

AMENDMENT LIST NUMBER 3 TO
TECHNICAL SPECIFICATION
FOR IGC-APPROVED GNSS FLIGHT RECORDERS

ISSUED 20 OCTOBER 2000 BY FAI
ON BEHALF OF THE INTERNATIONAL GLIDING COMMISSION

Preliminary remarks

para 2. Second sentence to read: "Other material concerned with validation of flights to IGC criteria is in the FAI Sporting Code Section 3 (Gliders and Motor Gliders) and its annexes, that are Annex A (SC3A, Championships), Annex B (SC3B, Equipment used for flight validation), and Annex C (SC3C, Official Observer and Pilot Guide). These are all public domain documents (AL3) "

para 3. Replace with the following: Proposals for amendments should be sent to the Chairman of the GNSS subcommittee and to the Chairman of GFAC, preferably in the form of draft wording for direct insertion, with reasons for the proposed changes or additions. Amendments may be issued at any time with the agreement of the IGC GNSS and GFA Committees and with the approval of the IGC President. (AL3)

Glossary:

EPE - Estimated Position Error. Add: Where the EPE value is recorded, it appears in the IGC file as a three number group in metres through the FXA code. (AL3)

Fix, Spurious: In first line, to read "... in time or two-dimensional position (Lat/long)."
Also, change last sentence to: "For flight analysis purposes such as proving presence in an Observation Zone, spurious fixes must be rejected. See SC3 Annex C (Pilot and Observer Guide) for examples and diagrams. (AL3)"

FR Serial Number. The first words to read: "A unique set of three alphanumeric characters (AL3)".

GNSS Altitude: Replace with: "Altitude calculated solely from GNSS position lines. In the IGC format file, GNSS altitude must be referenced to the WGS84 ellipsoid. Where GNSS altitude is not available from GNSS position-lines (2D fix, altitude drop-out), it shall be recorded in the IGC format file as zero so that the situation can be clearly identified during post-flight analysis. Note that in other GNSS systems, GNSS altitude may be set to show approximate altitudes above local sea level by calculating distance above a Geoid (normally through an electronic look-up table giving geoid heights above and below the selected ellipsoid) rather than distance above the ellipsoid appropriate to the selected Geodetic Datum. (AL3)"

GPS System Time: In third sentence, change 1997 to 2000 and 12 sec to 13 sec.

UTC: In penultimate sentence, change 1997 to 2000 and 12 sec to 13 sec.

Para 1.3, Application. Second sentence to read: "A fee shall be deposited in IGC's FAI account by each applicant. This fee is varied by IGC from time to time and details are available from the GFAC Chairman. At the time of writing (year 2000) it is 1500 Swiss Francs (ChF) for an application for a new type of GNSS FR, less for modifications to an existing IGC-approved design. The precise method of deposit (AL3)"

Para 1.3.2, fees for changes. In line 2, replace "1000 Swiss francs" by "up to the fee for a new type of GNSS FR".

Para 1.3.3.1, first submission. In the first sentence, replace "have tested it for at least 100 hours, and have shown" with: "send details to GFAC of the design such as specifications, drawings, draft manual, etc as soon as possible. When a complete prototype or beta test version is available, apply to FAI for IGC-approval and send a single example to the Chairman of GFAC for initial evaluation and feedback, before the fix-of-design stage is reached. Systems must show an error rate ..."

Para 1.3.3.2, changes. Modify to read: "for re-approval of a unit after changes, the other provisions of 1.3.3 apply. (AL3)"

Para 1.6.1, informing of changes. In line 1, remove brackets and after "changes" add: "(of whatever nature)".

Para 1.6.3, fees for changes. Replace "1000 Swiss francs" by "that for a new type of GNSS FR (AL3)".

Para 2.4, recording requirements.

After first semi-colon, to read: "continuous recording in accordance with the Sporting Code for Gliding including its annexes (these give fix time interval settings such as a maximum setting of 60 seconds for establishing flight continuity and recommend settings of 4, 2 or 1 sec when near to Observation Zones);"

After "with or without GPS recording" add ", with continuous time clock function (para 2.6.6.1.1)".

After "retention of data validity as battery voltage falls (until final failure causes recording to cease, but previously recorded data must not be lost)", add ", see Appendix 1 para 7 for use of the Three Letter Code LOV for low voltage;"

Make sub paras as follows:

After "... standard given in Appendix 1", insert "2.4.1 Creation of IGC data file." Before the existing sentence "After switching on the FR, .." and add at the end: "For more details, see Appendix 1 para 1.1.1."

Add before sub para on Desirable features: "2.4.2. Standard of signals. Receivers must be able to determine whether ranging signals are marked unhealthy or not, so that the receivers only use ranging signals in the navigation solution that are not marked unhealthy. If in doubt refer to GFAC before the design is fixed (AL3)."

Un-numbered sub para titled Desirable features, Re-number as para 2.4.3, and delete "low battery state warning" (transferred to main para 2.4 above).

Para 2.6.5 - Barograph Calibrations. Add the degree symbol (°) to 15C in line 3.

Also, after "The pressure altitude recording system shall continue to operate if the GNSS

is inoperative.", add: "For calibrations in an altitude chamber it must be possible to produce an IGC-format file of the pressure changes, without the need for any special switching of the FR except to switch it on before starting the calibration. For FRs that do not record continuously after switching on, this may be achieved by ensuring that a small rate of change of pressure altitude is enough to start recording fixes of pressure altitude with time. This will also ensure that pressure-altitude fixes are produced in flight in the absence of any GNSS data. Experience in the past has shown that a suitable trigger value is a pressure change of 1 metre per second for 5 seconds. (AL3) "

Para 2.6.6.1.1 - Continuous time clock function. Add: "This is to ensure that owners of IGC-approved GNSS FRs can use the unit as a pure barograph in the event of complete lack of GNSS fixes (for whatever reason, an example being a fault or damage to the antenna, its cable or connectors). For GNSS boards that do not incorporate a Real-time Clock (RTC) module capable of providing an accurate time base if time from GNSS fixes is not available, a separate RTC similar to that used in a PC must be fitted in order to sustain the time base (AL3)"

Para 2.6.7.2 - Data sampling interval settings. To read: "The settings for the time interval between data samples may be changed, either automatically (for instance at Waypoint Observation Zones) or by manual switching. The maximum time setting for data sampling for the purpose of establishing flight continuity is 1 minute (SC3 para 4.3.1). It must also be possible to set a data sampling interval of less than 5 sec for use near Observation Zones, so that pilots can use this shorter interval when near and in the OZ, as recommended in Annex C to the Code (SC3C) para 9.2. (AL3)"

Para 2.7.2.2.7.3 - IGC-approved connectors, Option 3. Replace "the 8mm IP40 plug" and all after, with the following: "RJ-45 8-pin connector. This is a female 12 x 6 mm RJ-45 socket with 8 connections, as used on ISDN and Ethernet connections. Pins are numbered from left to right, with the male plug held towards the observer with the pins uppermost and the cable running away from the observer (AL3).

Pins	Function
1&2	Volts +
3&4	Spare, for future application with GFAC approval
5	TX
6	RX
7&8	Earth (Volts -ve)"

Para 2.7.4.1, averaging algorithms. Add at the end: "Fixes recorded on the IGC data file must be based on real GNSS position-lines. Predicted fixes must not be recorded such as those from so-called Dead Reckoning (DR) and other forward-prediction algorithms designed for use on the ground if signal is lost due to terrain masking. If such a system is available on the GNSS board, it must either be permanently disabled or set at a time constant of less than 5 seconds if it is to be used for fixes recorded in an IGC flight data file (AL3)."

Para 2.7.5, serial number: The first sentence to read: "... three character alphanumeric Serial Number (S/N) unique to that manufacturer, marked physically ...".

Para 2.8.3.1 - Security Key Length. Add: In the case of RSA, a key of at least 196 bits will be required, and the equivalent for non-RSA systems. (AL3)

Para 2.9.3, security systems. In the fifth sentence, replace: " .. the IGC GNSS FR Technical Specification document .." with "Appendix 1."

Para 2.9.3.1, DATA program file. Replace the sentence in the middle on when an IGC file is to be created (begins "This programme must produce ...", with : "Appendix 1 para 1.1.1 gives the conditions for which this program must produce a separate IGC flight data file. (AL3)"

New para 2.9.3.6 - Short program file functions.

2.9.3.6. Other ways of producing the short program file functions. It is a requirement that the three short self-executing program files DATA, CONV and VALI are produced, for placing on the IGC GNSS web pages for general use. In addition, other versions may be produced which fulfil the same functions, for instance as part of a manufacturer's more comprehensive program for the FR, as long as the resulting IGC flight data file continues to pass the VALI check for electronic security when this is carried out later at the NAC or FAI using the latest version of the VALI-XXX.EXE program file. (AL3)

2.9.3.6.1. **Windows equivalents of the DATA, CONV and VALI program files.** FR Manufacturers may also provide direct Windows equivalents to the DATA, CONV and VALI DOS program files, using the same parameters as the DOS programs. These will be placed on the IGC GNSS web pages for general use, together with the required DOS program files. This is likely to become a mandatory requirement if the DOS requirement is ever dropped or operation under DOS becomes impractical. Windows versions of the DATA, CONV and VALI short programs conforming to the above will be added to those available for general use through the IGC GNSS web pages. Any manufacturer intending to provide these should first contact GFAC. (AL3)

Note: Work continues on producing a common interface to avoid wide differences in approach developing, and proposals will be circulated to manufacturers and IGC committees in the normal way. When a consensus has been reached, the above para will be amended and details of the common interface added. Also see below on long file names. (AL3)

Para 2.11.1 - ENL Values . Replace existing para with a new one:

2.11.1 Engine Noise Level (ENL) systems. These record a three-number ENL value with each fix, between 000 and 999. ENL is the preferred method for recording MoP operation, because no wiring external to the FR is needed, nor any special mounting of the FR in the cockpit, nor, for IGC-approved ENL systems, is a specific engine-run needed on each flight to "prove" the system. However, in design, careful processing (filtering and weighting) of the raw noise signal is required so that a MoP developing forward thrust always gives a characteristically high ENL value, whereas ENL values associated with normal gliding flight, are significantly lower. (AL3)

2.11.1.1 Default settings. Where a motor glider Engine Noise (ENL) function is incorporated, the default setting should ensure that this function is enabled for ENL recording. For FRs where it is possible to disable the ENL function, this should require a positive action to do so, because in gliders without a motor an ENL record has still been found useful as additional evidence during flight analysis. (AL3)

2.11.1.2 Recorded ENL values. Figures at or close to the maximum ENL value of 999 should be recorded in the IGC file as a result of loud noises such as the running of 2-stroke engines under high power and with the GNSS FR placed in a typical position in a glider cockpit. It is accepted that less noisy engines (4-stroke and Wankel (rotary)

engines) may not produce ENLs close to 999 even when at high power, but must still result in ENL values over 750 (and preferably 800) so that engine- or propeller-running can be clearly identified. At the other end of the scale, quiet gliding flight should result in low but positive ENL readings so that the system is seen to be "self-checking" with each fix. Periods showing 000 are not acceptable and figures varying around 020 should be achieved in quiet flight in a well-sealed sailplane. In the event of the FR being covered either inadvertently or deliberately with noise-insulating material, the design must ensure that ENL levels are maintained as far as possible; this is also intended to cover the case of quieter engines such as those which are electrically-powered. (AL3)

Appendix 1 para 1 - After the third sentence that ends "other FAI sports and activities", replace all the rest of para 1 with a new sub para:

1.1.1 Production of Flight Data File. It must be possible to produce a separate and complete IGC flight data file for each flight including all record types (para 2.2 following) relevant to the flight such as header records, flight declaration, etc. Two ways of achieving this are by continuous recording of fixes between the times that the FR was switched on and off, or, for FRs that have a "standby" state on switch-on, only recording fixes after preset movement and pressure thresholds are exceeded and ceasing recording when changes are below the thresholds (but see 1.1.1.2 on short periods without external power). (AL3)

1.1.1.1 FRs that do not start recording fixes immediately after switch-on. The following thresholds before fixes are recorded have been found suitable in the past: lat/long change, 10-15 km/hr; pressure altitude change, 1 metre per second for 5 seconds. Pre-takeoff and after-landing baselines of at least 20 fixes must be provided. After landing, this can be achieved by a time delay before stopping fix recording. For the pre-takeoff baseline, a small memory circuit can be used that continuously stores the appropriate number of previous fixes and, when movement is detected, puts them into the flight data record. (AL3)

1.1.1.2 Loss of external power for short periods. To allow for events such as changing or switching batteries in flight, a period of 5 minutes with no external power should be allowed to elapse before a new Flight Data File is created on powering up again. After this period has elapsed a new IGC file must be produced, so that if several flights are made on one day, each has a complete IGC data file of its own. (AL3)

1.1.1.3 Data transfer to a PC. If the data for several flights is held in the FR memory, it must be ensured that when the data is transferred, all record types in IGC files that are subsequent to the first file are those relevant to each subsequent individual flight. If any record types are changed between flights (such as declaration, pilot name, etc.) the changes must be included in the subsequent (but not previous) flight data files. (AL3)

Appendix 1 para 2.4 - Line on Time, change 1997 to 2000 and 12 sec to 13 sec.

Line 8 on altitude, add: ", separate GNSS and pressure values."

Last sub-para headed "GPS Altitude", replace by: "GNSS Altitude. Where GNSS altitude is not available from GNSS position-lines such as in the case of a 2D fix (altitude drop-out), it shall be recorded in the IGC format file as zero so that the lack of valid GNSS altitude can be clearly seen during post-flight analysis. (AL3)"

Appendix 1 para 2.5 - File Naming.

Line 2 before "style" add "2.5.1 Short file name".

After the line that begins "F = Flight number of the day", add:

"2.5.2 Long file name style. This uses a full set of characters in each field, a hyphen separating each field. For instance, if the short name for a file from manufacturer X is 36HXABC2.IGC, the equivalent long file name is 2003-06-17-XXX-ABC-02.IGC. Long file names may be generated by software that is compatible with long file names, although the DOS versions of the DATA, CONV and VALI programs must continue to generate and use short file names. (AL3)"

Before "The three-digit FR S/N", add: "2.5.3 FR Serial Number (S/N)."

Before "Existing FRs using serial numbers", add: "2.5.3.1".

Before "The date of flight used in the file name", add: "2.5.4".

Before "The file name is not protected", add: "2.5.5".

Change the example file name to:

2.5.6 Example: 16AFXYZ2.IGC = 10 June 2001, Filser FR number XYZ, Flight 2 of the day.

Replace "The following manufacturer codes" with: "2.5.7 Manufacturer codes".

2.5.7 Add: H - Scheffel SCH (AL3)

Appendix 1 Para 3.1 - FR Ident - the first sentence to read: "The A Record must be the first record in an FR Data File, and includes the three-character GNSS FR Serial Number (S/N) unique to the manufacturer of the FR that recorded the flight (AL3). "

Also, in the line starting "Manufacturer", change the reference at the end of the line to "2.5.7".

Line on ID to read: "Unique ID 3 bytes NNN Valid characters alphanumeric (AL3)"

Appendix 1 Para 3.2 - G Record, Security. After "Valid characters alphanumeric", add ", see Chapter 2, para 2.8.3.1 on security key length (AL3)"

Appendix 1 Para 3.3 - Header record

Before "The following H records are required", add: "3.3.1 Required records."

Below the line that starts "HSFTYFRTYPE:", add two lines:

```
"HSGPS:MANUFACTURERSNAME,MODEL,CHANNELS,MAXALT CR LF
HSPRSPRESSALTSENSOR:MANUFACTURERSNAME,MODEL,MAXALT CR LF
```

Under the line "GPS Datum 3 bytes NNN", add:

"HSGPS gives the GPS engine manufacturer and type, number of channels, and the maximum GNSS altitude in metres that could be recorded in the IGC file. Comma separators are used between each piece of information. For the Russian GLONASS system use the code GLO instead of GPS (listed in para 7). If another GNSS system is used, apply to GFAC for an appropriate three-letter code. (AL3)

HSPRSPRESSALT gives the pressure altitude sensor (Manufacturer and type) and maximum pressure altitude in metres that could be recorded in the IGC file. Comma separators are used between each piece of information. (AL3)"

Para below "GPS Datum" to read:

3.3.2 Additional H records. These are optional and additional data may be appended after the mandatory records. Two additional records (Comp ID and class) are shown below.

```
HSCIDCOMPETITIONID:TEXTSTRINGCR LF
```

```
HSCCLCOMPETITIONCLASS:TEXTSTRINGCR LF
```

Below this, add new para number:

"3.3.3 Names and identifications.

Similar names...."

Also, after SMITH BERNALD, add a new sub-para:

"Sufficient characters should be made available to allow for long names and identifications. Such as, for glider registration, allow for a registration such as XXXX-AAAA (where XXXX is the designator of the Nation or National Airport Body), requiring at least 9 characters to be available in this field. Manufacturers should provide for more rather than less characters in these fields so that flight declarations are easily made in full (AL3)."

Nation codes - Replace the sentence before the list of codes that start "AR ARGENTINA", with: "Where there is not space to put the Nation in full, the two-letter codes from the ISO 3166 list of National designators should be used (these are also used for Nations in Internet addresses). A selection of ISO 3166 two-letter National Codes are as follows (AL3):"

Appendix 1 para 7 - Three-letter codes. Amend the two lines on FXA to:

"FXA B, I, J, K records: Fix accuracy. When used in the B (fix) record, this is the EPE (Estimated Position Error) figure in metres (MMMM) for the individual fix concerned, to the 2-Sigma (95.45%) level unless specified differently (AL3)

FXA H record: Fix Data Accuracy Category. When used in the header record, this is a general indication of potential fix accuracy and indicates a category of receiver capability rather than an exact figure such as applies to each recorded fix in the B, I, J or K records, see above. If in doubt, use a three figure group in metres that refers to a typical EPE radius achieved by the receiver in good reception conditions. (AL3)"

Also, add new codes:

GLO H record: GLONASS, the Russian GNSS system, manufacturer, model, etc

Appendix 1 Para 9 - example file. Replace by the following:

9. EXAMPLE IGC-FORMAT FILE

9.1 The IGC file format starts with the A Record and is followed by the H (header) and other records. The record letter is always at the start of the appropriate line in the file when it is viewed in text format. For more details of formats for individual records, see the relevant paragraphs earlier in this Appendix.

9.2 In this example, spaces have been used between subject fields to make the layout and sequence clearer to a reader. In a real IGC-format file there should be no spaces in any record except within a text string as a word separator.

9.3 CRLF = line terminator, not flight data.

9.4 In a real file there would be many more B records at the preset fix intervals for cruise and fast fix rates.

9.5 In the example below, some notes appear in brackets. These are not part of the file format itself.

A XXX ABC FLIGHT:1
HFFXA 035
HFDTE 160701
HFPLT PILOT: Bill Bloggs
HFGTY GLIDERTYPE: Schleicher ASH-25
HFGID GLIDERID: ABCD-1234
HFDTM100 GPSDATUM: WGS-1984
HFRFW FIRMWAREVERSION:6.4
HFRHW HARDWAREVERSION:3.0
HFFTY FRTYPE: Manufacturer, Model
HFGPS MarconiCanada: Superstar,12ch, max10000m CR LF
HFPRS PRESSALTSENSOR: Sensyn, XYZ1111, max11000m CR LF
HFCID COMPETITIONID: XYZ-78910
HFCCL COMPETITIONCLASS:15m Motor Glider
HFSCM SECONDCREW: John Smith
I 02 36 38 FXA 39 41 ENL CRLF
J 01 08 12 HDT CRLF
(The following example of a C (Declaration) record)
(is for a 500 km triangle to be flown from)
(Lasham gliding centre in the UK)
C 150701 213841 160701 0001 02 500K Tri
C 5111359N 00101899W Lasham Clubhouse
C 5110179N 00102644W Lasham Start S, Start
C 5209092N 00255227W Sarnesfield, TP1
C 5230147N 00017612W Norman Cross, TP2
C 5110179N 00102644W Lasham Start S, Finish
C 5111359N 00101899W Lasham Clubhouse
(The following example of a B (fix) record)
(has altitudes of 280m (pressure), 421m (GPS))
(and FXA (EPE, radius) 205m, and ENL 950:)
B160240 5407121N 00249342W A 00280 00421 0205 950 CRLF
D 20331 CRLF
E160245 PEV CRLF
B160245 5107126N 00149300W A 00288 00429 0195 020 CRLF
B160250 5107134N 00149283W A 00290 00432 0210 015 CRLF
B160255 5107140N 00149221W A 00290 00430 0200 012 CRLF
F160300 06 09 12 36 24 22 18 21 CRLF
B160300 5107150N 00149202W A 00291 00432 0256 009 CRLF
E160305 PEV CRLF
B160305 5107180N 00149185W A 00291 00435 0210 015 CRLF
B160310 5107212N 00149174W A 00293 00435 0196 024 CRLF
K160248 090 CRLF
(note that this is specified above in the J record)
(as being HDT, true heading)
(in the above K record HDT is 090 (East))
B160248 5107220N 00149150W A 00494 00436 0190 018 CRLF
B160252 5107330N 00149127W A 00496 00439 0195 015 CRLF
L XXX RURITANIAN STANDARD NATIONALS DAY 1 CRLF
L XXX FLIGHT TIME: 4:14:25, TASK SPEED:58.48KTS CRLF
G REJNGJERJKNJKRE31895478537H43982FJN9248F942389T433T CRLF
G JNJK2489IERGNV3089IVJE9GO398535J3894N35895498300934 CRLF
G SKTO5427FGTNU5621WKTC6714FT8957FGMKJ134527FGTR6751 CRLF
G K2489IERGNV3089IVJE39GO398535J3894N358954983FTGY546 CRLF
G 12560DJUWT28719GTAOL5628FGWNIST78154INWTOLP7815FITN CRLF

----- ends -----