

# DRONE Integration through Information Management

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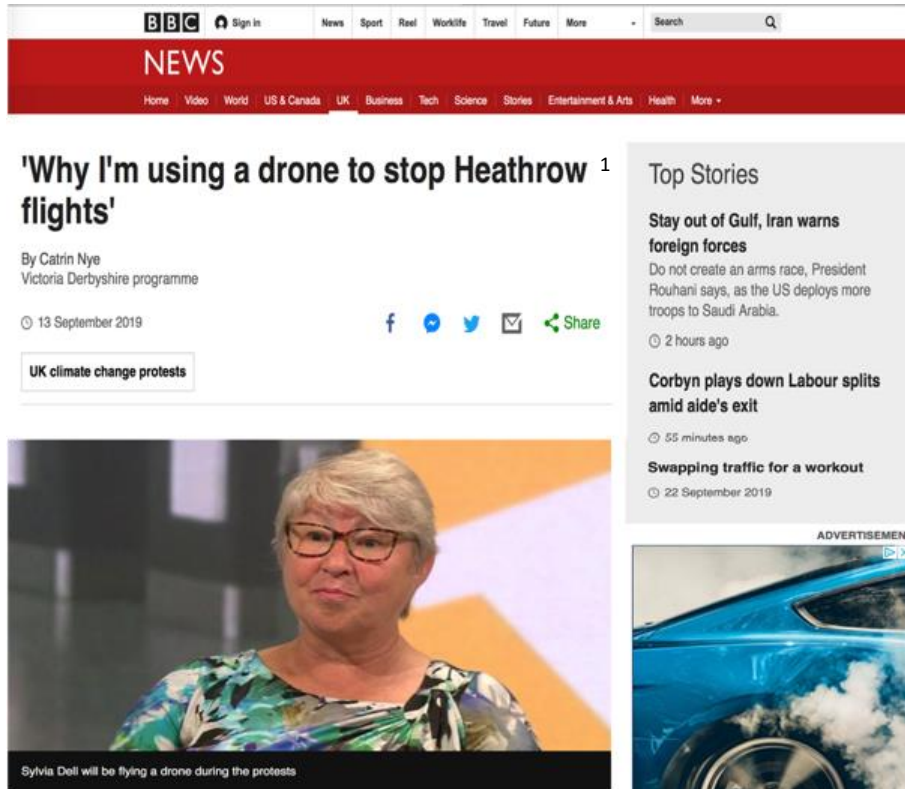
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# The new face of extremism? Eco-extremism?



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## 'Why I'm using a drone to stop Heathrow flights'

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13 September 2019

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- Climate change protestor using drones to stop Heathrow flight operations
- “Heathrow Pause” planned protests in September so that “no aircraft flights will take place at Heathrow”
- She believes it is "perfectly safe" to fly toy drones at head height, although she has no formal experience piloting a UAS
- How do assure safety, security and economic viability of ATM given this reality?

1 - <https://www.bbc.com/news/uk-england-london-49636149#>

## **Economics and Customer Preferences Driving Demand!**

During their operation, the **NASA space shuttles cost \$60,000 per kilogram** to get their payload into low Earth orbit.

Source: National Space Society, Back to the Moon – Getting There Faster for Less

The **SpaceX Falcon Heavy will cost an estimated \$447 per kilogram** to get its payload into low Earth orbit.

Source: The Space Review, Increasing the profit ratio

- Evolutionary technology and new business models delivering new missions
- Drones can better satisfy consumers
- IoT significantly increases available data
- Data analytics approaching safety critical services, tech leads to greener operations

88% of US Consumers say free shipping makes them more likely to shop online, **and 79% would select drones as delivery option** if it meant they could receive packages within an hour.

Source: Walker Sands Communications. Reinventing Retail: What Businesses Need to know for 2016 White paper

**Usage-based auto insurance enabled by the Internet of Things will grow nearly 1,200%** by 2023. This insurance uses real-time information about a driver’s actual driving to assess actuarial risk.

Source: IHS Markit, Usage-Based Insurance Expected to Grow to 142M subscribers globally by 2023, IHS says

In initial tests, **a machine learning algorithm created at Carnegie Mellon was able to predict heart attacks** four hours in advance, with 80% accuracy.

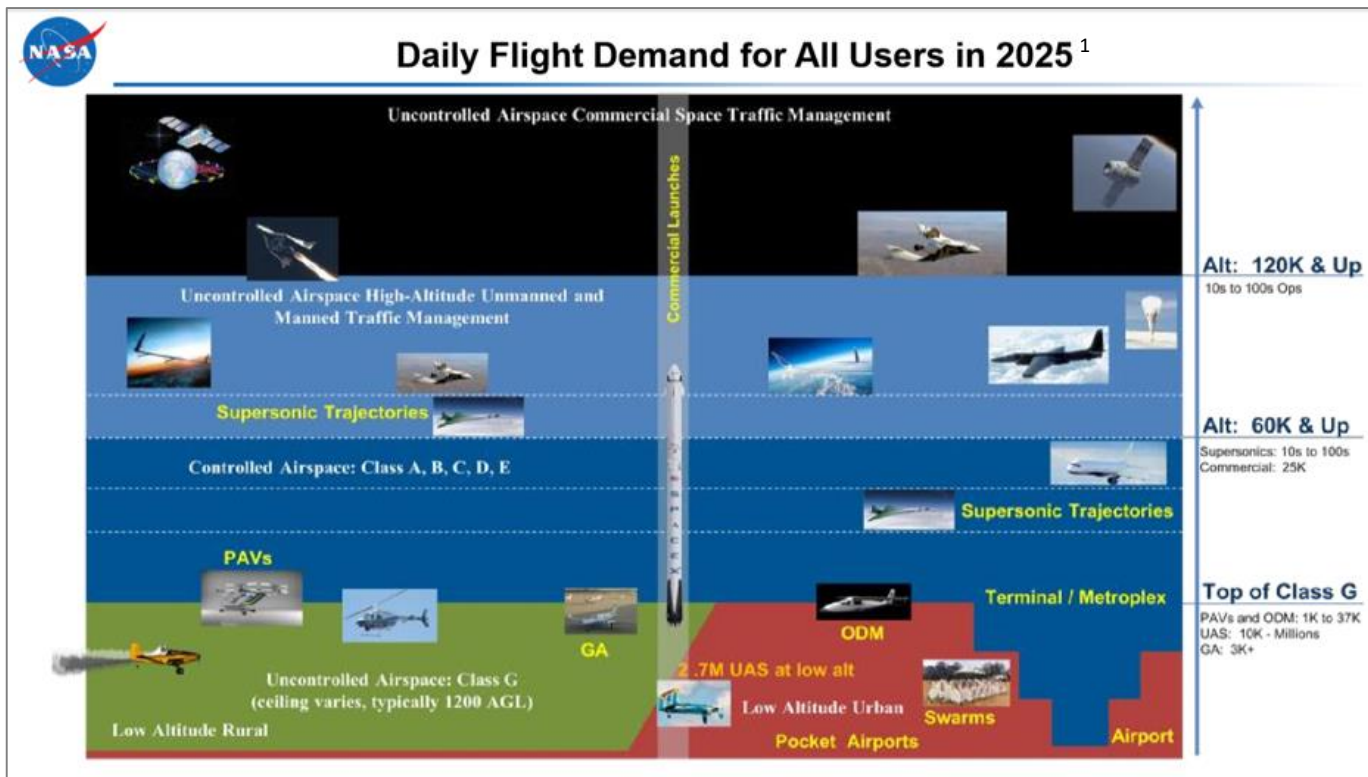
Source: The Economist. Of Prediction and Policy

**New digital technologies can enable a 20% reduction in global Carbon emissions** by 2030.

Source: Telstra Corporation, SMARTer2030: Australian Opportunity for ICT Enabled Emission Reductions

# Leveraging Airspace Capacity as an Asset: Shared Capacity

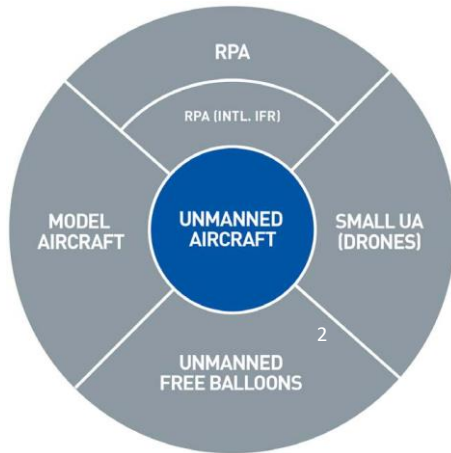
- Advancements driving new uses of airspace
- Commercial operations cross all airspace strata
- Must manage mission variability without impacting operations
- Information needs are different across strata
- Remotely pilots, ATM decision-makers need mission-tailored data



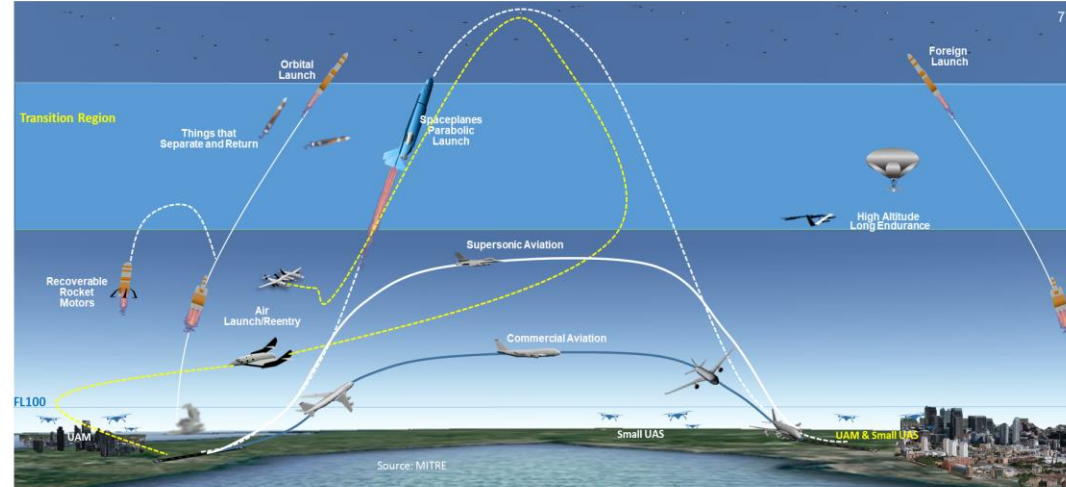
1- Graphic published by NASA

## So, what’s so different about these missions?

- Drones: remotely piloted platforms
  - An unmanned aircraft or ship that can navigate autonomously, without<sup>1</sup> human control or beyond line of sight
  - Any unmanned aircraft or ship that is guided remotely



- “Diversity of the mission is growing” Greg Leone from MITRE<sup>3</sup>



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- Intersecting flight trajectories, cross-IR impacts, new cyber attack vectors, UAS performance characteristics, airspace constraints, etc.

<sup>1</sup>- [Dictionary.com definition](https://www.dictionary.com)

<sup>2</sup>- [ICAO Unmanned Aviation Bulletin](#)

<sup>3</sup>- “Accelerating an Information-Driven Aviation Ecosystem”, Leone, Greg, MITRE, ATIEC Conference Briefing, 9/23/2019.

# Innovation changing physics, ATM system has to catch up!

- What does a flight plan look like for vehicles flying for 32+ hours? 60 hours? 2 weeks?

Global Hawk
1





Maximum Altitude:  
60,000 feet



Maximum Endurance:  
32+ hours



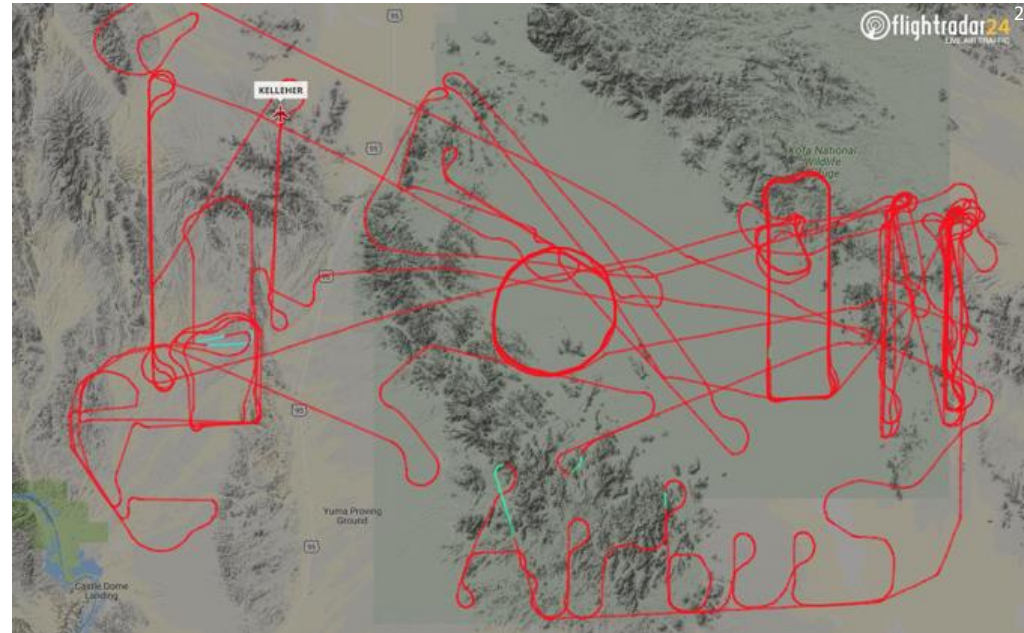
Operational Range:  
12,300 nautical miles



Near real-time  
communications



All-weather  
capability



- Extended range on UAS platforms challenging current systems and processes

1- Northrop Grumman Globalhawk Infographic  
 2- Flightradar24 #Zephyr, Aug. 4, 2018.

# Dragonflies and UAS ATM Information Management?

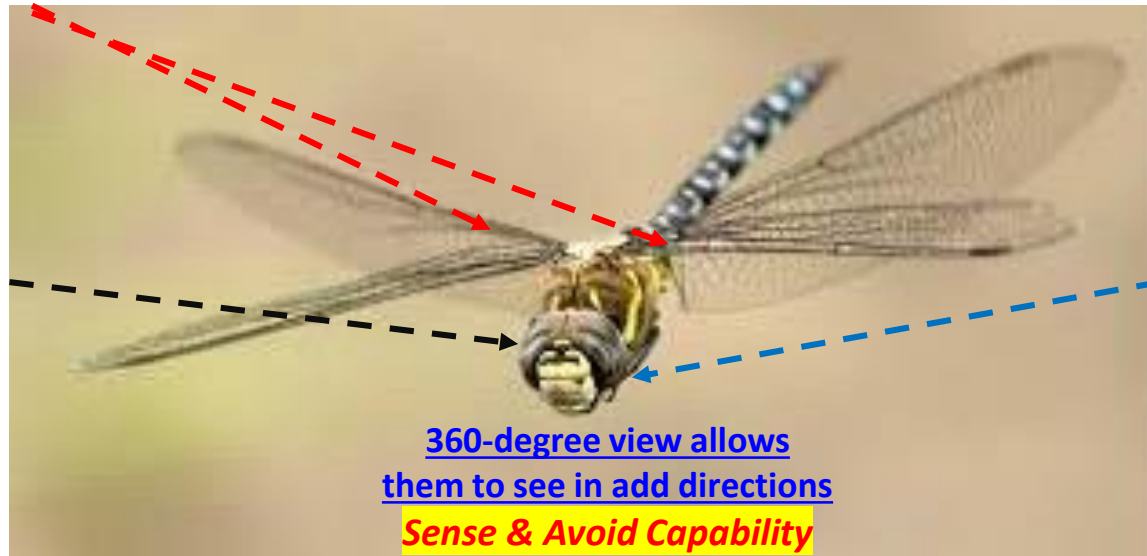
Calculate velocity for  
a perfect kill

Wings maneuver  
independently

**Geo-locate & Calculate Flight Intent**

Incredibly efficient: 95%  
Hunt to Capture rate

They isolate their  
prey in a swarm



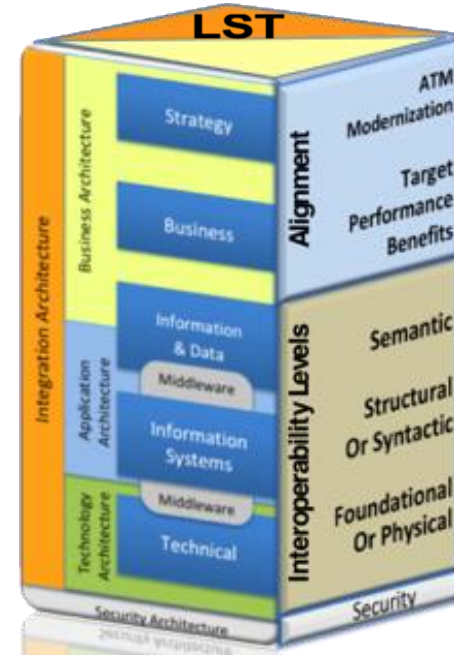
360-degree view allows  
them to see in add directions  
**Sense & Avoid Capability**

They crush their prey  
and never stop eating

1 CHRISTOPHER FURLONGGETTY IMAGES, Popular Mechanics, [Dragonfly Picture Link](#)  
"10 Surprisingly Brutal Facts about Dragonflies", Handley, Andrew. [Article Link](#), June 20, 2014.

# UAS Transforms Aviation Operations, is Digitalization Enough?

- Transformation changes business & workflow processes
- UAS workflows are modern, ATM must be modernized:
  - UAS concept is a highly automated system, operators responsible de-confliction & safe trajectory trajectories<sup>1</sup>
  - UAS process being invented now, digital workflows
  - Legacy ATM systems powered by analog workflows
- **UAS requires ATM integration through Information**



## LS Technologies Operations/IT Alignment Framework



Operations Center

Air Traffic Management Unit

Remote Cockpit

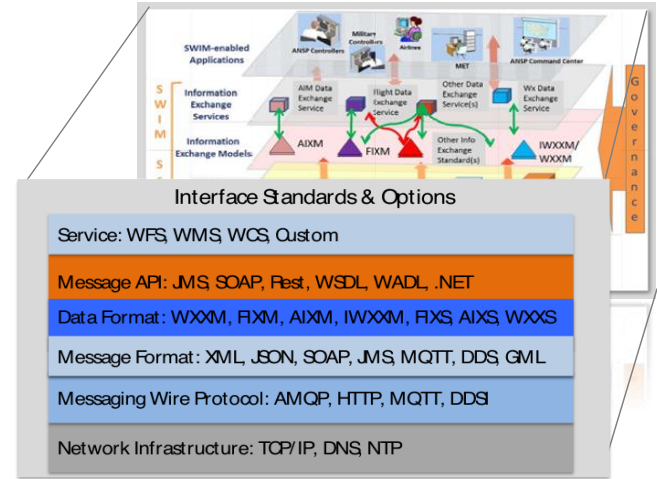
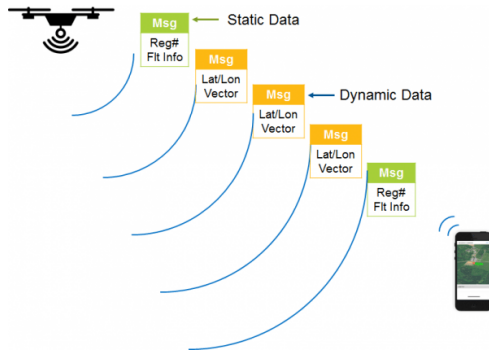
<sup>1</sup> “Unmanned Aircraft System (UAS) Traffic Management (UTM) Concept of Operations V1.0”, FAA NextGen (ANG), May 2018  
 U.S. Air Force photo by Bobbi Zapka - [Link to Original Photo](#)  
[Flicker User: iLighter](#)  
[SpaceX - https://www.flickr.com/photos/spacexphotos/16601442698/](https://www.flickr.com/photos/spacexphotos/16601442698/)



# Standards: ATM Integration and Interoperability

- Interoperability is assured by standards, but...
  - Automated information integration requires aligning standards at each technology layer
- Technology can facilitate digital transformation
  - SWIM & Service Orientation
  - Event Driven Architecture

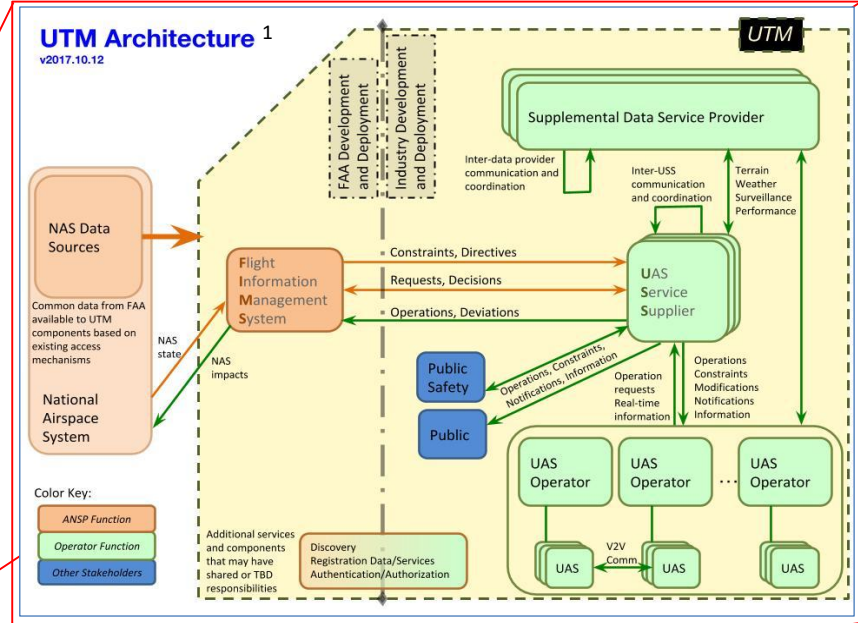
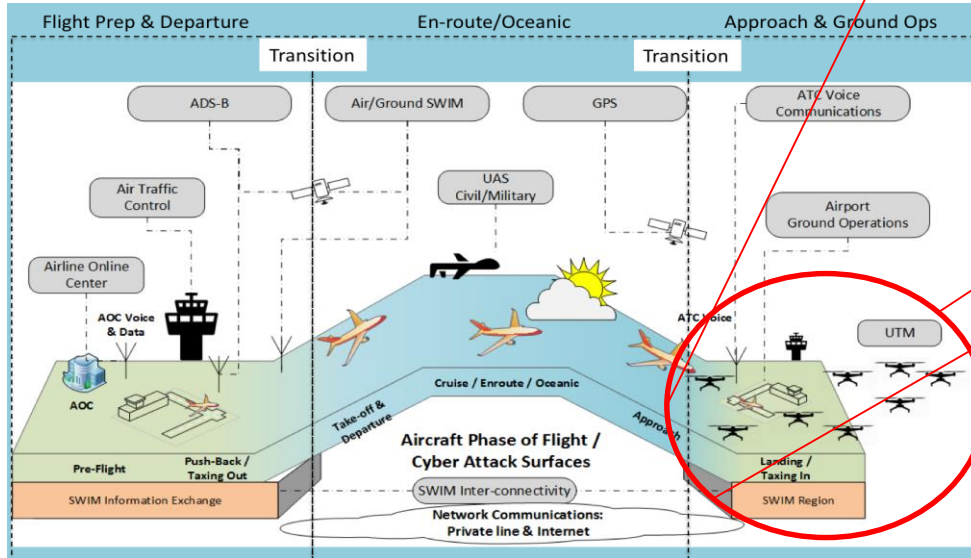
## Remote ID Use Case



- Emerging technologies must be considered:
  - Microservices
  - Artificial Intelligence
  - Machine Learning
  - Open Algorithms

# Example: UTM Integration

- **SWIM > data exchange** = integration enabler
- **Transform:** Do not re-create legacy processes
- Integrate data into **decision support tools**
- **Beware: More data != Better decisions**



- Example: UAS information sharing platform between USSs, UAS operators & ANSP
  - ANSP offer impacts, constraints & decisions
  - USS & Operators: deviations in ops, requests

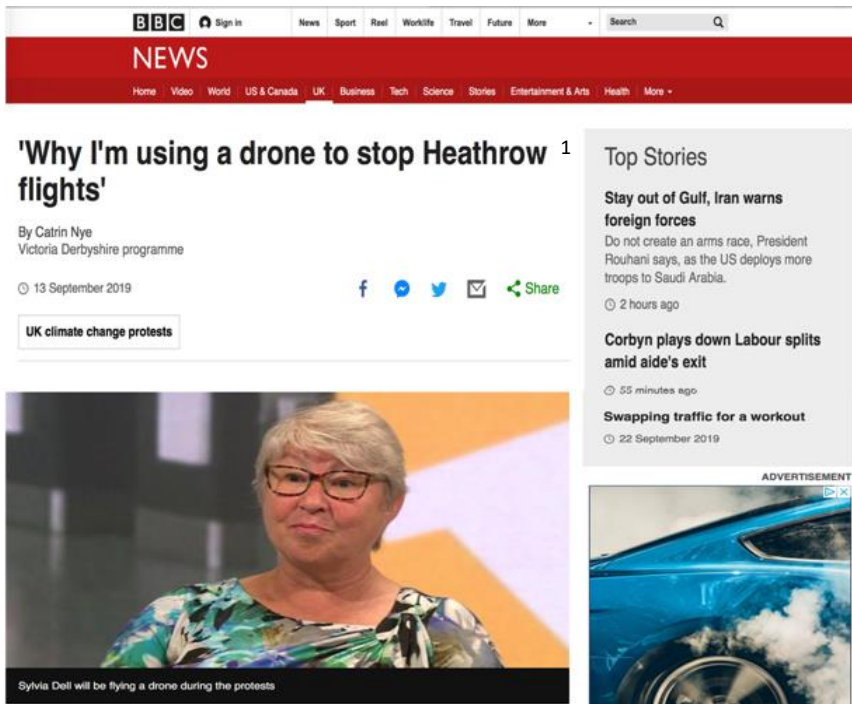
1 "Unmanned Aircraft System (UAS) Traffic Management (UTM) Concept of Operations V1.0", FAA NextGen (ANG), May 2018

## Remember: Security is “Safety Critical” & Trust Matters!

- **Disaster:** when dragonflies don't know performance characteristics for vehicles traveling in their sector
  - Who approved a high velocity 4-wheel vehicle to operate in same stratum as dragonfly's flight path?
- Decision-makers must have **information they need, when they need, where they need it**
  - Automation requires real-time information exchange in order for it to become viable
  - Validation for data quality is critical
- Efforts by **Trust Framework Study Group** are critical!
  - Establishing **policies**, **governance** and **standards** for trusted exchange from manufacture to operations



# Eco-Extremist: Ecological Warrior or Economic Terrorist?



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- What about Sylvia Dell?
  - Her cause may be noble, but her methods are irresponsible and endanger the public
  - New attack vectors to disrupt ATM are in play
  - Technology can help ensure secure operations
- Key information elements **MUST** be trusted
  - Flight Intent: operating within their plan
  - Airspace Restrictions: conformance
  - Operational constraints: timely notifications
  - Operational modifications:
  - Operational deviations: reporting & conformance
  - Security: ability to trust data exchanged
  - Identification: ability to identify UAS operators

<sup>1</sup> - <https://www.bbc.com/news/uk-england-london-49636149#>