



EUROPEAN AVIATION SAFETY AGENCY  
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE  
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

# Flight test activity in design organisations

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Your safety is our mission.



# Introduction

- ▶ The purpose of this presentation is to highlight the issues to be taken into consideration by an organisation which needs to make flight test for development or showing of compliance with applicable requirements.
- ▶ The relation between Flight conditions Forms (18A or 18B), PtF Forms (20A or 20B) and the flight test activity is described in the second part of the presentation.
- ▶ The presentation is focusing on cases related to small organisations, which are generally not maintaining a permanent flight test organisation, and are consequently using the resources of the aircraft operator (their customer) for operating and maintaining the aircraft during the flight test campaign.
- ▶ The flight test process presented here must be adapted to the complexity of each case. A specific session will be dedicated to the presentation of practical examples.



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- Flight Test Order –Operational Risk Management

## PART 2

- Form 18B and Form 18A
- Permit to fly



# Flight test programme



**Flight test activity should never start without a detailed flight test programme: Why are we flying? What aircraft are we flying? What are the limitations for each flight? What are we doing? Who is flying? Where are we flying...**



# Flight test programme

## Purpose

- Development
- Showing of compliance
- ...

## Planning

- Time line showing test campaign phases:
- Configuration
- Flight envelope limitations
- Involvement of EASA team
- ...

## Tests specification

More than one CVE can be necessary for the approval of a flight test program :

- Avionic
- Cabin safety
- Performances

procedures

• ...

## Configuration

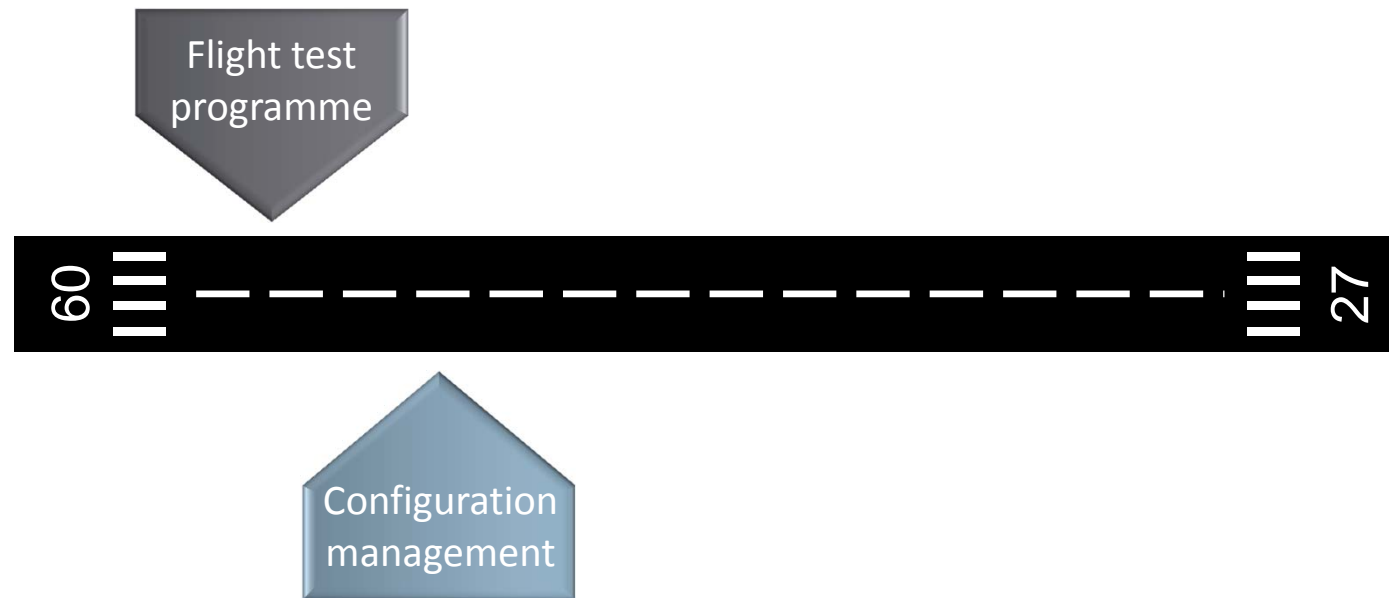
- Aircraft configuration base line and change management
- Weight and balance
- Flight test installation
- Limitations
- ...

## Flight test team

- Flight test pilot
- Flight test engineer
- ATC
- Ground engineer
- Maintenance staff



# Configuration management



**Configuration management process of the test article must be defined, in the flight test programme or in dedicated procedures.**



# Configuration management

## Handover from CAMO

- Aircraft airworthiness status (maintenance, AD...)
- Approved configuration (STC, minor changes, repairs)

## Test article configuration

- Approved definition +
- Non approved changes +
- Flight test installation

## Documentation

- Technical logbook
- ...

## Changes implementation

- Arrangement with MO and or PO
- Work orders
- Use of certifying staff
- ...

## Handover to CAMO

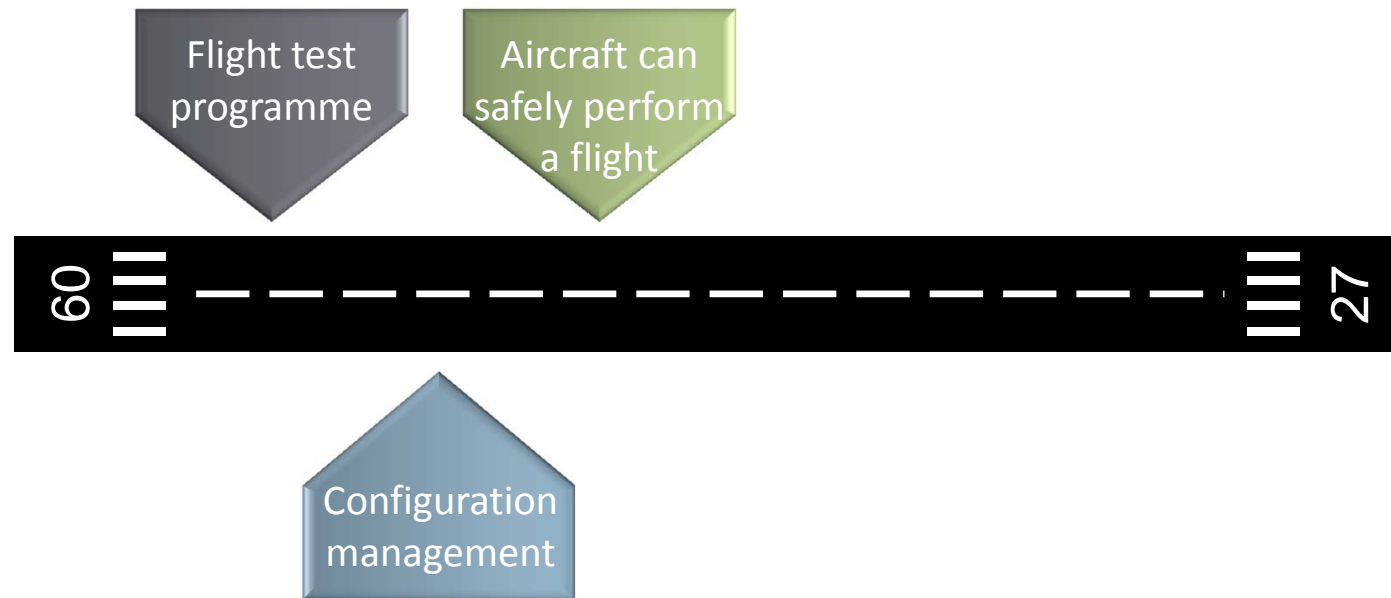
- Aircraft final configuration justification (statement of approved data)

### Output:

- Arrangements
- Tech-Log
- Flight Test Order
- ...



# Substantiation that aircraft can safely perform a flight



**The effect of the modification or of the specific configuration on the flight safety must be analyzed and mitigation means defined. Associated processes must be documented.**





# Substantiation that aircraft can safely perform a flight

## Calculations

- Structural analysis
- Weight and balance
- ...

## Ground tests

### Examples:

- Static test
- Flutter analysis
- System functional test
- Simulation
- FTI test
- Emergency system

## Safety analysis (xx. assessment)

### Output:

- Limitations
- Reports (independently checked, when under DOA privilege)
- Supplement AFM
- Supplement AMM
- Flight Test Order
- ...

## Maintenance instructions

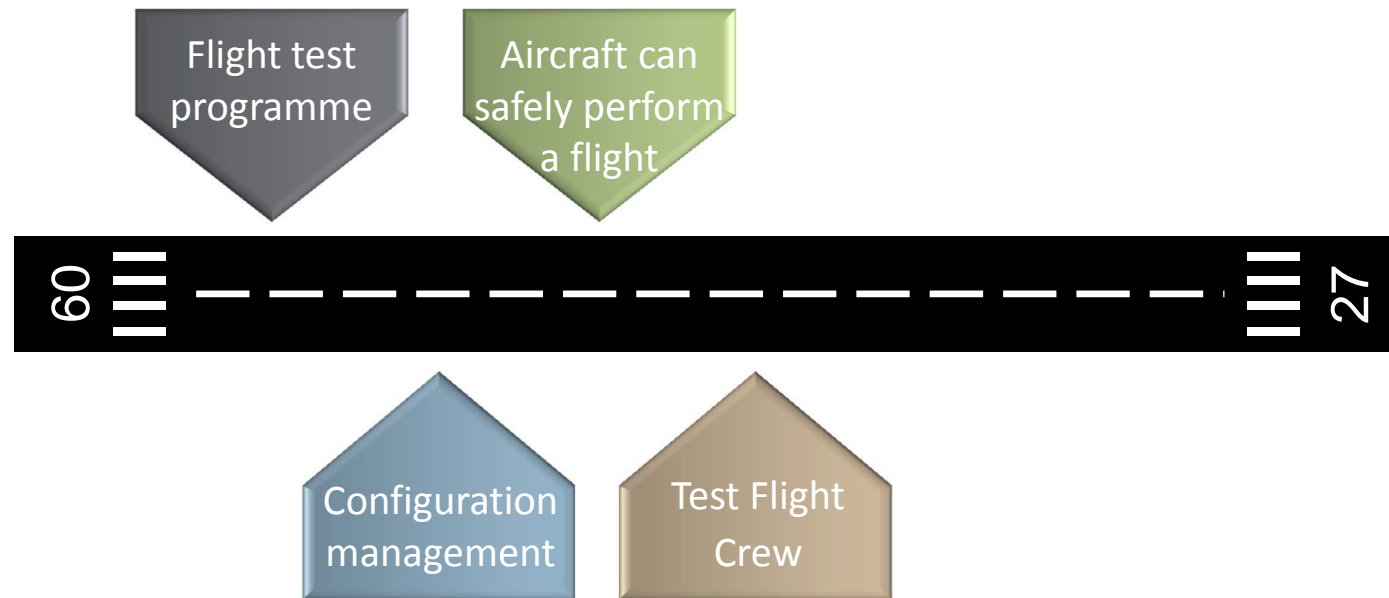
- Reference to existing applicable maintenance programme
- Supplemental maintenance data (IPC, AMM, MPD...)
- Test installation maintenance data

## Operational Limitations

- Operating procedures
- Weight and balance
- Flight envelope
- Weather conditions
- Facilities, runway
- Passengers
- Other operational aspects...



# Qualification of pilot and flight test engineer



**Qualifications required for the flight test crew must be established in flight test programme. Arrangement is needed when the task is subcontracted.**



# Flight categorisation (see NPA 2008-20)

## Category 1

- Initial flight(s) of a new type of aircraft or of an aircraft of which flight and/or piloting characteristics may have been significantly modified.
- Flights to investigate novel or unusual aircraft design features or techniques.
- Flights to determine or expand the flight envelope.
- Flights to determine the regulatory performances, flight characteristics and handling qualities in extreme conditions

## Category 2

- Flights done in the part of the flight which it is not envisaged to encounter (including manoeuvres and comprising manoeuvres, during which it is not envisaged to encounter characteristics (performance and flying qualities) significantly different from those of the aircraft.
- Display flights and demonstration flights of approved aircraft.
- Flights conducted for the purpose of demonstrating the reliability of the aircraft, its parts and appliances are reliable and function properly. It is reasonable assurance that the aircraft, its parts and appliances are reliable and function properly.

Pending Part 21 revision,  
concept of categorisation  
of flights can be used on  
a voluntary basis

## Category 3

- Flights performed prior to issuance of an individual certificate of airworthiness in order to establish the conformity of the relevant aircraft production to the approved type design

## Category 4

- Flights performed after embodiment of a new not yet approved design change which does not need an assessment of the general behaviour of the aircraft and/or the impact on crew procedures when the new or modified system is operating.



# Qualification of pilot and flight test engineer

## Category 1 - NPA 2008-20 says:

- Pilots involved in flight tests of categories 1 and 2 shall comply with the condition established in Part-FCL.
- For CS-25, CS-23 jets and CS-23 Commuters, the flight test engineer must have satisfactorily completed a specific training course accepted by the Agency.
- For Other CS-23, The flight test engineer shall have gained a significant amount of flight experience relevant for the task, and must have been trained for flight testing activities.

Pending revision of Part 21 and publication of Part FCL, local regulation may apply (See French Test Crew licensing system)

## Category 2 - NPA 2008-20 says:

- Pilots involved in flight tests of categories 3 and 4 shall comply with the condition established in Part-FCL.
- For CS-25, CS-23 jets and CS-23 Commuters, the flight test engineer must have gained a significant amount of flight experience relevant for the task, and must have been trained for flight testing activities.
- For Other CS-23, as for category 1.

## Category 3 - NPA 2008-20 says:

- A test pilot engaged in categories 3 and 4 of flight testing must hold a valid pilot licence appropriate to the category of aircraft under test issued in accordance with Part-FCL.



# Qualification of pilot and flight test engineer

## Category 4 - NPA 2008-20 says:

- A test pilot engaged in categories 3 and 4 of flight testing must hold a valid **pilot licence** appropriate to the category of aircraft under test issued in accordance with Part-FCL.
- For CS-25, CS-23 jets and CS-23 Commuters, flight crew members must have gained a **significant amount of flight experience relevant to the task**; and have participated in all flights on at least five aircraft up to the issuance of their individual certificate of airworthiness; or - in the case of single-pilot aircraft- have received a detailed briefing on the flight test to be performed; and - in the case of pilots, hold the relevant type or class rating issued in accordance with Part-FCL.
- For Other CS-23, Flight crew members must: have been **appointed by the organisation** performing the flight test; and have been **informed of the change** to type design for which the flight tests are to be undertaken; and in the case of pilots, hold the relevant type or class rating issued in accordance with Part-FCL.



# Qualification of pilot and flight test engineer

## Appointed by the design organisation

- Arrangement with operator
- Contract with pilot and flight test engineer
- Statement of undertaking
- ....

## On the basis of demonstrated competences

- Compliance with national FCL rules
- Justification of experience
- Training

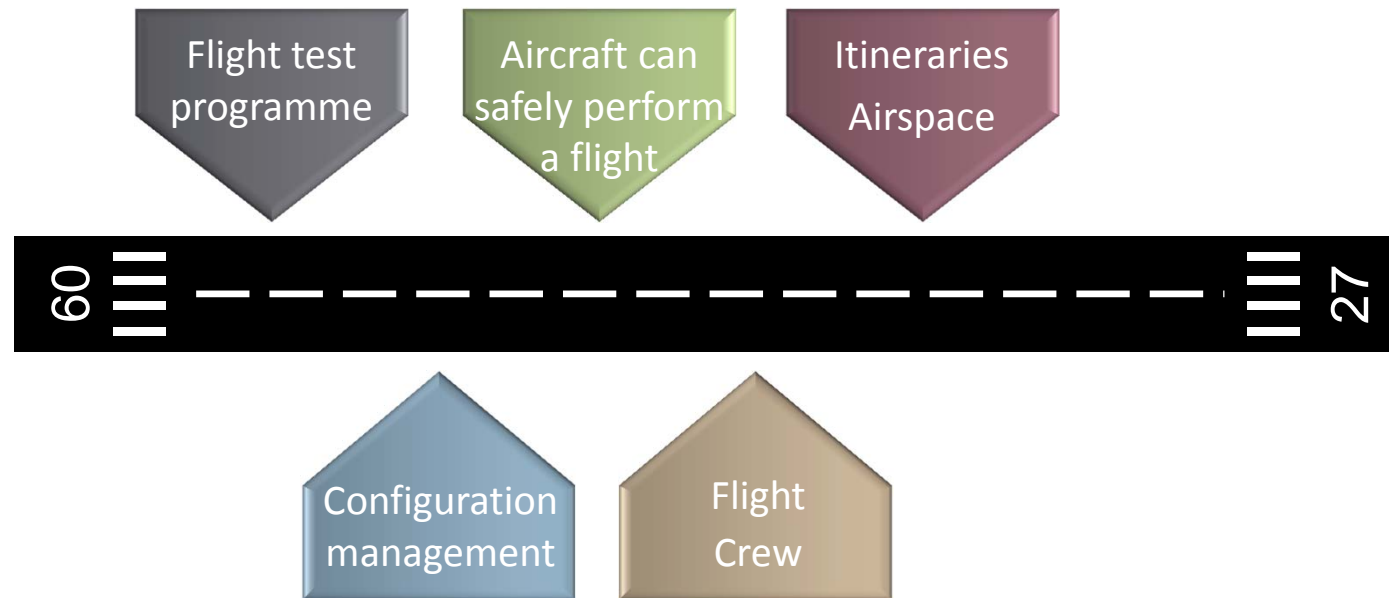
## And be informed about the change

- Technical awareness
- System behaviour simulation on ground
- Safety briefing

**This must be documented in the handbook.**



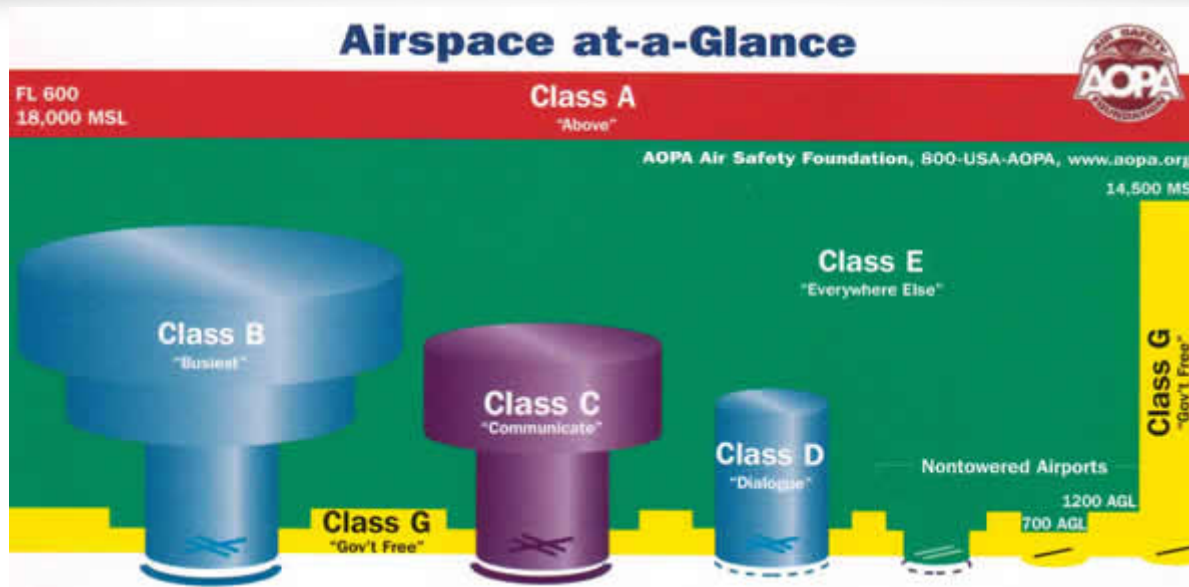
# Itineraries - Airspace



**Even minor modifications can trigger limitations concerning use of airspace.**



# Itineraries - Airspace



## Applicable rules must be specified!

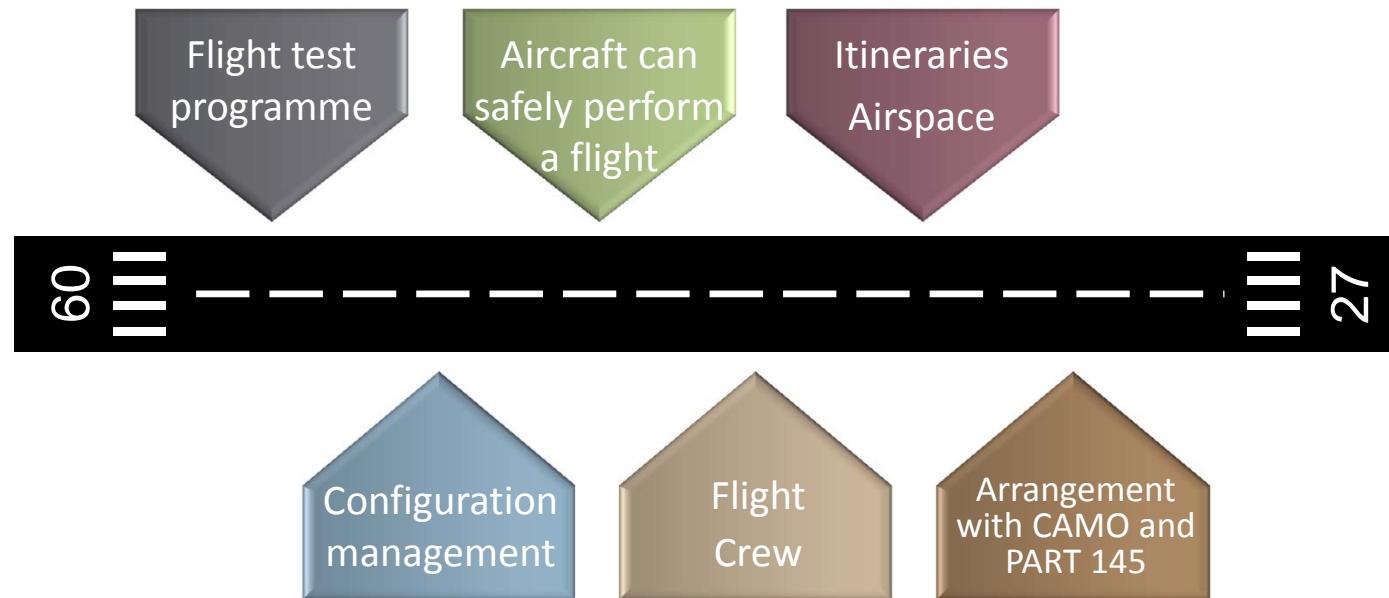
- Airspace and itineraries must be defined in the flight condition with specific limitations if needed.
- Coordination with national aviation authorities is needed.

Some airspace (Class C and D), for example, requires the aircraft to be equipped with a transponder. **If the purpose of the flight is to test a new transponder, can we consider that this aircraft is allowed to penetrate this airspace?**





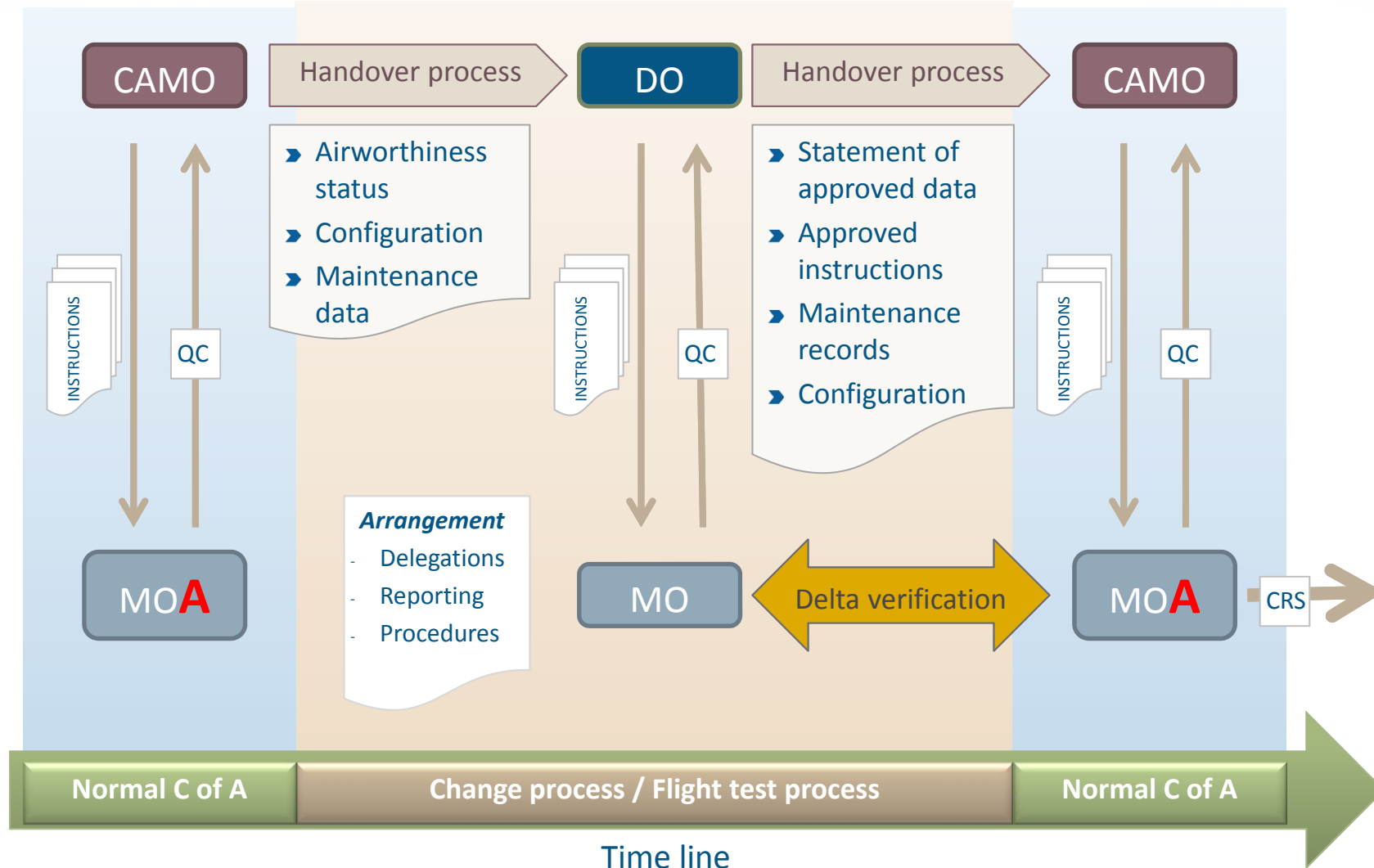
# Arrangement with CAMO and PART 145



**In most of the cases, arrangements with the continuing airworthiness and maintenance organisations are needed. Principle should be documented in the handbook.**

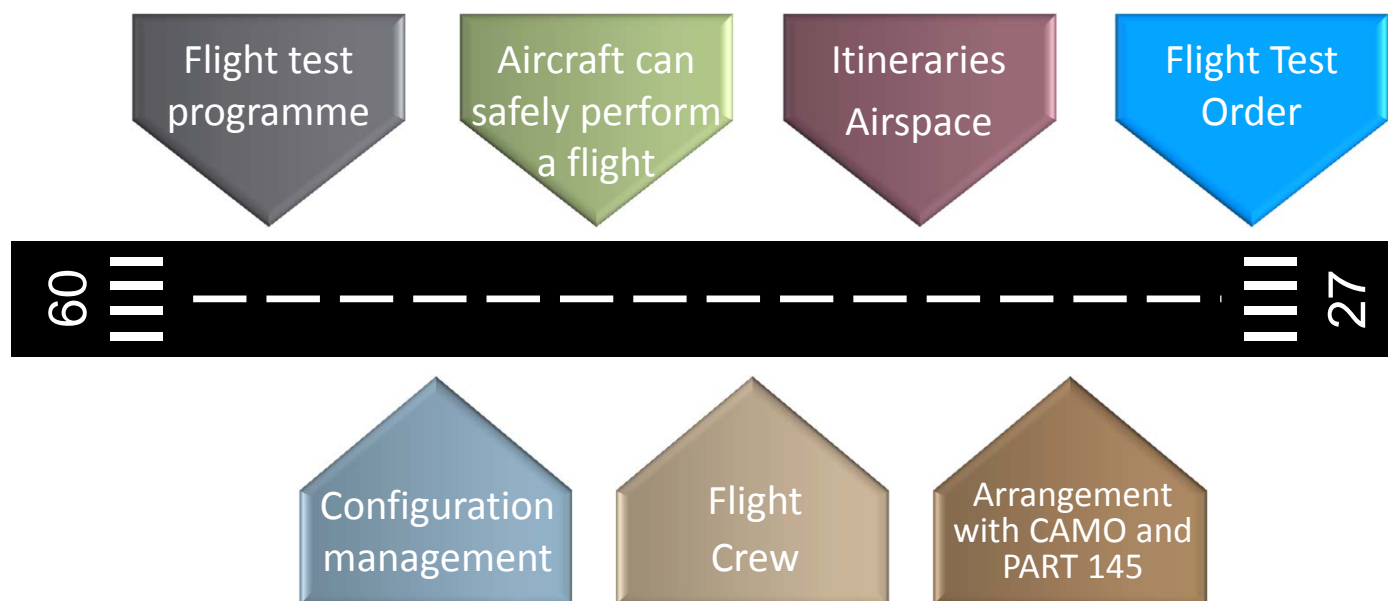


# Arrangement with CAMO and PART M/145





# Flight Test Order –Operational Risk Management



**The flight test order is a subset of the flight test programme, defining the specific conditions and test specifications for one flight.**



# Flight Test Order –Operational Risk Management

- In the context of a test flight, operational risk management is a process leading to the establishment of operational limitations, mitigating the risk associated to each specific test point. These operational limitations should be part of the flight conditions.
- The flight test order should record the final risk level of each test point and the associated mitigation measures.
- Example:
  - Installation of an external pod on a CS23 aircraft with potential impact on stall characteristics;
  - Test point: assess low speed behavior;
  - Risk: Stall, Spin -> consequences: potentially catastrophic;
  - Mitigation: Step by step approach, altitude > xxxx ft.

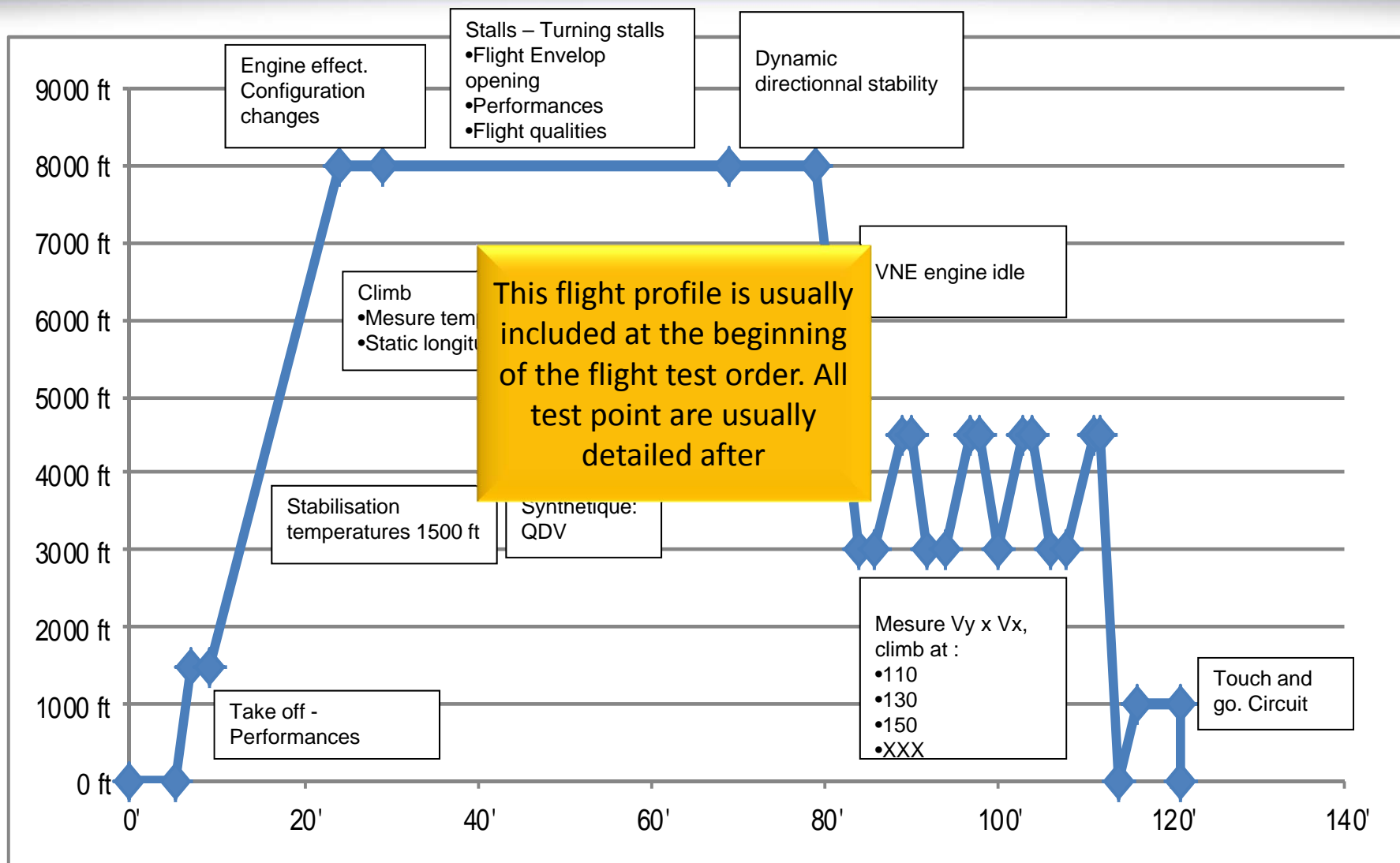


# Flight Test Order –Operational Risk Management

- The flight test order should document:
  - The reason for the flight
  - The aircraft configuration (directly or by reference)
  - All limitations or aircraft particularities to be brought to the attention of the crew
  - **Safety provisions & emergency procedures (see slide 20)**
  - Flight profile (see example next slide)
  - Test specification
  - Communication with the ground (ATC and operations)
- The flight test order should be reviewed during the briefing and signed by authorized signatories (Pilot and FTE)
- In some cases, flight test order is replaced by flight test cards. Both systems are not completely equivalent...
- A Flight Test Order can be used for the approval of flight conditions (Airbus case).



# Flight Test Order –Operational Risk Management



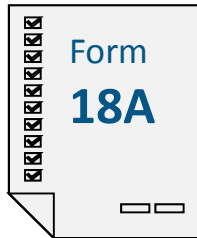


# Approval of Flight Conditions and Permit to Fly

This section aim at showing the relation between the Flight Conditions and Permit to Fly approval processes and the different aspects of the flight test activity presented before. It is also presenting the differences between the Forms to be used, whether DOA privileges are granted or not.

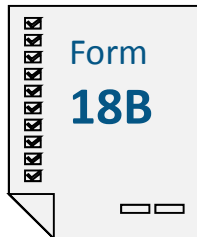


# Form 18B and Form 18A



## **1. Applicant approval nr.**

*[Name and organisation approval number of organisation providing the flight conditions and associated substantiations]*



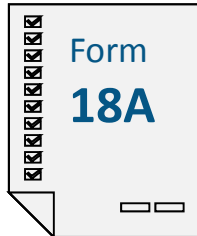
## **1. Applicant**

*[Name of organisation providing the flight conditions and associated substantiations]*





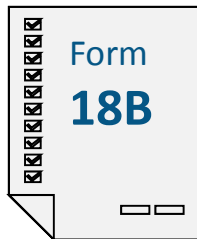
# Form 18B and Form 18A



## 2. Approval form nr.

### Issue:

*[number and issue, for traceability purpose]*



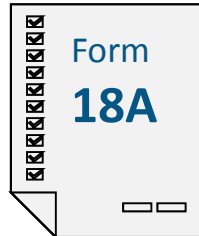
## 2. Approval form nr.

### Issue:

*[number and issue, for traceability purpose]*

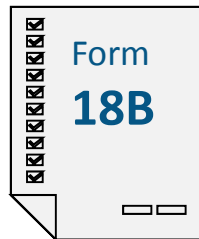


# Form 18B and Form 18A



**3. Aircraft manufacturer/type**

**4. Serial number(s)**

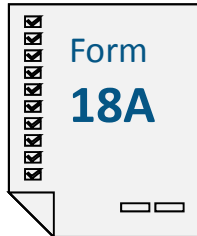


**3. Aircraft manufacturer/type**

**4. Serial number(s)**

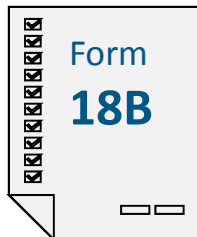


# Form 18B and Form 18A



## 5. Purpose

*[Purpose in accordance with 21A.701(a)]*

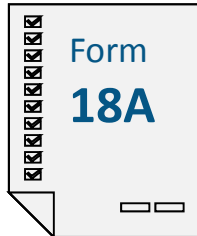


## 5. Purpose

*[Purpose in accordance with 21A.701(a)]*



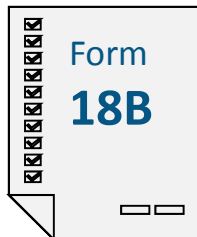
# Form 18B and Form 18A



## 5 6. Aircraft configuration

The above aircraft for which a permit to fly is requested is defined in *[add reference to the document(s) identifying the configuration of the aircraft]*.

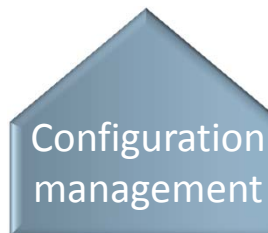
*[For change(s) affecting the initial approval form: description of change(s). This form must be re-issued.]*



## 5 6. Aircraft configuration

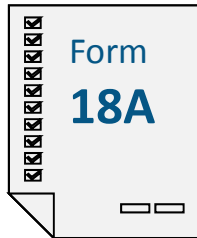
The above aircraft for which a permit to fly is requested is defined in *[add reference to the document(s) identifying the configuration of the aircraft]*.

*[For change(s) affecting the initial approval form: description of change(s). This form must be re-issued.]*





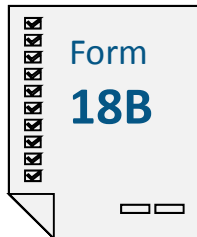
# Form 18B and Form 18A



## 6.7. Substantiations

*[References to the document(s) justifying that the aircraft (as described in 56.) can perform the intended flight(s) safely under the defined conditions or restrictions.]*

*[For change(s) affecting the initial approval form: reference(s) to additional substantiation(s). This form must be re-issued.]*



## 6.7. Substantiations

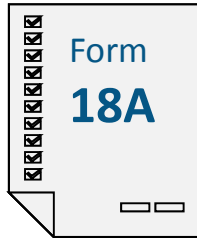
*[References to the document(s) justifying that the aircraft (as described in 56.) can perform the intended flight(s) safely under the defined conditions or restrictions.]*

*[For change(s) affecting the initial approval form: reference(s) to additional substantiation(s). This form must be re-issued.]*

Aircraft can  
safely perform  
a flight



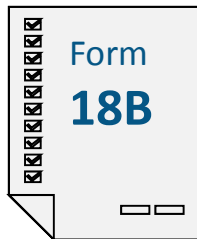
# Form 18B and Form 18A



## 7 8. Conditions/Restrictions

The above aircraft must be used with the following conditions or restrictions:

*[Details of these conditions/restrictions, or reference to relevant document, including specific maintenance instructions and conditions to perform these instructions.]*



## 7 8. Conditions/Restrictions

The above aircraft must be used with the following conditions or restrictions:

*[Details of these conditions/restrictions, or reference to relevant document, including specific maintenance instructions and conditions to perform these instructions.]*

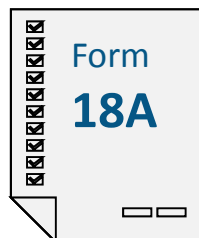
Itineraries  
Airspace

Test Flight  
Crew

Aircraft can  
safely perform  
a flight



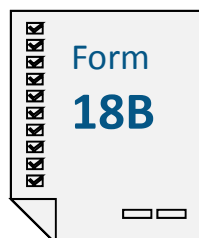
# Form 18B and Form 18A



## § 9. Statement

The determination of the flight conditions has been made in accordance with the relevant DOA procedure agreed by the Agency.

The aircraft as defined in block 6 above has no features and characteristics making it unsafe for the intended operation under the identified conditions and restrictions.



## § 9. Statement

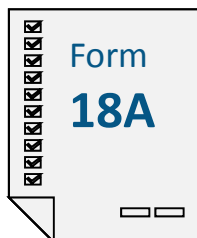
The flight conditions have been established and justified in accordance with 21A.708.

The aircraft as defined in block 6 above has no features and characteristics making it unsafe for the intended operation under the identified conditions and restrictions.





# Form 18B and Form 18A

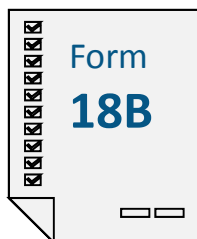


*[strikethrough what is not applicable]*

~~9a~~ **10a.** Approved under the authority of DOA EASA.21J.xyz *[when privilege of 21A.263(c)(6) applies]*

~~9b~~ **10b.** Submitted under the authority of DOA EASA.21J. xyz *[when privilege of 21A.263(c)(6) does not apply]*

Initial flights



*[when approved under a privilege of an approved organisation]*

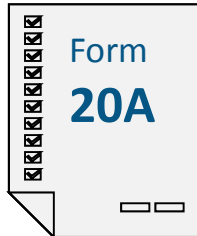
~~9~~ **10.** Approved under [ORGANISATION APPROVAL NUMBER]

POA



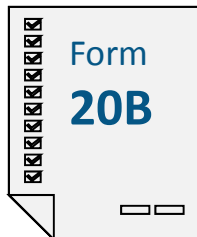


# Form 20 – Permit to Fly



Competent authority logo

9. Signature of the competent authority representative:



Member State of the Competent Authority having issued the organisation approval under which the permit to fly is issued; or

'EASA' when approval issued by EASA

9. Authorised signature:

Name:

Approval Reference No:

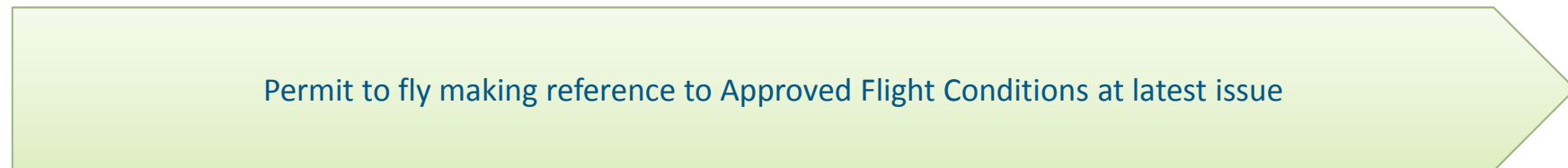
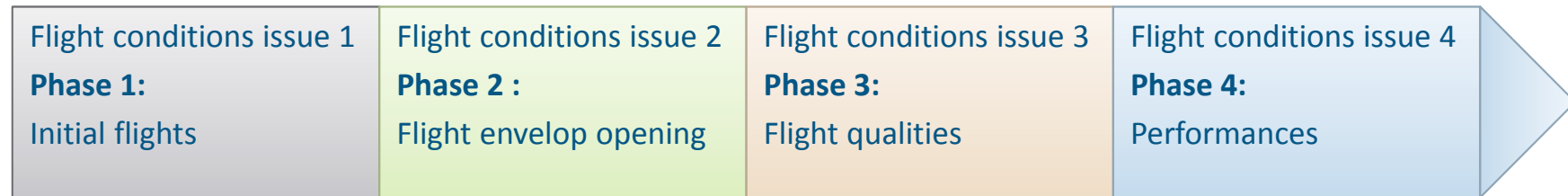


## Permit to fly

- The permit to fly remains valid if compliance with the conditions and restrictions of the FC associated to the permit to fly is demonstrated (21J.723);
- For short flight test campaign, one flight conditions approval can be sufficient;
- For longer flight test campaign, for which configuration and limitations must change as defined in the flight test programme, several flight conditions approval must be obtained (from EASA or through DOA privilege).
- Some organisations may even decide to reapprove flight conditions before each flight (Airbus case).



# Permit to fly



Permit to fly valid until 30/06/2011





EUROPEAN AVIATION SAFETY AGENCY  
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE  
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

Thank you!

<http://intranet/your-intranet-page>

Your safety is our mission.