# THE FAI INTERNATIONAL GLIDING COMMISSION (IGC)
# GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)
# FLIGHT RECORDER (FR) APPROVAL COMMITTEE (GFAC)

FAI web site: http://www.fai.org
IGC web site: http://www.fai.org/gliding
IGC GNSS web site: http://www.fai.org/gliding/gnss
Free software: http://www.fai.org/gliding/gnss/freeware.asp

To: FAI internet IGC-discuss group
Internet newsgroup rec.aviation.soaring
IGC GNSS web site under "List of Approvals"
Copy: Manufacturer concerned

10 April 2005

## IGC APPROVAL FOR EW MODELS A-D
## GNSS FLIGHT RECORDERS
## FOR BADGE FLIGHTS UP TO AND INCLUDING DIAMONDS

(i) Status. This document gives formal approval for this GNSS Recorder equipment to be used for the validation of flights under the rules and procedures of the FAI Sporting Code Section 3 (Gliders and Motor Gliders), subject to the conditions and notes given later. This document replaces those with earlier dates and only the IGC-approvals posted on the IGC web site are valid for use for IGC/FAI claims. IGC and FAI reserve the right to alter the terms of this approval in the future.

(i-i) Approval history. The original IGC-approval for these recorders was issued on 19 April 1997. Issue 2 dated 24 Aug 98 added EW model C and some additional Garmin GPS units. An amendment dated 29 Jan 99 added EW Model D. Amendments dated 19 Nov 99 & 10 Mar 2000 added more GPS units that can be used with the recorders. Manufacturer details were changed in this version dated 10 April 2005.

(ii) Approval levels. These recorders are IGC-approved for badge flights for Silver, Gold and Diamonds only. This is because of the lower standard of security associated with using a separate GPS receiver unit connected to the EW recorder unit by cable. Higher IGC-approval levels apply to recorders in which the GPS receiver and recorder units are integrated in one secure box (see Annex B to the Sporting Code for gliding, para 1.1.3.3).

(ii-i) Other flights including competitions. Use in competitions and for flights other than record, badge and diploma flights to IGC Sporting Code rules is at the discretion the body responsible for validating the types of flight concerned. Annex A to the Sporting Code for Gliding covers World Gliding Competitions and others that may use Annex A rules and procedures.

(iii) GFAC tests. These are concerned primarily with the data from this recorder that is in the IGC data format. Particular concerns are its accuracy and security, ease of transfer from the recorder to a PC, and conformity of the IGC file and the recorder design generally with the IGC Technical Specification for such recorders. Other aspects of the recorder system may not be tested and are a matter between the Recorder manufacturer and customers.

(iv) References. The attention of NACs, officials and pilots is drawn to the latest edition of the FAI Sporting Code Section 3 (Gliding) including its annexes and amendments. Annex A to this code (SC3A) deals with competition matters. Annex B (SC3B) deals with equipment used in flight validation (Chapter 1, GNSS Flight Recorders). Annex C (SC3C) is entitled "Official Observer and Pilot Guide" and consists of guidelines and procedures for the flight validation process. A separate document published by FAI is entitled "Technical Specification for IGC-Approved Flight Recorders" Copies of all of these documents may be obtained from the FAI/IGC web sites listed above and links are provided from the main IGC web site.

(v) Exclusions. This approval is not concerned with, and FAI has no responsibility for, matters related to: (a) Intellectual Property (IP) and Intellectual Property Rights (IPR) or, (b) the relations of the Organisation with any others except with FAI and its agents or as they affect FAI, its agents and this approval.

(vi) Standards and Procedures. This approval document is concerned solely with the standards of, and procedures relating to, the hardware, firmware and software for the type(s) of recorder described below and manufactured, updated or serviced by the Organisation listed below under "Manufacturer" and updated or serviced by such Organisation or its agents authorised by it to carry out such work.

(vii) Keep with recorder. It is recommended that a copy of this approval including its two annexes is kept with each unit of the equipment.

**MANUFACTURER**

EW Avionics, Uplands House, Upton, Near Banbury, Oxfordshire, OX15 6HJ, UK
Tel: +44 791 745 3374 Fax: +44 871 855 0284
Email: sales@ewuk.co.uk Web: http://www.ewuk.co.uk
Contact: Graham Paul, graham@ewuk.co.uk

**HARDWARE**

EWFR models A, B, C and D. These are IGC-approved only when connected by cable to the specific GPS units listed below. All models have a 9-pin 17mm wide female connector on an end face. This has EW-proprietary pin connections (see 1.1.1 and 1.1.2 for connector cables). (AL 1)

Models A, B and C. Versions or upgrades must have dates of May 1997 or later. Model A has an altitude capability of 10km., model B, 12 km., model C, 15 km. All three models are the same size, approximately 150 x 80 x 30 mm; weight is about 270 grammes. A 16-button keypad (about 60 x 60mm) and LCD (about 50 x 200mm) are on the front face.

Model D. This was introduced in Jan 99 and has an altitude capability of 15 km. Amongst other changes from previous models, it has more memory and can be powered externally. It is programmed through a PC rather than through a keyboard or display on the FR itself, and no keyboard or display are provided. Electronic flight declaration is included. Its size is about 170 x 60 x 32mm; weight is about 290 grammes. (AL 1)

GPS Units used with EW A-D recorders. The NMEA output data from GPS units to be used under the conditions of this approval must fulfil the following criteria: a regular stream of 4-D fixes (at a fix interval not more than 2 sec., although the FR may be set to record them longer intervals); and the Geodetic Datum for the fixes must either be included in the output data (with any changes of datum), or the GPS unit have a design such that the output fixes cannot be changed from the WGS84 datum. Also, it must not be easy to dismantle the GPS unit and to make unauthorised internal changes (such as re-programming output data). The current list of GPS units that IGC understands that fulfil these criteria is given below under "GPS units". Individuals who believe that other GPS units not listed may fulfil the criteria, and who wish to use such GPS units with the above models of FRs under the terms of this approval, are invited to send details (including the GPS specifications) to GFAC and the FR manufacturer.

National regulations. These may apply to electrical and electronic equipment, such as the EC "CE" mark for compliance with EC directives on EMC and voltages. Compliance with such regulations is not the responsibility of FAI. It is understood that these EWFR models have the EC CE mark.

**FR Firmware**

The firmware version is shown as part of the serial number of the EWFR, with four numbers for the year/week of the firmware, one letter for the model, and four numbers for the FR serial number.

**GPS Units**

The GPS units listed below are understood to fulfil the criteria for NMEA output given above under "Hardware - GPS units".

EW firmware 97XX or later may be used with the following GPS units: Garmin GPS 12 XL, 80-Mil, 89, 90 and 95, and the Garmin GPS 55 with software versions 1.12 or later.

EW firmware 98XX or later may be used with the GPS units above under 97XX, and also with the following: Garmin GPS II, II plus, III, III pilot, IIIPlus, 12, 12CX, 48, 92. Also the Garmin eTrex, eMap, GPSCOM 190, GPSMAP 195 and 295. (AL3)

**Software**

Programme file DATA-EWA.EXE for transfer of data from the FR to a PC and conversion to the IGC flight file format (*.IGC). CONV-EWA.EXE is for converting to the IGC format if this is not done when the DATA file is used. The DATA and CONV files have unrestricted access and are available from the FAI/IGC GNSS ftp and http web sites (see the references at the beginning of this document). The file VALI-EWA.EXE is for validation by NACs and FAI of the security and integrity of the *.IGC files, and is also available from the IGC web site. The DATA, CONV and VALI files are copyright of the FR manufacturer but are freeware.

Also, for persons familiar with it, EWView programme Version 9616A or later (dated 15 Apr 96 or later) for transfer of flight data from the FR and conversion to the *.IGC file format. Version 9824A or later is recommended as it contains various corrections. The version can be identified with the command EWVIEW -v (note the space between the W and -v).

**CONDITIONS OF APPROVAL**

1**Permitted Connections to the FR Module**.

1.1 To the 9-pin male socket on the FR body:

1.1.1 A cable between the FR and the separate GPS unit supplied either by the FR manufacturer, or by a supplier (and to a design) approved by the NAC concerned. The plug and cable connections should be designed so that the possibility of altering the wiring to inject false signals into the FR from a PC or GPS simulator, is minimised such as by the use of moulded plugs or those for which unauthorised re-wiring is difficult without being obvious. As well as the direct cable from the plug to the GPS unit to the 9-pin plug to the FR, there will be other wires and cables connected to the plugs. These include a cable to the fast sampling button, and, for Motor Gliders, to the Motor Glider means-of-propulsion sensor (microswitch). There may also be wires to an external battery to power the GPS unit, and a further cable feeding GPS information to a cockpit instrument. The cable between the GPS unit and the FR must be one continuous and undamaged run and the other cables must either be continuous and undamaged or have any joints sealed by an OO.

1.1.2 An EW Avionics proprietary cable to a PC, for transferring flight data. Note that although this cable has a 9-pin male plug at one end and a 9-pin female plug at the other, its wiring is different to other cables used for other FRs which also use these types of plugs.

1.2 To the battery compartment: A PP3 9 volt battery.

1.3 Model D, connections to external battery. (AL 1)

2. **Installation and Security**. See also para 4 and the checks and procedures given later.

2.1 **Installation in a glider**: The FR and GPS unit may be fitted anywhere in a glider (subject to para 3.2). If the GPS antenna or antenna port is accessible to the crew in flight, no attempt must be made to inject data at these places. *Any abuse of this may lead to a future requirement to place the antenna and antenna port out of reach of the flight crew.*

2.2 **Installation in a motor glider (including self-sustainers)**: Unless the MoP is sealed or inoperative in accordance with Sporting Code rules, the special microswitch provided must be installed so that it operates under all conditions in which forward thrust could be generated by the MoP. The cable to the microswitch must be easily accessible for inspection and must be unbroken except for joints sealed by an OO. The motor sensor must be operated both before and after the flight performance with continuous operation of the FR in between, so as to mark the flight data file with the appropriate codes.

2.3 **Sealing of data ports on the FR**: no requirement, but no unauthorised data must be passed into the FR during the time between takeoff and the finish of the post-flight transfer of data witnessed by an OO.

2.4. **Data Transfer from the FR to a PC**. Use the DATA-EWA.EXE program file, the MS Windows equivalent or the FR manufacturer's full software programme. The DATA file is available from the IGC GNSS web site given at the beginning of this document.

3. **Check of Installation in the Glider**. On the day of flight, an Official Observer must check the installation of the equipment in the glider, witness both the FR and the GPS unit being switched on, note the time, and the type and serial numbers of both the FR and the GPS unit. The GPS unit must be one of the exact types listed earlier under "Hardware". For Motor Gliders, the cable from the FR to the microswitch which is to record operation of the means of propulsion must be checked and it must be ensured that any positive thrust will involve operation of the microswitch. Following this; EITHER,

3.1 **Continuous Observation**. The glider must be under continuous observation by an OO until it takes off on the claimed flight, so that the GPS and FR cannot be transferred to another glider without this being observed; OR,

3.2 **Attaching or sealing to the Glider**. If para 3.1 cannot be met, the FR must be EITHER: attached in such a way that if the FR is removed from the glider, the connecting cable to the GPS Unit has to be disconnected, which will put a "disconnect" signal on the flight data file (this can be achieved by threading the cable through a part of the glider structure, instrument panel or cockpit), OR, the FR or the connecting cable must be sealed to the glider so that the FR

cannot be removed without breaking the seal. Any sealing method must be acceptable to the NAC and IGC.

4. **FR Security Seals, Physical and Electronic**. Several manufacturer's adhesive seals are placed across the join in the case. If the FR is opened, the 9V PP3 battery disconnects, all memory is lost, and the internal time clock stops; there is no other sustainer battery. If the FR is found to be unsealed, it must be returned to the manufacturer or his appointed agent for investigation and resealing, with a statement of how the unit became unsealed. Whenever any unit is resealed, the manufacturer or agent must carry out positive checks on the internal programmes and wiring, and ensure that they work normally. If any evidence is found of tampering or unauthorised modification, a report must be made by the manufacturer or agent to the Chairman of GFAC and to the NAC of the owner; the IGC approval of that individual unit will be withdrawn until the unit is re-set and certified to be to the IGC-approved standard.

5. **Analysis of Flight Data** - may be through any analysis programme which is approved by the relevant NAC. For a list of those which use the *.IGC file format, see the IGC GNSS web site under SOFTWARE). The NAC must check that the *.IGC file is valid and unaltered, by the use of a copy of the VALI-EWA.EXE file. The VALI file must have originated from the IGC web site or from the FR manufacturer. See Annex B for how to use.

6. **Manufacturer's Changes**. Notification of any intended change to hardware, firmware or software must be made by the manufacturer to the Chairman of GFAC so that a decision can be made on any further testing which may be required.

Ian Strachan
Chairman, IGC GFAC

Annexes: A. Notes for owners and pilots
B. Notes for Official Observers and NACs

Any Queries to:
Chairman IGC GFAC, Bentworth Hall West, Alton,
Hampshire GU34 5LA, England
Tel: +44 1420 564 195; Fax: 563 140
email: ian@ukiws.demon.co.uk

---

Annex A to IGC Approval
**NOTES FOR OWNERS AND PILOTS -**
**PART OF IGC APPROVAL FOR EW A-D GNSS FRs**

*To be read together with the main terms of approval to which this is an Annex. It is recommended that a copy of the approval document including annexes is kept with the equipment concerned, for the use of pilots and Official Observers.*

**Pilot's Responsibility**. It is the responsibility of the pilot to ensure or to note the following:

A1 **Antenna**. The antenna should be positioned to give sufficient signal strength for IGC purposes. No deliberate attempt must be made to inject data via the antenna or antenna port; any abuse of this may lead to a future requirement to position antennas and the antenna port out of reach of the flight crew.

A2 **Geodetic Datum**. The WGS84 Geodetic Datum must be set (IGC Sporting Code rule) and a GPS unit used where its NMEA output either is fixed to the WGS84 datum or which Geodetic Datum in its output so that it can be shown that WGS84 was used for the complete flight. See the list of approved GPS units earlier under "Hardware".

A3 **Connection to Ports**. Although this approval does not presently require sealing of any ports, no unauthorised data must be passed through any port during the time between takeoff and the start of the post-flight transfer of data by an OO; any abuse of this may lead to a future requirement to seal data ports. Note that if the cable connecting the GPS unit to the FR is disconnected and/or re-connected, a code (GCN, GDC) appears on the IGC flight data file, and the flight data is invalidated because a source of false data (such as a PC) could then have been connected.

A4 **Use in Motor Gliders (including self-sustainers)**. A microswitch sensor is supplied and must be installed in such as way that it operates if any configuration is obtained from which forward thrust could be generated, unless the MoP is sealed or inoperative. The cable to the microswitch must be easy to be inspected by an OO along its complete length to ensure that there are no breaks in it (unless they are sealed by an OO) and that other functions such as unauthorised switches are not attached to it. If motor detection is required, the pilot must activate the motor sensor before the start of the flight performance, to show that the detection system was working. This may be on the ground witnessed by the

OO, or on takeoff (for self launching) or in the air (for self-sustainers, or self-launchers taking an aero tow without use of own engine) before starting the flight performance. The motor sensor must also be activated after flight, witnessed by the OO who will record the time for comparison later with that recorded on the flight data file.

A5 **After Flight** - The pilot must ensure that the time and point of landing has been witnessed and recorded for comparison with that recorded by the GNSS FR (see para B2.1). Until an OO has witnessed the FR installation to the glider, the pilot must not alter the installation or turn off the FR or the GPS (this ensures that between the OO's pre-and post-flight checks, there is no opportunity to insert false data without disconnecting the cable to the GPS unit, such disconnection being recorded on the flight file). The OO will carry out the actions given in para B2.3, and the OO's copy of the transferred flight data will be sent to the NAC. The OO does not personally have to transfer the data from the FR, but witnesses the transfer (method, para B2.3) and takes or is given a copy on electronic media. Different rules may apply for competition flights, for which a central data transfer facility may be used, but for a flight to IGC record and badge rules, the above continues to apply.

A6 **Calibration of Barograph Function**. The manufacturer carries out a full barograph calibration on each FR unit before sale. A calibration should be repeated at annual intervals if IGC/FAI flights are to be claimed. See para B5 for advice on further calibrations. An IGC-format file showing the pressure steps used in the calibration must be recorded and kept as evidence. Altitude and height claims require a calibration for the flight performance concerned, and speed and distance claims need a calibration for calculating the altitude difference of the glider at the start and finish of the performance. Also, the NAC or FAI may wish to compare pressure altitudes recorded on the FR for takeoff and landing, with QNH pressures for the appropriate times recorded by a local meteorological office.

---

Annex B to IGC Approval

**NOTES FOR OFFICIAL OBSERVERS AND NACs -**
**PART OF IGC APPROVAL FOR EW A-D GNSS FRs**

*To be read together with the main terms of approval to which this is an Annex. It is recommended that a copy of this approval document is kept with the equipment concerned, for the use of pilots and Official Observers.*

B1 **CHECKS BEFORE FLIGHT**

B1.1 **Before Switching on the FR and GPS Units**. On the day of flight, an OO shall make a record of the type and serial number of the GPS unit, the type and serial number of the FR, the glider registration, date and time.
At this point, both the FR and GPS units should be switched off and the cable to the FR unit should be disconnected.

Only listed GPS units which conform to the criteria given under "hardware" at the beginning of this document are permitted for IGC flight evidence. These GPS unit types are listed under "firmware" at the beginning of this document. No other GPS types are allowed for IGC flight evidence under the terms of this approval, but individuals believing that other GPS units may comply with the criteria given under "hardware" are invited to send details to the FR manufacturer and to GFAC.

B1.1.1 **Cable Connector**. The cable which will connect the GPS unit to the FR must be inspected and shown to be an unbroken run with no joints or connections other than those to the Event/Fast sample Button and any Motor Glider microswitch (if fitted); if there are any joints in the cable to the Motor Glider microswitch, these must have been sealed by an OO. There must be no evidence of damage or tampering with the outer sheath of the cable. Any evidence of interference with this connecting cable any its attachments may lead to a future requirement to have a more secure cable with extra shielding and with sealed plugs (for instance by using plugs moulded into the cables).

After the above checks, the units may be switched on.

B1.2 **Switching on the FR and GPS units**. Model D has no keyboard or LCD and should be switched ON, connected to the GPS unit while the GPS unit is still OFF, and then the GPS switched ON so that this is recorded on the flight file. (AL 1)

For models A, B and C, the following is an edited extract from the Manufacturer's instructions to pilots and OOs:

The FR unit is switched on and put in GPS Function mode (ENT, 4, TIME), and the display should show "gp:dn" (GPS Disconnected).

With the GPS unit still off, approved cable should then be connected to the FR. This connects the GPS, the fast sample button, and any motor glider sensor.

The GPS unit with the serial number already recorded by the OO should then be turned on, and one of the following

should show on the FR display: "gp:cn", "gp:ca", or gp:1" (these mean GPS connected but not fixing; GPS connected awaiting first fix; GPS 1 sec since last fix). This indicates that the FR has registered the connection and that the code GCN (GNSS Connect) will later show on the flight data file. The OO must note the time for later comparison with the flight data file.

B1.3 **Motor Gliders**. If the MoP is not either sealed or inoperative, the pilot must activate the motor sensor prior to the start of the flight performance, to prove that the detection system is working. This may be on the ground witnessed by the OO, or on takeoff (for self launching) or in the air (for self-sustainers, or self-launchers taking an aero tow without use of own engine) before starting the flight performance. The EW display will briefly show OPEN and CLOS (Close) at these events and the code EUP (Engine Up) and EDN (Engine Down) will appear of the flight file at the times of activation. The OO may insist in witnessing this event.

B1.4 **Observation before takeoff**. If the glider cannot then be observed continuously by the OO until it takes off on the flight concerned, the FR must be attached to the glider so that it cannot be transferred to another aircraft without a "disconnect" signal on the flight data. This may be achieved either by sealing the FR, GPS unit or the cable connector to the glider, or by threading the cable connecting the GPS to the FR through part of the glider and cockpit/instrument panel structure in such as way that to remove it would involve disconnecting the cable to the GPS unit (putting the code GDC {GNSS Disconnect} on the flight file and invalidating the flight for IGC purposes).

B1.5 **At Takeoff**. The time and point of takeoff shall be recorded, either by an OO, other reliable witnesses, or by other means such as an Air Traffic Control or official Club log of takeoffs and landings. This will be compared to the FR takeoff data.

B2 **LANDING, AND AS SOON AS POSSIBLE AFTER LANDING**

B2.1 **At Landing**. The time and point of landing shall be recorded, either by an OO, other reliable witnesses, or by other means such as an Air Traffic Control or official Club log of takeoffs and landings. This will be compared to the FR landing data.

B2.2 **After Landing**. The following is an edited extract from the Manufacturer's instructions:

B2.2.1 **GPS and FR still running**. The complete system must be presented to the Official Observer with the FR and GPS still running and connected to all of the external devices used to verify the flight (such as the approved GPS unit, the fast fix button, and the motor glider microswitch).

B2.2.2 **OO's after-flight Inspection**. A visual inspection of all wires must be made to ensure that there are no devices connected between the FR and the GPS receiver, Fast Sample button or Motor Detection sensor (if fitted). The FR should still be running (para 2.2.1).

B2.2.2.1 **Motor Gliders**. The pilot must activate the motor sensor to prove the detection system is still working. The code EUP (Engine Up) and EDN (Engine Down) will appear later in the flight file at the times of activation.

B2.2.2.2 **Models A, B and C** - in the GPS Function mode (ENT, 4, TIME) the display should show "gp:cn" or "GP:X", where X is the number of seconds since the last GPS fix.

B2.2.2.3 **Model D** - has no keyboard or LCD but indicates GPS connected and recording by a double-flash of the Status LED once per second. (AL 1)

B2.2.3 **Turning off the GPS Module**. The GPS should then either be disconnected or turned off, leaving the FR on. The code GDC (GNSS disconnect) will later appear on the flight file for this time. The indication that the GPS signal is no longer being sent to the FR is as follows:

B2.2.3.1 **Models A, B and C**. The FR display should register "gp:dn".

B2.2.3.2 **Model D**. The Status LED should change from a double-flash to a single-flash. (AL 1)

B2.2.4 **Recording, and switching off the FR**. The OO shall record the time, the serial number and model number of the GPS, the serial number of the FR, the pilot's name, and the glider type and registration. The FR may then be turned off and the flight data transferred a short time later.

B2.3 **Transferring the Flight Data**. If a portable PC is available, the flight data may be transferred at the glider without disturbing the installation of the FR; if a portable PC is not available, the OO shall check and break any sealing

to the glider (this may consist of disconnecting the cable from the GPS unit to the FR), and take the FR module to a PC.

If the OO is not familiar with the actions required, the pilot or another person may transfer the data while the OO witnesses the process; security is maintained by electronic coding embedded in the FR and in the data transferred which is then independently checked later at the NAC (and at FAI if the claim goes to them).

Method: connect the PC to the main FR module's female 9-pin computer port, and use the either the EWView programme or (when available) the file DATA-EWA.EXE on either a floppy diskette or on the PC hard disk (see under `software' on page 1). The floppy disk may be self-booting and may have a short menu with instructions.
This process will produce a binary flight data file *.EWT, and may also produce an IGC flight data file (*.IGC). The file or files shall be on or copied to a diskette signed by the OO, and retained by the OO in safe keeping for later checking and analysis under NAC procedures. The OO's diskette shall originally either be blank or may be the one which contained the DATA-EWA.EXE file.

The *.EWT file is the minimum requirement, but it is recommended that conversion to a *.IGC format file is made at the same time to avoid this having to be done later.

The data transfer process will produce an IGC-format flight data file with the file name YMDCXXXF.IGC
where Y=year, M=month, D=day, C=manufacturer (E=EW), XXX=FR Serial Number and F = flight number of the day (full key, Appendix 1 to the IGC GNSS FR Specification). A copy of this IGC-format file shall be retained securely by the OO such as by immediately copying it to a separate diskette or PC card, or by the use of the OO's own PC.

Competitions: Different rules may apply for competition flights, for which a central data transfer facility may be used, but for flights to IGC record and badge rules the above must be followed although the competition data transfer facility, being independent of the pilot, may be used instead of an OO witnessing the data transfer. For competitions, the IGC file name may be modified, for instance to the glider registration number, but as the filename is not covered by electronic security this does not invalidate the data in the file itself which is covered by the electronic security (digital signature) system inherent in the IGC specification.

B.3. **Analysis of Flight Data Files**. A Data Analyst approved by the NAC will then evaluate the flight using an analysis programme approved by the NAC concerned (list of programmes, see the IGC GNSS web site under SOFTWARE). Either the WGS84 Geodetic Datum must be recorded on the flight file lat/longs and used for the whole flight, or it must be shown that a GPS unit was used which has its output data fixed on the WGS84 datum (see the list of approved GPS units under "hardware" at the beginning of this document). Independently recorded takeoff and landing position and time data must closely correspond with that recorded on the FR. In addition to checking flight data, an authenticated version of the file VALI-EWA.EXE shall be used by the NAC and by FAI (if the data goes to them) to check the electronic security coding, that the FR had not been interfered with, and that the flight data in the *.IGC file has not been altered since it was transferred from the FR.

B3.1 **Method**: Type VALI-EWA.EXE at the appropriate prompt or run function, followed by a space and the name of the *.IGC file to be checked. If the first screen is a prompt for geodetic datum, you have an obsolete version of VAL-EWA and should obtain version 9824A or later, such as from the IGC web site. The correct version will list the times of any position fixes which are not recorded as being relative to the WGS84 Geodetic Datum. Short periods of undefined datum can be ignored as long as other fixes are to WGS84 (see B.3 below).

B3.1.1 If the GPS receiver does not output datum codes, the VALI process will indicate that the whole trace is not specified as being relative to WGS84, for example: C:\>vali-ewa 85VE0004.IGC Missing HFDTM (header datum) record. This is only acceptable if the GPS unit output is permanently fixed on WGS84. See under "hardware" at the beginning of this document for GPS types which have been shown to have the required characteristics.

If the GPS receiver does output datum codes, VALI-EWA (version 9824A and later) will list any otherwise valid position fixes which are not recorded as being relative to WGS84. For *.IGC files produced by version 9824 or later of the DATA-EWA, CONV-EWA or EWVIEW (DOS version) programs there will be none of these, because any positions which are not recorded as being relative to WGS84 are marked as invalid. *.IGC files produced by earlier versions of these programs may contain a few position fixes which are marked as valid but not as relative to WGS-84 and so will be listed by VALI-EWA. If only short runs of such positions are listed then they can be ignored (see section B3.3). If there are longer runs then the circumstances should be investigated. Irrespective of the datum considerations, VALI-EWA will check whether the trace contents and its security code are consistent. If they are, the message should be shown: "EW Flight Recorder security checks indicate the file *.IGC is VALID". If the flight file has been altered or is corrupt, the message above will end with "... *.IGC is INVALID" in which case the circumstances should then be investigated.

B3.2 **CGD codes in the flight file**. Some older EW software involved in creating the *.IGC file causes a change of Geodetic Datum (CGD code in the *.IGC file) to be recorded as soon as the first valid GPS fix is logged. The correct Geodetic Datum (WGS84 must be set) is recorded, both in the header to the *.IGC file and after the (incorrect) report of a Geodetic Datum change. Such flights should not be invalidated simply for occasional CGD codes in the flight file, unless there is positive evidence that a change from the WGS84 datum has occurred. This has been corrected in later software releases so that the CGD code is not generated unless a genuine change of Geodetic Datum has been detected.

B3.3 **Datum number 999 in the flight file**. In analysing IGC format files, a "change of datum" event to a datum of 999 can be ignored, as long as the datum recorded on the flight file returns to WGS84 (IGC number 100) in a short time. This effect has been noted with the Garmin model 12XL, and may be due to processor scheduling within the unit.

B4 **Means of Propulsion (MoP) Record -Motor Gliders**. The MoP must either be sealed or inoperative, or the microswitch system used as indicated above.

B.5 **Altitude analysis and calibration**. Flight data files shall be analysed in accordance with Sporting Code procedures. Part of this is to compare the general shapes of the GNSS altitude and pressure altitude records with time and to ensure that no major differences are seen that could indicate a problem either in recording or even the possibility of artificially-manufactured (false) data. As part of this process, the Recorder must be calibrated in an altitude chamber in accordance with normal IGC procedures for barograph calibration.

B.5.1 **Calibration method, making a calibration table**. Pressure altitude recording starts as soon as the FR is switched on, there is no need for a GPS unit to be attached. The recorder and its battery should be placed in the pressure chamber and the calibration started. The calibrator should be asked to record the pressure steps used, for later comparison with the IGC file for the calibration. The stabilised pressure immediately before the altitude is changed to the next level, will be taken as the appropriate value unless the calibrator certifies otherwise. After the calibration, the data file containing the pressure steps is transferred to a PC as if it was flight data (see B2.3 above); this may be done later by an NAC-approved person other than the calibrator who, at a non-gliding calibration centre, may not have this knowledge. The IGC-format calibration data file will then be analysed, compared to the calibration pressure steps, and a correction table produced and authenticated by an NAC-approved person (for instance an OO or GNSS Recorder Data Analyst). The correction table will list true ICAO ISA altitudes against indicated altitudes from the recorder. This table can then be used to adjust pressure altitudes which are recorded during flight performances and which require correction to the ICAO ISA before the flight can be validated to IGC criteria. These include takeoff, start and landing altitudes for altitude difference and for comparison with independently-recorded QNH readings, and low and high points on gain-of-height and altitude claims. Only pressure altitude is valid for IGC altitude measurement purposes except for proof of flight continuity (no intermediate landing) where GNSS altitude may be used if pressure altitude has failed.

B.5.2 **GPS altitude figures recorded in IGC flight files**. Occasional short-duration differences in the shape of the GPS altitude/time graph for flights have been noted when compared to the pressure altitude figures. This is not unusual with GPS receivers operating without a local differential beacon or other accuracy-enhancing systems. The altitude accuracy from satellite-based systems will not be as good as accuracy in lat/long, because satellite geometry is not as favourable for obtaining accurate altitude fixes compared to fixes of horizontal position. This effect will be increased by poor antenna positioning in the glider. Data analysts and NAC officials should allow for the above when comparing the GPS altitude and pressure altitude records. Lat/long fix accuracy is not affected. From GFAC tests after 1 May 2000 when the GPS Selective Availability error was removed, the lat/long error taken from a moving vehicle at a surveyed point, averages between 11 and 12m for all 12 channel recorders tested since that date.

B.5.3 **Maximum Altitudes Recorded in the IGC file**. The pressure altitude sensor and the GPS system itself are capable of recording to almost unlimited altitudes, certainly up to 30km/100,000ft. However, the type of processor in the recorder and the need for good resolution (lack of large steps) across the altitude range, results in limitations in altitudes that can be recorded in the IGC file. The maximum altitudes in IGC files that apply to this recorder are given below.

B.5.3.1 **Pressure Altitude**. This is recorded up to a maximum of 42,000ft on the ICAO ISA. The maximum pressure altitude tested by GFAC was 40,000 ft

B.5.3.2 **GNSS altitude**. This is recorded as a figure above the selected ellipsoid (WGS84) and the maximum altitude depends on the GPS receiver unit that is used. GNSS altitude is not used for the purpose of IGC altitude measurement (for instance gain of height and altitude performances), for which pressure altitude to the ICAO ISA is required.

---