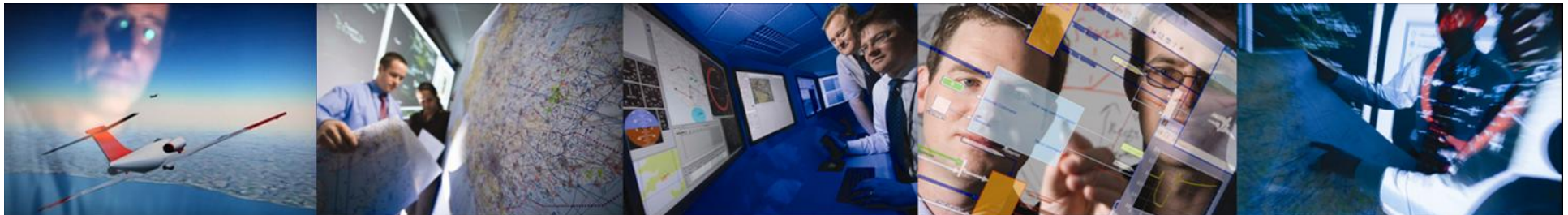




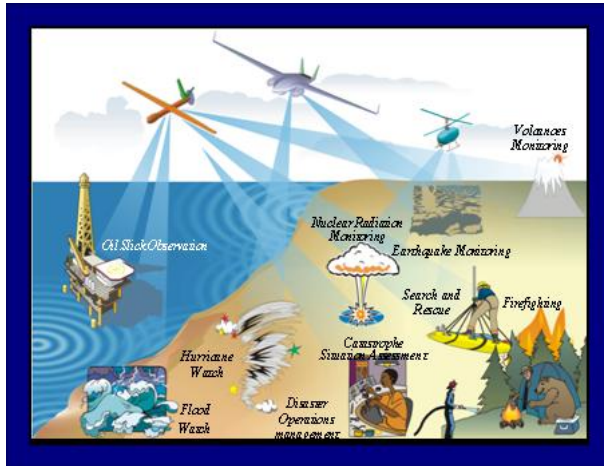
UAS Certification from the ASTRAEA Perspective

Nigel Mills
Technical Director AEG-TI
QinetiQ

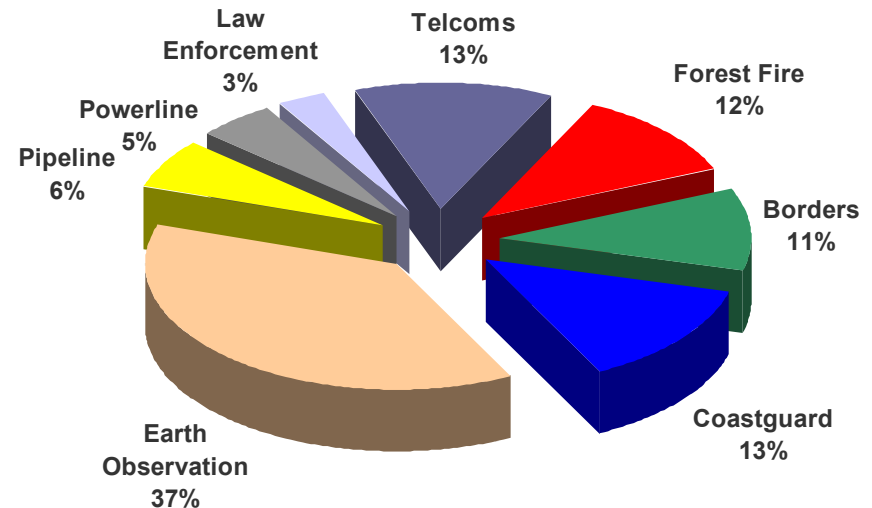
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UAV Civil Market



- Potential to address many applications in the civil sector.
- Service-oriented solutions could become the norm.
- Unmanned to Manned Autonomy Technology potential



Introduction to ASTRAEA



- **Certification of UAS – Catch 22 situation**
 - Regulators require example system to certify
 - Industry require regulations to specify requirements

- **ASTRAEA 1 - 2007 to 2009 - £32M**

- **ASTRAEA 2 - 2010 to 2012 - £30M**

- **Jointly funded by UK industry and the public sector**

- **Objective: to enable the routine use of UAS in all classes of airspace without the need for restrictive or specialised conditions of operation**

- **Aim: the development and demonstration of key technologies and operating procedures required to open up the airspace**

Who is involved?

A programme, jointly funded by industry and the public sector

➤ **TSB**

➤ **Regions**

- Welsh Assembly Govt
- Scottish Enterprise
- SEEDA
- SWRDA
- NWDA

➤ **Industry**

- Agent Oriented Software
- BAE Systems
- Cobham
- EADS Cassidian Systems
- QinetiQ
- Rolls-Royce
- Thales

➤ **Universities**

- Bath
- Bristol
- Cranfield
- Loughborough
- Sheffield
- Strathclyde

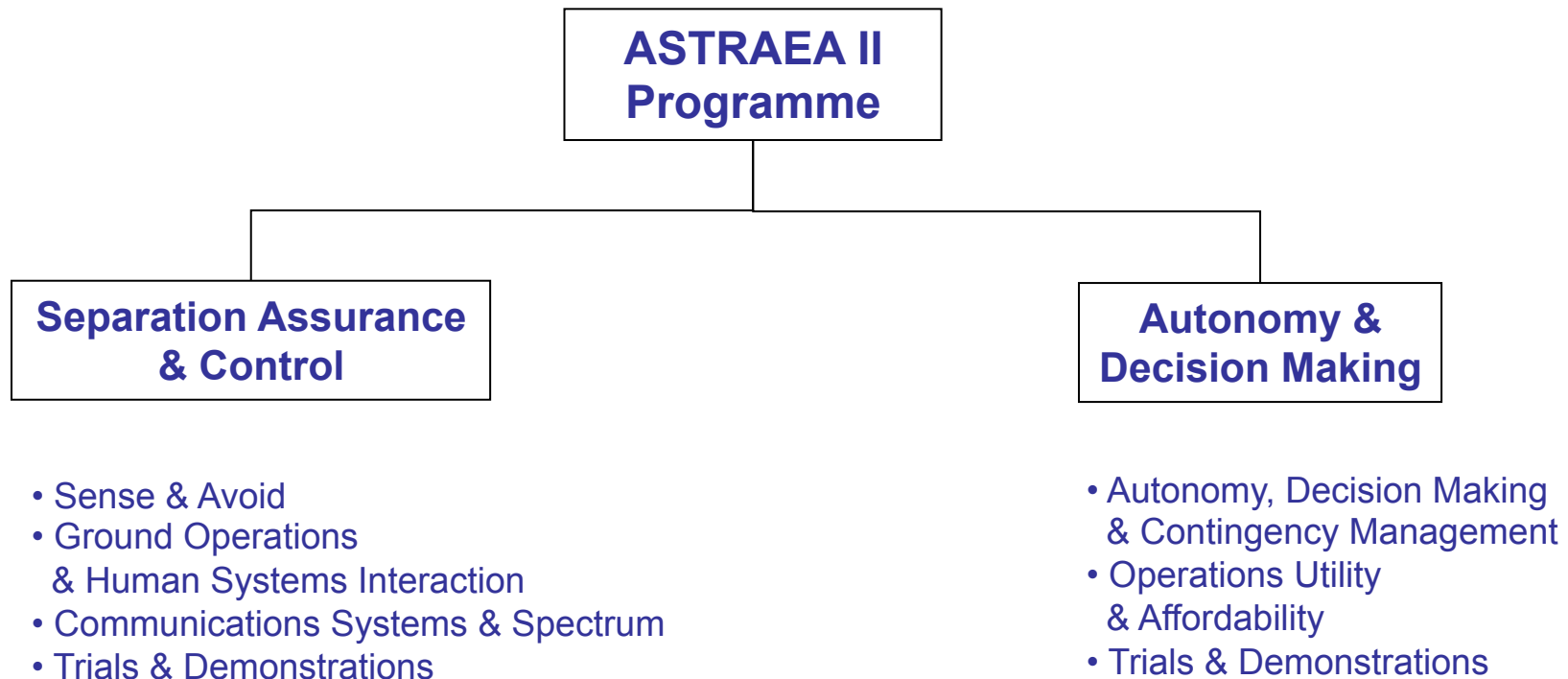
➤ **UK Civil Aviation Authority**

➤ **Subcontract SMEs and Universities**

Programme Construct



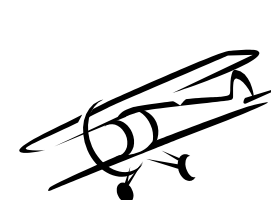
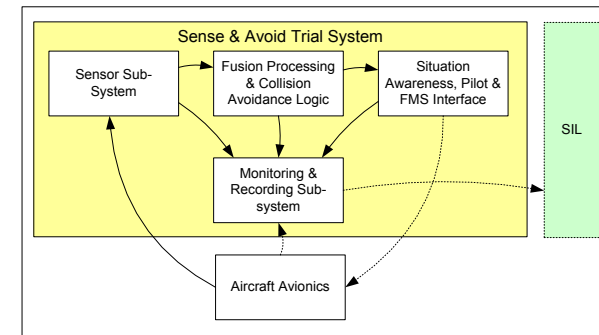
January 2009 – March 2013



Sense & Avoid



- To enable UAVs to **sense** (using visual, radar, co-operative transponder or other advanced technologies) **all other air traffic in the airspace or ground based obstacles**
- To determine whether **any air traffic poses a potential conflict**
- To provide the UAV pilot with **data to determine any course or altitude change to avoid intruders or to autonomously manoeuvre the UAV to eliminate the conflict**
- Develop **technology** that enables UAVs to avoid collision with other aircraft in situations where a loss of separation occurs
- Develop a clear **path to certification** through comprehensive regulatory engagement
- **Demonstrate** and explore technology solutions and operating standards to the stakeholder community in both synthetic and real world environments
- **Build public confidence** and develop a complete and robust safety case leading to an increased demand for UAS solutions in the civil domain

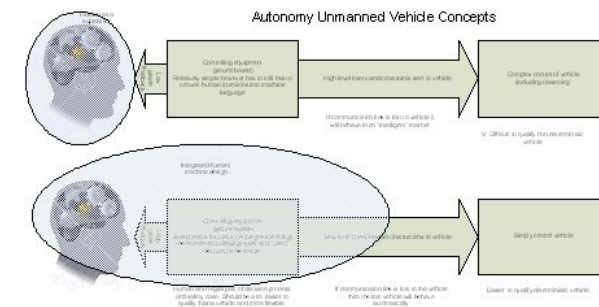
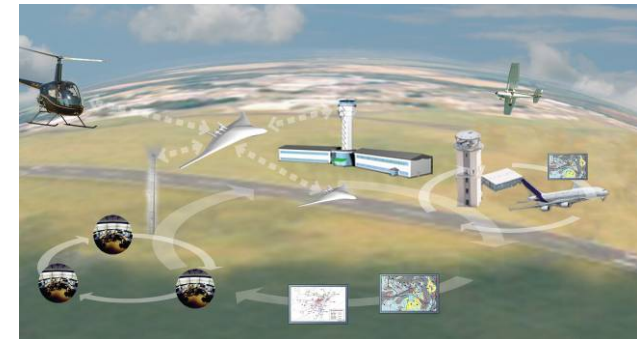


Ground Operation & Human Systems Interaction



- Identify the **ground operational environment** required for a UAS, including:
 - Tools required by the **operator** and the information that needs to be provided to allow **informed decisions** to be made
 - The required **interaction with ATC** and other authorities
 - The restrictions placed on the **ground operating environment by the regulatory authorities**, eg safety, security and certification requirements

- Identify how to fully **integrate the human into the autonomous system**, including:
 - Issues of **system trust** and maintaining operator awareness
 - Innovative HSI solutions
 - Numbers of operators, their **roles and skill levels**
 - Novel solutions to meet **training** needs

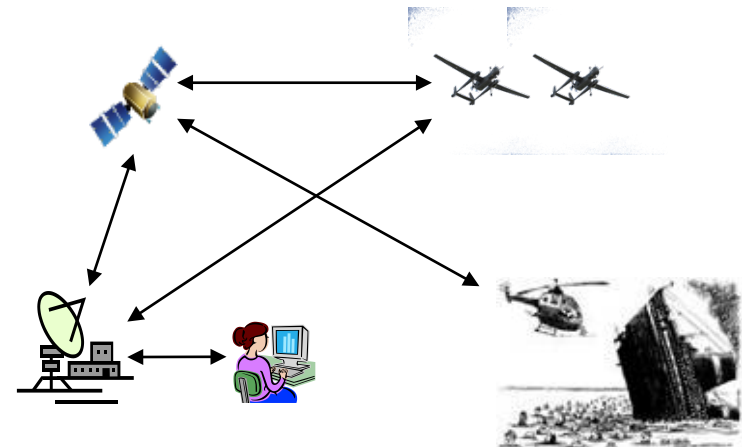


Communications Systems & Spectrum



- Determine how the future systems will **communicate both with the ground and other airborne assets** to provide safe flight and human in the loop capabilities in a civil environment.
 - Develop and demonstrate the **architecture** that allows the Human in the loop to maintain communications with the UAV both Line of Sight (LOS) and a Beyond Line of Sight (BLOS) situations.
 - To augment the capabilities of the UAV in its ability to **cooperate with other air assets** in normal and exceptional circumstances.
 - To ensure that the **Operator has the ability to intervene**, make decisions and take control if necessary thus maintaining public confidence
 - To enable **higher UAV density** through cooperation and mutual understanding of individual air vehicle intentions.

WRC-2012



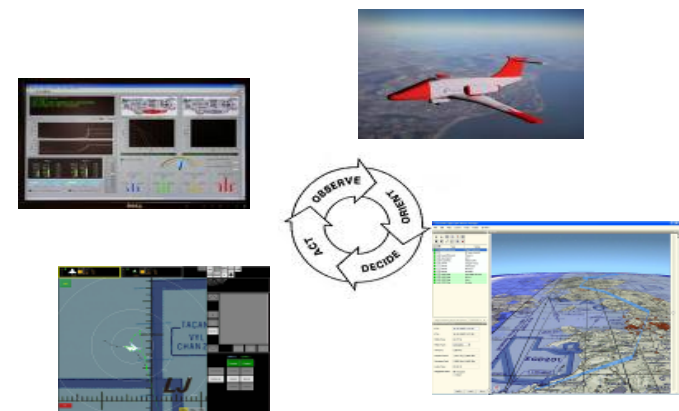
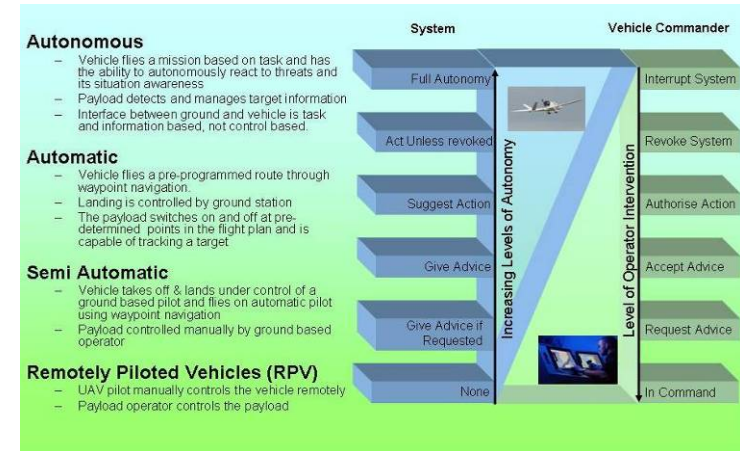
Autonomy & Decision Making

- Determine how the **decision making system** allows safe autonomous operations

- To **augment the capabilities of the remote operator** so that the UAV behaves in a sensible and safe fashion in the presence of normal and exceptional circumstances.

- To **reduce the workload of the remote operator** so he/she can focus on the top level mission goals while the UAVs perform the tactical tasks.

- To enable a **higher UAV to operator ratio** so that the full potential economic benefit can be realised.

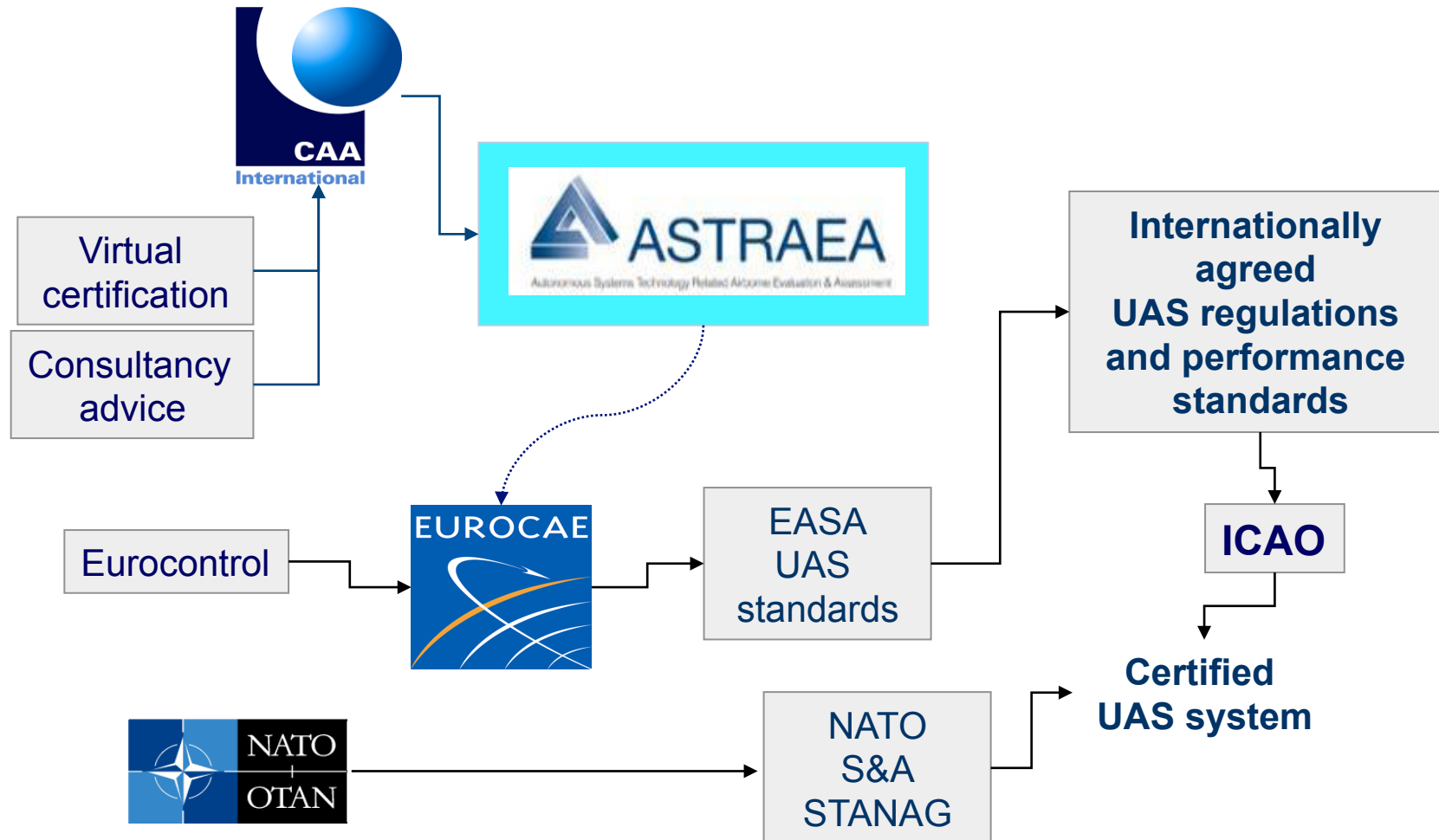


Demonstrations

- Synthetic Environments
- Hardware in the Loop
- Surrogate Aircraft



Stakeholder Engagement

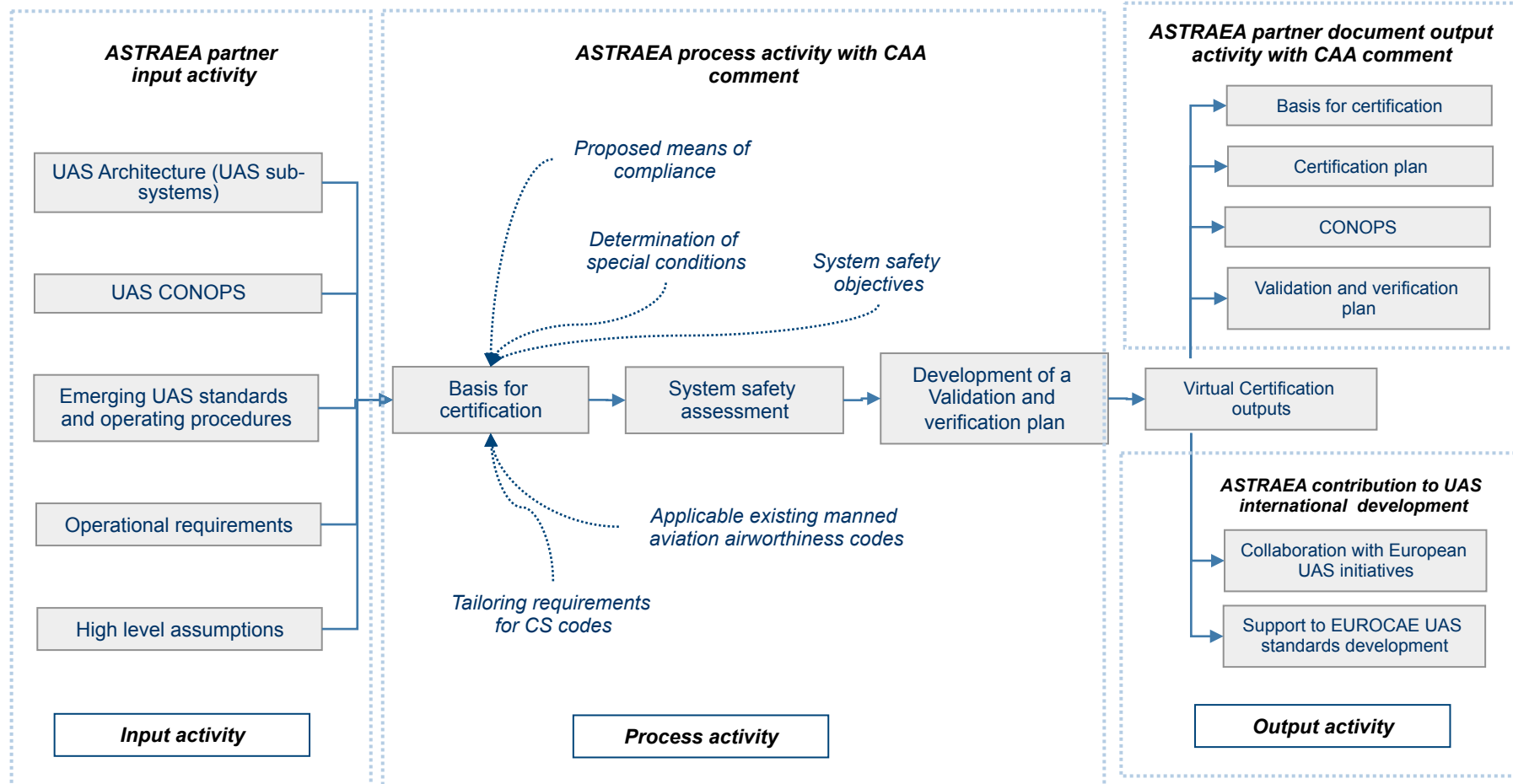


ASTRAEA – a route to UK, European and International certification

Virtual Certification

- **Aim**
 - To plot and document the route to UAS certification for a top level generic UAS relevant to the ASTRAEA partners
 - To enable a forum for the CAA to provide guidance on an acceptable technical and regulatory framework leading to certifiable solutions
- **Stage 1**
 - Documentation of the ASTRAEA UAS virtual architectural baseline. This will include a set of assumptions to attach to and bound the technical and operational functionality of the virtual UAS.
- **Stage 2**
 - Definition of content applicable to each technical theme. This process will expose the salient issues to allow any novel or UAS specific aspects to be considered beyond conventional CS23 or CS25 codes.
- **Stage 3**
 - Discuss the development of a route to certification plan, a strategy of how to achieve this, and suggested changes to regulations, with the UK CAA

UAS Virtual Certification Overview



Conclusions

Limited flight clearances are currently being offered for UAS operations in a number of countries, however, the ASTRAEA projects are addressing all technical aspects of certification which are necessary to ultimately achieve full access to airspace, even in the crowded skies and high population density of the UK.

The innovative virtual certification process will allow industry to gain insight into the regulatory requirements to achieve certification while helping the regulators to establish UAS specific conditions and standards

Going Forward Together



www.ASTRAEA.aero

