

FEDERATION AERONAUTIQUE INTERNATIONALE



S P O R T I N G C O D E

Section 8

ASTRONAUTICS

Class K - Spacecraft

Class P - Aerospacecraft

*Approved by the FAI Astronautics Commission
on 25 April 2003*

To Take Effect on 1st August 2003

Note : Section 8 and General Section combined make up the complete Sporting Code for Astronautics.

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CHAPTER 1

INTRODUCTION

1.1 The purpose of this Code is to provide for the international recognition of flights in space by men and women and of their achievements.

1.2 **VALIDITY AND SCOPE**

The text of the present section of the Sporting Code contains regulations applicable to records set by manned spacecraft (Class K) or aerospacecraft (Class P). Chapters 2, 6, 7 and 8 deal with common conditions for certification of all records. Chapters 3 to 5 deal with specific records for all or certain categories of spaceships.

In accordance with the provisions of the General Section of the Sporting Code, FAI does not certify records of unmanned spaceships.

1.3 **COMPLEMENTARY RULES**

The General Section contains the rules and regulations that apply to all FAI-recognised activities. The General Section and Section 8 combined make up the Sporting Code for spacecraft and aerospacecraft.

1.4 **AUTHORITY FOR THE CODE**

The drafting and amendment of this code are the responsibility of the FAI Astronautics Commission (ICARE).

CHAPTER 2

DEFINITIONS AND CONDITIONS

2.1 **MISSION**
A mission comprises all the happenings and activities, scheduled or not, of a spaceship and its crew from the moment and place of take-off to the moment and place of termination of flight.

2.1.1 **Near-space mission** : A mission which remains entirely inside the sphere of influence of the Earth.

2.1.2 **Outer-space mission** : A mission which at least in part abandons the sphere of influence of the Earth.

2.2 **DEFINITIONS AND CLASSES OF SPACESHIP**

a) **Spacecraft** (Class K)

Vehicle capable of flight in space.

b) **Aerospacecraft** (Class P)

A craft capable of flight in space and of sustained and controlled flight in the atmosphere. It must also be capable of soft touch-down on land and/or sea.

c) **Reusable Spaceship** (Class K or Class P) : A spaceship capable of making two manned consecutive flights in such manner that a minimum of 90% (in mass) of the elements constituting the take-off empty mass of the first flight will be present in the take-off empty mass of the second flight.

2.3 **CELESTIAL BODY**

Accumulation of matter in space (excluding the planet Earth) with sufficient mass and density to allow a spaceship to orbit in free fall around it.

2.4 **ALTITUDE**

The altitude reached is approximately the difference between the distance of the space vehicle from the centre of the earth and the radius of the reference ellipsoid corresponding to the sub-spaceship point at the given time.

The altitude (h) of a spaceship is precisely defined as:

$$h = r - a + (a - b) \sin^2 \varphi$$

r = geocentric distance of the spaceship

φ = geocentric latitude

a,b = semi-major and semi-minor axes of the Earth reference ellipsoid, as defined in Chapter 6 (a = 6 378 137 m; a - b = 21 384.7 m).

Note : Altitude records will only be considered for near-space missions.

2.5 **DISTANCE**

2.5.1 **Distance to Earth**

Approximately, the distance reached at the maximum separation between the Earth centre and the spaceship at any given moment of the mission after discounting the

equatorial radius of Earth. It shall be measured along the light path between the Earth centre and the spaceship location.

The distance to Earth (h) of a spaceship is precisely defined as:

$$h = r - a \quad (\text{See 2.4 above for explanation of symbols.})$$

Note : Distance to earth records will only be considered for outer-space missions.

2.6 TAKE-OFF PLACE AND TIME

The centre of the precise place and the time at which the spacecraft starts moving by its own means without external human help. For outer-space missions the reference system will be astronomically fixed (Sun plus fixed Stars). For near space missions the reference axis will be centred at the Earth Centre but not rotating with Earth. For suborbital flights, as defined in paragraph 2.12.6, the reference axis will be centred at the Earth Centre and rotating with Earth.

2.6.1 TAKE-OFF EMPTY MASS: The total mass of the spaceship at take-off place and time, excluding the masses of the crew, the propellant and all other consumables needed for the mission. If part of the crew and their life support consumables are replaced by ballast, that ballast will not count for the total mass.

2.7 TERMINATION OF FLIGHT

For the purpose of the record, the place and time of termination of the flight shall be either the point and time at which the pilot touches the earth's surface or the point and time at which he receives assistance by any means external to the original spaceship which achieved the maximum performance.

Note : Temporary halts at non-manned space stations or places other than the planet Earth, either with the purpose of refurbishing the spacecraft or making repairs, are not considered termination of flight as long as all work is performed by the original crew, the same original crew resumes the mission, and no other human beings are involved.

2.8 ASTRONAUT

The word "astronaut" may apply both to crew members and to scientific personnel aboard the spacecraft playing an active part in the mission during the flight.

2.9 UNCOMPLETED FLIGHT

A flight is deemed to be uncompleted if :

- a) an accident occurs during the flight resulting in the death of any member of the crew within 48 hours or,
- b) any member of the crew definitively leaves the spaceship during the flight.

Note : In the case of space stations which qualify as spaceships under 2.11 below, 2.9 (b) above shall not apply.

2.10 SPACE STATION

Any place outside the planet Earth built by humans and capable of receiving visits from astronauts or spaceships for the purpose of making repairs, refurbishing the spaceship or loading/unloading passengers, astronauts or cargo.

2.11 MANNED SPACE STATION

Any space station which is occupied, continuously or otherwise, by one or more human beings for at least 30% of the year(s) in question. Any space station not fixed to a celestial body may qualify as a spaceship for the purpose of records.

2.12 RECORDS - SPECIAL CONDITIONS

- 2.12.1 All flights must exceed an altitude of 100 km in order to qualify for records.
- 2.12.2 A new world record must exceed the previous one by 5% based on the respective definitions. (See also the provisions of paragraph 5.2.2.4).
- 2.12.3 The pilot and crew must be inside the spaceship component at take-off and all of them must reach the place of flight termination alive.
- 2.12.4 The pilot and crew of an aerospacecraft shall remain inside the vehicle during descent and landing. For spacecraft any method of descent and landing is acceptable provided the method is described in detail in the pre-flight plan.
- 2.12.5 For the purpose of all records (in particular for duration and distance records) the flight will start at take-off place and time and will finish at termination of flight as defined above.
- 2.12.6 A mission is sub-orbital if each of its arcs of trajectory above an altitude of 100 km has a length of less than 40 000 km (in the non-rotating geocentric set of axes).
- 2.12.7 For the purpose of certification of a record for mass lifted, one shall take into consideration the mass measured in kilogrammes on the ground of the spaceship and its crew, and all the parts attached to the spaceship and carried to a maximum altitude. Those parts of the spaceship which serve to place it in orbit shall not be included in the mass, but those parts used for further flight of the spaceship shall be included.
- 2.12.8 For the purpose of certification of a record of mass assembled in space on linked flights, the assembled mass is defined as the maximum total combined mass reached at any moment while linked, including that of the astronauts.

2.13 WOMEN'S RECORDS

Women's space records may be set in any of the authorized categories in Chapters 3, 4 and 5.

CHAPTER 3

ABSOLUTE SPACE RECORDS

Note : These records will be listed in either Category K or P, as appropriate, and the best performance will be called 'absolute record' .

3.1 DURATION

3.2 ALTITUDE

3.3 DISTANCE TO EARTH

3.4 *(Content deleted 1996)*

3.5 GREATEST MASS LIFTED TO ALTITUDE

3.6 EXTRAVEHICULAR DURATION IN SPACE

This is the time spent outside the spaceship, during which an astronaut does not depend for his survival on any connection with the spaceship but upon an autonomous life support system.

Note : Exit from and entry into the spaceship are defined as being the instant when the astronaut has completely overstepped the spaceship's outer cover.

3.7 *(Intentionally blank)*

3.8 ACCUMULATED SPACE FLIGHT TIME

This concerns the total number of hours in space registered by one astronaut.

3.9 RECORDS OF MANNED LINKED FLIGHTS OF TWO OR MORE SPACESHIPS WITH CREWS BELONGING TO TWO OR MORE NATIONS

Provided that the spaceships are launched from different countries and all the elements of the flight are manned during at least a part of the mission, the following records apply :

3.9.1 Assembled mass of spaceships linked in flight.

3.9.2 Total duration of flight of spaceships while linked.

3.9.3 Maximum altitude while linked.

3.9.4 Distance travelled while linked.

Note : The record under 3.9.4 applies only to outer space missions, and shall be measured along the path of light between the point of linking and the point of separation or termination of flight, whichever happens first.

3.10

DISTANCE IN UNTETHERED FREE FLIGHT OF AN ASTRONAUT IN SPACE OUTSIDE A SPACESHIP

Maximum distance traversed by an untethered astronaut in free flight away from the spaceship that took him into orbit. This distance is to be measured along a straight line from the point at which the astronaut started the free space flight. The astronaut must return to a spacecraft or aerospacecraft alive using and controlling his own propulsion system attached to the spacesuit. All motion out and back must be the result of prime mover(s) carried by the astronaut himself with no translational aid from the spaceship.

CHAPTER 4

RECORDS FOR SPACECRAFT ONLY (CLASS K)

(Note : For Spaceship Records, see Chapter 3)

4.1 **CATEGORIES OF MISSIONS**

- K1 Suborbital Missions
- K2 Orbital Missions
- K3 Missions to Celestial Bodies

4.2 **CATEGORY RECORDS**4.2.1 **K1 - Suborbital missions**

Two categories of spacecraft :
- spacecraft with one astronaut ;
- spacecraft with more than one astronaut

for the following records :

4.2.1.1 Duration

4.2.1.2 Altitude

4.2.1.3 Greatest mass lifted to altitude (the mass shall include that of the astronauts, all equipment required for vehicle operation and crew support and mass of payload or cargo).

4.2.1.4 Distance flown along the trajectory, from the point of launch to the point where the mission ends.

4.2.1.5 Number of people in suborbital flight

4.2.1.6. Minimum time between two consecutive flights in a reusable vehicle. The time is to be measured from the time of termination of the first flight to the time of take off of the second flight.

*Notes: Both flights have to comply with all other conditions for completed space flights.
The record holder will be the crew commander of the second flight.*

4.2.2 **K2 - Orbital missions**

Two categories of spacecraft :
- spacecraft with one astronaut ;
- spacecraft with more than one astronaut

for the following records :

4.2.2.1 Duration.

4.2.2.2 Altitude

4.2.2.3 Greatest mass lifted to altitude

4.2.3 K3 - Missions to Celestial Bodies

Two categories of spacecraft :

- spacecraft with one astronaut ;
- spacecraft with more than one astronaut.

for the following records :

4.2.3.1 Duration of stay on the surface of the celestial body.

4.2.3.2 Extravehicular duration on the surface of the celestial body by an astronaut.
This is the time spent outside the spaceship on the surface of a celestial body during which an astronaut must rely for his survival only upon autonomous life support system excluding any connection with a non-integrated survival source.

Notes : 1. Exit from and entry into the spaceship are defined as being the instant when the astronaut has completely overstepped the spaceship's outer cover.

2. If one or more astronauts travel on the surface of the celestial body aboard an air-conditioned vehicle, the time spent in that vehicle will not count in the duration of stay outside the spacecraft.

4.2.3.3 Duration of stay in orbit around a celestial body, computed from the termination of thrust application necessary to establish the orbit up to the time of application of thrust required to leave the orbit.

4.2.3.4 Greatest Mass landed on the celestial body.

4.2.3.5 Distance covered on the surface of the celestial body : The distance from the astronaut to the spacecraft shall be measured along the mean surface of the celestial body through the shortest distance between two points :

- a) performance achieved on foot ;
- b) performance achieved on board a vehicle.

4.2.3.6 Duration of a complete mission to a celestial body with return, including duration of stay on the surface of the celestial body.

4.2.3.7 Greatest mass of non terrestrial matter lifted from the surface of the celestial body and taken back to Earth or to a manned space station.

CHAPTER 5

RECORDS FOR AEROSPACECRAFT ONLY (CLASS P)

(Note : For Spaceship Records, see Chapter 3)

5.1 **CATEGORIES OF MISSIONS**

P1 Suborbital Missions
P2 Orbital Missions

5.2 **CATEGORY RECORDS**5.2.1 **P1 - Suborbital Flights**

5.2.1.1 Duration (measured from time of lift-off to the time of touchdown at point of termination of the performance).

5.2.1.2 Altitude above the Earth's surface with or without manoeuvres of the aerospacecraft.

5.2.1.3 Greatest Mass lifted to altitude (the mass shall include that of the astronauts, all equipment required for vehicle operation and crew support and mass of payload or cargo).

5.2.1.4 Length travelled along the trajectory measured from the point of lift-off to the point of touch down at which the planned operation is terminated.

5.2.1.5 Number of people in suborbital flight.

5.2.1.6. Minimum time between two consecutive flights in a reusable vehicle. The time is to be measured from the time of termination of the first flight to the time of take off of the second flight.

Notes: Both flights have to comply with all other conditions for completed space flights. The record holder will be the crew commander of the second flight.

5.2.2 **P2 - Orbital Flights**

5.2.2.1 Duration (measured from time of lift-off to the time of touchdown at point of termination of the performance).

5.2.2.2 Altitude

5.2.2.3 Greatest Mass lifted to altitude (the mass shall include that of the astronauts, all equipment required for vehicle operation and crew support and mass of payload or cargo).

5.2.2.4 Greatest payload mass lifted to greatest altitude (the payload is defined as the mass carried for scientific, technical, or operational reasons in the compartment(s) especially incorporated into the aerospacecraft design for such purpose and which is not required for the basic operation of the aerospacecraft or crew support). Altitude is measured in the standard manner as defined in 2.4 above. A new world record shall exceed the previous one by at least 5% in payload at the previous altitude or by at least 5% in altitude (based on the respective definitions) at the previous payload.

- 5.2.2.5 Greatest Mass lifted to altitude by an aerospacecraft using air breathing propulsion system plus aerodynamic controls in a significant part of lifting trajectory.

CHAPTER 6

MEASUREMENTS6.1 **MEASUREMENT**

The measurements required for an event may be made by any method sanctioned by the FAI.

6.2 **UNITS OF MEASUREMENT**

The units of measurement used in the record file shall be based on the international system. Time shall be recorded in UTC (Universal Time, Coordinated).

The reference ellipsoid shall be that of the International Astronomical Union and its characteristics are at present :

equatorial radius : 6,378,137 metres

$$\frac{\text{equatorial radius} - \text{polar radius}}{\text{equatorial radius}} = 0.0033528131$$

CHAPTER 7

RECOGNITION OF RECORDS

- 7.1 In order that a record performance be recognised for one of the classes of records mentioned above, a record file must be submitted to the FAI containing at least all the particulars described in Chapter 8.
- 7.2 The FAI will only concern itself with whether or not the conditions of any particular category or class of record have been met. However, the record attempt, in its entirety, must be verified as to accuracy by instrumentation, which must be sanctioned and approved by the N.A.C. concerned.
- 7.3 The N.A.C. of one country may seek the aid of another N.A.C. in order to obtain the appropriate measurements, as required for an official record.
- 7.4 A report giving the details of the record attempt must be included with the request for certification.

CHAPTER 8

COMPOSITION OF A RECORD FILE

- 8.1. Every record submitted for certification shall be the subject of a file containing at least all the particulars relating to the circumstances and the control of the performance, to enable the authority responsible for the certification to decide whether all the conditions laid down have been fulfilled.
- 8.2. The record file shall contain, on the one hand, documents which will be of the same kind for every type of record and, on the other hand, documents which will differ with each type of record. The documents required for every record are the following :
- 8.2.1. A description of the record to which the file refers.
- 8.2.2. The names and nationalities of the pilot-in-command and members of the crew.
- 8.2.3. The number and date of the FAI Sporting Licence of the pilot-in-command and of any astronaut attempting to set world records.
- 8.2.4. The name and brief description of the spaceship and its identification marks.
- 8.2.5. The name and brief description of the launching vehicle and the mark, brief description, thrust and number of engines of this vehicle.
- 8.2.6. A brief description of any apparatus installed in the launching vehicle and spaceship used to assist lift-off, control and landing.
- 8.2.7. The original preflight programme as submitted to the N.A.C. and particulars of the actual achieved flight.
- 8.2.8. A report by an appointed official giving the date, time (to the nearest second), place of take-off (in coordinates of latitude, longitude, to the nearest minute), proof of identification of the spaceship and its Commander.
- 8.2.9. A report by an appointed official giving the date, time (to the nearest second), place of termination of the performance (in coordinates of latitude, longitude, to the nearest minute), or evidence as required by the FAI Sporting Code if landing took place where no Official was present, and proof of identification of the spaceship and its Commander.
- 8.3. For the purpose of certification of a record for mass of the spaceship, the record file shall contain a brief description of the instruments by which the mass was measured and a list of those parts of the vehicle making up the mass.
- 8.4. A record file shall contain a description of the instruments used, the readings of which are necessary for certification of the sporting performance. The type and number of these instruments shall be approved by the N.A.C. concerned.
- 8.5. A record file shall contain the calibration data of the instruments described. The former must be approved by a national instrument laboratory of the country concerned.