CHAPTER 1
GNSS FLIGHT RECORDERS
IGC-APPROVAL AND OTHER PROCEDURES

1.1 **IGC FLIGHT RECORDERS - POLICY AND GENERAL**. IGC-approval of a particular type of GNSS Flight Recorder is achieved after Test and Evaluation (T&E) by the IGC GNSS Flight Recorder Approval Committee (GFAC), whose terms of reference are given below. GFAC and its advisors are agents of IGC, FAI Commissions such as IGC are agents of FAI; the legal entity is FAI and Swiss law applies. When a Flight Recorder system is submitted for IGC-approval, GFAC examines it for compliance with IGC rules and procedures for hardware, firmware, software, output data in the standard IGC data file format, and security of the Flight Recorder system both physical and electronic. The full level of IGC-approval indicates that the equipment meets the standards of availability, continuity, integrity, accuracy, and security that are required for the certification of flights for FAI/IGC World Records, all FAI/IGC Badges and Diplomas, Championships and Competitions. Other aspects are matters between customers and manufacturers, including the presentation on cockpit displays, navigational features, and post-flight analysis systems. See 1.1.4 for levels of approval for types of IGC flights for which a Flight Recorder may be used, also 1.1.7 for the position of displays in the cockpit.

1.1.1 **FAI Liability**. FAI has no liability for the consequences of the use of Flight Recorders covered by this document for purposes other than validation and certification of flights to FAI/IGC procedures. Such other purposes include, but are not limited to, navigation, airspace avoidance, terrain avoidance, traffic alert, proximity-warning and/or anti-collision functions, any other matters concerning flight safety; and uses outside IGC such as by other FAI Airsports.

1.1.2 **IGC Flight Recorder Operating Procedures**. Operating procedures for each type of Flight Recorder will be specified by GFAC in the IGC-approval document. The IGC-approval process has the objective of making procedures on the day of flight as simple as possible. This is particularly important before flight when the time available for carrying out extra independent checks may be short. Also, after flight it must be quick and easy to download secure flight data to a PC in the IGC flight data format. GFAC will specify procedures that minimise the possibility that either one Flight Recorder could be substituted in the glider by another that was not carried on the flight in question, or that the data in the Flight Recorder that was in the glider could be interfered with without this being detected. This may require either continuous observation of the glider before takeoff and/or after landing, or the physical sealing of the Flight Recorder unit to the glider by an OO at any time or date beforehand, to avoid the need for extra OO observation of the installation before takeoff. Such a seal must be applied and marked in a manner such that there is incontrovertible proof after the flight that it has not been broken. This can be achieved by marking it with the glider registration, the date, time and OO's name, signature, and the OO identification number. Other procedures specific to the type of Flight Recorder concerned may be required, such as stowage of certain modules out of reach of the flight crew, or limitations on the types of flight for which the recorder may be used. Such procedures and limitations will be an integral part of the IGC-approval document for the type of equipment concerned, and will depend on the Flight Recorder design and the results of the evaluation process. *(Amplification of SC3C para 1.7)*

1.1.2.1 IGC Policy on Processing of Claims. The Sporting Code for Gliding states that, when processing evidence, OOs and authorities responsible for validating flight performances should ensure that rules are applied in a reasonable way. Evidence that is initially incomplete can often be corrected after further evidence is taken from independent witnesses or experts. OOs and Officers responsible for validating claims must ensure that rules are met that are fundamental to proving the flight performance itself. However, their goal should be to validate flight performances, not turn them down for bureaucratic reasons or oversights that can be corrected later and included in the overall evidence for a claim. (Wording based on SC3C para 1.2). An example might be if the data in an IGC file is slightly different to that given in the current FR Technical Specification (TS), but the data required by the Sporting Code is present either in the IGC file in a different place (to that given in the current TS), or is available from independent evidence. In such a case, the flight performance should not be rejected for that reason, as long as the electronic Validation check (para 1.1.10.1) on the IGC file that was downloaded from the FR and contains the flight data for the claim, is satisfied.

1.1.3 **IGC-Approval Documents for Flight Recorders**. The IGC-approval document for each type of Flight Recorder is produced by GFAC on behalf of IGC. Before the approval document is finalised, it will be circulated in successive drafts to GFAC members, other technical experts and consultants, and the manufacturer concerned. When finally issued, the IGC-approval document will give the detailed procedures under which equipment must be checked, installed in the glider, and operated for flights that are to be validated and certificated to FAI/IGC criteria. The definitive version of the IGC-approval document for a particular type of flight recorder is that which is currently available on the IGC GNSS web page.

1.1.3.1 Format of IGC-approval documents. These documents have a standard format which consists of an introduction (including legal disclaimers agreed by FAI on matters such as flight safety and intellectual property); manufacturer details; details on hardware (including the type of GPS receiver and pressure transducer); firmware and software; connections to the Flight Recorder; and a list of Conditions of Approval. There are two annexes. Annex A contains notes and recommendations for pilots and Annex B contains notes and recommendations for Official Observers and bodies validating flight performances such as National Airsport Control authorities (NACs). Annex B includes checks that apply to that type and model of Flight Recorder, how to download flight data to a PC, procedures for checking the validity of the IGC file data, and pressure altitude calibrations. Also, for those Flight Recorders fitted with an Environmental Noise Level or a Means-of-Propulsion recording system under the codes ENL and MOP, Annex B contains details of ENL and MOP figures recorded during GFAC testing and to be expected in various phases of flight.

1.1.3.1.1 Checks on individual recorders. It is the responsibility of owners of recorders and pilots using them, to check that the characteristics of the recorder correspond to those in the IGC-approval document. If they do not, the recorder should be returned to the manufacturer or his authorised agent, to be re-set to the characteristics in the IGC-approval. This particularly applies to ENL and MOP figures recorded in IGC files which must be similar to those given in Annex B to the IGC-approval document, and to pressure altitude calibrations which must be to the ICAO International Standard Atmosphere (ISA). For the critical cases in ENL and MOP recording, see 1.4.2..

OOs shall inspect recorder installations before and after flight in accordance with the provisions of Annex B to the IGC-approval document for the type of recorder concerned. Where the FR uses instrument static pressure (rather than "cockpit static"), the tubing and the pressure connection to the FR shall also be checked to ensure that they are out-of-reach of the aircrew in flight so that no unauthorised adjustments to static pressure can be made.

1.1.3.2 IGC-approval document kept with the Flight Recorder. It is recommended that an up-to-date copy of the approval document including its two annexes is kept with each unit of the equipment, so that it can be consulted by pilots and OOs as required. A copy of the current IGC-approval document in either written of electronic form must be included with each recorder sold or updated.

1.1.3.2.1 Valid versions of the IGC-approval and program files. The latest versions of IGC-approvals and the FR Manufacturers DLL files (or the earlier short progam files) are posted on the IGC web site, and only these versions are valid for use with IGC/FAI claims. Earlier versions of the IGC-approval and DLL/program files must not be used in the validation of flights to FAI/IGC criteria.

1.1.4 **Levels of IGC-approval**. The IGC-approval document for individual types of Flight Recorders will specify procedures to be used and any limitations on types of flights for which the approval is valid. Reduced levels of approval apply to types of Flight Recorders that do not meet the requirements for full approval at the time that the approval is given, and will be determined by GFAC. Reduced levels also apply where the security of a type of recorder has either been compromised or is below the requirements of the current Specification, or where other features do not meet the current Specification. The following levels of IGC-approval apply:

1.1.4.1 IGC-approval for all flights. This applies to Flight Recorders that may be used for evidence for all flights up to and including FAI/IGC world records. For new types of recorders, compliance with the current Specification is required. For types with existing IGC-approvals to this level, "Grandfather Rights" (1.1.4.5 below) apply unless there are major differences compared to the current Specification, as assessed by GFAC.

1.1.4.2 IGC-approval for IGC/FAI badge and Diploma flights. This applies to Flight Recorders that may be used for evidence for all IGC/FAI badge and distance Diploma flights, but must not be used for IGC/FAI world record flights. For competition flights, see 1.1.4.6. This level may be used for new recorders that do not meet the current Specification in some areas. For types of recorder that are already IGC-approved, this level may be used for those whose characteristics are now significantly below the current Specification standard, particularly on security or accuracy of data, as assessed by GFAC.

1.1.4.3 IGC-approval for badge flights up to Diamonds. This applies to Flight Recorders that may be used only for evidence for FAI/IGC Silver, Gold and Diamond badge flights, although for competition flights see 1.1.4.6. This level may be used for recording systems that have significantly lower standards of security and other characteristics compared to those for higher levels of approval, as assessed by GFAC.

1.1.4.4 No IGC-approval/non-IGC-approved Recorders. This applies to types of Flight Recorders that have either not been tested and approved by GFAC to IGC standards, or to recorders that were previously IGC-approved but where a major security or other problem has been shown to exist which could compromise the integrity of flight data. It also includes FRs used in other FAI Airsports that output in the basic IGC file format where such recorders are not to be submitted for IGC-approval.

1.1.4.5 Grandfather rights and approval levels. The term "Grandfather Rights" is used for a situation where the conditions of an original IGC-approval are continued with time, even though the provisions of the IGC Specification or Sporting Code have changed. That is, the recorder would be subject to additional limitations or would not be approved at its existing approval level, if it were submitted for IGC approval as a new model. Continuity of the original approval is so that owners and manufacturers are not constantly required to carry out updates as the Specification or Sporting Code changes with time, unless a major difference exists in the type of recorder compared to the current Specification or Sporting Code. A similar policy is adopted in civil aviation by other aviation organisations such as the FAA and JAA with regard to already-certificated designs. However, GFAC reserves the right to change the conditions of an approval document where it considers that the current Specification or Sporting Code is sufficiently different to those under which the original approval was issued.

1.1.4.6 Competitions. The above sub paras apply to record, badge and distance diploma flights to be validated to FAI/IGC rules and procedures. For IGC competition flights, the types of recorders that may be accepted are (a) at the discretion of the competition organisers and (b) subject to any higher level rules and procedures that may apply to the organisers. For instance, Regional or National competition rules or Sporting Code Annex A procedures for World and other Championships that use Annex A rules.

1.1.5 **Changes of approval level.** If GFAC proposes to lower the approval level of a type of IGC-approved recorder, this will be discussed in confidence, first with the IGC ANDS committee and then with the manufacturer (approval levels, para 1.1.4). A recommendation will be made to the IGC Bureau at an appropriate stage. For further procedures, see Appendix A.

1.1.6 **World Records**. Evidence for the verification of an IGC World Record must be from a Flight Recorder that is IGC-approved for World Record flights (SC3 para 3.0.3). See 1.1.4 on approval levels.

1.1.7 **Cockpit displays**. IGC is concerned by the potential risk of collision between gliders, due to over-concentration on cockpit displays, where the pilot would be better advised to be visually scanning outside the cockpit. Displays and instruments that need regular checking should not be mounted in instrument panels in positions away from external view, but should be in prominent positions close to the view of the outside world. Although IGC cannot control the layout of instrument panels, it can draw attention to the potential dangers. Particularly in single-seat gliders and other FAI aircraft, the position of displays connected to a Flight Recorder should not be remote from sight lines used for pilot lookout and scan for other aircraft. Displays should not be positioned so as to obstruct potential sight lines that might be needed for lookout.

1.1.8 **Antenna Positioning**. If the GNSS antenna is accessible to the crew in flight, no attempt must be made to inject any data that would alter that from the GNSS system concerned. Any abuse of this may lead to a future IGC requirement to place the antenna out of reach of the flight crew.

1.1.9 **Sealing of data ports and plugs**. Wherever possible, IGC-approval will not involve sealing of ports and plugs before flight, but no attempt must be made by users to pass unauthorised data into the Flight Recorder. Any abuse of this may lead to a requirement for sealing.

1.1.10 **IGC Standard of Security for the Flight Recorder and the IGC Flight Data File**. For IGC-approval to be given, the type of Flight Recorder must be protected by both physical and electronic security. A manufacturer's physical seal must be fitted to the recorder case in such a way that it will be broken if the case is opened. Also, a system must be incorporated that makes the internal electronic security system inoperative if the recorder case is opened or otherwise becomes insecure. Flights made after any such event must continue to produce IGC files, but such files must be clearly marked as insecure and must fail the IGC Validate check of the IGC file (see 1.1.10.1 below). Re-set of a recorder to a secure state must only be through the manufacturer or his authorised agent, and the knowledge of confidential details that are part of any re-set procedure (such as private keys) must be restricted to the absolute minimum number of people.

1.1.10.1 Electronic Validation of IGC Flight Data Files. The IGC electronic Validation system checks the security and validity of data in an IGC file, and can be used at any time to check a file. To use the IGC Shell program, the manufacturer's IGC-XXX.DLL file must be in the IGC Shell directory (XXX = manufacturer identification letters). Having executed IGC-Shell.exe, select the FR manufacturer in the box at the top of the display, press the display's Validate button, highlight the IGC file to be checked and click "Open". The result of the validation check will then be shown in a box in the middle of the display. Older recorders for which the manufacturer has not provided a DLL file for the IGC Shell program have a VALI-XXX.EXE program file instead. The IGC Shell program, DLL and VALI files are available at:

http://www.fai.org/gliding/gnss/freeware.asp

If an IGC file passes the IGC electronic validation check, it shows (1) that the IGC file has originated correctly from a serviceable FR that has not been opened or been modified in an unauthorised way, and (2) that the flight data in the IGC file is identical to that which was originally downloaded immediately after flight. The IGC validation program will reject

an IGC file if only one character in the flight data is not the same as originally downloaded This can be checked by copying an IGC file that passes the Validation check, and, on the copied file, using a text editor to change one character (such as one figure in a Lat/long, ENL or other flight data). The resulting IGC file should fail the IGC validation check. Then, restore the original character and the IGC Validation program should once again pass the file.

1.1.11 **Proof of presence of the Flight Recorder in the aircraft**. There must be incontrovertible evidence that the particular Flight Recorder was present and recording in the particular aircraft for the flight concerned. The procedures given in the IGC-approval document shall ensure this as far as possible. This is particularly important because, unlike other elements in the verification process, a FR and its IGC file contain virtually all the evidence for the flight. Proof of presence is particularly important with small, lightweight types of FR that can easily be transferred from one aircraft to another. Two methods are employed: (1) OO inspection of the FR installation, and (2) independent evidence of takeoff, landing and other evidence for the claimed flight (independent of the FR and its IGC file). These two methods are amplified below:

1.1.11.1 OO inspection and/or sealing to the glider. If an OO is not present to witness and to check the Flight Recorder installation at takeoff or landing or immediately before and after these times, the FR that is to be used for flight validation must be sealed to the glider structure by an OO. This may be carried out at any time or date before flight as long as the sealing is timed, dated and with the OO's identification clearly marked so that the OO can identify it later if necessary.

1.1.11.2 Check of takeoff and landing , independent of the Flight Recorder data. The times and points of takeoff and landing, shall be recorded either by an OO, other reliable witnesses, or by other means such as an Air Traffic Control or official Club log of takeoffs and landings. This shall be compared to the Flight Recorder takeoff and landing data (SC3 para 11.3). This is intended as a simple independent check of these aspects of the FR data. Following this, the rest of the data may be accepted as valid evidence for the claim, subject to (1) any anomalies being satisfactorily explained, (2) compatibility of the data with independently-known conditions for the flight and (3) the IGC file for the claim passing the IGC Electronic Validate check (see 1.1.10.1 above). Known conditions that can be independently checked include: (1) Wind observations at relevant altitudes (including those recorded officially by local meteorological offices and airfields) compared to thermal and other drift from the IGC file data. (2) conditions experienced by other aircraft and gliders in the same area and at similar time, including those available on other IGC files for comparison, and (3) direct observation of the aircraft by other pilots, witnesses, etc.

1.1.12 **Anomalies in evidence.** Any anomalies in evidence for a claim under IGC rules from an IGC-approved GNSS Flight Recorder should be referred to the GFAC Chairman for further investigation and to obtain an opinion from GFAC and its technical experts on whether the flight data can be accepted for an IGC claim. This should be done as soon as an anomaly is discovered, by the OO concerned or by the body that will validate the flight (such as the NAC) so that other supporting evidence is not lost due to the passage of time. It is important that the recorder is kept in its original state and is not re-set or modified until the investigation is completed.

1.2 **IGC GNSS FLIGHT RECORDER APPROVAL COMMITTEE (GFAC)**. A committee of at least five persons shall be appointed by IGC to test, evaluate, and approve individual types of GNSS Flight Recorders in accordance with para 1.1. GFAC members may delegate specialist work to other experts but are responsible for co-ordinating the work and for producing final recommendations. The detail of the work and any opinions expressed within GFAC discussion are confidential to GFAC and any other experts and IGC officials who may be involved.

1.2.1 **Appointment of GFAC Members**. GFAC members will be appointed by IGC for an agreed period, and members will be eligible for re-appointment. Members will select the GFAC chairman from amongst their number.

1.2.2 **Working Language**. The English language shall be used for communications to and from GFAC, and within GFAC.

1.3 **NOTIFICATION BY MANUFACTURERS**. Manufacturers who may apply for IGC-approval for their equipment should make contact with the GFAC Chairman as early as practicable during the design process. In the manufacturer's own interest, this should be before any design-fix is made, and before any commitment to large-scale purchase of specialised components. This is because initial discussion with GFAC on the intended design may reveal that changes have to be made before IGC-approval can be considered. The GFAC Chairman will provide the applicant with the current procedures for the approval process, such as the application form and documentation requirements.

1.3.1 **Correspondence with GFAC**. Manufacturers applying for IGC-approval must correspond with GFAC through its chairman who will inform other members and technical advisors, and co-ordinate any responses to the manufacturer. In cases where specialist matters are being discussed, the Chairman may authorise direct correspondence with an appropriate specialist GFAC advisor (such as on the detail of GNSS systems, electronic security and recording technology), but the GFAC Chairman must be copied with all correspondence so that he is aware of progress and of the issues involved.

1.3.2 **Submission of a new model of IGC Flight Recorder**. Details of the intended design should be sent to the GFAC Chairman as soon as available. These should include a brief specification, drawings, draft manual (if it exists at this stage), commonality with any existing models, etc. Manufacturers should not wait until these documents are final, drafts should be sent as soon as they are available. The Chairman will circulate such details to GFAC members and appropriate technical advisors and will co-ordinate comments that will be sent to the manufacturer. For communication, email is recommended with attached files in common formats such as MS Word, Excel etc. For diagrams and pictures, use a format such as JPEG, compressed to not more than 200kB per graphic unless requested otherwise. Details sent by the manufacturer will be treated as confidential to GFAC and its advisors.

1.3.2.1. IGC flight data files. As soon as IGC-format files are available from early Flight Recorder hardware, email copies to the GFAC chairman so that the exact format can be checked for compliance with the IGC standard.

1.3.2.2. When recorder hardware is available. Recorders should not be sent until GFAC comments have been made on the specification of the type of FR concerned, and IGC files have been produced and sent. When a complete or beta test version is available, and before the fix-of-design stage is reached, notify the GFAC Chairman. When the Chairman requests, send an example of the appropriate equipment for initial evaluation and feedback. The Chairman's evaluation team will test the hardware and report to GFAC members, relevant technical experts and to the Flight Recorder manufacturer.

1.3.2.3 Fee to FAI. When hardware is sent, the Flight Recorder manufacturer must apply to FAI on the forms provided and pay the appropriate fee to FAI, unless this has been done earlier. See also para 1.3.5.

1.3.2.4 Sending Further Hardware. All individual GFAC members have the right to ask for hardware for testing themselves. Therefore, after appropriate correspondence between the Chairman and the Flight Recorder manufacturer, and after any necessary changes have been made to the prototype equipment already evaluated, the chairman will notify the manufacturer of those GFAC members who wish to receive equipment for testing. Further detail, para 1.4.

1.3.3 **Re-approval after changes to a recorder**. For re-approval or continued- approval of a type of Flight Recorder after changes have been made to its design, the provisions of 1.3.2 that are relevant to the changes, apply.

1.3.4 **Documentation**. The recorder manufacturer or applicant for IGC-approval shall provide information to GFAC on how the particular model of Flight Recorder is intended to meet the IGC Specification.

1.3.4.1 Security Protection. A detailed description of security protection must be provided, including the design features that prevent deliberate or inadvertent misuse or production of false data. GFAC members and their advisors will keep such information confidential.

1.3.4.2 Pressure Altitude Calibration. The pressure altitude recording system in the Flight Recorder must be calibrated to the ICAO ISA using IGC/FAI procedures for barograph calibration. A calibration table and the IGC file for the calibration from which the figures in the table were obtained, must be forwarded with any hardware that is sent. For more detail on the accuracy of calibrations, see Chapter 2, para 2.6.

1.3.5 **Fees and expenses for IGC-approval**. The appropriate fee must be deposited by the applicant in the FAI account (for the IGC Sub-account) when hardware is sent to the GFAC Chairman for evaluation. Expenses such as customs duties and national taxes for postage of recorder hardware must be paid by the applicant and not be an expense on GFAC members, IGC or FAI. If the receipt of payment is delayed, IGC-approval will not be given until the fee is received and all expenses attributable to the manufacturer have been paid. The fee is adjusted by IGC from time to time and details are available from the Chairmen of the IGC ANDS and GFA Committees. At the time of writing (year 2011) the fee is 1000 Euros (€) for an application for testing a new type of GNSS Flight Recorder for IGC-approval. For changes or modifications to an existing IGC-approved design, the fee depends on the complexity of the required evaluation as determined by GFAC, and may be the same or less. The current scale of fees is on the application form available from the GFAC Chairman.

1.4 **TEST AND EVALUATION FOR IGC-APPROVAL**. GFAC will complete Test and Evaluation (T&E) as soon as practicable on receipt of all of the appropriate material, normally within 120 days, unless there are unforeseen difficulties. The testing carried out by GFAC will be of a non-destructive nature but GFAC, IGC or FAI is not liable for any damage to, or loss of, any equipment. A sample test and evaluation schedule is at Appendix 2 of the IGC FR Technical Specification. The evaluation period starts when all members of GFAC who have expressed a wish to test the hardware themselves, have received all of the required equipment and documentation in good order and ready to test. The GFAC Chairman will notify the manufacturer of the contact details of the GFAC persons to whom hardware should be sent. If the Flight Recorder manufacturer is not able to send equipment to all persons at the same time, equipment will be sent from person to person. In this case, the target evaluation period does not apply although the evaluation will be completed as soon as practicable. Any excess expenses incurred by individuals (such as postal, excise and tax), shall be paid by the Flight Recorder manufacturer into the FAI account on request so that individuals can be re-imbursed and do not have to pay these expenses themselves.

1.4.1 **Laboratory Testing**. GFAC may decide that a report on the Flight Recorder (or a particular aspect of the FR and/or its peripherals) is needed from a recognised independent testing laboratory. In this case, the applicant will be responsible for the expense of this report in addition to the application fee. The applicant shall be given the opportunity to withdraw the application before incurring this expense. Such requirements may arise if test or evaluation is required that is outside the expertise or facilities available to GFAC members and their advisers.

1.4.2 **ENL System - General**. The IGC Environmental Noise Level (ENL) system is designed to differentiate between any engine running that generates forward thrust, and any flight condition encountered in normal soaring flight without the use of engine. Pilots and OOs should note that the critical engine-on case with all motor gliders is not when the engine is run at high power. Also, the critical engine-off case is not a quiet glide with a well-sealed cockpit. These cases are covered below, and are particularly important with low-noise engines such as those using electric power, and low-ENL engines such as jets, see 1.4.2.4. Pilots flying such motor gliders should ensure that engine-recording systems have been provided in accordance with Sporting Code requirements so that their flights can be validated to IGC standards.

1.4.2.1 High Engine Power. A combination of engine and propellor noise at high power are expected to give ENL figures over 800 out of 999, the maximum ENL number in the IGC file. Most two-stroke systems produce ENL values over 900 and some give the maximum of 999. Four-stroke and Wankel (rotary) engines give lower figures but normally enough to differentiate between power-on and power-off. Some electric and jet engines at high power have also been shown to give moderate ENL values; however, high power is not the critical case in terms of differentiating between power-on and power-off flight, see below.

1.4.2.2 Critical ENL Cases

1.4.2.2.1 Power - on. The critical power-on case that is used for testing ENL is not full power, it is when any positive forward thrust is generated by the engine (SC3 para 4.5.4b, SC3C para 12.1 and FAI GS 2.2.1.4). Under such conditions, recorded ENL must be high enough to differentiate from the Power-Off cases below; if it is not (such as with electric and small jet engines), an extra system operating under the MOP code must be fitted (see 1.4.2.4, also chapter 5 of the IGC FR Technical Specification).

1.4.2.2.2 Power - off. The critical ENL power-off case is not a quiet, well-sealed cockpit. It is a noisy cockpit, typically thermalling with air vents and cockpit panels open. This can produce ENL figures up to 300, more if sideslip is present and 400 has been seen. Another high-noise case is high speed flight with the cockpit panel(s) open, but this is not as realistic as thermalling with panels open because in the latter case the glider will be climbing and could be more easily be mistaken for use of engine.

1.4.2.3 ENL numbers. The three ENL numbers as recorded in IGC files must therefore differentiate between the "quiet engine" and the "noisy cockpit" cases. This is done by carefully selecting the frequency and gain at which the ENL system is most sensitive. The ENL system is then tested by GFAC in a range of motor gliders, gliders and powered aircraft. Experience has shown that peak sensitivity between about 70 and 300Hz with a typical "bell curve" (the statistical "normal distribution") either side of the peak frequency, gives a good ENL response to engine and propeller noise and less response to other cockpit noises.

1.4.2.4 Low-ENL Motor Gliders. Where an engine system produces low ENL values that make it difficult to differentiate between power-on and power-off flight (as assessed by GFAC using the criteria in 1.4.2), an additional system shall be provided in the motor glider concerned. This system must produce a signal that is shown in the IGC file under the three-letter code "MOP" (see Chapter 5 of the IGC FR Technical Specification), as an indication of forward thrust generated by the engine system. This applies to quiet engines such as those with electrical power, and others such as jets for which the frequency response or direction of noise does not register highly enough on ENL systems in cockpit-mounted recorders. This will be subject to GFAC evaluation and decision on the type of motor glider concerned.

1.5 **IGC-APPROVAL**. GFAC shall either approve, conditionally approve, or require modifications to the applicant's unit before IGC-approval to the appropriate level can be given (see 1.1.4 for levels). Drafts of approval documents will be circulated to GFAC members and associated experts, and to the Flight Recorder Manufacturer concerned. The final version is the responsibility of GFAC, which has the status of an agent of IGC and FAI (see para 1.1).

1.5.1 **Limitations before IGC-approval**. If GFAC decides that IGC-approval cannot be given to the appropriate level without changes being made (see 1.1.4 for IGC-approval levels), GFAC will inform the manufacturer of what is required in order to gain IGC-approval. This may involve an approval with limitations, such as an approval level other than "all flights" or an approval without an ENL system. If the manufacturer notifies GFAC within one month that the approval process should continue, the manufacturer will be expected to resubmit a modified Flight Recorder for further review by GFAC within the next six months. GFAC will aim to complete this review within three months, subject to not meeting any unforeseen difficulties. If this procedure is followed, no extra fee will be payable but the initial fee will continue to be held. An example might be where a motor glider Means-of-Propulsion (MoP) sensor system either was not included, or was assessed by GFAC as not being adequate. In this case an IGC-approval might be issued without the MoP sensor system, pending the development of a system which satisfies the IGC Specification, which would then be added to the Approval by amendment.

1.6 **APPLICANT'S AGREEMENT**. When an IGC-approval is issued, the applicant agrees to the following conditions:

1.6.1 **Changes to an IGC-approved Flight Recorder**. Notification of any intended change to hardware, firmware or software must be made by the manufacturer or applicant 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, large or small.

1.6.2 **Action on Changes**. GFAC may decide that a formal evaluation of such changed features is required, or, if the changes are extensive, that another full approval process is needed. This shall require a fee of up to that for a new type of FR.

1.6.3 **Changes in IGC-approvals**. IGC may remove or alter an existing IGC-approval document at any time.

1.6.4. **Manufacturer's details**. An IGC-approval is for the named product or products manufactured by (or under the control of) the Organisation whose details are given in the approval document in the paragraph headed "Manufacturer". Any changes to these details shall be sent to GFAC without delay, so that the approval document can be updated.

1.6.4.1 Transfer to another Organisation. An IGC-approval will only be transferred to another Organisation after consultation by GFAC with the previous and future Organisations, followed by amendment of the approval document.

1.6.4.2 Significant changes. If significant changes have been made in the Organisation listed in the IGC-approval document under "Manufacturer", FAI reserves the right to require a new IGC-approval process for the types of flight recorder concerned. In this context, the approval process will require the signature or re-signature of an approval application and GFAC may wish to test recorder equipment produced by the changed Organisation. What changes are considered significant will be as assessed by GFAC and include transfer of manufacturing responsibility to a different Organisation, acquisition of a name by another Organisation, or a change of structure or of key personnel within the same Organisation.

1.6.4.3 Cease of Manufacture and/or Support. Where a manufacturer ceases to make a particular type of recorder, GFAC shall be informed. The manufacturer shall state whether support for the type will continue such as updates and/or repairs to existing recorders.

1.6.4.3.1 Pilot aspects. Pilots should be aware that if they are using a recorder for which there is no manufacturer support, in the event of anomalies in the electronic data (IGC file) without manufacturer support to reduce any anomalies in IGC files, it may not be possible to validate such flights.

1.6.4.4 Exclusions. FAI, and their agents IGC and GFAC have no responsibility for, matters related to: (1) Intellectual Property (IP) and Intellectual Property Rights (IPR) or, (2) the relations of the Organisation with any others except with FAI and its agents or as they affect FAI, its agents and the IGC approval and others issued by IGC Air Sport Commissions.

1.7 **USE OF IGC FLIGHT RECORDERS WITHIN NATIONS**. A GNSS Flight Recorder operated in accordance with its IGC-approval document shall be used for all flights that require validation to FAI/IGC criteria including World Records (SC3, para 3.0.3) and World Championships (SC3 Annex A). An IGC-approved Flight Recorder must also be used for evidence for FAI/IGC Badge and Diploma Flights except that, for Silver and Gold badge flights only, evidence from a Position Recorder may be used under special Sporting Code rules (see the Glossary under "Position Recorder" for definition and SC3 references). For the different levels of IGC-approval from world records to badges, see para 1.1.4. IGC-approved FRs may

also be used by NACs for flights under their jurisdiction, where FAI/IGC standards are specified such as for national and regional records, and com petitions. Where flight validation is not required to FAI/IGC criteria, the choice of criteria is at the discretion of those responsible for validating the flight.

1.7.1 **IGC File Format**. For the format of the IGC Flight Data file, see Chapter 3 and Appendix A. These references give the normal sequence of data in the IGC file and the detail on how it is to be shown. In the case of older types of recorder with Grandfather Rights (para 1.1.3.4.5), there may be some differences compared to the current IGC file format, but for a performance to be validated to IGC standards, in all cases the file must pass the IGC electronic Validation check (para 1.1.10.1).

1.7.2 **Non-IGC FRs**. Where flight validation is not required to FAI/IGC standards, the choice of criteria is at the discretion of those responsible for validating the flight, such as competition officials or, for non-IGC FRs, other FAI Air Sport Commissions.

1.8 **NOTIFICATION AND ISSUE OF IGC-APPROVAL DOCUMENTS AND FILES**. Notification of issue of a new or amended IGC-approval document will be posted on the Internet newsgroup rec.aviation.soaring (r.a.s.) and also on the FAI IGC-discuss list. The complete IGC-approval document will be posted on the web site www.fai.org/gliding/IGC_approved_frs. In addition, the FR Manufacturers DLL file (or, for older types of recorder, the short program files) for downloading IGC files, and for validating the integrity of such files, will also be posted for free access on www.fai.org/gliding/gnss/freeware.asp .

1.9 **PRODUCTION STANDARDS**. IGC reserves the right to inspect and test examples of products covered by IGC-approvals, for the purpose of checking compliance with the standards and conditions of their approval.

1.9.1 **Testing production equipment**. Such testing will be carried out by GFAC and may be at any time and without prior notice. GFAC may obtain recorder units under its own arrangements such as from owners or sales outlets, but, if requested by GFAC, the Organisation listed in the IGC-approval document under "Manufacturer" shall supply one set of hardware required for such testing.

1.9.2 **Results of testing**. If any problems are found or questions are raised, GFAC will correspond with the manufacturer. If this cannot be done to the satisfaction of GFAC, the terms of the IGC-approval may be altered under the authority of para 1.6.3 above.

1.10 **PROBLEMS OR QUESTIONS IN USE**. If any problems or questions arise during use of IGC-approved Flight Recorders, the GFAC Chairman should be notified in the first instance. See also para 1.1.12.

Appendix A: Changes of IGC-approval Level

APPENDIX A
CHANGES OF IGC-APPROVAL LEVEL

A1 Changes of approval level. If GFAC proposes to lower the approval level of a type of IGC-approved recorder, this will be discussed in confidence, first with the IGC ANDS committee and then with the manufacturer (for approval levels, see para 1.1.4 in the main body of this document). The IGC Bureau may also be informed if appropriate at this early stage. Such lowering of level may apply to a particular type of recorder or to a specific modification state or a hardware and/or firmware version of the type. As much notice as possible will be given so that the manufacturer can be given the opportunity of offering an upgrade that will retain the existing approval level. After these discussions, if GFAC still decides to recommend a lowering of the approval level it will then make a detailed recommendation to the IGC Bureau. The Bureau may decide to make a public domain announcement asking for comments. The Bureau will then assess all of the evidence and make a decision. If they accept the GFAC recommendation to lower the approval level, the details will be announced immediately but the next IGC Plenary meeting will be asked for confirmation as part of the normal procedure for confirmation of Bureau decisions that were made between Plenaries. Announcements will be made on the FAI IGC discussion group (igc-discuss@fai.org) and on the international soaring newsgroup (rec.aviation.soaring) but will not include confidential or proprietary information.

A2 Data integrity factors. Factors that may lead to a lowering of approval level, particularly from "all flights" to a lower level, include the following. Evidence that flight data generated from an IGC-approved recorder has been or can be manipulated, altered or falsified. For instance, if it can be shown that the secure parts of an IGC flight data file can be changed and it still passes the electronic VALIDATION check. Also, evidence that the security function or functions have been compromised, or if IGC experts in data security assess or demonstrate that security could relatively easily be compromised by commonly-available equipment and methods. This includes a situation where it can be shown that the security microswitch can easily be by-passed. In these cases, the lowering of approval level will take effect at a date agreed between GFAC and the Bureau. In serious cases such as where there is a risk that compromised data could be submitted for flight claims from other recorders of the same type, this could be the date of the public announcement of the Bureau decision.

A3 Other factors. If the approval level is to be lowered for reasons other than those given above, the date of implementation will be decided by the Bureau and will not normally be before 12 months after the date of the public announcement of the Bureau decision.

A4 Appeal against a lowering of approval level. If it is decided to lower the approval level of a type or version of a recorder, the manufacturer of the recorder or any entity with an interest may appeal to the IGC Bureau to have the decision reviewed. The organisation or individual making the appeal must notify the IGC President of an intention to appeal within one calendar month of the public announcement of the lowering of the approval level. Notification by email or fax is acceptable and will be acknowledged using the same medium. Pending the appeal, the decision and its implementation timescale will stand. In submitting the appeal, the organisation or individual making the appeal agrees to accept the result, which is at the sole discretion of FAI as the legal entity and its agent IGC, and also agrees not to institute proceedings against the FAI or its agent IGC or against any person who was involved on behalf of FAI or IGC.

A4.1 Procedure and evidence. The Bureau will then appoint a tribunal of either three or five persons, one of whom will be nominated as Tribunal President. These persons must have an understanding of the technical area concerned but must have no direct commercial or strong personal interest in the result. Evidence shall be given in the English language and be sent by email to the Tribunal President. Tribunal members will correspond with each other by email. Evidence may include proprietary or confidential information that must not be divulged to the Public Domain. Such evidence must be kept confidential to the Tribunal members and parties authorised by the Tribunal to see it such as the manufacturer, the appellant (if different), the IGC GFA and ANDS committees and authorised technical experts used by IGC. Evidence should be submitted by email in commonly-used formats such as MS Word for text and JPEG for pictures and diagrams. GFAC, and if appropriate the ANDS committee, will present evidence to the tribunal in favour of the change of approval level; evidence from the organisation or individual making the appeal is covered in 1.4.2 below. Within 3 calendar months of receipt of appeal documentation from the appellant, unless exceptional circumstances prevail, the tribunal shall reach a decision and notify the IGC President of their findings and recommendations. These may include proprietary and confidential information. The President will pass these on to the Bureau and to the GFA and ANDS committees. An edited summary without any proprietary or confidential information and suitable for the Public Domain will be prepared and announced as soon as it is agreed by the Bureau and the manufacturer, the organisation or individual making the appeal (if not the manufacturer), and the GFA and ANDS committees have been given time to comment.

A4.2 Appeal documentation and financial deposit. Appeal documentation from the organisation or individual making the appeal must be received by the Tribunal President within three calendar months of the date that the change in approval level was announced in the public domain. The appeal financial deposit must be received by FAI within the same three calendar month period. The amount of deposit will normally be that specified for appeals under the FAI Sporting Code General Section (GS Chapter 9) unless decided otherwise by the IGC Bureau. The deposit is payable in Swiss Francs (ChF) and the amount can be obtained on request to the IGC President or the Chairmen of the GFA or ANDS committees. The deposit must be lodged with the FAI account in Zurich and banker's drafts must be marked "IGC account for IGC GNSS Recorder appeal" so that FAI and the IGC Treasurer will know what it is for. Bank and other transfer charges must be paid by the applicant so that the full deposit is received in the FAI account without any deductions for transfer or other bank charges by either the sending or receiving bank. The deposit is not returnable unless the case of the organisation or individual making the appeal is accepted without reservation, although a partial refund may be made if recommended by the Tribunal.
