

Annex to ED Decision 2015/026/R

'AMC/GM to Part-21 — Issue 2, Amendment 4'

Annex I 'Acceptable Means of Compliance and Guidance Material for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations' to ED Decision 2012/020/R of the Executive Director of the Agency of 30 October 2012 is hereby amended as follows:

The text of the amendment is arranged to show deleted text, new or amended text as shown below:

- (a) deleted text is marked with ~~strike through~~;
- (b) new or amended text is highlighted in grey;
- (c) an ellipsis (...) indicates that the remaining text is unchanged in front of or following the reflected amendment.

1. New AMCs are inserted as follows:

AMC to 21.A.143, 21.A.243, 21.A.14(b), 21.A.112B(b) and 21.A.432B(b)

Flight Test Operations Manual (FTOM)

1. General

a. Scope: The FTOM covers flight test operations.

The FTOM complexity should be proportionate to the aircraft and the organisation complexity.

b. Format

The FTOM may:

- be included in the Design Organisation Approval (DOA)/Production Organisation Approval (POA)/Alternative Procedure to DOA (APDOA) documents, or
- be a separate manual.

The FTOM may make reference to other documents to cover the contents listed below, e.g. for record-keeping.

c. Use by contractors or sub-contractors:

When flight tests are performed by contractors or sub-contractors, they should comply with the FTOM of the primary organisations, unless they have established an FTOM in compliance with Part-21, the use of which has been agreed between the two organisations.

2. The FTOM should contain the following elements:

a. Exposition (not applicable in the case of APDOA):

If the FTOM is presented as a separate document, it should include a chart indicating the structure of the organisation and, more specifically, the functional links of the people in charge of flight test activities. It should also mention the coordination between all departments affecting flight test, e.g. Design Office, Production and Maintenance, in particular coordination for the establishment and update of a Flight Test Programme.

b. Risk and safety management:

The FTOM should describe the organisation's policy in relation to risk and safety assessment, mitigation and associated methodologies.

c. Crew members:

According to the flight test category, the FTOM should describe the organisation's policy on the composition of the crew (including the need to use a Lead Flight Test Engineer (LFTE)) and the competency and currency of its flight test crew members, including procedures for appointing crew members for each specific flight.

All crew members should be listed in the FTOM.

A flight time limitation policy should be established.

d. Carriage of persons other than crew members:

According to the flight test category, the FTOM should describe the organisation's policy in relation to the presence and safety on-board, of people other than crew members (i.e. with no flying duties).

People other than crew members should not be allowed on board for Category 1 flight tests.

e. Instruments and equipment:

The FTOM should list, depending on the nature of the flight, the specific safety-related instruments and equipment that should be available on the aircraft or carried by people on board.

The FTOM should contain provisions to allow flights to take place in case of defective or missing instruments or equipment.

f. Documents:

The FTOM should list the documents to be produced for flight test, and include (or refer to) the procedures for their issue, update and follow-up to ensure the documents' configuration control:

(i) documents associated with a Flight Test Programme:

— Flight Order for a given flight, which should include:

- a list of the tests to be performed and associated conditions;
- safety considerations relevant to the flight;
- category of the flight (e.g. Category 1);
- composition of the crew;
- names of persons other than crew members;
- aircraft configuration items relevant to the test to be highlighted to the crew;
- loading of the aircraft;
- reference to approved flight conditions; and
- restrictions relevant to the flight to be highlighted to the crew.

— Flight crew report.

(ii) documentation and information to be carried on the aircraft during flight test;

(iii) record-keeping: the FTOM should describe the policy relative to record-keeping.

g. Permit to fly:

The FTOM should describe the involvement of the flight test organisation or flight test team (as appropriate) in the process for the approval of flight conditions and the issue of permits to fly in accordance with Subpart P.

h. Currency and training:

The FTOM should describe how training for flight test is organised.

Currency of the flight test crew may be ensured either through recent experience or refresher training.

For aircraft for which Appendix XII is applicable, minimum flight experience by year should be:

— for pilots: 50 hours. In addition:

- for pilots with a flight test rating, the 50 hours should include 20 flight test hours in any flight test category.
- for pilots performing a Category 3 flight test, the flight test experience should be expressed in terms of a number of flights leading to the issue of a Certificate of Airworthiness (CofA) (e.g. first flights).
- for pilots performing a Category 4 flight test, the minimum flight test experience should be proportionate to the activity envisaged.

— for LFTEs: 10 flight test hours in any flight test category.

The FTOM should specify the requirements for a refresher training in order to ensure that crew members are sufficiently current to perform the required flight test activity.

2. 2 new GMs to Appendix XII are inserted as follows:

GM No 1 to Appendix XII to Part-21

Lead Flight Test Engineer (LFTE)

LFTEs are Flight Test Engineers (FTEs) that have specific duties and privileges as a flight test crew member, to operate the test aircraft's systems either directly or through dedicated flight test instrumentation, that could significantly interfere with the aircraft basic systems (such as flight controls and engine controls), or that could significantly impact aircraft stability and control (e.g. through weight and balancing flight management or flight control configuration changes). As an example, an LFTE could be permitted to shut down the engines or change the engine parameters through controls which are not accessible to the pilots.

The word 'assisting' (the pilots) should be understood in the sense of the critical actions (e.g. actions described above) which could be performed by the LFTE, if requested by the flight test order and agreed by the pilot-in-command.

Flight test categories

The purpose of this GM is to help operators to:

- determine whether an operation is a flight test; and
- to classify the flight test.

Flight test categories are defined in Appendix XII to Part-21, and are described in this GM in such a manner that an operator who wishes to classify a flight, should first determine whether the flight is defined as a flight test according to the 'General' paragraph. The operator should then determine if the flight test falls within the definition of Category 1 before moving to Category 2 and so on throughout the list until the correct category is determined.

Other types of flights, such as maintenance check flights, are not included in the flights described in this GM and are, therefore, not subject to it.

a) General

The testing of aircraft performance, handling qualities and systems, including checking compliance with Certification Specifications (CSs), requires specialist techniques, skills and theoretical knowledge. Therefore, flight test training and specific experience is required to enable a test crew to:

- safely perform systematic and comprehensive flight envelope exploration;
- acquire specific skills and abilities for some particularly difficult tests;
- mitigate risks by anticipating potentially hazardous situations, and by applying methods that permit the safest flight possible in these situations;
- understand the relevant CSs; and
- learn methods to assess whether the aircraft or its systems comply with these regulations.

It should be noted that the content of the flight test determines its category, and the flight test category determines the required competence of the crew.

Nevertheless,

- flight tests of an aircraft which does not have a Type Certificate (TC) should be considered either as Category 1 or Category 2 flight test until the type has been certified; and
- flight tests for a modification of an already certified type may be Category 1, 2 or 4, depending on the purpose of the test.

The rationale for this difference is the fact that a new aircraft type is considered under continuous assessment until the TC is issued.

Cases where more than one aircraft is involved in a flight test point:

Chase flights are a typical example of flights in which more than one aircraft is involved. Every aircraft participating in the test point(s) should be evaluated through this classification. The guiding principle should be the role of the crew of the chase aircraft in the safety of the aircraft under test or of the formation.

b) Category 1 flight test

Below are examples of flight tests to be considered as Category 1:

- Fixed-wing aircraft: V_{MCG} , V_{MU} , spinning, initial stalling, or for rotary-wing aircraft: H/V diagrams and Category A engine failures.
- Where encounter of surprising or even hazardous flight characteristics can be expected.
- Upon determination, aircraft handling and performance in conditions where at least one of the following parameters is approaching the actual limits of the aircraft envelope: altitude, attitudes, weights, CG, speed/Mach, stalls, temperature, engine and aerofoil performance.
- Where the embodiment of new systems is anticipated to significantly affect the aircraft's handling or performance characteristics.
- When the crew of the chase aircraft has the duty to assist the test aircraft crew in recovering from a critical flight situation (i.e. assist the spinning aircraft crew in assessing the spin or triggering recovery actions).

c) Category 2 flight test

Below are examples of flight tests to be considered as Category 2:

- The flight test envelope has already been opened and it has been demonstrated that the general behaviour of the aircraft is adequately safe and there are no unsafe flight characteristics.
- All-engines-operating climb performance.
- Cruise performance.
- Static stability demonstration.
- Function and reliability flights.
- Systems tests of autopilot or guidance/warning systems such as Terrain Awareness and Warning System (TAWS) or Airborne Collision Avoidance System (ACAS), when the modes themselves are tested, requiring operating the aircraft by deviating from the standard operational procedures. Additionally, in the case of embodiment of such systems on an already certified aircraft, when the system integration in an existing cockpit requires a more global crew procedure assessment — for example, when the system has been integrated in cockpit screens and a centralised

warning system which requires a new cockpit procedure assessment (note that some system tests may fall under Category 4; see below).

d) Category 3 flight test

These flights are commonly referred to as production flight tests. They are performed on each new aircraft of a type that is already certified. The aim is to check that the aircraft and its systems are working properly and conform to the certified type. As the type is already certified, the behaviour of the aircraft is known.

However, experience has shown that during production flight tests of a new aircraft, unexpected failures can occur which could not be described in the Aircraft Flight Manual (AFM). For this reason, it is considered that special experience should be required.

It should be noted that a TC or a Supplemental Type Certificate (STC) should have been issued in order for a production flight test to be considered as Category 3. Until a TC or STC is issued, any flight, including production flight tests, will be Category 1, 2 or 4 according to classification criteria.

It should be noted also that if the flight of an aircraft with a TC or STC requires flying outside the AFM limitations, then this flight should be considered as Category 1 or Category 2 flight.

e) Category 4 flight test

Typical Category 4 flights are those required by a DOA to demonstrate compliance with the airworthiness requirements of 'not yet approved data':

- cabin conversion;
- zonal drying system installation;
- Emergency Locator Transmission (ELT) installation;
- new cabin installation;
- cabin aircraft location pictorial system installation;
- new entertainment system installation;
- SATCOM and telephone installation; and
- new radio equipment installation.

Category 4 includes also flights after embodiment of guidance/warning systems which are not Category 2 and for which:

- good functioning test only is required; and
- there is no need to fly the aircraft outside the AFM limitations.

The modification should not affect the behaviour of the aircraft in any way.

However, there may be modifications whose tests, despite the fact that they have no influence on the behaviour of the aircraft, require flying in conditions which deviate significantly from the standard operational use of the aircraft. These unusual flight test conditions may require classifying the flight as Category 2, as mentioned above. The typical example to consider here is the approval of the modification of an already certified TAWS system. In this situation, it is required to fly at very low

altitude and/or towards high terrain. Such a flight can be classified as Category 4 flight on a light aircraft (or helicopter) because that flight test is performed in a domain corresponding to the normal operation of the aircraft, whereas the same flight performed with a heavy CS-25 aircraft, especially if it needs to be flown in clean configuration significantly below gear and flaps warning heights, should be classified as Category 2 because such a flight does not correspond to the normal use of the aircraft and needs to adopt specific testing procedures as demonstrated in the Category 2 training.

GM No. 2 to Appendix XII to Part-21

Competence and experience of pilots for Category 3 and Category 4 flight tests and of Lead Flight Test Engineers (LFTEs)

Definition of similar 'complexity and characteristics':

Similar 'complexity and characteristics' for aircraft can normally be assumed for aircraft of the same category and in the same class, and certified under the same CSs, e.g. CS-23/CS-25. However, it could be considered that aircraft certified under different CSs but having small difference in weight and operating procedure (e.g. Citation 525/Citation 550, 560) have similar complexity and characteristics.

Flight experience of LFTEs:

The flight experience includes experience as a crew member in flight tests or other flights (e.g. flights as a student pilot or with a pilot licence).

3. 2 new AMCs to Appendix XII to Part-21 are inserted as follows:

AMC No. 1

Training courses for Lead Flight Test Engineers (LFTEs)

GENERAL

1. Competency-based training

- 1.1. LFTE training courses should be competency-based. The training programme should, as much as possible, follow the syllabus outlined below, but may be adapted taking into account the previous experience, skills and theoretical knowledge level of the students.
- 1.2. It should also be recognised that the syllabus below assume that suitable flight test experience will be gained subsequent to course attendance. Should the student be significantly experienced already, then consideration should be made of that experience and it is possible that the course content might be reduced in areas where that experience has been gained.
- 1.3. Furthermore, it should be noted that LFTE courses are generally specific both to a certain category of aircraft (aeroplanes or helicopters) and to a certain category of flight test (Category 1 or 2). Therefore, an LFTE wishing to extend their privileges to further categories of aircraft or to further categories of flight test (this is only relevant for someone having already undertaken

a Category 2 course) should not be requested to undertake the same course as an 'ab initio applicant'. In these cases, the organisation providing the training should develop specific 'bridge courses' taking into account the same principles mentioned above. Additionally, where applicable, if the training courses do not include instruction on a CS-25 or CS-29 (or equivalent airworthiness codes) aircraft, the instruction differences for a LFTE with duties on a CS-23 or CS-27 aircraft wishing to extend their privileges to a CS-25 or CS-29 (respectively) aircraft, should be addressed. If needed, bridge courses should be developed, taking into account the principles above.

- 1.4. To allow proper consideration of the student's previous experience, a pre-entry assessment of the student's skills should be undertaken on the basis of which the organisation providing the training may evaluate the level of the applicant in order to better tailor the course. Consequently, the syllabi listed below should be regarded as a list of individual demonstrable competencies and qualifications rather than a list of mandatory training objectives.

2. Continuous evaluation

- 2.1. Training courses should be built on a continuous evaluation model in order to ensure that successful completion of the course ensures that the student has reached the level of competence (both theoretical and practical) necessary to carry on their functions.

COURSE CONTENT

3. In addition, the content of the course should vary taking into account whether the student wants to undertake a Category 1 or Category 2 flight test, as well as the relevant category of aircraft, and their level of complexity. In order to better take these factors into account, LFTE training courses have been divided into levels similar to those for the pilot flight test rating.

3.1 Competence Level 1 courses apply to Category 1 flight tests on:

- a. helicopters certified in accordance with the standards of CS-27 or CS-29 or equivalent airworthiness codes;
- b. aeroplanes certified in accordance with:
 - (i) the standards of CS-25 or equivalent airworthiness codes; or
 - (ii) the standards of CS-23 or equivalent airworthiness codes within the commuter category or having a design diving speed (MD) above 0,6 or a maximum ceiling above 25 000 ft.

3.2 Competence Level 2 courses apply to:

- a. Category 2 flight tests for:
 - (i) helicopters certified in accordance with the standards of CS-27 or CS-29 or equivalent airworthiness codes;
 - (ii) aeroplanes certified in accordance with:
 - the standards of CS-25 or equivalent airworthiness codes; or
 - the standards of CS-23 or equivalent airworthiness codes (including those mentioned in 3.1.b.(ii)), except for aeroplanes with a maximum take-off mass of less than 2 000 kg.

- b. Category 1 flight tests for aeroplanes certified in accordance with the standards of CS-23, with a maximum take-off mass of 2 000 kg or above, with the exclusion of those mentioned in 3.1.b.(ii) (which are subject to competence Level 1 courses).

AEROPLANES

4. Competence Level 1 courses for aeroplanes

4.1. These courses should include approximately:

- a. 350 hours of ground training; and
- b. 60 hours of flight training, during which at least 10 flights should be made without an FTE tutor on board (i.e. unsupervised).
- c. Principles of test management and risk and safety management should be integrated throughout the course. In addition, principles and methods applicable to the certification activity and safety assessments should be taught. A review of the principles of Crew Resource Management (CRM) tailored to the flight test environment should be included.

4.2. These courses should include instruction on at least six different aircraft types, of which, for LFTE duties on CS-25 aircraft, at least one should be certified in accordance with CS-25 standards or equivalent airworthiness codes.

4.3. During the course, the student should be required to develop at least five substantial flight test reports.

4.4. The student should be evaluated through examinations on all of the theoretical knowledge subjects, and should undertake a final in-flight test upon completion of the syllabus.

4.5. Syllabus. The following subjects should be covered in the course:

COMPETENCE LEVEL 1 — AEROPLANES		
Theoretical knowledge	<ul style="list-style-type: none"> — Aerodynamics — Stability and control/handling qualities — Engines and performance — Measurements and flight test instrumentation (including telemetry) — Human factors 	
Flight test techniques and flight training	Performance (at least one flight test report should be developed)	<ul style="list-style-type: none"> — Airspeed calibration — Climb multi-engine — Take-off and landing, including turboprop/turbofan one-engine-inoperative (OEI) — Level flight performance
	Engines	<ul style="list-style-type: none"> — Turboprop/turbofan limitations and relight envelope
	Handling qualities (at least two flight test reports should be developed)	<ul style="list-style-type: none"> — Flight controls characteristics — Longitudinal handling qualities — Longitudinal manoeuvre stability

		<ul style="list-style-type: none"> – Take-off and landing multi-turboprop/turbofan, including Vmcg and Vmu – Lateral-directional handling qualities – Handling qualities evaluation – Variable stability demo flights including High-Order Flight Control Systems (HOFCs) – Stalls – Spins – Vmca
	Systems (at least one flight test report should be developed)	At least three different systems, for example: <ul style="list-style-type: none"> – Autopilot/Automatic Flight Control System (AFCS) – Glass cockpit evaluation – Radio navigation, instruments qualification and integrated avionics – Enhanced Ground Proximity Warning System (EGPWS) – ACAS
	High-speed certification test	
	Final evaluation exercise (a flight test report should be developed)	

5. Competence Level 2 courses for aeroplanes

5.1. These courses should include approximately:

- a. 150 hours of ground training; and
- b. 30 hours of flight training, during which at least 6 flights should be made without an FTE tutor on board (i.e. unsupervised).
- c. Principles of test management and risk and safety management should be integrated throughout the course. In addition, principles and methods applicable to the certification activity and safety assessments should be taught. A review of the principles of CRM tailored to the flight test environment should be included.

5.2. These courses should include instruction on at least five different aircraft types, of which, for LFTE duties on CS-25 aircraft, at least one should be certified in accordance with CS-25 standards or equivalent airworthiness codes.

5.3. During the course, the student should be required to develop at least three substantial flight test reports.

5.4. The student should be evaluated through examinations on all of the theoretical knowledge subjects, and should undertake a final in-flight test upon completion of the syllabus.

5.5. Syllabus. The following subjects should be covered in the course:

COMPETENCE LEVEL 2 — AEROPLANES		
Theoretical knowledge	<ul style="list-style-type: none"> — Aerodynamics — Stability and control/handling qualities — Engines and performance — Measurements and flight test instrumentation (including telemetry) — Human factors 	
Flight test techniques and flight training	Performance (at least one flight test report should be developed)	<ul style="list-style-type: none"> — Airspeed calibration — Climb multi-engine — Take-off and landing multi-turboprop/turbofan — Level flight performance
	Handling qualities	<ul style="list-style-type: none"> — Flight control characteristics — Longitudinal static/dynamic stability and control/handling qualities — Lateral-directional stability and control/handling qualities — Stalls — Spins
	Systems (at least one flight test report should be developed)	At least three different systems, for example: <ul style="list-style-type: none"> — Autopilot/AFCS — Glass cockpit evaluation — Radio navigation, instruments qualification and integrated avionics — EGPWS — ACAS
	Final evaluation exercise (a flight test report should be developed)	

HELICOPTERS

6. Competence Level 1 courses for helicopters

6.1. These courses should include approximately:

- a. 350 hours of ground training; and
- b. 60 hours of flight training, during which at least 15 flights should be made without an FTE tutor on board (i.e. unsupervised).
- c. Principles of test management and risk and safety management should be integrated throughout the course. In addition, principles and methods applicable to the certification activity and safety assessments should be taught. A review of the principles of CRM tailored to the flight test environment should be included.

6.2. These courses should include instruction on at least six different aircraft types, of which, for LFTE duties on CS-29 rotorcraft, at least one should be certified in accordance with CS-29 standards or equivalent airworthiness codes.

6.3. During the course, the student should be required to develop at least five substantial flight test reports.

6.4. The student should be evaluated through examinations on all of the theoretical knowledge subjects, and should undertake a final in-flight test upon completion of the syllabus.

6.5. Syllabus. The following subjects should be covered in the course:

COMPETENCE LEVEL 1 — HELICOPTERS		
Theoretical knowledge	<ul style="list-style-type: none"> — Aerodynamics — Stability and control/handling qualities — Engines and performance — Measurements and flight test instrumentation (including telemetry) — Human factors 	
Flight test techniques and flight training	Performance (at least one flight test report should be developed)	<ul style="list-style-type: none"> — Airspeed calibration — Level flight, climb and descent, vertical and hover performance
	Engines	<ul style="list-style-type: none"> — Digital engine governing — Turbine/piston engine evaluation
	Handling qualities (at least one flight test report should be developed)	<ul style="list-style-type: none"> — Flight control characteristics — Longitudinal static/dynamic stability and control/handling qualities — Lateral-directional stability and control/handling qualities — ADS 33 — Rotor assessment with different control powers — Variable stability demo flights including High-Order Flight Control Systems (HOFCs)
	Systems (at least one flight test report should be developed)	At least three different systems, for example: <ul style="list-style-type: none"> — Navigation management systems — Auto-pilot/AFCS — Night-vision goggles/electro-optics — Glass cockpit evaluation
	Height/velocity envelope and Engine-Off Landings (EOL), including relights	
	Category A procedure	
	Vibrations and rotor adjustments	
Autorotations		
Final evaluation exercise (a flight test report should be developed)		

7. Competence Level 2 courses for helicopters.

7.1. These courses should include approximately:

- a. 150 hours of ground training; and
- b. 30 hours of flight training, during which at least 6 flights should be made without an FTE tutor on board (i.e. unsupervised);
- c. Principles of test management and risk and safety management should be integrated throughout the course. In addition, principles and methods applicable to the certification activity and safety assessments should be taught. A review of the principles of CRM tailored to the flight test environment should be included.

7.2. These courses should include instruction on at least four different aircraft types, of which, for LFTE duties on CS-29 rotorcraft, at least one should be certified in accordance with CS-29 standards or equivalent airworthiness codes.

7.3. During the course, the student should be required to develop at least three substantial flight test reports.

7.4. The student should be evaluated through examinations on all of the theoretical knowledge subjects, and should undertake a final in-flight test upon completion of the syllabus.

7.5. Syllabus. The following subjects should be covered in the course:

COMPETENCE LEVEL 2 — HELICOPTERS		
Theoretical knowledge	<ul style="list-style-type: none"> — Aerodynamics — Stability and control/handling qualities — Engines and performance — Measurements and flight test instrumentation (including telemetry) — Human factors 	
Flight test techniques and flight training	Performance (at least one flight test report should be developed)	<ul style="list-style-type: none"> — Airspeed calibration — Level flight, climb and descent, vertical and hover performance
	Engines	<ul style="list-style-type: none"> — Digital engines governing — Turbine/piston engine evaluation
	Handling qualities	<ul style="list-style-type: none"> — Flight control characteristics — Longitudinal static/dynamic stability and control/handling qualities — Lateral-directional stability and control/handling qualities
	Systems (at least one flight test report should be developed)	<p>At least three different systems, for example:</p> <ul style="list-style-type: none"> — Navigation management systems — Auto-pilot/AFCS — Night-vision goggles/electro-optics

		— Glass cockpit evaluation
	Vibration and rotor adjustments	
	Final evaluation exercise (a flight test report should be developed)	

AMC No. 2**Conditions for appointment of Lead Flight Test Engineers (LFTEs) — Medical fitness**

1. Before the organisation issues an authorisation for an LFTE, the LFTE should undergo an initial medical examination and assessment. Afterwards, the LFTE should be regularly (typically every 2 years) reassessed to ensure that they will remain physically and mentally fit to safely discharge their duties. These examinations and assessments should take due account of the actual flight environment of the intended flight test activity.
2. Any medical examination or assessment should be carried out according to best aero-medical practice by an aero-medical practitioner who has sufficient, detailed knowledge of the applicant's medical history.
3. The organisation should maintain a record of medical fitness for each LFTE.
4. These assessments should attest that the LFTE:
 - a. is in good health;
 - b. is free from any physical or mental illness which might lead to incapacitation or inability to perform crew duties;
 - c. has normal cardiorespiratory function;
 - d. has normal central nervous system;
 - e. has adequate visual acuity 6/9 with or without glasses;
 - f. has adequate hearing; and
 - g. has normal function of ear, nose and throat.
5. If the LFTE holds a Class 1 or Class 2 medical certificate issued in accordance with Part-MED, the assessment or examination is not necessary.