

NERC Earth Observation Technology Cluster – UAV Theme

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RSPSoc 2011

Image courtesy of NASA



Achievements to Date

- Formally launch RSPSoc UAV Special Interest Group (September 2010)
 - Coordinate and focus interest in platform developments
 - Educate RS community about low-altitude UAVs
 - Provide a focus for use of data and related sensor development
- NERC EO Technology Cluster UAV Workshop held in Durham (July 2011)
- Establishment of International Expert Panel

NERC Earth Observation Technology Cluster

UAV Theme Workshop



Image by Grey Colley, SUAVE taken at Durham UAV Workshop



Overview

Advantages of unmanned aircraft

- Operation at very high and very low altitudes
- Long endurance (usually HALE systems)
- Operate in dangerous / dirty situations
- Ease of deployment
- Low cost of operation
- Noise / pollution low



Overview

Challenges

- Operation in non-segregated airspace
- Predominantly a military technology
- Endurance for small / lightweight systems
- Availability of suitable platforms for science applications
- Suitability of instrumentation for LUAVs

Scoping Study Recommendations

1. Fund science projects that can **utilise immediate access to existing large UAVs** for high-impact science

NASA Global Hawk – NASA/NERC workshop 26 May 2010

2. Provide a **UK science centre for small UAV** operations

1-3 aircraft of different types (small and mini-UAVs), but all with advanced stabilisation and high levels of autonomous operation, a general-purpose ground segment, one or more core instrument sets

3. Establish a programme to **develop skills in mini- and micro-UAV** operations

A multi-year programme, focusing on piloting and other operational skills for mini- and micro-UAVs

4. **Fund development of miniaturising technology** for UAV-based sensing

Fits with drive for nano-satellites and sensor networks



Dugdale (2007) Smartplane
Intertidal zone monitoring



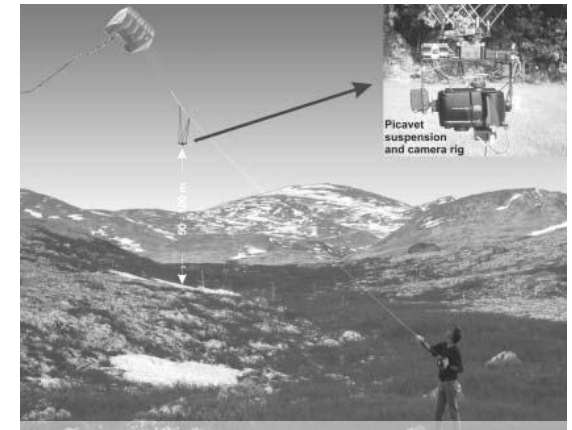
Vierling et al (2006) SWAMI blimp
Biophysical Monitoring



Lejot et al (2006) Pixy Drone
Bathymetric Maps



Grenzdorffer et al (2008) Plane
Forestry/Agriculture



Wundram & Loffler (2008) Kite APs
Monitoring vegetation

Quest 300 light electric-powered UAS by QuestUAV

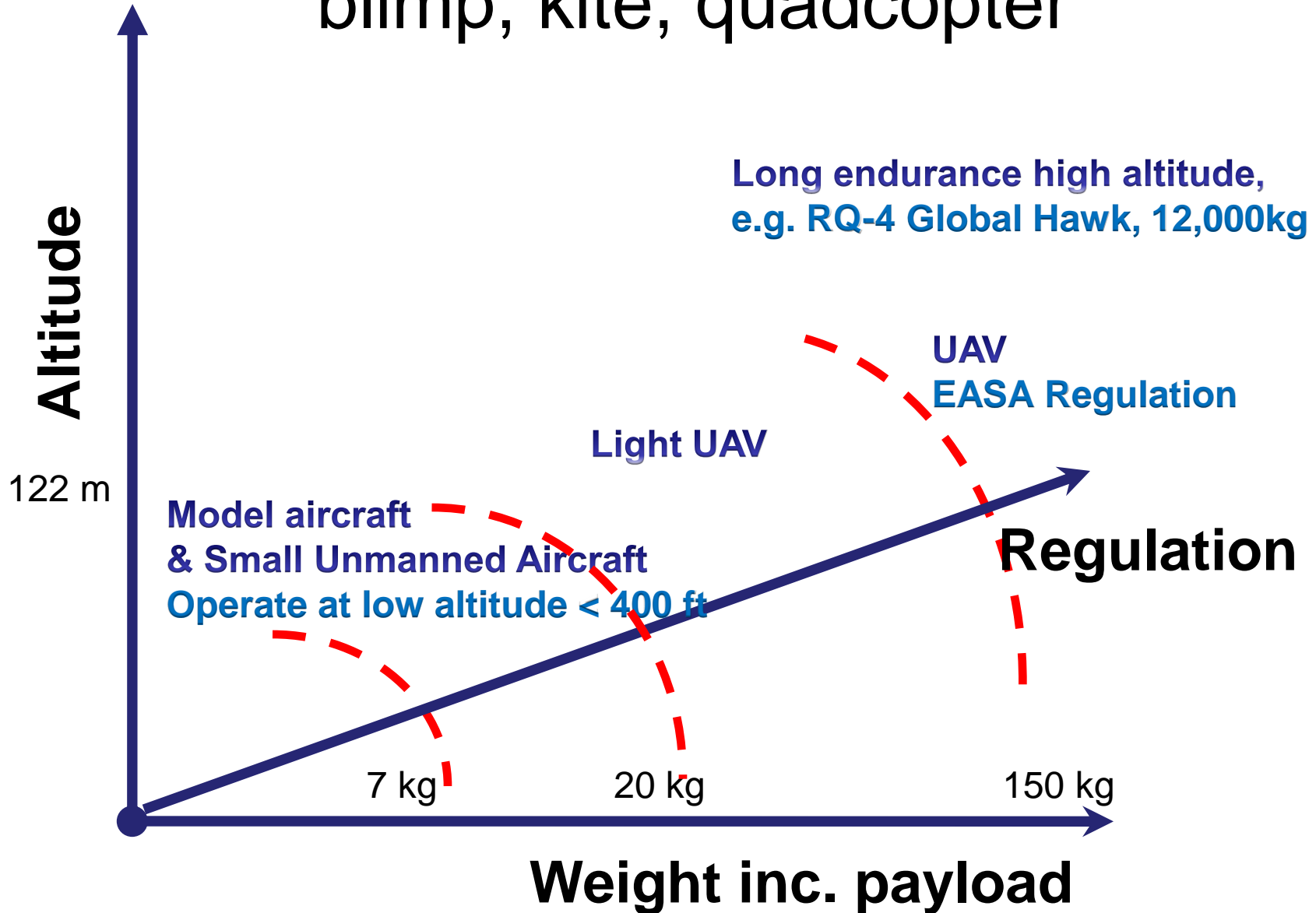


American MLB-Bat 3 used by USDA





Low-altitude = small UAV, balloon, blimp, kite, quadcopter





Instrumentation

- Imaging Devices
 - Conventional frame cameras
 - Video devices
 - Hyper- and Multi-spectral sensors
 - Thermal infrared sensors
 - LiDAR, RADAR
- Non-imaging science instruments
 - Temp, pressure, RH
 - Aerosols
 - Gas analysis



Imaging Devices

- Payload
 - weight > 150 kg
 - Standard airborne / satellite instrument suites
 - Weight < 150 kg
 - Modified airborne instrument suites; automated control and storage; IFUs?
 - Weight < 7 kg
 - Modified compact cameras; need for instrument development to include hyper- and multi-spectral sensing, positioning and post-processing



Typical small UAV Applications

- Atmospheric boundary layer sampling
- Very fine spatial resolution mapping
- DEM production
- Flexible agricultural monitoring
- Arid rangeland
- Riparian vegetation mapping
- Macroalgal biomass assessment
- Geomorphology: erosion / deposition
- Forestry
- Archaeology



Durham
University

Hand deployed SmartPlanes PAMS



Stonehaugh forest, Northumberland
July 2011 – Forest establishment experiment

Image provided by SmartPlanes



Imagery acquired downloaded and mosaicked
in 30 minutes from Dept vehicle



Review of activity

- In-depth review drawing on peer review and grey literature publications including presentations from recent conference sessions
- Provide a balanced appraisal of the scientific impact of UAV technology and applications
- Contribute to NERC Aircraft Review
- Report will be published on the web and a fuller article will be prepared for Technology Cluster Journal Special Issue



Future Activity

- Technology workshop Glos Airport 2012
 - radiometric, geometric and spectral capability of lightweight imaging devices
 - lightweight multi- and hyper- spectral imaging devices
 - altimetry, GPS and data downlink capability
 - difficulties of post-processing image data
- Working group on UK ultra-light multispectral camera development

For more information please
visit ...

EO Tech Cluster web site

[http://www.nottingham.ac.uk/eotechcluster/
about.aspx](http://www.nottingham.ac.uk/eotechcluster/about.aspx)

RSPSoc Special Interest Group

<http://rspsoc.org/information-zones/sigs/>