



The European Organisation for Civil Aviation Equipment
L'Organisation Européenne pour l'Équipement de l'Aviation Civile

*Responding to standardisation
challenges of the future air
transport system*



Unmanned Aircraft Systems

Dewar Donnithorne-Tait
Secretary WG-73 UAS

Based on a briefing prepared by Dan Hawkes
Chairman WG-73 UAS

ICAS UAS Workshop
Seville, September 2007

The information in this presentation references draft material for use by EUROCAE WG-73 UAS and should not be regarded as statements of EUROCAE policy. Photographs are illustrative only and do not constitute any endorsement.

This presentation provides a status report
on the work of WG-73 UAS.

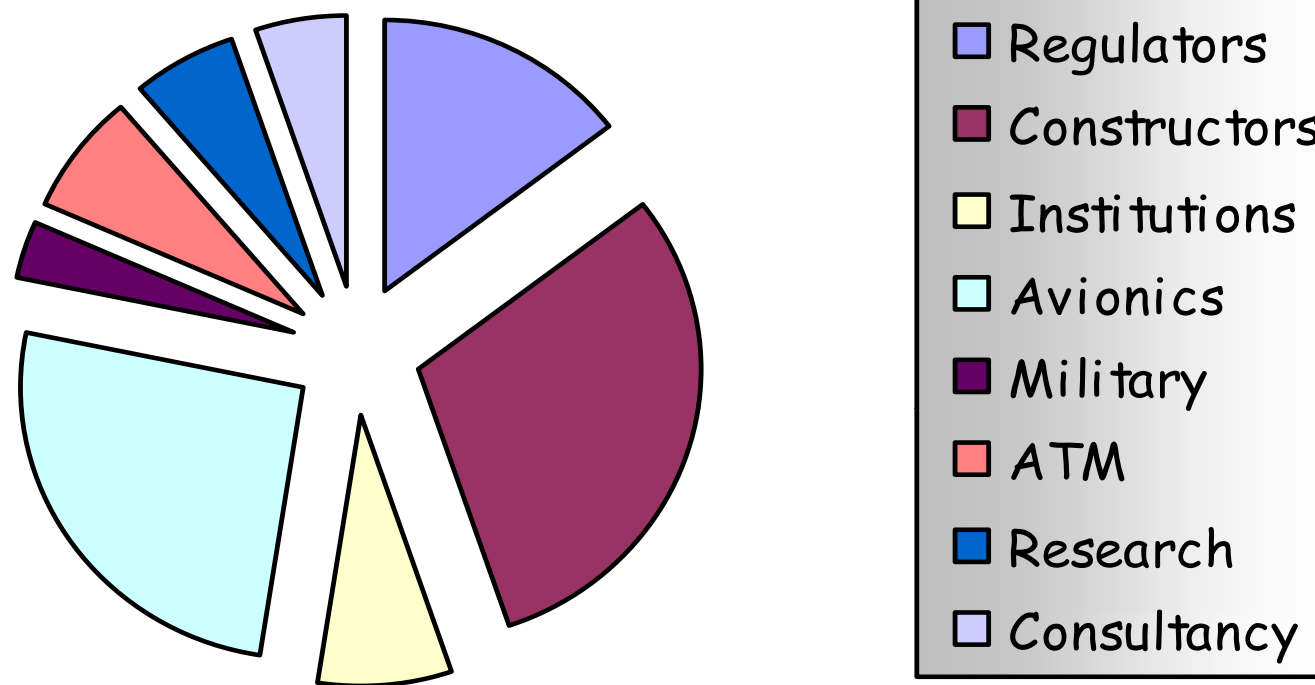


EUROCAE WG-73 UAS meeting, January 2007 at Palm Coast,
Florida in cooperation with FAA, NATO and RTCA SC-203

EUROCAE Working Group 73

- ❑ In 1999, following a EUROCONTROL/ NATO workshop, the JAA was requested to consider certification and operational issues for civilian unmanned aircraft.
- ❑ A JAA/EUROCONTROL task force was created leading to the publication of a report in May 2004.
- ❑ Following discussions between the JAA, EASA and EUROCAE, WG-73 was launched in April 2006.
- ❑ EASA is to propose WG-73 as the European UAS expert group that will assist development of airworthiness criteria and Special Conditions to supplement *Policy for Unmanned Aerial Vehicle (UAV) certification* (EASA A-NPA-16/2005).

WG-73 Membership



The working group is currently supported by some 190 members.



EUROCONTROL provides the Chairman together with experts from its ATM, Navigation, Radio Spectrum, Military, Safety, and Operational Research domains.



WG-73 Structure

Chairman		Daniel Hawkes	
Secretary		Dewar Donnithorne-Tait	
Vice Chairman		Gérard Mardiné (Industry)	
Vice Chairman		Kenneth (Doug) Davis (FAA)	
EUROCAE Focal Point		Gilbert Amato	
RTCA SC-203 Focal Point		John Walker	
Terminology & Acronyms		Peter van Blyenburgh	
ICAO & EUROCONTROL Liaison		Holger Matthiesen	
Subgroup 1 UAS Operations and Sense and Avoid	Subgroup 2 Airworthiness & Continued Airworthiness	Subgroup 3 Command & Control, Communications & Spectrum, Security	Small UAS Focus Group
Gérard Mardiné	Michael Allouche	Norbert Tränapp	Joe Barnard

UAV v UAS

- ❑ UAV - Unmanned Aerial Vehicle
 - Is it or is it not an aircraft?
- ❑ UA - Unmanned Aircraft
 - Clearly an aircraft, hence subject to aircraft regulations and standards.
- ❑ UAS - Unmanned Aircraft Systems
 - This terminology adds the control station and other system elements such as Communications Links and Launch and Recovery Elements.

WG-73 elected to change its name from UAV to UAS to show that the whole system was being addressed.

UAS Applications

- More than 600 models of UA being developed or in service. Many military UAS. Civil & commercial UAS applications include:
 - Surveillance. Weather, terrain, maritime, railways, disaster, search & rescue, pipelines, power grids, traffic, sports, crowds, environmental, agriculture, prospecting, wildlife, law enforcement, facility inspection, mapping
 - Communications. Broadcasting, signal relay
 - Security. Safeguarding of important people, sites, infrastructure
 - Cargo and Transport. Mail and packages, hazardous material, animals and, maybe in the future, passengers.

The Objectives



1250 kg Eagle-Heron I
at Istres



5000 kg Mariner

- ❑ A requirements framework that will support civilian UAS airworthiness certification and operational approvals.
- ❑ Safe operation within non-segregated airspace in a manner compatible with other airspace users.
- ❑ Compatibility with the existing ATM regulatory framework, existing ATM infrastructures, existing procedures, and without degrading ATM efficiency.

Deliverables requested from WG-73



250 kg I-View
Australian ADF



5.6 kg Mini UAV Bird Eye 400

- ❑ ***Deliverable 1. UAS related elements regarding the Operational Concept.***
 - Provides a preliminary inventory of airworthiness certification and operational approval items to be addressed (Jan 07).

- ❑ ***Deliverable 2. Work Plan.***
 - Identifies work packages and timescales to guide the future activities of WG-73. (May 07)

Deliverables (2)

❑ ***Deliverable 3. A Concept for UAS Airworthiness Certification and Operational Approval in the Context of Non-segregated Airspace.***

- Will assist development of recommendations and a requirements framework for civilian UAS such that they will operate safely within non-segregated airspace.

❑ ***Deliverable 4. UAS Command, Control and Communication Systems.***

- Will define the requirements for command, control and communication systems including autonomous operation.



20 kg Fulmar Aerovision



Deliverables (3)



300 kg EADS CL289



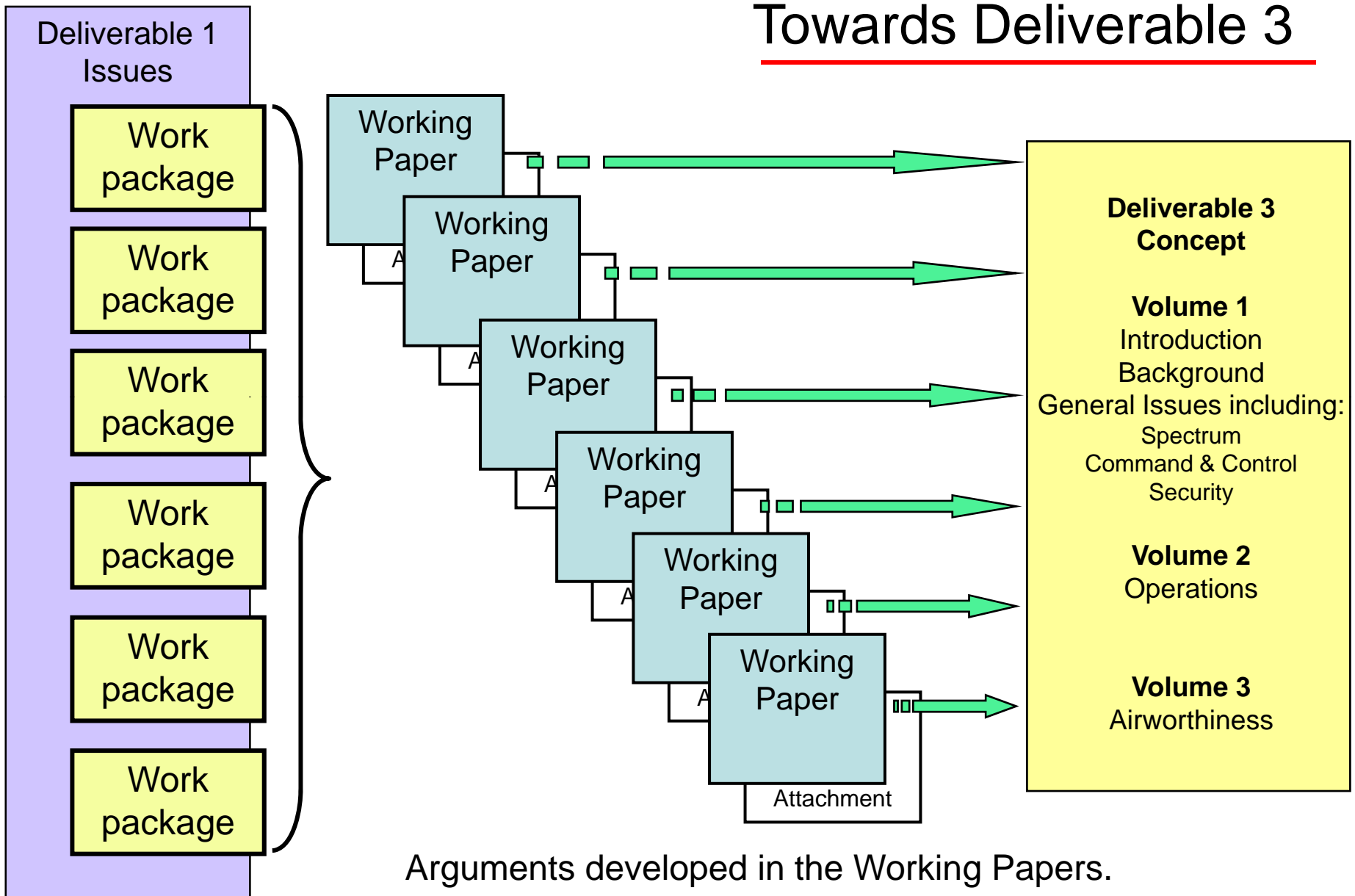
Deliverable 5. UAS Sense and Avoid Systems.

- Will define the functional requirements for sense and avoid systems.

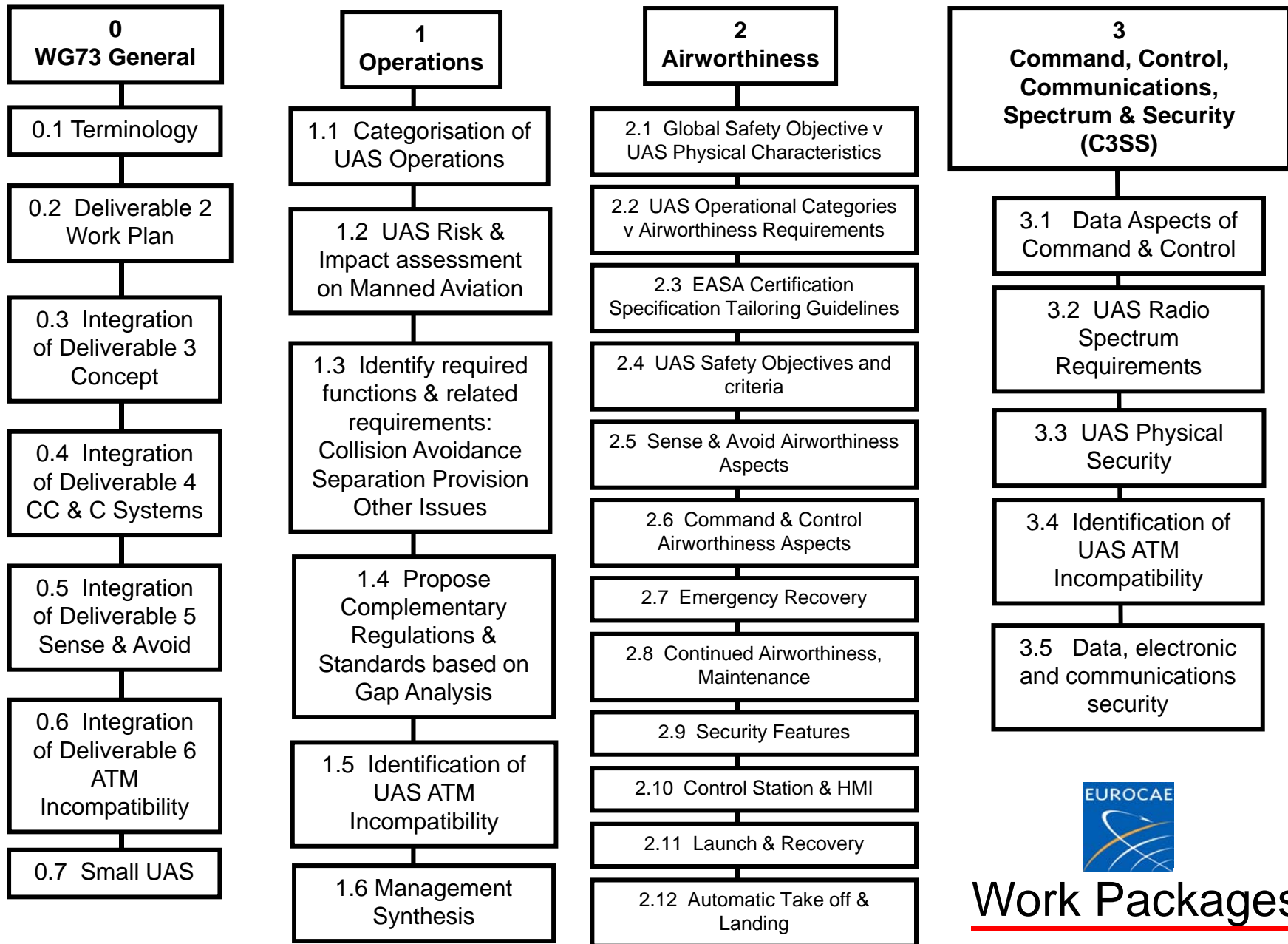
Deliverable 6. Catalogue of UAS ATM Incompatibility Issues.

- Will identify those aspects of UAS normal and abnormal operations that would require special ATM consideration.
- Will identify potential technical and operational solutions that could assist ATM compatibility development.

Towards Deliverable 3



Arguments developed in the Working Papers.
Text for Deliverable 3 proposed in the Attachments.



Work Packages

Specific Issues

- ❑ In January 2007, WG-73 completed its first deliverable, a report entitled ***UAS related elements regarding the Operational Concept***.
- ❑ The report provides a preliminary inventory of airworthiness certification and operational approval items which need to be addressed.
- ❑ The inventory was derived from a review of the *JAA/EUROCONTROL UAV Task-Force Final Report*, May 2004, other existing and relevant documents, and taking account of the current regulatory context.
- ❑ A summary of the main issues follows...

Radio Spectrum



3266 kg Altair



14,628 kg Global Hawk

- ❑ An ITU allocation of radio spectrum is needed to support safe civilian UAS operation in non-segregated airspace.
- ❑ For this purpose, information needs to be obtained about civilian UAS communication characteristics which involve command, control, UA flight and system monitoring, and relay of air traffic communications.
- ❑ WG-73 is supporting ICAO, EUROCONTROL, FAA and RTCA in a team effort to develop a technical case to support a bid for UAS spectrum allocation at the 2011 World Radio Conference. **This bid will require concerted international support if it is to succeed.**

Airworthiness Certification



1020 kg Bell Eagle Eye 2



30 kg QinetiQ Observer

- ❑ Many types of UAS could be available with a large variation in weight, size, performance, and means of control.
- ❑ UAS Type Certification categories and safety targets need to be defined with related certification requirements.
- ❑ Generic Special Conditions & Interpretive materials to be recommended for specific issues: e.g. UAS Safety Assessment, Command and Control, Control Station, Automatic Take-off & Landing.

Operational Approval



BAE Corax "Raven"



1450 kg Hermes 1500



- ❑ Applications from potential UAS operators are likely to be received by the responsible authority of the State of the operator.
- ❑ Many different types of operation can be expected.
- ❑ Operational categories will need to be defined for which related conditions for operating approval can be published.
- ❑ UAS operating certificates can be granted to operators that demonstrate ability to comply with the operating conditions.

Command and Control

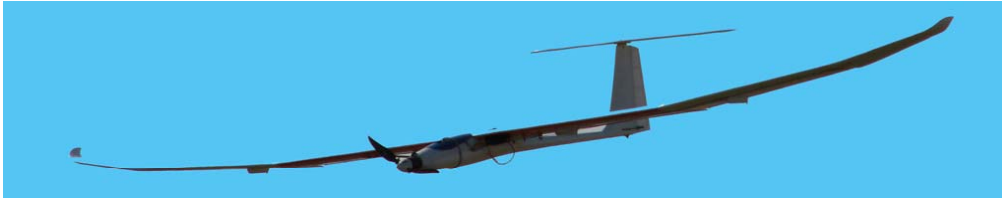


AAI Shadow 200



Tadiran Control

- ❑ There can be a trade-off between the autonomous capability of the UA and the capacity of the flight control data link.
- ❑ Issues include:
 - the degree of autonomy of the UA
 - compatibility with the evolving ATM
 - the capacity, integrity, redundancy and security of flight control data links
 - application of EUROCAE ED-78A and the means of compliance for certification
 - control station human-machine interface
 - data synchronisation at control station handover (normal and abnormal conditions)
 - support tools for mission planning
 - and personnel training and qualification



Sense and Avoid

- ❑ '*See and avoid*' is a **principle** (ICAO Annex 2) whereas separation assurance (with traffic or with terrain) and collision avoidance (with traffic or with terrain) are **functions**.
- ❑ The separation assurance function is, in some cases, the responsibility of ATC (IFR/IFR in class A to E for example), in others, the responsibility of the pilot using the '*see and avoid*' **principle** and applying the right-of-way **rules**.
- ❑ These functions are presently achieved in manned aviation through the sensing by pilot's eyes and through other sensors not referred to in the '*see and avoid*' principle (ATC radar and ADS-B for traffic separation, ACAS for traffic collision avoidance, E-GPWS for terrain avoidance, weather radar for bad weather avoidance).

Sense and Avoid (2)

- ❑ The issue is how to define the functional perimeter of a UAS physical **system** that is equivalent to the manned aircraft ‘*see & avoid*’ **principle** and its **rules**.
- ❑ Recognising that different notions are involved (principles, functions, rules, physical systems), the initial intent is to remain as far as possible at the functional level and to issue functional requirements or recommendations.
- ❑ A so-called ‘sense & avoid’ **system** could implement most of the sub-functions of the separation provision responsibility of the UA controlling operator, and of the collision avoidance function. This **system** could still include a human in the loop.

Sense and Avoid (3)

- ❑ 'What needs to be detected and avoided' has to be considered.
 - Does it include airport ground traffic, the 'congested areas of cities..' or 'open-air assemblies of persons' as stated in Annex 2?
 - Will it determine the minimum over-flight height and decide to fly around an area if a minimum height cannot be achieved?
- ❑ WG-73 is discussing with RTCA SC-203 how the required functionality, safety, performance, and interoperability requirements could be developed jointly with the objective of achieving a common technical standard.
- ❑ The *sense and avoid* function of a UAS is recognised as being critical for safe UAS operations in non-segregated airspace. A reliable solution will be of benefit also to manned aviation.

Security



- ❑ WG-73 will address the security, physical and electronic, of the UAS, the pilots, the ground control stations, and the launch and recovery aspects.
- ❑ Security of communications between the UA and the controlling operator will also be addressed.
- ❑ The intent is to propose policy, guidance, and requirements, as appropriate, to ensure an adequate level of security so that unmanned aircraft might be safely operated only by authorised personnel with a minimal risk of accidental or deliberate intrusion and disturbance.



3kg Micropilot Cropcam

EASA 150kg Threshold

- ❑ EASA position that UA with a mass of less than 150kg are subject to national certification and regulation
- ❑ WG73 focus is on UA >150kg
- ❑ UA <150kg can have significant capabilities and trans-national operating ranges. Issue of international interoperability
- ❑ Possible that standards developed for UV >150kg could be appropriate for some lighter UA (subject to national regulation)
- ❑ International ATM system must cater for aircraft of all masses
- ❑ EUROCONTROL to explore UAS issues using simulation, including UA <150kg
- ❑ WG73 has established a 'Small UAS Focus Group' and is developing a work package to address the issues

WG-73 Current Status

- ❑ Deliverable 1 (Inventory of Issues)
 - Agreed January 2007
- ❑ Deliverable 2 (Work Plan)
 - First Version agreed 31 May 2007
- ❑ Deliverable 3 (Concept Document)
 - 1st iteration due early 2008
- ❑ Deliverable 4 (Command & Control) and Deliverable 5 (Sense & Avoid)
 - In accordance with Work Plan and discussions with SC-203.
- ❑ Deliverable 6 (ATM Incompatibility Issues)
 - Ongoing activity



Questions



**The European Organisation for
Civil Aviation Equipment**

102, rue Etienne Dolet, 92240-Malakoff, France
Tel.: +33 1 40 92 79 30 www.EUROCAE.eu

The information in this presentation references draft material for use by EUROCAE WG-73 and should not be regarded as statements of EUROCAE policy unless approved by the Council.



190407