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

References:

FAI web site: www.fai.org

IGC web site: www.fai.org/gliding

IGC GNSS FR web site: [www.fai.org/gliding/IGC approved frs](http://www.fai.org/gliding/IGC_approved_frs)

IGC GNSS site for software: www.fai.org/gliding/gnss/freeware.asp

To: IGC GNSS web site under "List of Approvals"
Notification to: IGC email mailing list <igc-discuss@fai.org>
Internet newsgroup rec.aviation.soaring
Copy: Manufacturer concerned

15 September 2011

IGC-APPROVAL FOR GNSS FLIGHT RECORDER

Level of Approval: Badge flights up to Diamonds (see para i-ii)
Recorder Name: DSX SaFly V 3.0

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

(i-i) Document Versions and Scope. This document is the initial approval for this type of recorder and only applies to the functions concerned with recording the IGC flight data file and setting up the data to be recorded. The operation of other modules and functions in the recorder and in any external units that may be linked to the recorder is a matter between customers and the manufacturer.

(i-ii) IGC-approval Level. This recorder is IGC-approved for badge flights for Silver, Gold and the three Diamonds. This type of recorder can also be used in gliding competitions in which the organisers allow this level of IGC-approval. The Levels of IGC-approval are listed in Annex B to the Sporting Code for Gliding, para 1.1.3.3.

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

*(ii) This document is concerned with the functions of the equipment that record 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 IGC and FAI. FAI is the legal entity and Swiss law applies. FAI Commissions such as IGC are agents of FAI; GFAC and its advisors are agents of IGC. 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 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 mentioned above. In particular this applies to any function linked with aspects that could be critical to flight safety such as navigation, air-space avoidance, terrain avoidance and any aircraft traffic alert, 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) and/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 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) 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) 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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Manufacturer codes: Three letter DSX, single letter D

EQUIPMENT

1. **HARDWARE**

1.1 **Recorder Name.** DSX SaFly Version 3.0. This is shown in the header record of IGC-format files in the form: "HFFTYFRTYPE: DSX,Safly 3"

1.2 **Hardware Version.** DSX SaFly V1 was the original IGC-approved hardware standard. Later versions may be used if they are IGC-approved, see para 10 below. The Version number is shown in the header record of IGC-format flight files in the form "HFRHW HARDWARE VERSION: DSX SaFly V1"

1.3 **Dimensions, Weight, Power Source.** The recorder unit is 115 x 70 x 27mm in size, less connectors on an end face and a button on the top, and weight is about 190 grammes. The recorder is powered by an internal battery. It may also be powered through a micro-USB connector or an IGC-standard RJ45 connector, both of which are on an end face and are also used to charge the internal battery. Input voltage range is from 5V to 14V. For Connectors, see para 4.

1.4 **GPS receiver.** A 22-channel IT500 or UP500 GPS receiver by Fastrax of Finland (www.fastraxgps.com) is fitted. The IT500 has an external antenna and the UP500 is the same receiver with a built-in antenna. The type of receiver and the number of channels are shown in the header record of IGC files in the form "HFGPS: Fastrax IT500,22,20000". The last figure is the maximum GPS altitude in metres that is processed by the recorder.

1.5 **Pressure altitude sensor.** A MS5534C Pressure Altitude sensor by Intersema Sensoric SA of Switzerland (www.intersema.ch) is fitted. This is shown in the header record of IGC files in the form "HFPRSPRESSALTSensor: Intersema,MS5534C,20000". The last figure is the maximum altitude processed by the recorder to the altitude resolution requirements of para 4.4.1 of the IGC Specification. The pressure altitude system is 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.

1.6 **National and other regulations.** These regulations may apply to electrical and electronic equipment. Compliance with such regulations is not the responsibility of FAI.

1.7 **Attached modules.** Other modules are attached through the connectors on an end face of the recorder. Connectors are described in para 4.

2. **FIRMWARE.** Firmware Version DSX 11C02 (standing for 2011 Type C Version 2) and later are covered by this document. The Firmware Version is in the header record of IGC files in the form: HFRFW FIRMWARE VERSION: DSX 11C02. Para 10 below requires the FR manufacturer to inform GFAC of any updates or other changes.

3. **SOFTWARE**

3.1 **Downloading of Flight Data.** Downloading the IGC file is via the RJ45 connector or the micro-USB connector (see para 4 for connectors). The IGC Shell download function can be used, as can DSX or other download software, the essential requirement being that the downloaded IGC file passes the IGC Shell electronic Validation test, see 3.2 below.

3.2 **Validation of Flight Data.** Checking that the format of the downloaded IGC file complies with the FR Technical Specification is through the Validation function of the Microsoft Windows-based IGC Shell system. The IGC Shell system is available without charge from the IGC GNSS web site in the form of the file igcdll.zip.

3.2.1 **IGC Shell Files.** The IGC Shell files should be downloaded to a specific directory that is named in advance (for instance "IGCshell"). For the Shell program to work with a particular type of Recorder, the Dynamic Link Library (DLL) file IGC-XXX.DLL from the recorder manufacturer must be copied to the IGC Shell directory, where XXX is the three-letter code allocated by IGC to the FR manufacturer and shown above under "MANUFACTURER".

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

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

3.2.4 IGC Standard for Flight Data Validity. 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 B3.3.1.1 for more details.

4. **CONNECTORS, LIGHTS & SWITCH**. Other than the SIM Card, these are on an end face of the recorder casing and are, from right to left looking at the end face.

4.1 Micro-USB Connector. A 7mm wide micro-USB female socket is for downloading data after flight and making inputs into the recorder.

4.2 RJ-45 Connector. An 11mm 8-pin RJ-45 female socket wired to the IGC standard is to the left of the micro-USB socket, Like the micro-USB socket, this is for downloading flight data and making inputs to the recorder.

4.3 Three Lights. Red, yellow and green lights in a vertical array are to the left of the RJ-45 socket.

4.3.1 Green light. This indicates GPS operation. A fast blink indicates that the GPS is OK but data recording is not taking place, changing to a slow blink when data is being recorded.

4.3.2 Red light. A fast blink indicates lack of GPS and a slow blink indicates low battery condition.

4.3.3 Yellow light. This indicates operation of the Global System for Mobile communications (GSM), a mobile telephone standard. A slow blink indicates network search or offline, fast blink indicates logged in to network and steady yellow is when transmitting.

4.4 GPS Receiver Antenna. If the Fastrack IT500 receiver is fitted, a SMA (Sub-Miniature type A) 6mm diameter screw fitting is next to the RJ-45 connector. The Fastrack UT500 receiver has a built-in antenna. Also see para 1.4

4.5 Switch. An on/off switch is to the left of the GPS Antenna connector.

4.6 Other 6mm SMA connectors. Two other 6mm SMA connectors marked SAT and GPRS are to the left of the switch and are for a locator and tracking system that enables continuous position monitoring by a base station, using satellite communications. This function is described in the SaFly instruction manual, and is outside the scope of this IGC-approval.

4.6.1 SAT (Satellite) connector. This is for transmission of data to satellites in low earth orbit.

4.6.2 GPRS Connector. This stands for General Packet Radio Service and is part of the Global System for Mobile communications (GSM) that is used by cell phones.

4.7 SIM Card. On the opposite end face to the above is a socket for a SIM Card (Subscriber Identity Module) for use with the GPRS system (4.6.2 above). This function is described in the SaFly instruction manual, and is outside the scope of this IGC-approval.

CONDITIONS OF APPROVAL

5 **Security of the Equipment**. The holographic-type stick-on seals over the screws attaching the two halves of the case, and the seals across the joint between the two halves, must be intact and show no signs of tampering. With this reservation, 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 para 9 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 8 on sealing. The position of the operating button and any connected displays used in flight in single-seat gliders should be close to sight-lines used for pilot lookout and scan for other aircraft and gliders.

7. **Motor Glider Engine Recording.** No motor glider engine recording system is fitted. If this type of recorder is used in a glider with a means-of-propulsion (MoP), its engine (MoP) must be either disabled or sealed before flight with an OO's seal that must be checked after flight to ensure that the seal is still intact.

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.** Tamper-evident seals with the recorder manufacturer's name are fitted over screws that hold the case of the recorder unit together, and over the join between the top and bottom parts of the case. In addition, an internal security mechanism detects if the internal modules inside the case have been tampered with or become corrupted.

9.2 **Electronic Security.** If the internal modules inside the case concerned with recording the IGC flight data file have been tampered with or become corrupted, 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. Electronic security is based on the RSA public/private key system with a private key length of 512 bits. Firmware updates for the recorder are encrypted and the encryption key is known only to the manufacturer. The firmware state of the recorder is checked during power-up, and if corrupted or tampered firmware is detected, IGC files will still be generated but will fail the IGC Validate test (see 3.2 and B4).

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 National Airspace Control authority (NAC) of the owner (the National body that validates flights to the criteria of IGC). 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 inside the recorder such as GPS receiver boards, pressure altitude transducers and anything related to either physical or electronic security. If in doubt, GFAC should be notified.

Ian W Strachan
Chairman, IGC GFAC

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

Any questions to: Chairman IGC GFAC,
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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. Badge flights up to the three Diamonds, see para (i-ii).
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 Antenna and other connectors**. This IGC-approval does not presently require sealing of any connectors, ports or plugs, or stowage out of reach of the pilot(s), and no attempt must be made to pass unauthorised data into the Recorder including through the GPS antenna.

A2 **WGS84 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 also entered to the WGS84 Geodetic Datum (IGC rule).

A3 **Setting the Fix Interval**. The fast-fix facility operates when the Pilot Event button on the top of the recorder case is pressed. The fix rate can be set through 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 manufacturer's set-up program 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 followed by fast fixing. 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 on Fix Interval Settings. IGC rules are an absolute maximum fix interval setting of 60 seconds (SC3 para 4.3.1 and Annex C to SC3, para 7.1) and a 10 second setting 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 **Checking the Recorder before a Claim Flight**. Pilots are recommended to check and analyse a selection of IGC files from their recorder before attempting flights that will require Validation. It is the pilot's responsibility to ensure that the recorder is performing correctly and in accordance with this approval, for instance ensuring that GPS fixes, pressure altitude, and other values are recorded as expected. See also A13 on pressure altitude calibration.

A5 **Pre-flight Declaration in the IGC file**. Electronic pre-flight declarations of Waypoints are made by selecting Start, Finish and Turn Points from Waypoint data that has been uploaded into the recorder. Before making a flight that is to be claimed and requires a pre-flight declaration, pilots are advised to check that they can successfully carry this out, and that an IGC file is produced that satisfies the Sporting Code on electronic pre-flight declarations.

A6 **Observing the Recorder installation in the glider**. The pilot must ensure that an OO has checked the place of the recorder 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. On the position of the display, see para 6 in the Conditions of Approval which refers to sight-lines and the need for pilot lookout and scan.

A7 **Switch on**. The recorder is switched on by pressing the switch on the end face between the connectors marked GPS and SAT. 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.

A8 **Takeoff - Independent evidence**. 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 the recorder, see B1.2.

A9 **Use in Motor Gliders** (including self-sustainers). No motor glider engine recording system is fitted. If this type of recorder is used in a glider with a means-of-propulsion (MoP), its engine must be either disabled or sealed before flight with an OO's seal that must be checked and certified after flight to ensure that the seal is still intact.

A10 **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 A11 below. **Pilots are advised not to switch off the recorder for 5 minutes after landing, otherwise flight data may be lost if the recorder is switched off too early.**

A10.1 **After-flight calculation of security**. When the recorder is switched on again after having been switched off (for instance after landing), a digital signature is calculated 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 completed 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.

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 B2.1).

A12 **Switching Off**. Use the switch on the end face between the GPS and SAT connectors. **Caution:** *Disconnecting external power will not switch the unit off because it has an internal battery capable of running the unit for several hours.*

A13 **Downloading the Flight Data**. Downloading is through the micro-USB or RJ-45 connector. For the RJ-45 a cable is needed, wired to the IGC standard. For more details, see B3.3.

A13.1 **OO's actions**. For a flight to IGC standards of evidence, an OO will then 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 should transfer the data from the Recorder, but witnesses the transfer, and immediately after takes or is given a copy from the USB memory stick or SD card.

A13.2 **Competitions**. Different rules may apply for competition flights, for which pilots may be allowed to bring their own flight data to competition control, or a central data transfer facility may be used. However, for a flight to IGC rules such as for records and badges, OO monitoring as in A13.1 continues to apply.

A14 **Calibration of Barograph Function**. Unless a pressure altitude calibration to IGC standards is supplied with the Recorder, pilots are advised to have a pressure altitude calibration carried out by an NAC-approved calibrator before the Recorder is used for a claimed flight performance. For the procedure, see para B6. A valid IGC 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.

----- 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. Badge flights up to the three Diamonds, see para (i-ii).

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 Installation in the Glider. The recorder unit can be fitted anywhere in the glider subject to the pilot being able to operate the Pilot Event (PEV) button when required. An OO shall witness and record the position of the Recorder in the glider, the type and serial number of the Recorder, the glider type and registration, date and time. Before flight, if requested, the OO shall then seal the Recorder to the glider in a way acceptable to the NAC and to IGC. Such sealing may be at any time or date before flight. If sealing is not used, 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 (B3.3), see para 8 of the Conditions of Approval on sealing. If any displays are connector to the Recorder, see para 6 in the Conditions of Approval which refers to sight-lines and the need for pilot lookout and scan.

B2 Takeoff - Independent Evidence. The time and point of takeoff must 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 Recorder data.

B3 Landing

B3.1 Independent Evidence of Landing. The time and point of landing must 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 Downloading the Flight Data. Downloading should be made by the Official Observer (not by the pilot or anyone associated with the pilot) via either the micro-USB socket or via the RJ-45 socket to an RJ-45 plug wired to the IGC standard. Downloading may be use the IGC Shell program or software from the FR manufacturer. Security of downloaded IGC files is maintained by coding embedded in the Recorder which is then independently checked later at the NAC (and at FAI if the claim goes to them) through the IGC Validation program. See para B4 below for how this is done.

B3.3.1 Files Produced. This process will produce an IGC-format ASCII flight data file with the file name YMDFXXXN.IGC, where Y = year, M = month, D = day, F = firmware manufacturer, XXX = Recorder Serial Number/letters and N = flight number of the day. For the full key, see Appendix 1 to the Technical Specification for IGC GNSS Recorders, also copied in Annex C to the Sporting Code (SC3C).

B3.3.2 OO's Copy. A copy of the IGC file that has been downloaded by the OO after flight must be retained securely by the OO such as by immediately copying it to storage media such as a memory stick, data card, or the hard disk of the OO's own PC. The process must be independent of the pilot and anyone associated with the pilot. The IGC file must be retained by the OO for later checking and analysis. The OO must be able to positively identify the flight data file as being from the flight concerned, and takeoff and landing data independent of the IGC file must also be available, see above in B2 and B3.1.

B3.3.3 Competitions. Different rules may apply for competitions, for which pilots may be allowed to download their own flight data and take it to Competition Control on portable storage media such as a USB stick or memory card, or 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. However, if a flight is to be claimed under IGC rules for badges, diplomas or records, the normal IGC rules for such flights continue to apply such as OO downloading.

B4 Validation of and 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 initially downloaded from the Recorder to the PC. This is done by checking the IGC file through a current copy of the IGC Shell program and using the Validate function in the IGC Shell menu (see below). The Recorder 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 program approved by the NAC concerned and checking that IGC rules for the type of flight are fulfilled.

B4.1 IGC Shell Program. Download the IGC Shell program from the IGC GNSS web pages under "software" and place all the files in one directory (such as "IGC Shell"). These files are available on the IGC GNSS web pages

through the file igcdll.zip. For the Shell program to work with a particular Recorder, the appropriate Dynamic Link Library (DLL) file from the recorder manufacturer must be copied to the IGC Shell directory. After copying it, execute IGCshell.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 include the line "*DSX High Tech*" and this should be selected.

B4.1.1 Validation of IGC files. Select the DSX logo from the top menu box (as above), press the "Validate" button and select the IGC file to be checked. If successful, the message "File has been successfully validated" appears. If there is a security problem, the message "Integrity Bad" appears, together with a likely reason.

B5. Use in Motor Gliders (including self-sustainers). No motor glider engine recording system is fitted. If this type of recorder is used in a glider with a means-of-propulsion (MoP), its engine (MoP) must be either disabled or sealed before flight with an OO's seal that must be checked and certified after flight to ensure that the seal is still intact.

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 before the flight in an altitude chamber in the same way as a drum barograph. Before calibration, the fix interval should be set to a small value such as 1 or 2 seconds.

B6.1 Calibration method, making a calibration table. 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 a particular 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 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.. The Calibration IGC file must be kept with the calibration paperwork so that it is not confused with other calibration files.

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 local or regional corrections such as EGNOS, WAAS or a local Differential GPS. 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 poor antenna positioning. 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. GFAC tests from a moving vehicle record accuracy at surveyed points in average reception conditions, and show an average error of between 11 and 12m.

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

B6.3.1 Pressure Altitude. Pressure altitudes are recorded up to 20 km (65,617 ft) but the maximum altitude in the calibration table supplied by the manufacturer is 9 km (29,528 ft). For higher altitudes, a separate calibration should be carried out to the altitude required.

B6.3.2. GNSS altitude. GPS altitude is recorded up to 20 km (65,617 ft).

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