GNSS FLIGHT RECORDER APPROVAL COMMITTEE (GFAC)
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of the
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References: See para (i-iv) below

To: IGC GNSS web site under "IGC-approval Documents"
        GFAC Chairman's web site
        FR Manufacturer, igc-news@fai.org , Newsgroup rec.aviation.soaring   Date of issue: 20 May 2020

IGC-APPROVAL FOR GNSS FLIGHT RECORDER
Level of Approval: See para (i-ii) below
Manufacturer - Recorder Names: DSX - 7100 T-Advisor and 8000 Tracer

(i) General. This document gives formal approval from the above date for the Flight Recorder (FR) described below to be used for the validation of flights under the FAI Sporting Code Section 3 (Gliders and Motor Gliders) and under the rules and procedures of other FAI and other activities that use IGC-approved recorders, subject to the conditions and notes given later. This document replaces those with earlier dates. Only the terms of the IGC-approval documents currently posted on the IGC web site are valid for use for IGC/FAI claims, and IGC reserves the right to alter this approval in the future.

(i-i) Document Versions and Scope. The initial IGC-approval document for this type of recorder was dated 12 April 2008. A future change of IGC-approval level was notified in the document version dated 20 October 2019, and the change was made on 1 January 2020, see (i-ii) below. This version includes a new para (i-iv) with directions to the current web sites for documents related to the FR IGC-approval process, and the GFAC Chairman's new email address on page 4.

(i-ii) IGC-approval Level. This is IGC Level 2 (all IGC badges and distance diplomas). The Levels of IGC-approval are listed in the Sporting Code for Gliding, Annex B para 1.1.4. This type of FR may also be used in gliding and FAI competitions and events to which the IGC Level 2 recorder standard applies. The rules and procedures for World Gliding Championships (and other Competitions that use the same rules) are given in Annex A to the Sporting Code for Gliding (SC3A). Until the end of 2019 the IGC-approval level was Level 1 (all flights including world records), but this was changed due to increases in IGC Specification conditions for Level 1 that are not met by this type of FR.

(i-iii) GNSS System. The Global Navigation Satellite System (GNSS) in this Recorder is the US NAVSTAR Global Positioning System (GPS).

(i-iv) Current web sites. References for the latest versions of documents relating to IGC-approval of FRs (including the latest version of this document) are given in para 2 on page 1 of the main table that lists all IGC-approvals. The latest version of the table is available through <www.fai.org/igc-documents> and the GFAC Chairman's web site <www.ukiws.uk/GFAC>. The detailed references are placed in the main FR table rather than in each IGC-approval document, so that if the reference changes, only the main table has to be updated rather than all IGC-approval documents.

(ii) Equipment Functions. This document is concerned only with, and applies to, the functions of the equipment that record flight and related data. More specifically, with the accuracy and reliability of recorded data for the exclusive sole purpose of validation and certification of flight performances to the criteria of FAI and in particular, but not exclusively, IGC. FAI is the legal entity and Swiss law applies. FAI Commissions such as IGC and others are agents of FAI; GFAC and its advisors are agents of IGC. Tests made by GFAC on behalf of IGC and FAI primarily concern accuracy and security of data, transfer and conversion to and conformity of the output data with the specified IGC file format for the validation and certification purposes mentioned above. 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 above. In particular this document does not give the approval of GFAC, IGC and/or FAI to any function linked with aspects that could be critical in any way to flight safety such as navigation, the avoidance of controlled or other restricted airspace, 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) Intellectual Property. This approval is not concerned with, and FAI, IGC and GFAC have no responsibility for, matters related to: (a) Intellectual Property (IP) and Intellectual Property Rights (IPR) and/or, (b) the relations of the Manufacturer listed below with any other entities except with FAI and its agents, including IGC and GFAC, or as they affect FAI, its agents and this approval.

(iv) FAI Sporting Code Section 3. The attention of National Airsport Control (NAC) authorities, FAI National Members, 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 to the Code (SC3B) with equipment used in flight validation, Annex C to the Code (SC3C) deals with 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) Keep with the Equipment. 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 when required.

MANUFACTURER

It is understood that this manufacturer is no longer active.

    Contact details used to be as follows:
    DSX High Tech Sagl, Via Camara 50, CH 6932 Breganzona, Near Lugano, Switzerland
    +41 78 688 5918   +39 347 220 0800
    info@d-s-x.net   www.d-s-x.net   Contact: Lucas Marchesini
    IGC manufacturer codes: Three letter DSX,   single letter D

1. HARDWARE

1.1 **Recorder Names**. DSX 7100 T-Advisor series and DSX 8000 Tracer series. The Tracer is a T-Advisor without the Traffic Alert function. 7100 and 8000 are the basic models. An additional USB connector on the case is indicated by different DSX numbers, DSX 7110 for the T-Advisor and DSX 8010 for the Tracer.

1.2 **Hardware Version**. The original IGC-approved hardware standard was Version AC3. Version AC4 added the ENL function for Motor Gliders. Later versions may be used if they are IGC-approved, see para 11 below about IGC-approval of updates. The Version number is shown in the header record of IGC-format flight files in the form "HFRHWHARDWARE VERSION: DSX AC 3" which can be seen by using a text editor to view the start of the IGC file.

1.3 **Dimensions, Weight, Power Source**. The recorder unit is in a rectangular metal or plexiglass (perspex) case about 111 x 92 x 26mm in size. It weighs about 165 grammes without external cables or display units. The recorder unit is essentially a "Black Box (BB)" design, in that no lights or displays are fitted to the recorder module. These are provided through connections to separate display units. An external DC source giving between 8 and 30 Volts is required and the recorder unit continues to work down to about 7 volts. When external power is off, a small sustainer battery maintains a number of security functions and maintains time (UTC) through a Real-Time Clock (RTC).

1.4 **Connectors.** One of the 92 x 26mm end faces has six connectors and the DSX 7110 and 8010 models have a USB connector as well. The other end face is blank. A screw connector to a transmit and receive (TX/RX) AE is on the 111 x 92mm top face.   The connectors are described in more detail in para 4 below.

1.5 **GPS receiver**. A 12-channel Copernicus GPS receiver by Trimble Navigation is fitted (www.trimble.com). This is shown in the header record of IGC-format flight files in the form "HFGPS: Trimble,Copernicus,12,20000" where the last two figures are the number of channels and the maximum GPS altitude for which this recorder is designed. The header record can be seen by using a text editor to view the start of the IGC file.

1.6 **Pressure altitude sensor.** A MS 5534 Pressure Altitude sensor by Intersema Sensoric SA of Switzerland (www.intersema.ch) is fitted. Later models have the MS 5534C sensor. This is shown in the header record of IGC-format flight files in the form "HFPRSPRESSALTSENSOR: Intersema,MS5534C,20000", where the last figure is the maximum pressure altitude for which this recorder is designed. The header record can be seen by using a text editor to view the start of the IGC file. Pressure altitude figures in the IGC file are compensated for temperature variation and calibrated to the 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 regulations may apply to electrical and electronic equipment and compliance with such regulations is not the responsibility of FAI.

> 1.7.1 <u>Traffic Alert function</u>. The DSX Traffic Alert (Proximity Warning) function is not part of this IGC-approval, which concerns only the recording function (see para (ii) on page 1). Users of the Traffic Alert function are advised to check their National regulations before using it. FAI, IGC and GFAC have no responsibility or liability for such use, also see para (ii) on page 1.

1.8 **Other modules**. Other modules such as for cockpit in-flight displays may be connected but are not part of this IGC-approval and are a matter between the manufacturer and the customer.

2. FIRMWARE.

2. **FIRMWARE.** Version 8.04a (standing for the first version (a) in April 2008 (4/08)) was the original IGC-approved firmware standard. Earlier versions refer to previous standards before IGC-approval. Later versions may be used if they are IGC-approved, see para 10 below for IGC-approval of updates. The firmware version is listed in the header record of IGC files in the form "HFRFWFIRMWARE VERSION: DSX 8.01a" and can be seen by using a text editor to view the start of the IGC file.

3. **SOFTWARE.** Downloading of flight data is through the Microsoft Windows-based IGC Shell system that is available without charge from the IGC GNSS web site in the file igcdll.zip. Downloading can also be made through the manufacturer's DSX Win program. The IGC Shell files should be downloaded into a specific directory that is named in advance (the name IGCshell is recommended). 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. For this recorder, the file IGC-DSX.DLL is available on the IGC GNSS web site.

    3.1 **Latest versions**. The latest versions of the files in igcdll.zip and the manufacturer's DLL files must be used, obtained from the IGC GNSS site for software given at the beginning of this document.

    3.2 **Free availability**. The IGC Shell program is free and the manufacturer's DLL file is freeware but is copyright of the recorder manufacturer.

    3.3 **Validity of Flight Data**. The IGC standard for electronic flight data is that the IGC file must pass the IGC VALIDATE check. The Validate function of the IGC Shell program is used to interrogate the IGC file that is to be Validated. The IGC Validate procedure checks that the IGC file has correctly originated from a specific recorder and that it is identical to when it was initially downloaded. See B3.3.4 for more details.

CONDITIONS OF APPROVAL

4 **Connections to the Recorder.** All are on one of the 92 x 26mm end faces except the Traffic Alert antenna which is on the top of the recorder unit.

    4.1 GPS Receiver Antenna. A circular SMC (Sub-Miniature type C) female screw connector of 3mm diameter is on the left end of an end face of the recorder. The antenna cable has an SMC male connector of about 5mm external diameter.

    4.2 4-pin RJ-10 connector. A 4-pin RJ-10 telephone-type socket is between the antenna and RJ45 connectors and is for connecting the manufacturer's display module. The display module has an on/off switch and a button for Pilot Event (PEV) and fast fixing. Other functions such as directional lights for the traffic alert function are not part of this IGC-approval and IGC has no responsibility or liability for such functions.

    4.3 RJ-45 connectors. Two 8-pin RJ-45 sockets are on the same face as the antenna connector, next to the RJ10 connector. The RJ45 next to the RJ10 is wired to the IGC standard and includes connections for DC external power (see 1.4) and for upload and download of data to and from the recorder either to a PC or to the manufacturer's USB download module, where this is supplied. The second RJ-45 is for other functions including sending data to a Personal Digital Assistant (PDA), but no damage will result if the IGC-wired RJ-45 is connected.

    4.4 Traffic Alert function - transmit/receive antenna. Where the Traffic Alert (proximity warning) function is fitted, a recessed 6mm diameter SMA screw fitting on the top 111 x 92mm face is for the Traffic Alert transmit and receive (TX/RX) antenna (AE).

    4.5 USB connector. The DSX 7110 T-Advisor and the DSX 8010 Tracer have the USB download system fitted internally and in these models a USB connector for a memory stick is on the end of the recorder next to the RJ45 connectors.

    4.6 Traffic Alert antenna. A 5mm diameter SMA screw fitting on the 111 x 92mm top face is for a cable to an antenna (AE) for a the DSX Traffic Alert (proximity warning) transmit and receive (TX/RX) function.

5 **Security of the Equipment**. GFAC is presently satisfied with the physical and electronic security of this equipment in terms of the integrity of the recorded flight data and the level of this approval for the types of flights concerned. See paras 8.1 and 8.2 on security 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.

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 7.4 on ENL and para 8 on sealing. 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.

7 **Cockpit Noise Level Recording - ENL system**. In later models, a microphone and frequency filter and weighting system automatically produces an ENL (Environmental Noise Level) value with each fix. The system is designed to highlight any engine noise but to produce low ENL values in gliding flight. The ENL system is essential for Motor Gliders in order to show that the engine was not used to produce forward thrust during the part of the flight that contains the claimed glide performance. ENL data has also been shown to be useful for non-motor gliders in the case of accidents and incidents.

    7.1 ENL Recording System. The ENL system in this recorder is made by recorder manufacturer DSX.

7.2 ENL figures. ENL figures in each fix in the IGC file are 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 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 Engines with low ENL signatures. This approval does not include use with Motor Gliders that have engines that produce low ENL figures in the IGC file, particularly under reduced power such as for level flight. This applies to electric propulsion but may apply to other types of engine. If insufficient ENL values are produced (as assessed by GFAC), another variable additional to ENL and proportional to engine RPM must be recorded in the IGC file. This is in accordance with Annex B to the Sporting Code for Gliding, para 1.4.2, particularly sub-para 1.4.2.4. GFAC should be therefore notified before such engines are to be used for flights that require IGC standards of evidence, so that ENL values produced can be assessed.

7.4 ENL System and Cockpit Positioning. 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. For details of typical ENL values found on GFAC tests with internal combustion engines, see para B.5.

8. **Check of Installation in the Glider**. There must be incontrovertible evidence that the recorder was in the glider for the flight concerned, and was installed and operated in accordance with IGC procedures. This can be achieved either: by independent 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. For how this is to be done, see para B1 later in this document.

9 **Security - Physical and Electronic**.

9.1 Physical Security. A tamper-evident seal with the manufacturer's name is fitted over one or more of the case securing screws. In addition, an internal security mechanism activates if the case has been opened.

9.1.1 Sealing of data ports and connectors: 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, the security record (G-record) will be removed from subsequent IGC files and a line placed in the IGC file header record that includes the words "SECURITY CHECK FAILED". Also, such files will fail the IGC Validation test for electronic security. This test will also fail if the IGC file being analysed is different from that originally downloaded from the Recorder, even by one character in the flight data area.

9.3 Recorder found to be unsealed. If either physical or electronic security is found to have failed, before it can be used again for flights to the IGC standard 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.

9.3.1 Checks before re-sealing. Whenever any unit is resealed, the manufacturer or his 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 to the IGC-approved standard.

10 **Manufacturer's Changes, later Versions of Hardware, Firmware and Software**. 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 to retain IGC-approval for the change. This includes changes of any sort, large or small. It includes details of later Versions of hardware, firmware and software, also any changes to modules such as GPS receiver boards, pressure altitude transducers and anything related to either physical or electronic security. If in doubt, GFAC should be notified so that the responsibility for any possible action passes from the manufacturer to GFAC.

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

NOTES FOR OWNERS AND PILOTS
PART OF IGC APPROVAL

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

A(ii)   IGC-Approval level. See para (i-ii) on page 1

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:

A1 **GPS receiver antenna**. The SMC antenna has a screw fitting and pilots are advised to ensure that it is screwed fully in and tight. It may be lightly fixed with locking agent so that it cannot be loosened or become detached due to vibration or turbulence in flight. The locking agent used should prevent it from inadvertent un-screwing but enable it to be detached later if required.

> A1.1 Reception. The antenna should be positioned to give sufficient signal strength for fix recording. No deliberate attempt must be made to inject data via the antenna.
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> A1.2 Position of Antenna. The manufacturer advises that the GPS antenna should be positioned at a distance of at least 15 cm from the transmit/receive antenna at the top of the unit.

A2 **Geodetic Datum (Earth Model)**. For IGC purposes, all latitudes and longitudes recorded by the Recorder must be to a Geodetic Datum (earth model) of WGS84. This type of recorder is fixed on the WGS84 datum and no selection or switching is required except to ensure that other lat/long data such as for start, turn and finish points, is entered also to the WGS84 Geodetic Datum (IGC rule).

A3 **Setting the Fix Interval**. The fast-fix facility operates when the Pilot Event button on display unit is pressed. The fix rate can be set though the manufacturer's setup software and gives 30 fixes at the chosen rate. A one second interval is recommended for fast fixing. The fix interval for cruise flight between PEV events (such as between Waypoints) is set by the pilot before flight through the set-up program provided by the manufacturer that allows fix intervals up to 60 seconds. There is therefore no need to set a very short fix interval for cruise flight because points of interest can be marked by PEV events and take advantage of the fast fix facility. Setting a short fix interval for cruise flight leads to IGC files of large byte size, particularly for long flights. This uses up more of the recorder's memory, causes downloading after flight to take a long time, increases the chance of data corruption and may also cause problems with some analysis programs because of the large number of fixes that have to be processed.

> A3.1 IGC rules. IGC rules on fix intervals for cruise flight are an absolute maximum of 60 seconds (SC3 para 4.3.1 and Annex C to SC3, para 7.1) and 10 seconds for competitions complying with Annex A to SC3 (SC3A para 5.4C). SC3C para 7.1 says: "10 to 20 seconds has been found to be suitable, and does not use up as much memory as a more frequent setting for the whole flight. A more frequent fix interval is recommended near a Waypoint to ensure that a fix is recorded within its observation zone".

A4 **Use in Motor Gliders** (including self-sustainers): In hardware versions AC4 and later (para 1.2 earlier), an internal microphone automatically records the level of acoustic noise at the recorder and the signal is processed to emphasise engine noise. This is recorded in the IGC file with each fix in the form of a three-figure ENL value (Environmental Noise Level). The recorder must be placed so that engine noise is clearly received when the engine is giving power and the recorder must not be covered or insulated (even so, automatic gain should continue to ensure high ENL readings under engine power).

> A4.1 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.4.2.
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> A4.2 Pilot check of ENL figures. Pilots should check that the ENL figures produced by their recorder and its installation in their glider show a clear difference between engine-on and engine-off flight. ENL figures should be in accordance with those found in GFAC tests and listed in para B5. This may be vital on a later flight when a claim is made. If ENL figures are found to be significantly different to those in para B5, the recorder should be returned to the manufacturer for the ENL system to be re-set. The ENL system is designed for Motor Gliders that have internal-combustion engines that give substantial acoustic noise levels in the cockpit. For other types of engine, see para 7.3 before the annexes.

A5 **Calibration of Pressure Altitude Function**. Pilots are advised to have a pressure altitude calibration carried out 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.

A6 **Recorder installation** . The pilot must ensure that an OO has checked the place of the equipment in the glider and how it is fixed to the glider. If it may be difficult to obtain an OO immediately before takeoff, or to witness the landing, an OO should be asked 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. Regarding the position of displays concerned with the Recorder, see para 6 in the Conditions of Approval which refers to sight-lines and the need for pilot lookout and scan.

A7 **Connection to Ports**. Although this approval does not presently require sealing of any ports or plugs, no attempt must be made to pass unauthorised data into the Recorder. See para 9.1.1 in the Conditions of Approval.

A8 **Pilot checks of the Recorder before a Claim Flight**. Pilots should check and analyse a selection of IGC files from their recorder before attempting flights that will require Validation to IGC standards. This is to ensure that the recorder is performing correctly and in accordance with this approval. It should be ensured that GPS fixes, pressure altitude and ENL values are recorded as expected. In particular, ENL values should be in accordance with the figures given in para B5. See also A4 on ENL and A5 on pressure altitude calibration.

A9 **Observation of the Installation**. See A3 above.

A10 **Takeoff**.

> A10.1 Switch on. Pilots are advised to switch on at least 5 minutes before takeoff and check that GPS lock-on has occurred in time to establish a baseline of fixes before takeoff starts. GPS lock-on is indicated by the red GPS light on the display going out.

> A10.2 Independent evidence 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.

A11 **After Landing**. Until an OO has witnessed the Recorder installation to the glider, the pilot must not alter the installation or remove the Recorder from the glider. The pilot must ensure that there is evidence of the landing independent of the flight recorder data, see A9 below. After landing, the recorder may be switched off, connected to a PC for downloading flight data or connected to the DSX USB memory stick module for downloading to a memory device with a USB connector. For recorders with a USB connector on the case, a memory stick may be connected directly to it.

> A11.1 After-flight calculation of security. On downloading after flight, the recorder calculates a digital signature for the IGC file for the flight. 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-DSX.DLL file in the same directory. The digital signature is calculated and the IGC file is ended after a landing is detected.

A12 **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 B2.1).

A13 **Switching Off**. This is by switching off the external power or disconnecting the RJ45 connector from the recorder.

A14 **Downloading the Flight Data**. The RJ45 sockets in the recorder are wired to the IGC standard. A PC and a 12V battery can be connected to a cable wired to this standard with a male RJ45 on the recorder end. The OO will carry out the actions given in para 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 Airsport 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.

> A14.1 Use of Portable PC at the glider. Where a PC is to be used for downloading rather than a USB memory stick, the PC may be owned by the pilot or any other person. The PC should be set up for ease of data transfer, such as by easy access to the IGC Shell program with the IGC DLL file for this recorder in the same directory. Transfer of flight data is witnessed by the OO, and the flight files in IGC format must be given to the OO for safe keeping and analysis, such as on portable media such as a USB memory stick, diskette or equivalents.

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

NOTES FOR OFFICIAL OBSERVERS AND NACs - PART OF IGC APPROVAL

B(i)   *Status*. *To be read together with the main terms of approval to which this is an Annex.*
B(ii) *IGC-Approval level*. *See para (i-ii) on page 1*
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 Check of Installation in the Glider**. Para 8 of the main body of this document states that there must be incontrovertible evidence that the recorder was in the glider for the flight concerned, and was installed and operated in accordance with IGC procedures. This is particularly important due to the portability of this Recorder, making it easy to transfer it from one glider to another, or from a powered aircraft to a glider. To fulfil the above, an OO shall witness and record the glider type and registration, the position of the Recorder in the glider, the type and serial number of the Recorder, the date and time, and the procedures in either B1.1 or B.1.2 must be followed. On the position of displays connected to the Recorder, see para 6 in the Conditions of Approval that refers to sight-lines and the need for pilot lookout and scan.

    B1.1 Observation of Installation before Takeoff or at Landing. For independent Observation, either a preflight check of the installation must be made by an IGC Official Observer (OO) and 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 within the rules, and that another Recorder has not been substituted before the data is transferred to a PC after flight.

    B1.2 Sealing to the Glider before Flight. If direct observation under para B1.1 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. Seals must be marked so that there is incontrovertible proof after the flight that they have not been tampered with, such as by marking with the glider registration, the date, time, and OO's name and signature; and 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, and the type of tape used must avoid this possibility. The OO must seal the Recorder unit to glider parts that 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.

B2 **Takeoff - Independent Evidence**. 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. After flight, this will be compared to the takeoff data from the Recorder.

B3 **Landing**

    B3.1 Independent Evidence of 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. After flight, this will be compared to the landing data from the Recorder.

    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 above. The transfer of flight data shall then take place in accordance with B3.3.

    B3.3 Transferring and Validating the Flight Data. The IGC flight data file may be transferred at the glider to a PC or a USB memory stick without disturbing the installation of the Recorder. For a memory stick download, use the USB connector on the end face of the recorder or, for recorders without this connector, use the manufacturer's DSX USB interface module supplied with the recorder. In the absence of the USB doenload, if a portable PC is not available, 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 above actions, 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 at the NAC (and at FAI if the claim goes to them). The IGC file may be downloaded using the IGC Shell program (see below) or the manufacturer's DSX Win software, but electronic validation of the IGC file can only be carried out through the validation function of the IGC Shell program.

B3.3.1 <u>Method</u>:   Either use a cable to the IGC RJ45 wiring standard to a PC or use a USB memory stick.

B3.3.1.1 <u>Downloading to a PC</u>. The cable from the RJ45 plug should branch to a female 9-pin RS232 plug for connecting to a PC and DC external power (see 1.4) connections to power the recorder. For the IGC Shell program, download the program from the IGC GNSS web pages under "software" and place all the files in one directory (the name IGC Shell is recommended). The latest versions of the IGC shell and DLL files must be used. These can be obtained from the IGC GNSS site for software listed at the beginning of this document. 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. After copying it 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 "DSX high tech ... ". This should be selected. With the recorder connected to the PC and the correct Com Port selected on the IGCshell screen, selections for data Download and Validation can now be made using the screen buttons provided. You can now download the flight data that appears directly in IGC format.

B3.3.1.2 <u>Downloading to a USB memory stick</u>. Some recorders have a USB socket on the case and in others, the DSX USB interface module supplied with the recorder is connected to the RJ45 connector next to the smaller RJ11. The instructions in the manufacturer's manual for USB download should be followed. This will result in the IGC file for the last flight being downloaded to the memory stick attached to the USB connector either on the case or the separate module.

B3.3.2 <u>Files Produced</u>. The above process will automatically produce an *.IGC-format ASCII flight data file with the file name YMDMXXXF.IGC, where Y=year, M=month, D=day, E= manufacturer, XXX = Recorder Serial Number/letters and F = flight number of the day (full key, Appendix 1 to the IGC GNSS Recorder Specification, copied in Annex C to the Sporting Code, SC3C).

B3.3.3 <u>OO's Copy</u>. A copy of the IGC file for the flight to be claimed shall be retained securely by the OO, such as by immediately copying it to a separate memory stick, PC card or diskette, or the OO's own PC's had disk. The IGC file shall be retained by the OO in safe keeping for later checking and analysis under NAC procedures. The OO may keep the required data file on industry-standard portable storage media. The hard disk of a PC may also be used but the OO must be able to positively identify the flight data file as being from the flight concerned (for this purpose, takeoff and landing data independent of the IGC file must also be available, see above in B2 and B3.1).

B3.3.4 <u>Validation of IGC files</u>. To gain access to the IGC file for this recorder, the DLL file from the recorder manufacturer (IGC-LXN.DLL DLL) must be in the same directory as the IGC Shell program. With the recorder connected to the PC and the IGC Shell program menu selected, 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 there is a security problem, the message "Validation check failed" appears, together with a likely reason.

B3.3.5 <u>Competitions</u>. Different rules may apply for competitions, for which a central data transfer facility may be used. For ease of identification within the competition, file names may be changed, 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 validation process described in B3.3.1 above.

B4 **Analysis of Flight Data Files**. 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 is identical to the file that was downloaded from the Recorder to the PC. This is done by checking the IGC data file with an authorised copy of the IGC Shell program and using the Validate function in the IGC Shell menu. The manufacturer's DLL file will also be needed in the IGC Shell directory. The shell program and DLL file must be the same as those on the current FAI/IGC web site for software at the beginning of this document. A Data Analyst approved by the NAC shall carry out this IGC Validation check on the IGC file and then evaluate the detailed flight data using an analysis programme approved by the NAC concerned (list, see the IGC GNSS web site under SOFTWARE).

B4.1 <u>Data Validation - Method</u>. Use the IGC Shell program together with the manufacturer's DLL file as explained in B3.3.1 above. Scroll to the IGC file to be checked and use the Validate software button.

B5. **Means of Propulsion (MoP) Record - Motor Gliders**. The MoP must either be sealed or inoperative, or the built-in Environmental Noise Level (ENL) system used. This has a microphone in the recorder that enables the acoustic noise at the recorder to be transformed into three numbers that are added to each fix on the IGC file. 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 ENL values are to be expected than when soaring (B4.3), typically up to 300 for winch and 200 for aerotow. During the ground roll, short-term higher values have been recorded, probably due to wheel rumble, and values of 400 have been seen for a few fixes.

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. ENL values of 999 have 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 substantial energy is being added, which can therefore be attributed to energy not associated with soaring. The values quoted above are for 2- and 4-stroke engines. Tests with Wankel (Rotary) engines indicate that they produce ENL values between those of 2- and 4-strokes.

B5.2.1 Quiet engines. This approval does not include use with Motor Gliders with electric or other engines that produce little noise in the cockpit (see Para 7 in the Conditions of Approval). If such a quiet engine is to be used, in addition to ENL, a variable proportional to RPM must also be recorded in the IGC file, in accordance with Annex B to the Sporting Code for Gliding, para 1.4.2 (particularly 1.4.2.4).

B5.3 ENL during gliding flight. ENL readings of less than 020 indicate quiet gliding flight. With a particularly well-sealed cockpit, ENL readings of 000 may be recorded in gliding flight; this does not indicate that the ENL system is not working, as long as positive ENL is recorded at takeoff, landing and at other times during the flight (and for engine running, if the engine is run on that flight) and the IGC file must pass the IGC Validation check (see B4.1 above).

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 700 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 cockpit 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 recorded as well as a generally higher level of ENL because the glider is no longer aerodynamically clean. ENL values of up to 500 have been recorded.

B5.5 ENL during landing. During contact with the ground during takeoff and landing, short-duration ENL readings of up to 600 have been recorded, probably due to wheel rumble. Unlike engine running, these last only for a short time, showing a short "spike" on the noise/time trace.

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 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 and sideslip, or nearby 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 is calibrated in an altitude chamber in the same way as a drum barograph.

B6.1 Calibration method, making a calibration table. For a pressure altitude calibration, you are advised to set the normal fix rate to a low fix interval such as 1 or 2 seconds. Recording starts after a pressure change of 1 metre per second for 5 seconds, and no GPS fixes are required for a pressure altitude trace to be produced. The calibrator should be advised to make a short pressure change to trigger recording before starting the calibration itself. 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.

B6.1.1 After Calibration. After the calibration, the data file containing the pressure steps is transferred to a PC as if it was flight data (see B3.3 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 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. and the file should be kept with the calibration paperwork so that it is not confused with other calibration files. As the original IGC file will have a nominal date/time, the file can be copied and the file name changed to one that can be identified as the calibration. A text editor can be used to change add a realistic date and time, although this will mean that the Validation check will fail and the original IGC file must also be kept unaltered.

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 compared to the pressure altitude figures. This is not unusual with GPS receivers operating without a local differential beacon. 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 may be increased by less-than ideal antenna positioning in some gliders. 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 accuracy reduction system was removed, the lat/long error taken from a moving vehicle at a surveyed point in average reception conditions, shows an average error of between 11 and 12m for all recorders tested since that date.

B6.3 Maximum Altitudes Recorded in the IGC file. The GPS system is capable of recording to almost unlimited altitudes, certainly up to 30km/100,000ft. The pressure altitude sensor is also capable or recording to high altitudes, although as air density reduces at height, a small pressure step becomes a large altitude difference. However, the type of processor in the recorder and the need for good resolution (small steps) across the altitude range, results in limitations in altitudes that can be recorded in the IGC file. The maximum altitudes for figures in IGC files that apply to this recorder are given below.

B6.3.1 Pressure Altitude. In early models with the Intersema MS 5534 sensor, the maximum pressure altitude for which this recorder is designed is 18,000m (59,055ft). Later models have the MS 5534C sensor and are designed to record up to 20,000m (65,617ft).

B6.3.2. GNSS altitude. The maximum GPS altitude for which this recorder is designed is 20,000m (65,617ft).