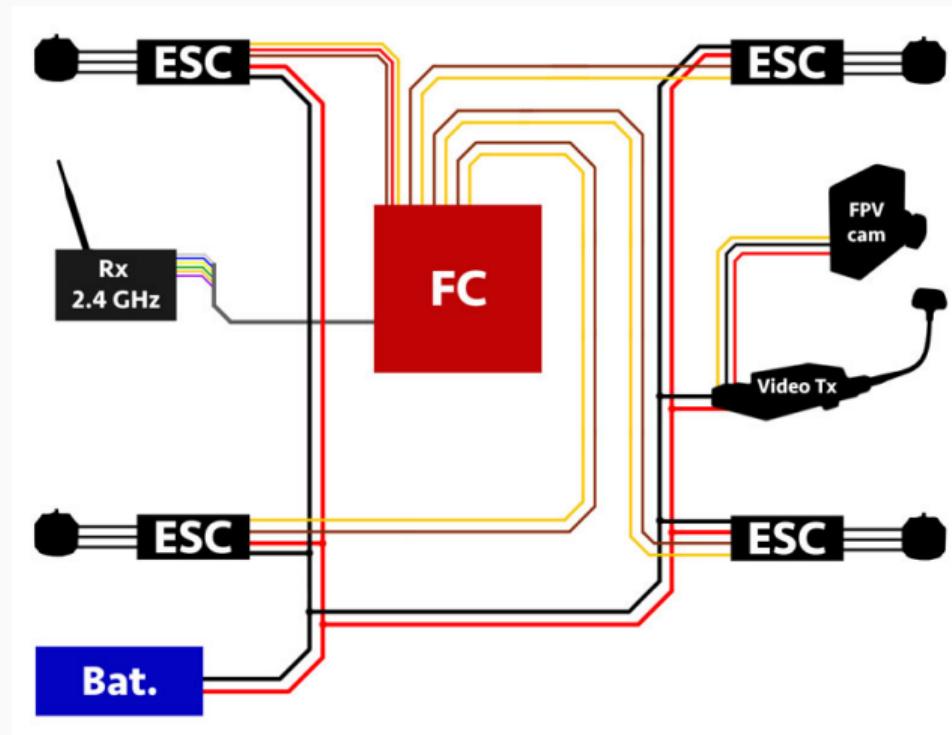
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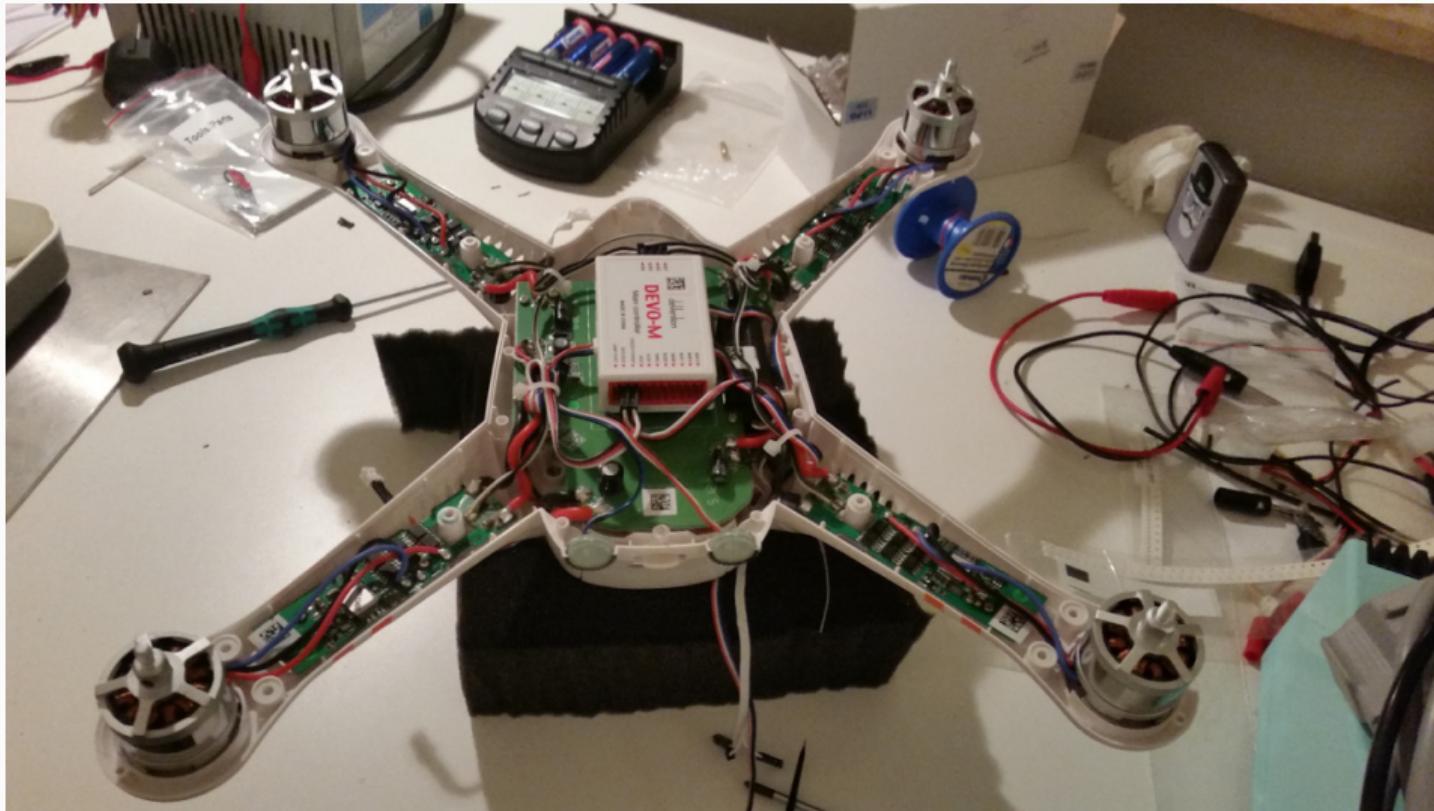
## Drone technology background

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# Drone tech



# Drone tech - Hardware



# Drone tech

Example: Walkera QR-X350 Pro

- Battery: 5Ah 30C Li-Po → 10-20 min. of flight w/ Cam + GPS
- Weight (incl. gimbal, camera, battery, transmitter): 1250g
- Topspeed: 71 km/h
- Cost: ca. 400 EUR

Remote-control

- Devo-7: 2.4Ghz, output: up to 20db (100mW) - up to 3km range

FPV - Camera stream transmission

- 5.8 Ghz transmitter, 600mw - up to 2km range, most often below 600m

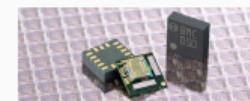
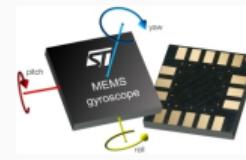
Telemetry - Serial data connection

- 433 Mhz - more than 1km range

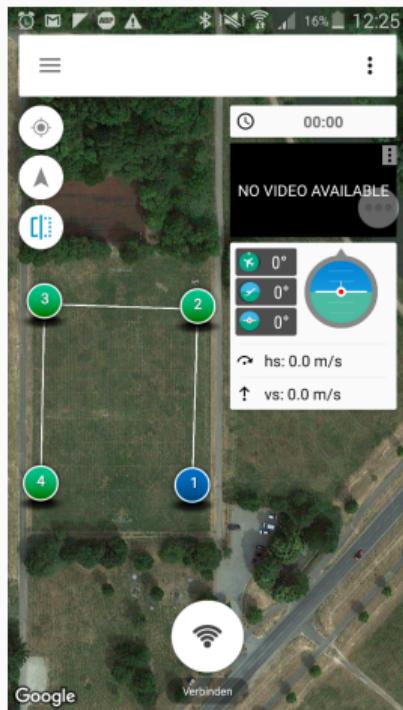
## Drone tech - Sensors

To maintain stability and navigate, the Flight Controller is usually connected to a lot of onboard sensors:

- Acceleration/Turnrate: Accelerometer + Gyroscope
- Height: Barometer
- Global orientation: Magnetometer (Compass)
- Global positioning: GPS
- Relative speed: Optical flow



# Drone tech - GPS and positioning



- Mavlink-protocol to communicate with FlightController
- Get telemetry-data (current position, angles, height)
- Set targets, send control instructions

Tower android app

# Drone tech - Computer vision

## Off-Drone-Processing

- Re-use compute-hardware
- Latency
- Limited range

## On-Drone-Processing

- No latency
- Requires additional hardware,
  - more weight
  - more power-usage
  - hardware evt. destroyed

Suitable hardware not existent yet

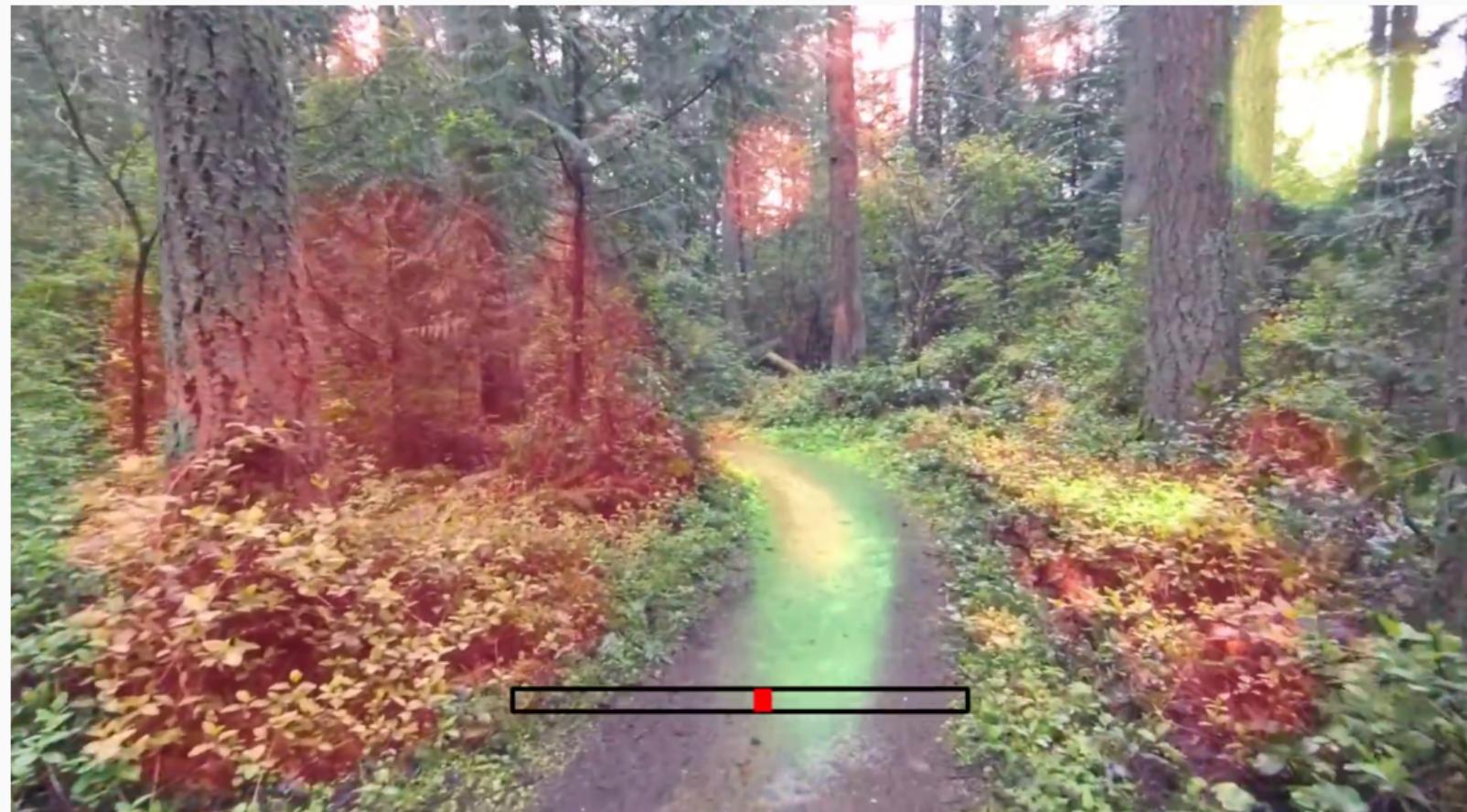
## **Drone- and weapon-related science and projects**

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## Drone- and weapon-related science and projects

- DoD: Perdix micro-drone-swarm
- No Info about localization found: ETH Zurich (D'Andrea):  
<http://flyingmachinearena.org/research/>,  
<https://www.youtube.com/watch?v=RCXGpEmFbOw>
- The pentagon wants you to develop drone swarms:  
<https://thenextweb.com/insider/2017/10/23/the-pentagon-wants-you-to-develop-drone-swarms-for-the-military/>

# NVIDIA - Autonomous Drone video (3:10)



## NASA JPL autonomous drone race



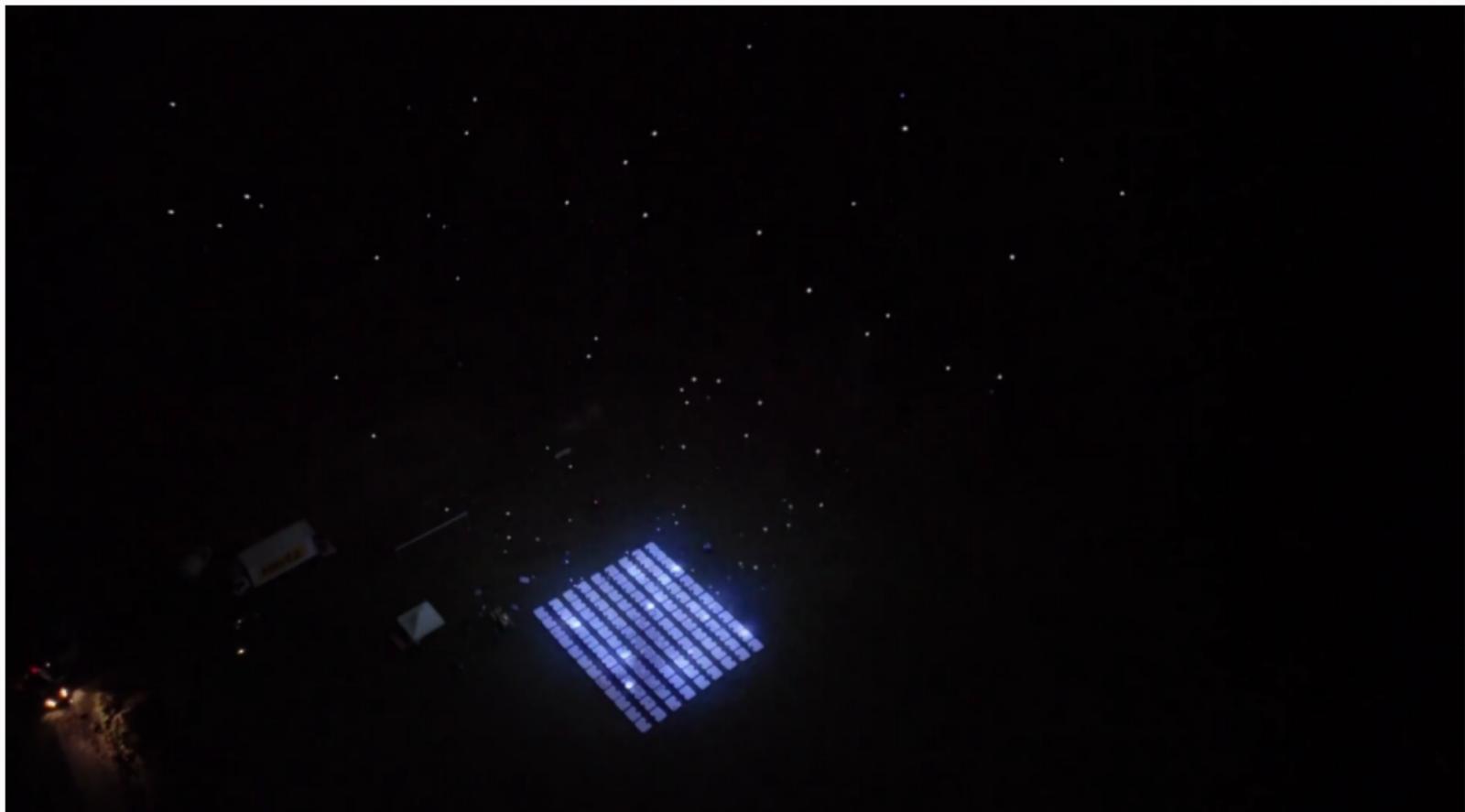
**then matches it with a pre-loaded map.**

## NASA JPL autonomous drone race

- Localize by comparing current camera-picture against pre-built map

<https://www.nasa.gov/feature/jpl/drone-race-human-versus-artificial-intelligence>

## Intel drone swarm



## **Live-demo**

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Livedemo

## **Assessment**

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# **Assessment**