



EASA
European Aviation Safety Agency

UAV certification

flight panel considerations

Riccardo Frollo, FTE Aircraft, Airships & UAVs

Your safety is our mission.

An agency of the European Union 

TE.GEN.00409-001



EASA

European Aviation Safety Agency



MURPHY'S LAWS OF FLIGHT

Loud, sudden noises in a helicopter WILL get your undivided attention.



EASA

European Aviation Safety Agency

UAV Unmanned Air Vehicle

UAS Unmanned Air System

RPAS remotely piloted aircraft system

‘unmanned aircraft’

etc etc ... all meaning:

no pilot and no personnel on board!

Your safety is our mission.

An agency of the European Union 

TE.GEN.00409-001



Unmanned Aircraft Certification Projects

- The Agency has currently two certification projects ongoing in the unmanned aircraft domain
 - Airbus Atlante
 - Schiebel Camcopter S-100



Atlante





Camcopter S-100





Atlante Certification Basis

- EASA Policy 1301 : Kinetic energy at impact
- Will define the corresponding reference CS based on weight/speed at impact on ground
- Cert basis is CS VLA with a set of special conditions



Schiebel Certification Basis

- EASA Policy 1301 : Kinetic energy at impact
- Cert basis is CS VLR + Special conditions
- JARUS Joint Aviation rulemaking unmanned systems: UAS < 600 kg
- JARUS created CS - LURS (heli) and CS – LUAS (Airplanes)
Not yet endorsed by EASA but adopted CS-LURS in a Special Condition



EASA RPAS Special Conditions

- SC-RPAS.RPS-01 Remote Pilot Station
- SC-RPAS.FC Flight Control System
- SC-RPAS.ANC-01 RPAS Ancillary elements
- SC-RPAS.ERC.01 RPAS Emergency Recovery Capability
- SC-RPAS.CNS 01 Communication, Navigation and Surveillance
- SC-RPAS.HF.01 Human Factors
- SC-RPAS.C2.01 Command and Control
- SC-RPAS.101.01 Electronic Equipment Fault Detection and Isolation
- SC-RPAS.1309.01 Equipment Systems and Installation

- All SC can be consulted on the web:
 - [https://www.easa.europa.eu/document-library/public-consultations?search=&date_filter\[min\]=&date_filter\[max\]=&&](https://www.easa.europa.eu/document-library/public-consultations?search=&date_filter[min]=&date_filter[max]=&&)



US STANAG 4671

- *Fixed-wing military UAV Systems*
- *maximum take-off weight 150 to 20,000 kg*
- *regularly operate in non-segregated airspace*

Based on CS23, tailored to unmanned flight



Flight requirement selection

Each existing CS Subpart B requirement was assessed:

- requirements with pilot subjective opinion
- requirements having as background the pilot human reaction and ability to fly (i.e. stability etc)
- Some requirements have been moved from Flight to Systems as the pilot interface is no longer significant



US STANAG 4671

SUBPART B – UAV FLIGHT	1-B-1
GENERAL	1-B-1
PERFORMANCE	1-B-3
FLIGHT CHARACTERISTICS	1-B-10
CONTROLLABILITY AND MANOEUVRABILITY.....	1-B-10
STABILITY.....	1-B-12
STALLS.....	1-B-13
SPINNING.....	1-B-14
GROUND HANDLING CHARACTERISTICS.....	1-B-14
MISCELLANEOUS FLIGHT REQUIREMENTS	1-B-15
CATAPULT ASSISTED AND ROCKET ASSISTED TAKE-OFF UAV	1-B-15
PARACHUTE LANDING SYSTEM	1-B-16



STABILITY REQUIREMENT

USAR.171 General

- (a) The UAV, augmented by the FCS including all degraded modes, and including the effects of sensor and computational errors and delays must be longitudinally, directionally and laterally stable in any condition normally encountered in service, at any combination of weight and centre of gravity for which certification is requested.
- (b) Transient response in all axes during transition between different flight conditions and flight modes must be smooth, convergent, and exhibit damping characteristics with minimal overshoot of the intended flight path.
- (c) In addition to data obtained by computation or modelling, stability analysis must be supported by the results of relevant flight



STABILITY REQUIREMENT (ctd)

145 Longitudinal control

- 147 Directional and lateral control

- 151 Aerobatic manoeuvres

- 153 Control during landings

- 155 Elevator control force in manoeuvres

- 157 Rate of roll

- 175 Demonstration of static longitudinal stability

- 177 Static directional and lateral stability

- 181 Dynamic stability

..... All now no longer applicable!



Challenges

- *Mission definition*
- *kind of UAV: Automatic / Semiautomatic*
- *Pattern Tresholds and alarms*
- *Emergency drills , coordination with all actors*



Challenges

*Kind of propulsion:
Classical but also Electric, hydrogen
cells...*

Impact on system flight testing?

AFM, RFM??



Challenges

*Miscellaneous flight requirement:
HMI*

What about secondary pilot inputs?



SC.RPAS 1309 Equipment, Systems and Installations

CAT extremely improbable & not from single source

Emergency recovery capability

Crash recovery site



1309 Challenges

*Is the flight profile all under human control?
Role of crew??*

*Does the FHA consider also ground phases
such as start, taxi etc?*

What if we have a runway excursion?



Challenges

Pilot minimum training requirements

Length of flights

Security

Sense and Avoid



Future challenges

More projects on more vehicles arriving (i.e. Stratobus Airship)

Redefine FTE/FTP role from manned to unmanned (cfr. training on common errors made on UAV certification)

Interactions with all crew and ATC



QUESTIONS
????????????



MURPHY'S LAWS OF FLIGHT

Loud, sudden noises in a helicopter WILL get your undivided attention.