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

References:

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>

IGC-approval documents: <http://www.fai.org/gliding/gnss/approvaldocs>

IGC GNSS site for free software: <http://www.fai.org/gliding/gnss/freeware.asp>

To: IGC GNSS web site under "List of Approvals", for permanent reference

Copy: Manufacturer concerned

Notice of issue: FAI/IGC lists igc-news@fai.org and igc-discuss@fai.org

Internet international newsgroup: rec.aviation.soaring

Date of issue: 26 February 2007

IGC-APPROVAL DOCUMENT FOR GNSS FLIGHT RECORDER

Flights: ALL GLIDER FLIGHTS

Recorder Type - EW microRecorder

(i) *This document gives IGC-Approval from the above date for the GNSS Flight Recorder equipment described below to be used for validation of flights under the rules and procedures in FAI Sporting Code Section 3 (Gliders and Motor Gliders), subject to the conditions and notes given later. IGC reserves the right to alter this approval in the future.*

(i-i) *Document history. The initial IGC-approval document for this type of recorder was dated 10 June 2006. An update dated 20 November 2006 added an Engine Noise Level (ENL) system for recording in-cockpit noise. This version adds an SD card facility for downloading flight data.*

(i-ii) *IGC-approval Level. This IGC-approval is for "all glider flights". This includes claims for world records, all badges and certificates and all Championships and Competitions, all where flight data is to be validated to IGC standards of security and evidence. The Levels of IGC-approval are listed in the Sporting Code for Gliding, Annex B para 1.1.3.3.*

(ii) *This IGC-approval document is concerned with the functions of the equipment that are concerned with recording of data. More specifically, with the accuracy and reliability of the resulting data for the exclusive sole purpose of validation and certification of flight performances to the criteria of IGC and FAI. Tests made by GFAC on behalf of IGC and FAI concern accuracy and security of data, transfer and conversion to and conformity of the output data with the standard *.IGC file format in relation to the above mentioned validation and certification purposes. Other functions of the equipment are not part of this IGC-approval and the relevance of this document does not extend beyond the specific validation and certification purposes mentioned above. In particular this applies to any function linked with aspects that could be critical to flight safety such as navigation, airspace avoidance, terrain avoidance and any aircraft proximity-warning and/or anti-collision functions. This document does not constitute any approval, guarantee and/or any statement by GFAC, IGC and/or FAI as to the reliability or accuracy of the equipment for operation in flight and any liability in connection therewith is hereby expressly excluded.*

(iii) *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 Manufacturer listed below with any other entities except with FAI and its agents or as they affect FAI, its agents and this approval.*

(iv) *The attention of National Airport Control (NAC) authorities, officials and pilots is drawn to the latest edition of the FAI Sporting Code Section 3 (Gliding) including its annexes and latest amendments. Annex A to this code (SC3A) deals with competition matters, annex B to this Code (SC3B) deals with equipment used in flight validation, Annex C to this Code (SC3C) consists of guidelines and procedures for Official Observers, pilots, and other officials involved in the flight validation process. Copies of all of these documents may be obtained from the FAI/IGC web sites listed above and links are provided from the IGC web site. A separate document published by FAI is entitled "Technical Specification for IGC-Approved Flight Recorders" and is also available through the IGC/GNSS web site shown above.*

(v) *It is recommended that a copy of this approval including its two annexes is kept with each unit of the equipment so that it is available for pilots and Official Observers.*

MANUFACTURER

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IGC-allocated manufacturer codes: Three letter EWA, single letter E

EQUIPMENT

1. **HARDWARE**

1.1 **Model Name.** EW Avionics microRecorder.

1.2 **Hardware Version.** Hardware Version v4.0 is the original IGC-approved standard and v5.0 has the Engine Noise Level (ENL) system. Later versions may be used if they are IGC-approved, see para 11 for IGC-approval of updates. The hardware version number is shown in the header record of IGC-format flight files in the form "HF RHW HARDWARE VERSION: v4.0", which can be seen by using a text editor on a PC to view the IGC file being analysed.

1.3 **Dimensions.** The recorder case is about 114mm long, 84mm wide and 26mm deep and weight is about 260 grammes.

1.4 **Connectors and lights.** A SMC 6mm antenna connector is part of the GPS receiver board. A conversion plug is included from the SMC to one of the IGC-standard connectors, the 9mm BNC bayonet. This conversion connector projects 29mm from one of the 84 x 26mm faces. USB-B and RJ45 female connectors are on the same face as the antenna and there are also red and green lights and a button. In units after March 2007 there is also an SD card slot on the end face with the connectors and antenna fitting. Connectors are described in more detail later in para 4.

1.5 **GPS receiver.** The GPS receiver board is the 12-channel JP15 SiRFSTARII by Falcom Wireless Communications GmbH of Germany (www.falcom.de).

1.6 **Pressure altitude sensor.** The pressure altitude sensor is the MS 5534 from Intersema Sensoric SA of Switzerland (www.intersema.ch). This is compensated for temperature variation and calibrated to the ICAO International Standard Atmosphere (ICAO ISA). The recorder case is not pressure-sealed and "cockpit static" pressure is recorded on the IGC file.

1.7 **National and other regulations.** These may apply to electrical and electronic equipment although compliance with such regulations is not the responsibility of FAI. However, this recorder has the European Union (EU) "CE" mark that denotes compliance with EU directives on EMC and voltages.

1.8 **Other modules.** Other modules may be connected but are not part of this IGC-approval and are a matter between the manufacturer and the customer.

2. **FIRMWARE**

Firmware Version v5.6 was the original IGC-approved standard and v6.44 incorporates the Engine Noise Level (ENL) system. Later versions may be used if they are IGC-approved, see para 11 for IGC-approval of updates. The firmware version is shown in the header record of IGC-format flight files in the form "HF RFW FIRMWARE VERSION:6.44", which can be seen by using a text editor on a PC to view the IGC file being analysed.

3. **SOFTWARE**

Downloading of flight data is either through the SD card slot fitted to the case (units after March 2007) or by connecting a PC USB socket to the 9 x 8mm female USB-B connector on one end of the recorder unit. On connecting to a working PC, the recorder is recognised as another drive.

3.1 **Validity of Flight Data.** For data in the IGC-format file to be valid, it must pass the IGC VALIDATE check. That is, by using the validate function of the IGC Shell program together with the IGC-EWA.DLL file in the same directory and interrogating the IGC file that is to be Validated. See B2.3.1.1 for more details.

3.2 **Use of Latest Files - Free Availability.** The DLL file is copyright of the Recorder manufacturer but is freeware. The IGC Shell program is freeware and can be used with all manufacturers' DLL files though a single menu. The latest versions of these programs must be used and can be obtained directly from the IGC GNSS Internet site for software or through the main IGC site through a link. See the web site titles given at the beginning of this document.

CONDITIONS OF APPROVAL

4. **Permitted Connections.** These are on an end face, the other end face being blank.

4.1 **GPS antenna.** A 6mm SMC (Sub-Miniature type C) screw-type connector is at the edge of the side face and is fitted with a 29mm long interface connector for the IGC-standard 9mm BNC bayonet antenna connector.

4.2 **USB-B connector for Data In and Out.** A female 9 x 8mm USB-B connector is next to the antenna socket. This is used for downloading IGC files, for setting up the recorder and inserting flight declarations. When connected, the internal battery of the recorder is charged..

4.3 **RJ-45 Connector.** A female 11 x 8mm 8-pin RJ-45 fitting is next to the USB-B socket and is wired to the IGC standard. This is used for charging the internal battery from a 12V DC supply, for operating the Pilot Event (PEV) and fast-fix system through a button, and may be used with other units such as displays. Such other units are not part of this IGC-approval and are a matter between the manufacturer and customers. See para (ii) above.

4.4 **Red Light.** A 3mm diameter red light is used to signify that the unit is switched on. For details see para A4.

4.5 **Green Light.** A 3mm diameter green light indicates the state of the GPS receiver. For details see para A4.

4.6 **Button.** A 2mm diameter button is used for switching the unit on and off. A single press switches the unit on and a double press switches it off.

4.7 **SD Card.** In units after March 2007, a fitting for a full-sized Secure Digital (SD) memory card is on an end face above the USB and RJ45 connectors. The SD card is 24 x 32 x 2.1mm in size. Exact weight depends on the manufacturer but is about 2.0 grammes. IGC flight files are automatically downloaded to this card after a landing has been registered and are also stored in the recorder memory for downloading independent of the SD card if required.

5. **Security of the Equipment.** GFAC is presently satisfied with the physical and electronic security of this equipment. See para 8 on installation and para 9 on security and seals. GFAC reserves the right to inspect production-standard equipment from time to time for security, general compliance with the IGC Specification and the calibration of sensors such as for pressure altitude and Engine Noise (ENL).

6. **Installation in a glider.** From the point of view of data recording, the unit may be fitted anywhere in the glider, subject to para 8 on sealing and, for Motor Gliders (para 7), that the position is suitable for recording Engine Noise Levels (ENL). However, the position of any displays, lights and operating buttons and controls used in flight in single-seat gliders should not be remote from sight-lines used for pilot lookout and scan for other aircraft and gliders. If the GPS antenna is accessible to the crew in flight, no attempt must be made to inject false data; any abuse of this may lead to a future requirement to place the antenna out of reach of the flight crew.

7. **Cockpit Noise Level Recording - ENL system.** In Hardware versions 5 and over, an ENL (Engine Noise Level) recording system is fitted and is permanently enabled so that acoustic noise levels at the recorder are always recorded with each fix in the form of three numbers. This is essential for Motor Gliders in order to show that the engine was not run during the claimed glide performance, and has been shown to be useful for non-motor gliders in the case of accidents and incidents.

7.1 **ENL Recording System Manufacturer.** The ENL system in this recorder is made by EW Avionics

7.2 **ENL figures.** ENL figures in the IGC file range between 000 and 999 in steps of 001.

7.3 **ENL IGC-approval - Engine Types.** This document gives IGC-approval for the use of the above system for the validation of glide (non-powered) performances to IGC standards of evidence when flown with Motor Gliders that have internal-combustion engines that give substantial acoustic noise levels in the cockpit.

7.3.1 **Electric or other Quiet Engines.** This approval does not include use with Motor Gliders with electric or other engines that produce little noise in the cockpit, particularly under reduced power such as for level flight. If an electric or other quiet engine is to be used, GFAC should be notified beforehand so that tests can be carried out.

7.4 ENL System and Cockpit Positioning. A microphone and frequency filter and weighting system automatically produces an ENL (Engine Noise Level) value with each fix. The system is designed to highlight any engine noise but produce low ENL values in gliding flight. The recorder must be positioned in the glider so that it can receive a high level of engine and propeller noise when forward thrust is being generated.

7.5 ENL testing. GFAC has tested the Recorder in motor gliders with different types of internal-combustion engines, but not with electric or other power sources that produce little noise in the cockpit. For details of typical ENL values, see para B.5.

8. Check of Installation in the Glider. There must be incontrovertible evidence that the particular recorder was present in the glider for the flight concerned. This can be achieved either by observation at takeoff or landing or by sealing the recorder to the glider at any time or date before takeoff and checking the seal after landing.

8.1 Observation of Installation before Takeoff or at Landing. The recorder may be sealed to the glider in accordance with 8.2. Either a pre-flight check of the installation must be made and the glider must be under continuous observation by an Official Observer (OO) until it takes off on the claimed flight, or an OO must witness the landing and have the glider under continuous observation until the recorder installation is checked. This is to ensure that the installation is in accordance with the rules, and that another recorder has not been substituted before the data is transferred to a PC after flight.

8.2 Sealing to the Glider before Flight. If direct observation under para 8.1 cannot be achieved, the recorder must be sealed to the glider by an OO at any time or date before flight so that it cannot be removed without breaking the seal. The sealing method must be acceptable to the NAC and IGC. Paper seals must be marked in a manner such that there is incontrovertible proof after the flight that seals have not been tampered with, such as by marking across the join in the seal with the glider registration, the date, time and OO's name and signature. It must be possible for the OO to recognise the seal markings afterwards. The use of adhesive plastic tape is not satisfactory for IGC-approved sealing because it can be peeled off and re-fitted. Gummed paper tape is recommended, as used for sealing drum-type barographs. The OO must seal the recorder unit to glider parts which are part of the minimum standard for flight. It is accepted that such parts can be removed for purposes such as servicing; such parts include the canopy frame, instrument panel, and centre-section bulkhead fittings. If the recorder is sealed to such removable part, if such a part is transferred between gliders, any recorder seal for the previous glider must be removed.

9. Security Seals, Physical and Electronic.

9.1 Physical Security. A silver-coloured tamper-evident seal with the manufacturer's logo, is fitted over at least one of the screws on the end of the case that has the switch and connectors (the other end has access to the battery that can be changed without disturbing the secure part of the recorder). In addition, an internal security mechanism is included that activates if the case of the recorder is opened, see 9.2 for details.

9.1.1 Sealing of data ports and plugs. No present requirement, but no attempt must be made to pass unauthorised data into the recorder.

9.2 Electronic Security. If the internal security mechanism has been activated (such as by opening the case), any data in the memory will be lost, settings will revert to defaults, and the electronic security algorithms in the recorder will be deleted. On start up the Red light will flash rapidly to indicate that security has been breached and any flight data files subsequently produced will fail the VALI test for electronic security (see para B3). This test will also fail if the IGC file being checked differs in any way from that initially downloaded from the recorder.

9.3 Recorder found to be unsealed. If either physical or electronic security is found to have failed, the Recorder must be returned to the manufacturer or his appointed agent for investigation and resealing. A statement should be included on how the unit became unsealed.

9.4 Checks before re-sealing. Whenever any unit is resealed, the manufacturer or agent must carry out positive checks on the internal programs 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 returned to the IGC-approved standard.

10. **Analysis of Flight Data**. Analysis for flights to be validated to IGC criteria must be through the use of a program that complies with IGC rules and procedures and is approved for this purpose by the relevant National Airspace Control authority (NAC). For a list of programs which are capable of reading and displaying flight data in the *.IGC file format, see the fai.org/gliding/gnss web site under the link to SOFTWARE (the full web reference is at the beginning of this document). Before a Flight Performance is officially validated, the authority responsible for validation must check that the data in the *.IGC file has originated from the Recorder concerned, and has not been altered after it was download from the Recorder to a PC. This is done by checking the IGC data file by using the validate function in the IGC Shell program. The IGC Shell program must have originated from the current FAI/IGC web site for software listed at the beginning of this document. See B2.3.1.1 for details on security and on how to use the validate system.

11. **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. This includes changes of any sort, small or large. If in doubt, notify the change so that the responsibility for any possible action passes from the manufacturer to GFAC.

(Original Signed)

Ian W Strachan
Chairman, IGC GFA Committee

Annexes:

- A. Notes for owners and pilots
- B. Notes for Official Observers and NACs

Any Queries to:

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----- Annexes follow -----

NOTES FOR OWNERS AND PILOTS
PART OF IGC APPROVAL FOR
RECORDER TYPE - EW microRecorder

A(i). Status. To be read together with the main terms of approval to which this is an Annex.

A(ii). IGC-Approval level. This type of recorder is IGC-approved for all flights including world records.

A(iii). Copy of this document. It is recommended that a copy of this approval document 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:

Before the day of the flight to be claimed

A1 **Antenna** – Check that the antenna is positioned in order to give sufficient signal strength for IGC purposes. No attempt must be made to inject false data via the antenna, and any abuse of this may lead to a future requirement to position antennas out of reach of the flight crew.

A2 **Geodetic Datum**. Latitudes and longitudes recorded by the Recorder must be to the WGS84 Geodetic Datum, or the flight data will be invalid for IGC purposes. This recorder is fixed on the WGS84 Datum. No pilot action is required except to ensure that other lat/long data such as for start, turn and finish points, is also entered to the WGS84 Geodetic Datum (IGC rule).

A3 **Recorder installation in the glider**. The pilot must ensure that an OO has checked the place of the Recorder module in the glider and how it is fixed to the glider. If it may be difficult to find an OO immediately before takeoff, or to witness the landing, you are advised to ask an OO to seal the Recorder to the glider, and **this can be done at any time or date before flight**. See para 8 in the conditions of approval. On the position of any other displays connected to the Recorder, see para 6 in the Conditions of Approval which refers to sight-lines and the need for pilot lookout and scan.

A4 **Connection to Ports**. Although this approval does not presently require sealing of any ports, plugs or connectors, no attempt must be made to pass unauthorised data into the Recorder. See paras 8 and 9 in the conditions of approval.

A5 **Use in Motor Gliders** (including self-sustainers). In firmware versions 6.44 and above, an Engine Noise Level (ENL) system is fitted. It is permanently enabled and cannot be turned off. The internal microphone and associated circuitry automatically records an ENL (Engine Noise Level) value between 000 and 999 with each fix. The recorder must not be covered or insulated, although even so, automatic gain should continue to ensure high ENL readings under engine power.

A5.1 **Cockpit noise**. Pilots should note that cockpit noises other than the engine will produce ENL figures on the IGC file, and should avoid those that could be mistaken for use of engine. **Flight with the cockpit Direct Vision (DV) and/or ventilation panel(s) open can produce a low-frequency sound (organ-pipe note) which will register as high ENL. This is magnified if sideslip is present and in particular at high airspeeds. High airspeeds with cockpit panels open should therefore be avoided in case the ENL recorded is mistaken for use of engine.** High ENL may also be produced by stall buffet and spins, particularly in Motor Gliders if the engine bay doors flutter (vibrate or move in and out). Flight close to powered aircraft should also be avoided, except for normal aero-tow launches. For ENL levels that have been recorded on GFAC tests, see B.5.2.

A5.2 **Pilot check of ENL figures**. Pilots are recommended to check that the ENL figures produced show a clear differentiation between engine-on and engine-off flight. ENL figures should be in accordance with those found in GFAC tests and listed in para B4. This may be vital on a later flight when a claim is made. If ENL figures are found to be widely different to those in para B4, the recorder should be returned to the manufacturer for the ENL system to be re-set.

A6 **Calibration of Barograph Function**. Pilots are advised to have a barograph (pressure altitude) calibration carried out either by the manufacturer or by an NAC-approved calibrator before any GNSS Recorder is used for a claimed flight performance. For the procedure, see para B6. A valid IGC-format file showing the pressure steps used in the calibration must be recorded and kept (Sporting Code rule). 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 points. Also, the NAC or FAI may wish to compare pressure altitudes recorded on the Recorder for takeoff and at landing, with QNH pressures for the appropriate times recorded by a local meteorological office.

On the day of the flight to be claimed

A7 **Switching On.** Press the button on the end face with the connectors and lights. After a short time, the red light will flash, the number of flashes indicating the state of charge of the internal battery. Four flashes indicates over 80% charge, one flash indicates a low battery. The red light then indicates continuously except that after the Pilot Event (PEV)/fast fix button is pressed, the red light flashes for the 30 second period of the fast fix sequence. The green GPS receiver light will first be on continuously while the receiver searches for satellites, it then flashes when lock-on is achieved. The recorder may also be switched on by providing external power to the RJ45 socket.

A8 **Independent Check of Takeoff.** The pilot must ensure that the time and point of takeoff has been independently witnessed and recorded for comparison with takeoff data in the IGC file from this recorder, see para B1.2.

A9 **In Flight - PEV and fast fixing.** When the Pilot Event (PEV) button is pressed, PEV is recorded on the GPS fix at the time. After this, 30 fast fixes at 1 second intervals are recorded except that the first two fixes after the PEV event are still at the "cruise" fix rate due to power-reduction measures in the recorder that delay the onset of the 1 second fix rate.

A10 **After Landing.** Until an OO has witnessed the recorder installation to the glider, the pilot must not alter the installation or break any sealing. The pilot must ensure that there is evidence of the landing independent of the flight recorder data, see A11 below.

A10.1 **After-flight calculation of security.** After landing, the recorder calculates a digital signature for the IGC file for the flight, using a Public/Private Key encryption system. This process places security codes at the end of the IGC file for the last flight, which is then complete and stored in the memory ready for downloading. These codes are used to verify the integrity of the whole file at any later time by using the Validate function of the IGC Shell program with the IGC-EWA.DLL file in the same directory (see B4.1). The digital signature is calculated and the IGC file is ended after one of the following three conditions: (1) if no movement has been detected for the "Auto-off" time and conditions set by the pilot before the flight in the EW-USER.TXT file; (2) after deliberate action has been taken to switch off the recorder (see A12 below), or; (3) if the recorder is still powered after the flight, if a live USB plug is inserted to start the download process (see A11 and B3.3).

A11 **Independent Check of Landing** - The pilot must ensure that the time and point of landing has been witnessed and recorded for comparison with IGC file data from the recorder (see para B3.1).

A12 **Switching Off.** Press the button on the end face twice and after a short time the recorder will switch off, indicated by the red and green lights going out. Alternatively the recorder will switch off automatically after the time set in minutes in the EW-USER.TXT file has elapsed with no movement.

A13 **Downloading the Flight Data.** This is either through the SD card or the USB socket on the end face of the recorder next to the RJ-45 and antenna connectors, see B3.3. The OO will carry out the actions given in B3.3, and the OO's copy of the transferred flight data will be sent to the organisation that will validate the flight, such as the National Airport Control authority (NAC). The OO does not personally have to transfer the data from the Recorder, but witnesses the transfer 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 the rules for IGC records and badges, the above continues to apply.

A13.1 **Use of Portable PC.** The PC used either for downloading at the glider or for reading the SD Card may be owned by the pilot or any other person as long as the download of flight data is witnessed by an OO. After download, the IGC files must be given to the OO for safe keeping and analysis, such as via portable media such as a USB memory device or an SD card. Data integrity is preserved by using the IGC Validate program, see B4.1.

----- end of Annex A -----

NOTES FOR OFFICIAL OBSERVERS AND NACs - PART OF IGC APPROVAL FOR RECORDER TYPE - EW microRecorder

B(i). Status. To be read together with the main terms of approval to which this is an Annex.

B(ii). IGC-Approval level. This type of recorder is IGC-approved for all flights including world records.

B(iii). Copy of this document. 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 Pre-Flight

B1.1 Installation in the Glider. An OO shall witness and record the position of the Recorder in the glider, the type and serial number (s/n) of the particular Recorder, the glider type and registration, date and time. The s/n of each individual recorder consists of three characters made up of letters and/or numbers. These are written on the case and can be seen in first line of the header record of any IGC file from the particular recorder in the form "A EWA XXX" where XXX is the s/n. If the recorder is not sealed to the glider, either a pre-flight check of the installation must be made after which the glider must be under continuous observation by an OO until it takes off on the claimed flight, or an OO must witness the landing and have the glider under continuous observation until the Recorder installation is checked. This is to ensure that the installation is correct, and that another Recorder has not been substituted in the glider before the data transfer (B2.3). See paras 5 and 6 of the Conditions of Approval. On the position of any extra displays connected to the Recorder, see para 6 in the Conditions of Approval which refers to sight-lines and the need for pilot lookout and scan.

B1.2 Pre-flight Declaration. This device is capable of recording up to ten Turn Points in addition to start and finish points. Where less than 10 Turn Points are declared, non-declared turn point lines in the IGC file C-record appear as zero N and zero E and should be ignored as part of the valid pre-flight declaration..

B2 Takeoff - Independent Evidence. The time and point of takeoff shall be recorded by sources independent of the Recorder, 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 then be compared to the takeoff data recorded on the IGC file.

B3 Landing

B3.1 Independent Evidence of Landing. The time and point of landing shall be recorded by sources independent of the Recorder, 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 landing data recorded on the IGC file.

B3.2 Checking the Installation of the Recorder. As soon as practicable after landing, an OO shall inspect the installation of the Recorder in the glider (including any sealing to the glider), so that this can be compared to the check described in para B1.1 above. The transfer of flight data shall then take place in accordance with B2.3.

B3.3 Downloading the Flight Data. The flight data is downloaded using either the SD Card (for recorders with one) or direct to a PC from the recorder USB port. For how to download, see the sub paragraphs below. The flight data can be transferred at the glider without disturbing the installation of the Recorder (see para A13). If this cannot be done at the glider, the OO shall check and break any sealing to the glider, and take the Recorder 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 Recorder which is then independently checked later by the Authority that is to certify the flight performance. This is done by the IGC Validate program being used by the OO, the Competition Organisation, the NAC or at FAI (if the claim goes to them).

B3.3.1 Method 1 - SD Card. For units with the SD Card slot, when a landing is detected, the flight files are automatically downloaded to the SD Card. The Card can then be removed under OO supervision and read by a PC Card reader. If the SD Card is used, there must be incontrovertible evidence that it and its files came from the recorder and glider concerned.

B3.3.2 Method 2 -USB Port. The USB-B female socket on the end face of the recorder is connected to a PC USB socket. The PC will then recognise the recorder as another drive in the same way as using a USB memory device. By using Windows Explorer or an equivalent program, the IGC files in the memory are displayed together with a file named EW-USER.TXT. The latest IGC files can then be transferred to the PC using the normal "Copy" function. The TXT file is used to change the recorder setup in areas such as fix rate, pilot and glider details, and pre-flight declaration.

B3.3.3 Files produced. The download process will produce an *.IGC-format flight data file with the file name YMDEXXXXF, where Y=year, M=month, D=day, E= manufacturer (EW Avionics), XXX = Recorder Serial Number/letters and F = flight number of the day (full key, Appendix 1 to the IGC GNSS Recorder Specification, also listed in Annex C to the Sporting Code, SC3C).

B3.3.4 OO's Copy. A copy of the *.IGC files shall be retained securely by the OO such as by immediately copying them to standard storage media. These flight data files shall be retained by the OO in safe keeping for later checking and analysis under NAC/IGC procedures.

B3.3.4.1 Storage media and Integrity of data. The OO may keep the required data files on standard portable storage media such as the hard disk of a PC, USB memory device or other type of portable memory card. The IGC files may be copied because the IGC VALIDATE check will work with copies in the same way as the original. Integrity of flight data on the IGC file is preserved by comparing checks on takeoff and/or landing from sources different to the recorder, and by the VALIDATE check (B4..1) that can be carried out at any time.

B3.3.5 Competitions. Different rules may apply for competition flights, for which a central data transfer facility may be used. For ease of identification within the competition, IGC file names may be changed by the organisers, for instance to the glider competition number or the pilot's name. Integrity of data within the file is preserved by the electronic security system and may be checked at any time by using the VALIDATE check (B4.1). The data in the original IGC file name is repeated in the IGC file header, is protected by the IGC security system (VALI check) and can be read at any time through a text editor.

B4 Analysis of Flight Data Files. A Data Analyst approved by the authority that is to certify the flight will then evaluate the flight using an approved analysis program such as one approved by the appropriate NAC. For a list of analysis programs, see the IGC GNSS web site under SOFTWARE. In addition to checking flight data, an authenticated version of the IGC Shell Validation program shall be used by the Authority that is to certify the flight performance.

B4.1 Validation Program - What it Checks. The IGC Validate program checks the electronic security coding in the IGC file, that the Recorder had not been interfered with, and that the flight data in the file has not been altered since it was transferred from the Recorder. The latest version of the Validation program must be used and is available free from the IGC GNSS web site for software given at the beginning of this document. It can be used at any time to validate an IGC file, such as by the Data Analyst, OO, the Competition Organisation, the NAC or at FAI (if the claim goes to them).

B4.1.1 Use of IGC Shell program. Download the free IGC Shell program and place all the files in one directory (the name IGC Shell is recommended). These files are available on the IGC GNSS web pages through the file igcdll.zip. For the shell program to work with a Recorder, the appropriate Dynamic Link Library (DLL) file from the recorder manufacturer must be copied to the IGC Shell directory.

B4.1.1.1 IGC Shell Program Menu. After copying the IGC-EWA.DLL file to the directory that contains the IGC Shell files, execute IGC-SHELL.EXE. Set the path to the IGCshell directory using the "Set Directories" button on the screen. The IGCshell menu will now appear in a grey rectangular box with 9 software buttons for selecting the recorder type, recorder settings and flight logs. The recorder software box at the top should now include the line "EW Avionics Micro Recorder and ABCD loggers", which should be selected.

B4.3.1.2..Validation of Data. Select the manufacturer from the top menu box, press the "Validate" button and select the IGC file that is to be checked. If successful, the message "File has been successfully validated" appears. If security has been breached the message "Validation check failed" appears with a likely reason. In addition, if the case has been opened, the security mechanism activates and the EW-USER.TXT file shows "Security Status: COMPROMISED" and the end of the IGC file, when viewed by a text editor, has no security coding and

says instead: ### Flight Recorder Security Compromised ###. In this case the Validation program has the message: "Validation check failed, missing G records".

B4.3.1.2 Latest Program Versions. The latest versions of the free IGC shell and DLL files shall be used, otherwise the Validation of flight data may not be genuine. These can be obtained from the IGC GNSS site for software listed at the beginning of this document.

B5 **Means of Propulsion (MoP) Record - Motor Gliders**. The MoP must either be sealed or inoperative, or the built-in microphone system used that records a three-number Engine Noise Level (ENL) with each fix on the IGC file. See para 7 in the main body of this document for more details on the ENL system. ENL values recorded on GFAC tests are given below, in the sequence of a flight.

B5.1 ENL during launching. During winch and aerotow launches, higher average ENL values are to be expected than when soaring (B4.3). On aerotow, a reading of 110 has been recorded and 150 during a winch launch. During the ground roll, short-term higher values up to 300 have been seen, probably due to wheel rumble, particularly on hard surfaces.

B5.2 ENL during engine running. On engine running at powers needed to climb, an increase to over 800 ENL is expected. Over 900 is typical for a two-stroke engine, over 800 for a 4-stroke. An ENL value of 999 has been recorded with a two-stroke engine running at full power. During engine running, these high ENLs are produced for a significant time, and when altitude and speed are analysed it can be seen that a large amount of energy is being added, which can therefore be attributed to energy that is not part of soaring. Wankel (rotary) and electric engines have not been tested with this recorder, but previous tests with Wankel engines indicate that they produce similar ENL values to 4-strokes.

B5.2.1 Electric Power. If an electric engine is to be used, please contact GFAC as soon as possible so that tests can be carried out.

B5.3 ENL during gliding flight. ENL readings of less than 050 indicate normal quiet gliding flight with a well-sealed cockpit.

B5.3.1 Higher Speed. In a high-speed glide, or in a glider with more cockpit noise, the ENL will increase. **With canopy panel(s) open, a much louder noise may be present and pilots are recommended to avoid this so that high ENL readings cannot be mistaken for engine running, particularly if the glider is climbing such as in wave lift. At 100 knots IAS with canopy panels open, ENL values of 900 have been recorded and this condition should be avoided because it could be mistaken for use of engine.**

B5.3.1 Thermal Turns. Thermalling with the cockpit panel(s) open can produce low frequency noise ("organ-pipe" effect), particularly if sideslip is present. Thermalling turns with canopy panels open has produced an average ENL up to 200 with some short-term readings up to 500. High cockpit noise when climbing should be avoided so that high ENL readings cannot be mistaken for engine running.

B5.3.1 Stalling and Spinning. High ENL may also be recorded during stalling and spinning, particularly if the engine doors flutter or vibrate (move slightly in and out due to stall buffet, producing a clattering noise).

B5.3.1 Pylon movement. Finally, where the engine is mounted on a retractable pylon, a high ENL reading will be shown if flying with the pylon up and engine not running, due to the high aerodynamic noise.

B5.4. ENL during the approach to land. ENL values are always higher on a landing approach due to aerodynamic noises such as due to airbrakes, undercarriage, sideslip, turbulence, etc. Short-term peaks due to specific actions such as opening airbrakes, lowering undercarriage, etc., will be noted as well as a generally higher level of ENL because the glider is no longer aerodynamically clean. ENL values of up to 100 have been recorded and 050 in a quieter machine.

B5.5 ENL during landing. During ground contact during landing, short-duration ENL values up to 500 have been recorded, probably due to wheel squeak and rumble, particularly on hard surfaces. Unlike engine running these last only for a short time, showing a short spike on the noise/time record.

B5.6 ENL analysis. It is normally easy to see when an engine has been running and when it has not. Other data such as rates of climb/descent and groundspeed, will indicate whether or not non-atmospheric energy is being added. Short term peaks in ENL (10 seconds or so) may be due to the other factors mentioned above such as undercarriage and/or airbrake movement, sideslip, open cockpit panel combined with sideslip and /or high airspeed, the nearby passage of a powered aircraft, etc. If in doubt, email the *.IGC file to the GFAC Chairman for further analysis and advice (see earlier for email address).

B6 Altitude analysis and calibration. Flight data files will be analysed in accordance with Sporting Code procedures. Part of this is to compare the general shapes of the GNSS and pressure altitude fix records with time and to ensure that no major differences are seen that could indicate malpractice or manufactured (false) data. As part of this process, the Recorder can be calibrated in an altitude chamber in the same way as a drum barograph.

B6.1 Calibration method, making a calibration table. No GPS fixes are required for a pressure altitude trace to be produced. However, before a calibration, you are advised to set the normal (cruise) fix rate to a small time interval such as 5 seconds or less. Recording at the pre-set fix interval starts when power is connected to the recorder and the pressure altitude change threshold is exceeded (about 1 m/sec for 5 sec). The calibrator should be asked to cycle the pressure briefly up and down before starting the calibration itself, so that recording will start. The calibrator will record the pressure steps used, for later comparison with the flight file. 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 by an NAC-approved person other than the calibrator who 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 by an NAC-approved person (for instance an OO or GNSS Recorder Data Analyst). The correction table will list true against indicated altitudes. This table can then be used to adjust pressure altitudes which are recorded during flight performances and which require correction before validation 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 purposes except for proof of flight continuity (no intermediate landing) where GNSS altitude may also be used.

B6.2 GPS altitude figures recorded in the IGC file. Occasional short-duration differences in the shape of the GPS altitude/time graph 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 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 and tests on this recorder show it to be typical of that for a 12 channel GPS system. 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.

B6.3 Maximum Altitudes Recorded in the IGC file. The maximum altitudes in IGC files that apply to this recorder are given below.

B6.3.1 Pressure Altitude. This is recorded up to 11 km (36,089 ft) on the ICAO ISA.

B6.3.2 GNSS altitude. This is recorded up to 18 km (59,055 ft) above the WGS84 ellipsoid.

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