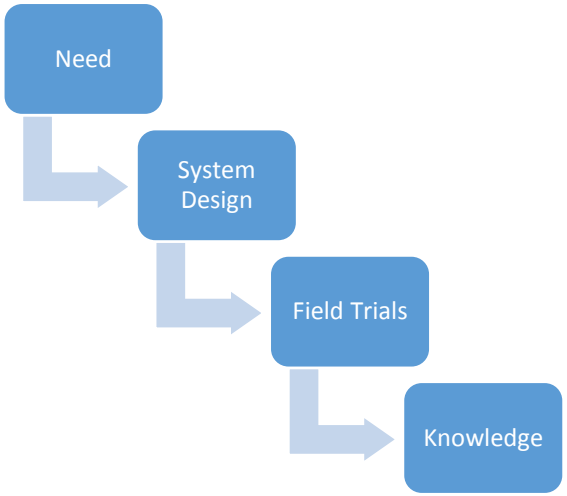
CASCADE

(Complex Autonomous aircraft Systems Configuration, Analysis and Design Exploratory)



Cranfield UNIVERSITY

University of BRISTOL

MANCHESTER 1824
The University of Manchester

Imperial College London

UNIVERSITY OF Southampton

CASCADE Programme grant

- £5-6M EPSRC /NERC flexible funding
- Feb 2017 start
- 12 case studies
- 6 tranche 1 case studies defined
- 6 tranche 2 case studies subject to steering cttee approval
- 13th steering board defined “capstone” case study
- £300k “Catalyst” fund

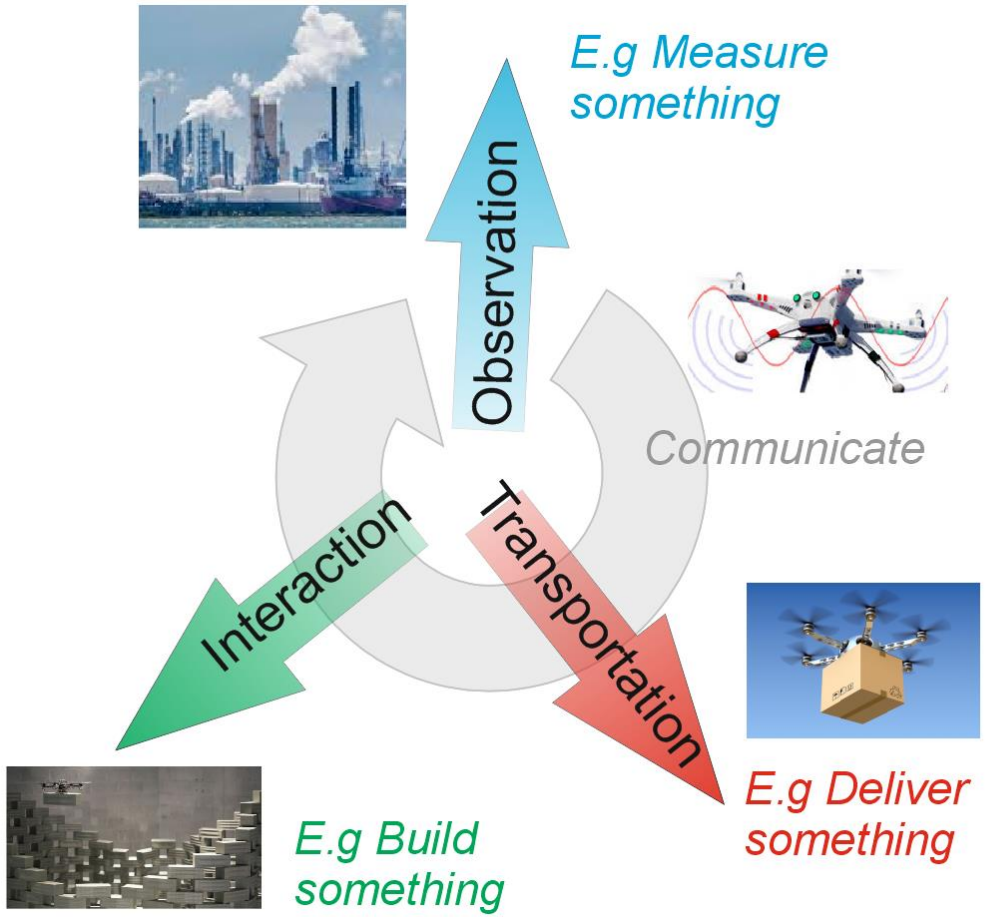
Timing; Queen's speech May 18 2016; Modern Transport Bill

- "Setting the framework for autonomous vehicles, paving the way for ..drone operations in the UK"
- "Legislation that will put the UK at the forefront of safe technology in the autonomous vehicles industry, such as drones..".
- drone production will soar from current worldwide production of $4 billion annually to $14 billion, Totalling $93 billion in the next ten years*.
- With addition of military drone research spending this would rise to $123 billion over the decade*.

* The Teals Group's 2015 UAV Market Profile and Forecast

CASCADE: The Vision

- Vision is to deliver **knowledge** and understanding that enables **holistic design** of Unmanned Aerial Systems within a mission space that covers the predicted commercial use of UAVs.
- We expect the future drone network will be fully integrated with **wireless** communications networks. We expect all vehicles in the network to know precisely where they are. We expect unlimited access to **cloud computing**.
- Uncertainty over **Legal** and **social** acceptance of what is technologically possible and the degree to which systems have to be safe. Need to try and predict and stimulate the arrival of game changing technologies.



The CASCADE Mission Space

Partnerships (16 so far)

CASCADE Partnership guidelines			
		Expected financial contribution (cash /in-kind)	
Involvement	Benefit	Large commercial Organisation	SME/ Non-profit organiation
Sit on steering committee	Ability to influence the general direction of the research and have an input to goals and deliverables	£5,000	£2,000
Participate in/ observe case study trials	Ability to access technology/ platforms/ equipment	£5,000	£2,000
Access to CASCADE final project knowledge base	Organisation will have access to the CASCADE knowledge base including platform design data, safety cases, reliability data. This knowledge will not be made publicly available.	£20,000	£10,000
Specify and agree final capstone case study	The final 12 month capstone case study will pull on a wide range of CASCADE project deliverables covering control, safety, operations	£50,000	£20,000
Sponsor a PhD student	A PhD student can be sponsored to focus on a specific technlogy relevant to the sponsoring organisation but in the context of the CASCADE programme	£50,000	£20,000
Specify an exclusive Tranche 2 case study	Organisation can specify a specific 2 year case study that one of the universitiy teams will undertake. These have a nominal funded budget of £300k	£100,000	£20,000

Queen's speech May 18 2016; Modern Transport Bill

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CASCADE Family of Case Studies

Volcano plume sampling BVLOS

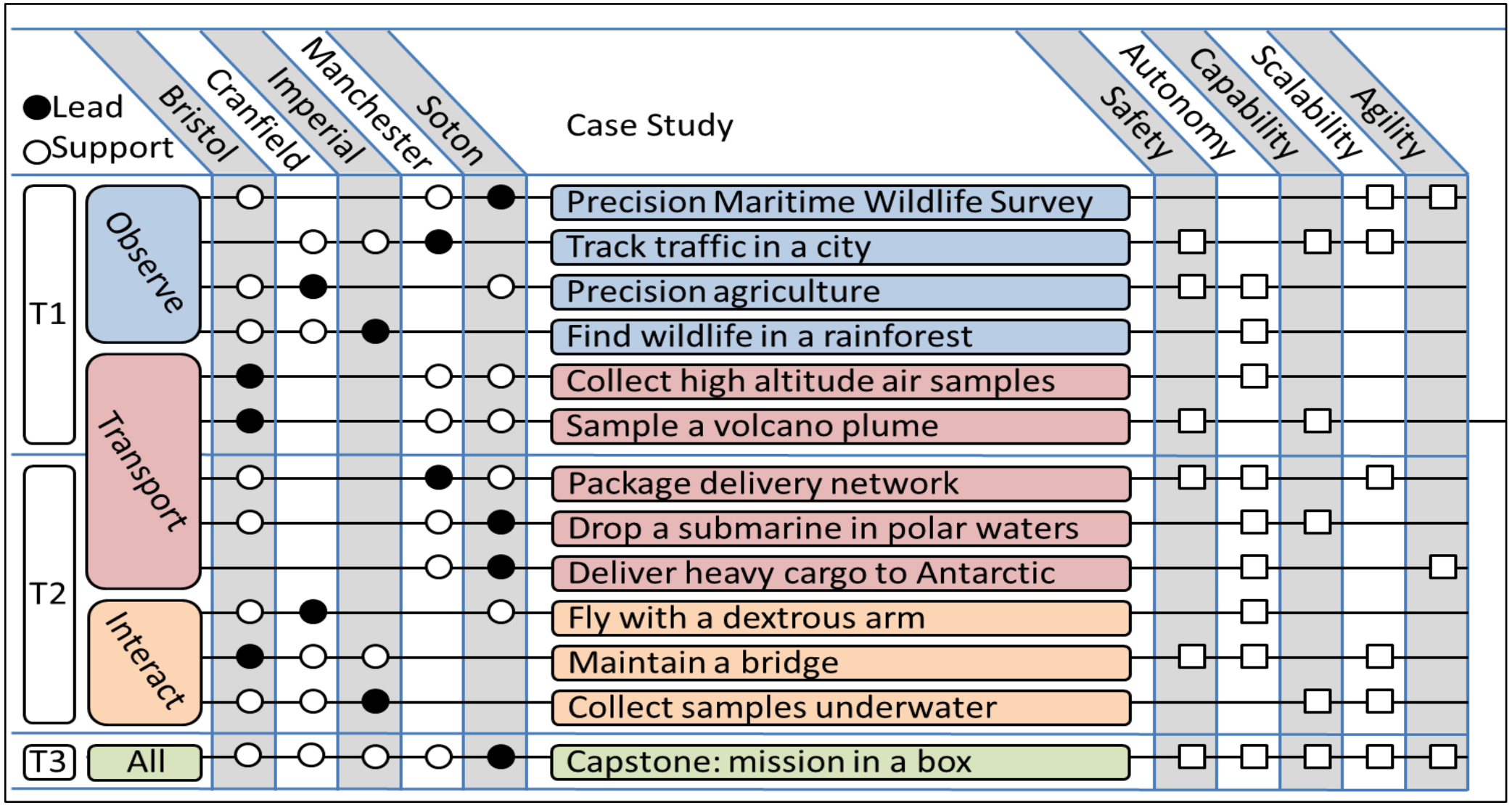
(Inter-)urban parcel delivery network

Extreme environments

Flood response with water sampling

Responsive large-scale infrastructure maintenance

Case Studies



UK wide ARGUS (Aerial Robotics Group for Universities and Scientists)

- Part of the EPSRC RAS network
- NERC (science “users” and EPSRC engineer “developers”)

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

University of Bath

Queen's University

The University of Liverpool

Coventry University

Loughborough University

University of Bristol

Scottish Association for Marine Science

Manchester 1824
The University of Manchester

University of Exeter

University of Southampton

The University of Birmingham

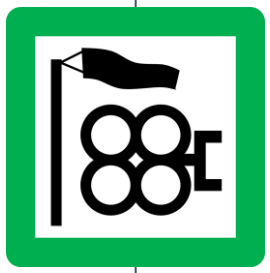
Imperial College London

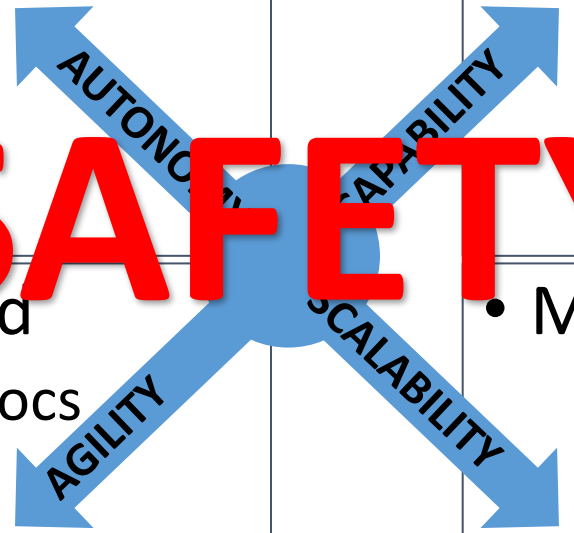
UK-RAS NETWORK
ROBOTICS & AUTONOMOUS SYSTEMS

Challenge Axes of CASCADE

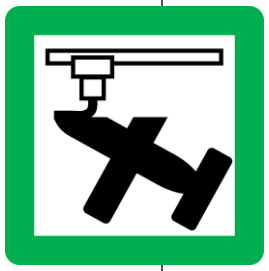
- Reduced dependence on human
  - Less training • Pilot → Supervisor
  - On-board decisions
  - GPS-denied navigation
  - Trustworthy systems

- Radical new flight capabilities
  - Fly in turbulence
  - Interact with environment
  - Multi-modal operations
    - Fly • Perch • Walk • Swim
  - Proximity to people & property

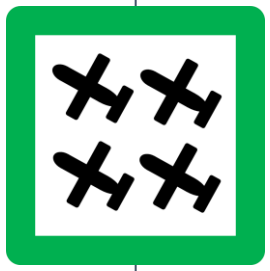




- Rapid mission turnaround
  - Need → design → kit + docs
  - Automated design
  - Rapid prototyping
  - Design for safe operation



- Multi-drone operations
  - Scalable data processing
  - Resource allocation
  - Multi-agent cooperation
  - More drones than pilots



Planned Impact

- High Profile publicity around demonstration applications
- Influence emerging UK and International regulators
- Accelerate critical technologies
- Create knowledge base
- Technology transfer to key UK commercial organisations
- “NERC” scientific knowledge and capabilities

Management

- Steering board
  - DfT
  - CAA
  - ARPAS (Industry)
  - NERC funded scientists
  - Key Partners

NERC SCIENCE OF THE ENVIRONMENT

ARPAS-UK Association of Remotely Piloted Aircraft Systems

Civil Aviation Authority

Department for Transport

Type of impact that we don’t want

Thankyou