FAI Sporting Code

Fédération Aéronautique Internationale

Section 14 - Electrically-powered Aeroplanes

Class CE - Electrically-powered Aeroplanes

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To take effect on . . .

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FEDERATION AERONAUTIQUE INTERNATIONALE
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i FAI Statutes, Chapter 1, para. 1.6
ii FAI Sporting Code, General Section, Chapter 3, para 3.1.3.
iii FAI Statutes, Chapter 1, para 1.8.1
iv FAI Statutes, Chapter 5, para 5.1.1.2; 5.5; 5.6 and 5.6.1.6
v FAI Bylaws, Chapter 1, para 1.2.1
vi FAI Statutes, Chapter 2, para 2.3.2.2.5
vii FAI Bylaws, Chapter 1, para 1.2.3
viii FAI Statutes, Chapter 5, para 5.1.1.2; 5.5; 5.6, 5.6.1.6
ix FAI Sporting Code, General Section, Chapter 3, para 3.1.7
x FAI Sporting Code, General Section, Chapter 1, paras 1.2. and 1.4
xi FAI Statutes, Chapter 5, para 5.6.3
xii FAI Bylaws, Chapter 1, para 1.2.2

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FAI Sporting Code

Section 14 - Electrically-Powered Aeroplanes

The FAI Sporting Code for Electrically-powered Aeroplanes (the "Code") sets out the rules and procedures to be used to verify Electrically-powered Aeroplanes (EpA) flight performances. The essence of these rules is to ensure that an EpA flight performance is achieved to a level of proof that is consistent for all flights. When processing the evidence supplied, Official Observers (OO) and the National Airsport Control (NAC) should ensure that these rules are applied in the spirit of fair play and competition.

In this Code, a word or phrase appearing in small capital letters within the text of a chapter indicates that it has a distinct definition as it applies to the Code. In subsequent chapters the capitalisation is not used for these words or phrases.

References outside a chapter are by paragraph number.

Text in italic is informational in nature and not part of the rules and regulations of the Code.

Amendment list (AL) record

Formal amendments are published by the FAI Secretariat. Within nations, the organisation responsible for National Airsport Control (NAC) for EpA is then responsible for distributing amendments to all holders of Section 14 of the Sporting Code (SC14). This amendment list is for SC14 only - separate lists exist for the annexes to SC14.

When amendments have been made to the text of the Code, a copy of the amendment list instructions should be inserted after this page so that, at a later date, the subjects of the amendment may be easily identified. Alternatively, users may download the amended Code from the document page of the FAI web site.

The latest amendments are indicated by a vertical line to the right of any paragraph that has been changed, as shown here.

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GLOSSARY OF TERMS and ABBREVIATIONS

This section amplifies a number of terms that are used in the main text and gives some generally accepted definitions and abbreviations relevant to air sports.

- Geodesic - a line on the surface of an ellipsoid, the shortest distance between two points on the surface of the ellipsoid.
- EpA - Electrically-powered Aeroplanes
- GS - General Section of the FAI Sporting Code
- FR - Flight Recorder
- MoP - Method of Propulsion
- OO - Official Observer
- SoE - Source of Energy
- WP - Way Point

CHAPTER 1

GENERAL RULES and DEFINITIONS

1.0 GENERAL

1.0.1 The General Section (GS) of the Sporting Code contains general definitions and rules applying to all air sports. This Section (Sec 14) gives specific rules that apply to Electrically-powered Aeroplanes (EpA) (GS 1.4 Class CE).

The maturity of this kind of aeroplane is still limited. For this reason, for the time being, this document deals mainly with rules for records attempts and not with competitions.

1.0.2 Terms, rules, and requirements are defined first in a general sense. More detail is described in later paragraphs.

1.0.3 AIRCRAFT: A vehicle that can be sustained in the atmosphere by forces exerted on it by the air (GS 2.2.1.).

1.0.4 AERODYNE: A heavier-than-air aircraft which derives its lift in flight mainly from aerodynamic forces (GS 2.2.1.).

1.0.5 AEROPLANE: A fixed wing aerodyne with means of propulsion (GS 2.2.1.3).

1.0.6 ELECTRICALLY-POWERED AEROPLANE (EpA): An aeroplane (GS 2.2.1.3) powered solely by an electrical motor.

1.0.7 METHOD OF PROPULSION/SOURCE OF ENERGY (MoP/SoE): During the claimed flight performance, Electrically-powered Aeroplanes can make use of the electric energy stored before flight within their on-board energy storage system or generated in flight .

Depending on the technology adopted for on-board storing or generating electrical energy, the following EpA sub classes apply:

- ELECTRICALLY-POWERED AEROPLANE Battery Operated : an EpA the electrical motor/s of which is/are fed by electrical energy stored into electrical batteries only.
- ELECTRICALLY-POWERED AEROPLANE Fuel Cells Operated :an EpA the electrical motor/s of which is/are (directly or via intermediate storage systems) fed by electrical energy totally supplied by on-board fuel cells

1.1 DEFINITION of FLIGHT TERMS

1.1.1 EpA FLIGHT PERFORMANCE: The performance during that portion of an EpA flight from the START POINT to the FINISH POINT.

1.1.2 WAY POINT: A precisely specified point or point feature on the surface of the earth using a words description and/or a set of coordinates. A WAY POINT may be a START POINT, a TURN POINT, or a FINISH POINT and has an associated OBSERVATION ZONE.

1.1.3 LEG: The portion of a flight between two successive WAY POINTS.

1.1.4 COURSE: The line joining all successive WAY POINTS of an EpA FLIGHT PERFORMANCE.

1.1.5 OBSERVATION ZONE: The area over which an EpA must pass to verify that a WAY POINT has been reached (see 3.6.2.c). It is a 90 degree sector, having no upper limit, with its apex at the WAY POINT. This sector is:

a. For a TURN POINT, symmetrical to and remote from the bisector of the inbound and outbound LEGS of the TURN POINT,
b. For a START POINT, symmetrical to and remote from the outbound LEG,
c. For a FINISH POINT, symmetrical to and remote from the inbound LEG.

1.1.6 START: The beginning of the EpA FLIGHT PERFORMANCE. It must be either:

a. Leaving the OBSERVATION ZONE of a START POINT, or
b. Crossing a START LINE.

1.1.7 START POINT: The WAY POINT marking the start of an EpA FLIGHT PERFORMANCE. It must be either:

a. A WAY POINT declared as a START POINT, or
b. The midpoint of a START LINE.

1.1.8 START LINE: A horizontal line one kilometer in length, oriented approximately perpendicular to the first LEG. The midpoint of the line (the START POINT) is at ground level.

1.1.9 TURN POINT: A WAY POINT between two LEGS of a flight.

1.1.10 FINISH: The end of the EpA FLIGHT PERFORMANCE. It must be accomplished by:

a. Landing the EpA, or
b. The EpA entering the OBSERVATION ZONE of the FINISH POINT, or
c. Crossing a FINISH LINE,

1.1.11 FINISH POINT: The WAY POINT marking the end of an EpA FLIGHT PERFORMANCE. It is:

a. The point at which the nose of the EpA comes to rest after landing, or
b. A WAY POINT declared as the FINISH POINT, or
c. The midpoint of a FINISH LINE

1.1.12 FINISH LINE: A horizontal line one kilometer in length, oriented approximately perpendicular to the final LEG. The midpoint of the line (the FINISH POINT) is at ground level.

1.2 DEFINITION of EpA FLIGHT PERFORMANCE MEASUREMENT TERMS

Depending upon the type of flight, the following parameters may be determined to assess an EpA FLIGHT PERFORMANCE. The requirements for gathering flight measurements and the precision of measurement are given in Chapter 3.

1.2.1 OFFICIAL DISTANCE: The length of the COURSE in the sequence of the LEGS used, minus any applicable DISTANCE PENALTY (1.2.9).

1.2.2 START TIME: The time that the EpA FLIGHT PERFORMANCE starts.

1.2.3 START ALTITUDE: The altitude of the EpA above sea level at the START.

1.2.4 MAXIMUM ALTITUDE: The maximum altitude above sea level acquired by the EpA during the relevant flight section.

1.2.5 MINIMUM ALTITUDE: The minimum altitude above see level acquired by the EpA during the relevant flight section.

1.2.6 FINISH TIME: The time that the EpA FLIGHT PERFORMANCE finishes.

1.2.7 FINISH ALTITUDE: The altitude of the EpA above sea level at the FINISH.

1.2.8 DURATION: The time elapsed between the START TIME and the FINISH TIME.

1.2.9 LOSS OF HEIGHT: The START ALTITUDE minus the FINISH ALTITUDE (see also 1.4.3.1).

1.2.10 GAIN OF HEIGHT: The difference between the MAXIMUM ALTITUDE and a (previous) MINIMUM ALTITUDE during the EpA FLIGHT PERFORMANCE.

1.2.11 DISTANCE PENALTY FOR LOSS OF HEIGHT: A distance equal to 100 times the excess over 1000 meters LOSS OF HEIGHT. (See 3.4.2 for how the penalty is applied.)

1.3 OTHER DEFINITIONS

1.3.1 OFFICIAL OBSERVER: The Official Observer (OO) is the person who has the official control of flights undertaken for FAI record attempts and of the data gathered to prove a EpA FLIGHT PERFORMANCE (see Chapter 4).

1.3.2 DECLARATION: The official description of the task and other data as listed and defined in 3.2.

1.3.3 BAROGRAPH: A recording device measuring external air pressure.

1.3.4 BAROGRAM: The trace, recording, or electronic data output of a BAROGRAPH.

1.3.5 FLIGHT RECORDER: An electronic device which has been approved by the CIACA to record data, including position and altitude, during a flight (such as a GNSS flight recorder).

1.3.6 GEODESIC: (Also geodesic line and geodesic distance.) The shortest distance between two points on the surface of an ellipsoidal world model. See also 3.4.1 and annex C Appendix 2.

1.4 TYPES of EpA FLIGHT PERFORMANCES

1.4.1 General requirements

a. An EpA FLIGHT PERFORMANCE may be claimed for
   - absolute altitude
   - duration
   - distance
   - speed
   - speed around the world
b. An EpA FLIGHT PERFORMANCE may be claimed from any flight which meets the requirements of proof for that performance.
c. A PRE-FLIGHT COURSE DECLARATION is required except where specifically not required in the rules, such as for altitude and duration performances and for "free flight" records where WAY POINTS may be selected after flight.
d. WAY POINTS must be used in the sequence declared except where specifically not required in the rules.

1.4.2 Altitude and duration performances No PRE-FLIGHT COURSE DECLARATION is required. For altitude performances, pressure altitude to the ICAO ISA shall be used for measurement.

a. GAIN OF HEIGHT. An EpA PERFORMANCE measured for the difference in altitude between a minimum altitude point and a later maximum altitude point.
b. ABSOLUTE ALTITUDE: A EpA PERFORMANCE measured for maximum altitude achieved. An absolute altitude performance is valid only if preceded by a GAIN OF HEIGHT of at least 5000 meters.
c. DURATION: An EpA FLIGHT PERFORMANCE measured for time DURATION between a START POINT and a FINISH POINT.

1.4.3 Distance performance An EpA PERFORMANCE measured for the distances as specified below. The WAY POINT(S) of distance record flight must be declared preflight. The three distance record types are:

a. STRAIGHT DISTANCE: A flight from a START POINT to a FINISH POINT with no TURN POINTS.
b. OUT AND RETURN DISTANCE: A CLOSED COURSE flight having one TURN POINT.
c. DISTANCE ALONG A COURSE: A flight from a START POINT via up to three TURN POINTS to a FINISH POINT. The TURN POINTS must be at least 50 kilometers apart.

1.4.3.1 Loss of height penalty for distance flights

a. For distance flights of more than 100 kilometers, where the LOSS OF HEIGHT (1.2.9) exceeds 1000 meters, a DISTANCE PENALTY (1.2.11) must be subtracted from the length of the COURSE to give the OFFICIAL DISTANCE.
b. For distance flights of 100 kilometers or less, a LOSS OF HEIGHT exceeding 1% of the length of the COURSE will invalidate the FLIGHT PERFORMANCE.
c. For duration flight a LOSS OF HEIGHT exceeding 1000 meters will invalidate the FLIGHT PERFORMANCE.

1.4.4 Speed The following two performances are considered for Speed Records:

1.4.4.1 Speed Over a 3 Kilometer Course

The objective of this record task is to achieve the greatest average speed over a 3,000 meter COURSE.

a. The course shall be approved or declared in writing prior to takeoff.
b. All the following requirements shall be met:
   - the COURSE shall be a minimum of 3,000 meters in length;
   - the COURSE shall have defined start and finish straight corridors of at least 1,000 meters in length,
   - the COURSE and its corridors shall have a maximum width of 200 meters.
c. The FLIGHT PERFORMANCE shall be flown as two consecutive runs over the COURSE, in opposite directions.
d. The FLIGHT PERFORMANCE begins at the START POINT and ends at the FINISH POINT.
e. The FINISH ALTITUDE of each run shall not be lower than the START ALTITUDE.
f. The AEROPLANE shall not descend more than 100 meters and not climb more than 100 meters between the the START POINT and the FINISH POINT.
g. The FLIGHT PERFORMANCE shall be completed within 30 minutes.
h. The achieved speed shall be the average speed of the two individual runs.

i. The speed measurement shall be accomplished by timing each run using synchronized timing devices to determine START TIME and the FINISH TIME. The elapsed time is the difference between the FINISH TIME and the START TIME. The course length shall be divided by the elapsed time to determine the speed for each run.
j. The AEROPLANE shall not land during the FLIGHT PERFORMANCE.

1.4.4.2 Speed over a 15 Kilometer Course

The objective of this record task is to achieve the greatest average speed over a 15,000 meter COURSE.

a. The COURSE shall be approved or declared in writing prior to takeoff.
b. The following requirements shall be met:
   - the COURSE shall be a minimum of 15,000 meters in length and
   - the COURSE shall have defined start and finish straight corridors of at least 1,000 meters,
   - the COURSE and its approach courses shall have a maximum width of 1000 meters.
c. The FLIGHT PERFORMANCE shall be flown as two consecutive runs over the COURSE, in opposite directions.
d. The FLIGHT PERFORMANCE begins at the START POINT and ends at the FINISH POINT. The FINISH ALTITUDE of each run shall not be lower than the START ALTITUDE.
e. The AEROPLANE shall not descend more than 500 meters and not climb more than 500 meters between the the START POINT and the FINISH POINT.
f. The second run shall start within 30 minutes from completion of the first run.
g. The achieved speed shall be the average speed of the two individual runs.
h. The speed measurement shall be accomplished by timing each run using synchronized timing devices to determine the START TIME and the FINISH TIME. The elapsed time is the difference between the FINISH TIME and the START TIME. The course length shall be divided by the elapsed time to determine the speed for each run.
i. The AEROPLANE shall not land during the FLIGHT PERFORMANCE.

1.4.5 Speed around the World The COURSE, including suitable control points (to be dealt with as WAY POINTS), shall be approved in advance by the NAC's concerned (Control points shall be chosen from a pre-defined list of possible WAY POINTS). It must start and finish at the same aerodrome, crossing all meridians. The length of the COURSE shall not be less than 36,787.559 kilometers (equal in length to the Tropic of Cancer).

All control points must be at latitude of less than 66° 33' (outside the North and South Frigid Zones).

If, for any reason, the final landing cannot be made at the aerodrome of departure, the AEROPLANE may fly to an alternate landing place, provided that a satisfactory photograph taken from within the observation zone of the final landing be produced, in accordance with

the rules for photographic evidence 3.6.2.bii. Intermediate landing places shall coincide with the subsequent take-off place. Any time spent on the ground between start and finish shall be counted as flying time. Repairs or replacements of AEROPLANE components and propulsion motor(s) are permitted except that the wings and fuselage may not be changed.

Pilot(s) may not be changed during the attempt. In the case that pilots change along the performance, another kind of record can be attributed to the specific aeroplane "team".

The START TIME shall be the time of intial take-off; the FINISH TIME shall be the time of final landing.

1.5 Night flight

In the case of a flight which continues beyond the hours of legal daylight in the country concerned the Electrically-powered Aeroplane and pilot shall comply with the laws of that country for night flight or a specific dedicated permission shall be obtained.

CHAPTER 2

ELECTRICALLY-POWERED AEROPLANES WORLD RECORDS

This chapter defines all the FAI world records for Electrically-powered Aeroplanes and the general handling of world record claims. General rules relating to FAI records are in the General Section of the Sporting Code.

2.0 GENERAL

FAI world Electrically-powered Aeroplanes record attempts require no advance notice provided that arrangements have been made for controlling the flight (4.1.2 and 4.1.3).

2.0.1 FAI Sporting Licence The pilot/s must possess a valid FAI Sporting Licence (GS 8.1) in order to attempt and to claim an FAI world record.

2.0.2 Records in any one flight Any record or records may be broken in any one flight for which the requirements are met.

2.0.3 Verification of world records World Records must be verified using the evidence of a GNSS flight recorder approved by the International Gliding Commission of FAI, or with other techniques previously accepted by CIACA. (See 1.3.5).

2.1 RECORD CATEGORIES, CLASSES, and TYPES

Record categories are concerned with the pilot/s, record classes with the Electrically-powered Aeroplane, and record types with the nature of the Electrically-powered Aeroplane flight performance.

In the case of a Speed around the World record performed by more than one pilot, the record can be attributed to the specific aeroplane "team".

2.1.1 Pilot categories There is a General category for all pilots regardless of gender. No feminine or masculine category exists.

2.1.2 Aeroplane classes World records are recognized in the classes and sub-classes listed in 1.0.7.

Table 2.1: TYPES of RECORD FLIGHTS

	Flight Performance	Exceed old old record by	Ref	Remarks (see Chapter 1 for full record requirements)
a	Straight Distance	10 km	1.4.3a	Way points declared pre-flight for pre-declared performance, claimed after flight for "free flight" records.
b	Out-and-Return Distance	10 km	1.4.3b	As above. Way points declared pre-flight.
c	Distance along a course	10 km	1.4.3c	Way points with up to 3 turn points declared pre-flight for pre-declared performance, claimed after flight for "free flight" records.
d	Absolute Altitude	2%	1.4.2b	5000 m gain of height required.
e	Duration	1%	1.4.2c	Time between start and finish points.
f	Speed Over 3km Course	1%	1.4.4.1	Average speed over 3km closed course.
g	Speed Over 15m Course	1%	1.4.4.2	Average speed over 15km closed course.
h	Speed Around the World	2%	1.4.5	Average speed around the world.

2.1.3 Designation of records Electrically-powered Aeroplane records are designated by the code letters CE (they include the FAI code letter for Aeroplane (C), then the code letter for Electrically-powered class (E)).

For sub-classes the following applies:

ELECTRICALLY-POWERED AEROPLANE Battery Operated (EC-BO).

ELECTRICALLY-POWERED AEROPLANE Fuel Cells Operated (EC-FCO).

2.1.4 Types of record flights are shown in Table 2.1

2.1.5 Minimum achievement for new record classes or types. Where a new record category, class or type is created, a minimum level of performance may be set by the CIACA, which must be exceeded before a world record will be validated. It may be published in this Code, or published separately by the FAI.

2.2 TIME LIMITS ON RECORD CLAIMS

2.2.1 Notice of a claim for a world record must be received by the FAI within seven days of its completion as a record attempt. Notice may be submitted by the pilot, an OO, an NAC or other person or organisation associated with the claim. In exceptional circumstances, the president of the FAI Commission d'Aéronautique Sportive Internationale (CASI, the FAI Air Sport General Commission) may grant an extension. Telephone, fax, electronic mail and similar types of notification are acceptable. See the amendments page for current contact data.

2.2.2 A World Record claim must be supported by a file containing all the information and certification necessary to prove that the conditions have been met. The file must be submitted by the organising NAC after the record was recognised as a National Record where required by General Section 6.1.2, and must be received by the FAI Secretariat within 120 days of the attempt, unless an extension is granted by the relevant Air Sport Commission President having reviewed any factors that may have made it difficult to submit the file in the normal timescale. The FAI Secretary General shall acknowledge receipt of the record file to the claimant and the organising NAC. The file must be in the standard format set out in the relevant section of the Sporting Code and shall include a statement that the attempt was made in accordance with the regulations of the Sporting Code including the provisions of General Section 5.2.2.3 on Unsporting Behaviour.

CHAPTER 3

VERIFICATION REQUIREMENTS and METHODS

This chapter defines the evidence, measurements and calculations required to verify Electrically-powered Aeroplane performances.

3.1 FLIGHT DATA REQUIREMENTS

The following is a list of all the flight data that needs to be gathered or measured to provide evidence of the completion of any Electrically-powered Aeroplane performance:

a. declaration (1.3.2)
b. start point (1.1.7)
c. start time (1.2.2)
d. start altitude (1.2.3)
e. way point(s) (1.1.2)
f. finish time (1.2.6)
g. finish altitude (1.2.7)
h. maximum altitude (1.2.4)
i. gain of height (1.4.2a)
j. flight continuity (3.3.3)

Different flight performances will require different subsets of this list.

3.2 DECLARATION

For each flight, certain information is required to be recorded before the flight in order to ensure that proof of the EpA Flight performance is available after the flight. This data, including way points (e) is known as the declaration. For some performances, some data is not required, but the Official Observer must ensure that all required data is recorded. Way points must be declared pre-flight for pre-declared performances, but may be claimed after flight for "free flight" records.

3.2.1 Declaration content The information shall be written on a single sheet of paper or board, or recorded in the memory of a flight recorder prior to the flight.

a. Date of flight
b. Name of pilot

c. Type and registration of EpA
d. Type, serial number or other identification document of barograph or flight recorder(1.3.5)
e. Way points and the sequence to be flown, start, turn(s), finish as applicable to the specific flight performance
f. Date and time of declaration
g. Signature of pilot (not required for electronic declarations)

3.2.2 Declaration validity

a. The last declaration made before takeoff is the only one valid for the flight.
b. If a declared turn point is abandoned, a distance along a course flight may still be claimed from the resulting shorter course provided that the turn points achieved are in the sequence specified in the declaration.

3.3 FLIGHT DATA VERIFICATION

3.3.1 Flight data collection A barograph or device incorporating a barograph must operate throughout the flight. The barogram so produced must provide indisputable verification of flight continuity (see 3.3.3) and of all altitudes critical to the flight performance. The device may record parameters in addition to barometric pressure and time if it is suitable for the purpose (see 3.4). If data is recorded at intervals, the sampling rate setting must be no slower than once per minute.

For flight recorders, timing and pressure altitude data will be taken at the boundary of the observation zone interpolated between the times of valid fixes; or for a start or finish, this data may be taken from the fix in the observation zone which is most favorable to the pilot.

3.3.2 Landing The landing location must be certified by one or more of the following:

a. By an OO present or arriving soon after the event and there is no doubt about the position of landing or,
b. By two witnesses (see 4.2.3.c),
c. By position data from a flight recorder (but see also 3.6.4.aii).

3.3.3 Flight continuity There must be evidence that the EpA did not land during the claimed flight performance. An interruption in the barogram data will not compromise proof of flight continuity provided that the OO and NAC are convinced no critical data is missing and that the evidence for flight continuity remains indisputable.

In the event of failure of the pressure altitude recording in a flight recorder, evidence of flight continuity may be assessed from a time plot of GNSS calculated altitudes provided the rule on the setting of sampling rates is followed (3.3.1).

3.3.4 Altitude Absolute altitude, gain of height and start altitude must normally be verified from atmospheric pressure data to the ICAO ISA recorded by a barograph or the pressure altitude function of a GNSS Flight Recorder. External measurement (see 3.7.1) may be used only when the required accuracy can be verified, such as for start or finish lines.

3.4 CALCULATIONS and CALIBRATIONS

Time, geographical position, altitude, and means of propulsion/source of energy are flight performance data which must be either recorded or measured for some or all types of flights. Using this data, calculations of distance, duration, gain of height, altitude difference, height penalties and start height may be done.

3.4.1 Calculations for distance and speed For world records, distances between two points in excess of 1000 kilometers, and in any case of dispute over a distance, the distance flown is deemed to be the length of the geodesic line joining the start point and the finish point or, if there are turn points, the sum of the geodesic lines for each leg of the course.

a. EARTH MODEL TO BE USED For the purpose of the calculation of FAI geodesic distances, the WGS84 earth model (Geodetic Datum) or its contemporary successor shall be used. When calculation of the exact distance is not critical, less accurate methods may be used.
b. GEOGRAPHICAL COORDINATES OF WAY POINTS Latitude and longitudes used in distance calculations shall be those referenced to the WGS84 earth model (Geodetic Datum). Where local mapping gives latitudes and longitudes to other Geodetic Datums, these shall be converted to WGS84 latitudes and longitudes before calculations are made for FAI distances.
   NACs are to specify procedures for recording the geographical coordinates of way points from maps of their national territory using geographical co-ordinates such as Latitude and Longitude, map grid, or national grid (if such a grid exists for the area concerned).
c. MAP SCALES Measurement of co-ordinates of way points should be from a map with a scale at least as detailed as 1:250,000, and preferably 1:50,000 (if such a map exists which includes the way point concerned). If a scale less detailed than 1:50,000 was used, the NAC should be able to show that co-ordinates were taken from the most accurate map available for the way point concerned.

3.4.2 Application of the loss of height distance penalty

a. For distance flights of more than 100 kilometers, where the loss of height (1.2.9) exceeds 1000 meters, a distance penalty (1.2.11) must be subtracted from the length of the course to give the official distance.
b. For distance flights of 100 kilometers or less, a loss of height exceeding 1% of the length of the course will invalidate the flight performance.
c. For duration flight a loss of height exceeding 1000 meters will invalidate the flight performance.

3.4.3 Flight data requirements The minimum flight data required for each type of flight performance is given in Table 3.1.

3.4.4 Accuracy of measurement The minimum accuracy of measurement and calculation required for each type of flight data is given in Table 3. Any inaccuracy in a measurement or calculation is to be interpreted to the maximum disadvantage of the pilot.

Table 3.1: Minimum data requirements

Flight Performance	Measurements			Calculations		
	Time	Position	Height	MoP/SoE	Distance	Height
Distance	X	X	X	X	X	X
Duration	X		X	X		X
Altitude	X		X	X		X
Speed	X	X	X	X	X	X
Speeed around the world	X	X		X	X	

Table 3.2: Minimum accuracy requirements

Flight Performance	Measurements			Calculations		
	Time	Position	Height	MoP/SoE	Distance	Height
Distance	1 min	500 m	Smaller of 1/1000 of length or 50m	active	1 km	30 m
Duration	1 min		100m	active		30 m
Altitude	1 min		1%	active		10 m
Speed	1 sec	10m	10m	active	10m	10 m
Speed around the world	1 min	500m		active	1 Km	

Precision of measurement: Care should be taken to correctly assess the precision of measurement devices so that an invalid level of accuracy is not introduced into calculations.

3.4.5 Combinations of measurement methods Any combination of the measuring methods is acceptable for the various types of flights, provided the minimum requirements for accuracy of equipment in paragraphs 3.4.3 and 3.4.4 are fulfilled.

Each method used must comply with this Code as if it were the only means of proof employed.

3.4.6 Timing device calibration When used, clocks and other time recording equipment shall be checked against official time signals both immediately before and again after the flight, covering a period of at least three hours. Any error found shall be taken into account and rounded up in the calculations. The GNSS time output from a flight recorder may be used as an official time signal.

3.4.7 Barograph calibration period Barograph calibrations are required to ensure that the measurement of barometric pressure and time are checked against, and corrected as necessary, to official standards. For records, both (a) AND (b) calibrations below are required, and the least favourable calibration of the two shall be used making the calculations for the record.

a. PRIOR TO THE FLIGHT The calibration used must have been performed within 12 months prior to the flight or, for IGC-approved electronic barographs and flight recorders, 24 months.
b. AFTER THE FLIGHT The calibration used must have been performed within one month after the flight.

3.5 TIME MEASUREMENT and EVIDENCE

3.5.1 Time measurement Time data requirements may be fulfilled by any of the following measuring methods:

a. By direct observation from the ground by an observer with direct access to approved time measuring equipment (e.g. a synchronized timepiece). If a time piece displaying only minutes is used, 59 seconds is to be added to each duration measured to allow for the possibility that the reading was taken just before the minute changeover. Pilots and OOs should use timing devices with outputs in seconds whenever possible.
b. With a barograph, to measure time differences,
c. With a time camera, to measure time differences (except for duration flights),
d. A recording device with correct real time output, such as a flight recorder.

3.5.2 Time evidence

a. Evidence of timing and time recording of flights must be under the control of an OO. Time recording equipment carried on board an EpA must be capable of being physically or electronically sealed and, where a human action is required, shall be sealed and unsealed only by the OO.
b. The equipment must be positioned so that the time parameters cannot be altered by the pilot or passenger during the flight.
c. If a means is provided for the pilot to make inputs into a device for remote recording of flight events, such inputs must be confined to functions not critical to the validation of the flight.
   For example, it is permissible for a pilot to make a mark on the time base to register an event such as a particular position, or in GNSS systems to change the sampling rate in flight.

3.6 POSITION MEASUREMENT and EVIDENCE

3.6.1 Position measurement Flight position data requirements may be fulfilled by any of the following measuring methods:

a. By direct observation from the ground for start, turn, and finish points,
b. Satisfactory photographic evidence from a camera in the EpA,
c. Satisfactory data from a flight recorder in the EpA.

3.6.2 Position evidence - general

a. CROSSING A START LINE

   (i) When the start line is controlled by observation from the ground, visual observation of a crossing in the direction of the first leg at an altitude of not more than 1000 meters above the line.

   (ii) When using flight recorder evidence, by clear proof that the start line was crossed in the direction of the first leg.

b. CROSSING A FINISH LINE

   (i) When the finish line is controlled by observation from the ground, the nose of the Electrically-powered Aeroplane crosses the finish line unassisted from the direction of the last leg at a height of not more than 1000 meters above the line.

   (ii) When using flight recorder evidence, by clear proof that the finish line was crossed from the direction of the last leg.

c. WAY POINTS Where photography is used, way points shall be point features and should be selected to make interpretation of photographs easy, even on photographs taken in difficult light conditions such as low contrast. Where a flight recorder is being used for verification, the way point co-ordinates do not need to represent a point feature on the ground.

d. OBSERVATION ZONE Evidence is required that the EpA was within the observation zone (1.1.5) of a way point used during the flight. This may be collected by using one or more of the following three methods:

   (i) Direct observation, in which the EpA is positively identified as being within the observation zone by an OO on the ground at the turn point. Magnification and tracking devices may be used.

   (ii) Photographic, where the pilot presents a satisfactory photograph taken from within the observation zone in accordance with the rules for photographic evidence below.

   (iii) Flight recorders, where the data record shows incontrovertible proof that the EpA was in the observation zone, with one position fix recorded either exactly on the position of the way point or within the observation zone, or else a straight line drawn between two consecutive valid fixes crosses the observation zone.

3.6.3 Photographic position evidence Photographs can be used to prove evidence of position and generally substantiate the EpA performance by means of a sequence of photographs on a single length of film. There shall be proof that all pictures were taken from the aeroplane on the flight concerned and that turn point(s) were photographed between the start time and finish time. Digital cameras are not allowed.

a. PHOTOGRAPHIC CONTROL METHOD The following method shall be used:

   (i) Mounting in the cockpit The camera must be held in fixed mountings in the cockpit so that every photograph will show the wingtip. The lens housing should be positioned inside the canopy or camera window so that the random line mentioned in (iii) below will show on the film.

(ii) Sealing the camera The camera must be sealed unless the same OO is controlling both the preflight photograph(s) and the processing of the film, in which case sealing is not necessary. When a time recording camera is used to supply time evidence, it must be sealed by an OO before the flight in such a way that the film cannot be removed and the time adjusting mechanism cannot be accessed until the seal is broken by an OO after flight.

(iii) Before takeoff Just prior to takeoff an OO shall mark the outside of the canopy or window across the front of the lens with a random line and display the flight declaration for the pilot to photograph with the camera installed.

The random line should be dark or opaque and at least 3 mm wide if it is to show on the image.

(iv) After flight Following landing and the completion of the photographic sequence, an OO shall take charge of the film and have it developed. Every effort is to be made to preserve the film as a continuous strip. However, if it is cut or broken while out of control of the pilot or OO, this evidence remains valid if close examination of the pieces show that they form the original continuous length of film. An OO shall describe the circumstances under which the film was broken or cut.

b. PHOTOGRAPH SEQUENCE The film shall contain photographs in the following sequence:

(i) the pre-flight clock synchronisation photo(s) if a time camera is used (see 3.5.1.c and 3.5.2.a),

(ii) the declaration,

(iii) at least one photograph showing indisputable evidence of the presence of the Electrically-powered Aeroplane in each of the observation zone(s) of the way point(s) used, in the correct sequence,

(iv) the EpA on the landing field with surrounding features and its registration markings appearing clearly on the photo, or the above declaration with landing time added.

(v) the post flight synchronisation photo(s) if a time camera is used. Photographs in (ii) and (iii) above must show the shape of the canopy mark (see 3.6.3.aiii) on the film image. Additional photographs which may have been taken after the declaration and before the landing must also show the canopy mark.

3.6.4 Flight recorder (GNSS) position evidence All flight recorder evidence must be produced by an FAI/IGC approved system. The WGS84 Geodetic Datum shall be set for all Lat/Long data that is recorded and transferred after flight for analysis.

a. FLIGHT RECORDER CONTROL METHOD The OO shall familiarize himself with the terms of the approval for the GNSS and flight recorder equipment concerned. There must be incontrovertible evidence, independent of the FR data, that the FR from which the flight data was taken was in the EpA flown by the pilot during the claimed flight performance.

(i) Before the flight The OO shall sign the pilot's written flight declaration, except where the declaration is stored electronically in the flight recorder (1.3.2). The OO shall

enter a secret code into the flight recorder if the approval for the equipment requires this. The flight recorder system shall be placed, configured or sealed in such a way that it will be physically impossible to operate any controls other than those specifically allowed for use in flight; and to connect or disconnect any device to the flight recorder system other than in accordance with the approval for the equipment. The method(s) of sealing, if any, shall be specified in the approval for the equipment.

(ii) Takeoff and landing An OO shall ensure that there is evidence for the times and points of takeoff and landing, pilot(s) names, aeroplane type and registration, and the type and serial number of the FR for flight evidence. This evidence shall be independent of the data produced by the FR.

(iii) After flight After landing, the flight data shall be transferred from the FR to a diskette or other contemporary storage medium via a PC or other device in the manner specified in the CIACA approval for the equipment. The OO shall check any seals which were applied before the flight. The storage medium containing the flight data shall then be sent to a person approved by the NAC to make the analysis.

b. DATA ANALYSIS The analysis of the flight data shall be performed by a qualified person approved by the NAC, whose duty is to ensure that the appropriate evidence is present to verify the attainment of way points, heights, times and position, as required. If the flight performance qualifies for a record, the following shall be forwarded to the NAC:

(i) The original data diskette (the first copy) storing the flight data. This must include the data file in the CIACA recommended format, and the file in its original format (if different) as transferred from the flight recorder immediately after landing.

(ii) The appropriate claim form(s), including OO's evidence that manually recorded times and exact locations correspond to the equivalent flight recorder data.

(iii) For record flights, the achieved way points shall be determined from the flight recorder evidence and specified in the claim for the record. The flight recorder "pilot event marker", if incorporated, may be used to indicate the desired way point position(s).

(iv) Any other measured data and/or auxiliary material required by an NAC to support the mandatory evidence.

3.7 ALTITUDE EVIDENCE and CONTROL

3.7.1 Altitude evidence Altitude data requirements may be fulfilled by any of the following measuring methods:

a. A barogram, calibrated to the ICAO ISA from a barograph or the pressure altitude sensor of an approved type of GNSS Flight Recorder.
b. Optical measurement from the ground (e.g. a suitable height frame or theodolite),
c. Radar measurement from the ground,
d. For continuity of flight purposes only, the GNSS altitude output of a flight recorder.

3.7.2 Altitude control methods For altitude recording other than by external measurement, a barograph or flight recorder must be carried in the aeroplane. Any marking of the barogram during flight shall be done from the cockpit by remote control, not by direct access to the barograph itself. The barograph shall be placed in the EpA in such a way that no part of the barograph is accessible to the pilot or passenger during the flight. The pressure altitude recording system in a flight recorder is a barograph and must comply with other rules in the Code for barographs and their calibration. Altitude control methods for flight recorders are the same as those used for position evidence (see3.6.4).

a. BEFORE TAKEOFF

(i) Mechanical barographs The OO shall make an identification mark on the barogram paper/foil and then seal the barograph.

(ii) Electronic barographs The OO shall seal the barograph and then enter a secret multi-character code into the barograph memory before flight (a second entry of this code shall be required to retrieve the stored data). This step is not required if the barograph stores continuous date and time data which cannot be altered without the fact of such alteration being automatically reported on all data printouts from its memory after such alteration, and the OO is able to verify the date and time of the takeoff and landing of the EpA on the flight concerned.

(iii) GNSS Flight Recorder Pre-flight procedures shall be as laid down in the FAI approval document for the type of Flight Recorder concerned.

b. AFTER THE FLIGHT

(i) Mechanical barographs The OO shall take control of the barograph, and ensure that its seal is secure and that the barogram has the identification mark placed on it prior to takeoff. The information required in paragraph 5.1 may then be added to the chart.

(ii) Electronic barographs An OO must either supervise the transfer or printing of data from the barograph while it is in the EpA, or supervise the removal of the electronic barograph from the EpA and shall then take charge of it until the flight data is printed out. The OO then confirms that the date and time on the printout is correct and that the date and times of the altitudes and other flight data recorded and printed out correspond to the date and times of the flight concerned, and correspond with other relevant aspects of the claimed performance.

(iii) GNSS Flight Recorder After-flight procedures shall be as laid down in the FAI approval document for the type of Flight Recorder concerned.

CHAPTER 4

OFFICIAL OBSERVERS

4.1 AUTHORITY

4.1.1 Official Observer appointment OO are appointed by a National Airsport Control (NAC) on behalf of the FAI and CIACA.

4.1.2 OO duties The OO shall, as the FAI and CIACA representative, control and certify the record flight performances.

4.1.3 Control and certification

a. CONTROL is the observing of takeoff, start, finish and landing and, where applicable, the timing of individual events such as declarations, sealing, installation, removal and unsealing of barographs, flight recorders and cameras, means of propulsion/Source of Energy recorders and other devices.
b. CERTIFICATION is the checking of evidence and signing of appropriate certificates covering the evidence concerned.

4.1.4 Competence OOs must be knowledgeable in the Code and have the integrity, skill and competence necessary to control and certificate EpA flights without favour. Before being approved by the NAC, the OO should be given briefing or training appropriate to the duties of an OO.

4.1.5 Geographical area of authority OOs are entitled to control and certificate flights of EpA in:

a. The country of their own NAC, and
b. In any country and for EpA pilots of any nationality, if the country's NAC so permits.

4.1.6 Conflict of interest Official Observers may not act in such capacity for any record attempt in which they have any financial interest. Ownership of the EpA shall not be considered "financial interest". The essence is that monetary or other substantial gain shall not depend on the successful certification of the claim by the OO or other individual concerned.

4.1.7 Violation of duty In case of violation of duty, the appointment of the OO shall be withdrawn. In addition, negligent certifications or willful misrepresentations are grounds for disciplinary action by the NAC concerned.

4.2 CERTIFICATION OF EVENTS

4.2.1 General

a. The date, times and points of takeoff and landing on the flight concerned must be verified, and there must be evidence that recording devices used for flight evidence were in the EpA concerned during the flight.
b. Record flights shall be certified by the OO by completing and verifying the information in the official FAI record claim forms or, for national records, claim forms containing similar information (see 5.4).

4.2.2 OO presence at the event OOs may certificate individual events (such as sealing and breaking seals, installation and removal of equipment, takeoff, timing at start and finish, landing, etc.) if they were present at the event for which certification is required, or are able to satisfy themselves either through evidence from persons who witnessed the event or from other reliable sources. Evidence from air traffic control or club flying logs may be used. Barometric pressure may be obtained from the log of a nearby meteorological office.

4.2.3 Certification by non-OOs

a. Certification of events by people other than OOs must be countersigned by an OO after verifying the statements.
b. Air traffic controllers on duty may certifiy observations of takeoffs, start and finish lines, turn and control points and landings.
c. Outlandings may be certified by two independent witnesses who give their names, addresses, and preferably telephone numbers, if any (see 5.2).

CHAPTER 5

CERTIFICATES and PROOFS

5.0 GENERAL

All certifications and calibrations must clearly relate to the flight, event, or equipment being certified or calibrated, and include the date of the certification/calibration, the signature of the person doing the certification/calibration and, where applicable, the OO's signature. Each separate sheet of paper must have this identification. Diskettes or other electronic data storage devices storing flight or calibration data must be labeled clearly.

5.1 BAROGRAM

Except as permitted for flight recorders and electronic barographs (see 3.6.4 and 3.7.2), a barogram shall have the following information clearly registered on it:

a. Identification mark of OO before takeoff,
b. For altitude records, the pressure at ground level (QFE) at time of takeoff,
c. Date of flight,
d. Name of pilot,
e. Type, serial number and altitude range of barograph,
f. Type and registration of EpA,
g. Proof of no intermediate landing,
h. Date and signature of OO after landing.

5.2 LANDING CERTIFICATE

The landing certificate shall state precisely the location of the landing place and the time of landing.

5.3 BAROGRAPH CALIBRATION CERTIFICATE

The barograph calibration certificate shall include:

a. Type, serial number and altitude range of barograph,
b. Date of calibration,
c. Calibration trace, graph or table,
d. Date, name and signature of calibration laboratory official.

5.4 TIMING DEVICE CALIBRATION STATEMENT

The timing device calibration statement shall include:

a. Type and serial number of timing device used,
b. Description of method for (and result of) calibration of the timing device (3.4.6),
c. Date and signature of OO or calibration laboratory official doing the calibration.

5.5 FAI RECORD CLAIM FORMS

For claims submitted to the FAI, the current FAI Official Claim Forms approved by CIACA must be used. For national claims, the NAC may issue its own forms similar to the FAI versions. When submitted to the FAI, the pages of each form should be printed on one sheet of paper such as by using back-to-back printing on A3 size paper (or 11" x 17" paper in North America).

Designation	Record type
Form A	Altitude
Form B	Distance
Form C	Duration
Form E	Speed
Form F	Speed around the world

The FAI forms are available from the FAI web site <http://www.fai.org/>, and in hard copy from the FAI office and NACs.