

To: Recipients of IGC Agenda

From: Chairman IGC GNSS Flight Recorder Approval Committee (GFAC)

## **IGC GNSS FLIGHT RECORDER APPROVAL COMMITTEE (GFAC) CHAIRMAN'S REPORT**

*This report on GFAC activities is dated 10 January 2011 and an update will be given to the IGC Plenum*

1. **GNSS Recorder IGC-approvals.** A total of 47 types of Flight Recorders (FRs) from 19 different manufacturers have been approved since the IGC-approval system started in March 1995. This is an increase of two FRs and one new manufacturer since the last report to the Plenum dated 10 January 2010. Table of approvals: [http://www.fai.org/gliding/system/files/igc\\_approved\\_frs.pdf](http://www.fai.org/gliding/system/files/igc_approved_frs.pdf)

1.1 **IGC-approvals in the last year.** In February 2010 the Zander GP940 approval was changed for motor gliders to allow an airborne engine run rather than only a ground run.

In April 2010 for the EWA Models A-D, the list of permitted stand-alone GPS receivers are now in a separate, smaller document as an Annex to the main IGC-approval. This will make additions and deletions of GPS receivers easier to make.

In June 2010 initial approval was issued for the LXNAV LX9000, and an ENL system was approved for the LXN/Flarm Mini Box and Red Box.

In August 2010 initial approval was issued for the LXNAV Nano miniature recorder.

2. **GPS Lat/Long Accuracy.** Results of GFAC accuracy tests are the same as last year. This is an average error of 11.47m for lat/long fixes recorded in IGC files from a sample of over 2000 test points.

3. **Anomalies found during the year.** Many IGC files have been analysed including those from FRs being tested, and those sent to GFAC by a number of organisations for comment and analysis. Advice has been given to a number of NACs, pilots and OOs on FR aspects of claims for badges and records.

4. **ENL figures in the IGC file.** ENL stands for Environmental Noise Level. In an IGC FR designed for Motor Gliders, three ENL figures from 000 to 999 are produced for each fix in the IGC file, using a microphone-based system inside the secure FR case. Typically, where an FR is in the cockpit, two-stroke, four-stroke and Wankel engines driving propellers, produce high ENL numbers (800-999) at high power and moderate ENL (500 or above) at low power.

4.1 **2007 - Quiet Electric-powered Motor Gliders - the 2007 solution.** Tests on motor gliders with electric engines showed that at low engine power, ENL figures as low as 150 were produced, and sometimes as low as 100. Such figures can be confused with soaring such as thermalling with canopy panels open, for which ENL up to 350 has been seen, and occasionally 400. For proof that the engine was not run during the soaring performance, this low-power condition is therefore more critical than the higher ENL values that are shown close to maximum power. The criterion that invalidates a soaring performance in a motor glider is any positive forward thrust, in accordance with SC3 para 4.5.4b, SC3C para 12.1, and para 2.2.1.4 of the General Section of the FAI Sporting Code.

Therefore, in 2007 Annex B to the Sporting Code was amended, requiring for such low-ENL motor

gliders an additional three-number variable to be recorded under the terms of the RPM code in the Technical Specification (TS) document for IGC FRs. The current Annex B references are para 1.4.2.2 for critical ENL cases and para 1.4.2.4 for low-ENL MGs.

The next step was to get manufacturers of FRs and electric motor gliders to recognise that there was a problem, and to produce such a system for GFAC to test.

4.1.1 Early 2010 - Tests on an Electric MG. Last year I reported to the Plenary that a system was being tested that recorded an RPM-related figure for the motor of a Lange Antares 20E motor glider using a sensor outside the FR and connected to it by wire. This would add a three-number group in the IGC file under the RPM code, in addition to the ENL system within the FR case. This extra system was designed to comply with Para 1.4.2.4 of Annex B to the Sporting Code, as mentioned above.

Unfortunately this system did not work, probably because it was complex and attempted to read a signal of exact RPM, rather than a simpler method such as measuring the electrical current taken by the engine (which GFAC agreed was related to RPM). Current can be measured through a sensor clamped round an engine supply cable, without breaking in to the cable itself. The merit of such a system is because any changes to wiring to the engine could have airworthiness implications, and this might also apply to picking off RPM signals to use in an FR. The ANDS chairman consulted OSTIV and caution was advised on any system that needed modification of any engine function.

I am pleased to report that a system has been designed that measures current through a sensor outside the main supply cable, and should be tested by the date of the 2011 Plenary.

4.2 Mid-2010 - GFAC tests on Jet MGs. In mid-2010 GFAC had an opportunity to make tests on a Ventus 2cxaj, the "j" standing for the 23.5 kg thrust Olympus Jet from the AMT company ([www.amtjets.com](http://www.amtjets.com)). It was flown at low and high power with several different types of IGC-approved FRs.

To our surprise, ENL values were lower than we had thought. At power for level flight these were as low as 160, less than ENL values for thermalling gliders with cockpit panels open. The reason is probably a combination of high engine RPM and the fact that most jet noise is to the rear of the jet pipe rather than forward into the cockpit. The RPM of the Ventus AMT engine is between 35,000 (idle) and 108,500 (max), much higher than the piston/propeller combinations for which ENL systems were designed.

Due to the compactness of engines such as this, many more similar jet-powered MGs may be produced in the future. Clearly, something had to be done so that the use of such engines, even at low power, can be properly recorded in the IGC file for the flight. At the same time, the electric engine situation needed to be addressed.

The solution was for GFAC to decide on an appropriate FR system that would allow positive recording for all engine types, even when producing small amounts of forward thrust. In developing such a system, manufacturers of FRs and Motor Gliders, other IGC committees and OSTIV were consulted. The resulting system was to be incorporated in the next amendment to the FR Technical Specification. This would then be given publicity, for instance to producers of analysis programs for IGC files, to IGC and its committees and to the world gliding movement generally.

**5. November 2010 - Amendment to the FR Technical Specification.** The Technical Specification (TS) for IGC GNSS FRs was first issued in October 1997, and has been substantially amended since then. In 2010 the next amendment would be number 12. Amendments to the TS are the responsibility of the IGC ANDS and GFA Committees and do not have to follow the dates of the Sporting Code amendment cycle. In the next amendment, to address the issue of low-ENL engines, after discussion of various alternatives, it was decided to make the extra RPM-related system more versatile in two ways:

5.1 The new MOP code. A new three-letter code "MOP" has been created (MOP = Means of Propulsion), to apply to any system with a sensor attached to the FR by wire, recording any engine-related variable that an FR manufacturer puts forward for IGC-approval. Approval as usual to be the responsibility of GFAC.

The sensor could record fuel flow, electrical generator output, RPM (if a signal is available), electrical current to the engine (for electric engines), acoustic noise under or near the propeller of an electric engine

or near the jet pipe of a jet. Or any other variable that GFAC agrees will respond to engine power whenever forward thrust is generated, the FR system resulting in high enough three-number MOP values in the IGC file for the flight even at these low thrust levels.

A fundamental part of this system, continuing the 2007 concept of recording RPM, is that the three MOP numbers are in addition to those for ENL. This is so that ENL numbers can be compared with those for MOP in the same IGC file. This is a significant "double check" on the integrity of the MOP system which, being remote from the FR and connected by wire, is inherently less secure than the ENL system that is all inside the FR case that is protected by microswitch and public/private key codes. However, the TS requires methods to be incorporated that will detect any discontinuity of the MOP wire or interference with the wire or sensor, and there are a number of ways of doing this, the detail of which should remain confidential.

5.2 MOP Sensor Description. Because the type of sensor may be one of several, in such recorders an extra line must be added to the header record of each IGC file with a short description of the type of sensor used.

6. **December 2010 - Second Edition of the FR Technical Specification (TS)**. The above new MOP system was added to the draft Amendment 12. However, it had been realised for several years that after so many amendments, any document tends to be subject to duplications and poor structure. The TS was no exception.

In November 2010, it was decided to make the effort and produce a Second Edition of the Technical Specification (TS2), reducing duplication and transferring detail from the main body to annexes. This took many man-hours of work, involved many different drafts, and not only involved the ANDS and GFA Committees but also the IGC Bureau and the Sporting Code Committee. Suggestions from IGC President Henderson and VP Mozer were incorporated in TS2.

The GFAC email list of FR manufacturers and potential manufacturers was used not only to inform them of what was happening, but also to ask for suggestions. The same with some producers of analysis programs for IGC files, so that the new MOP code can be incorporated in their programs.

The final version of TS2 was published on 20 December 2010. It was announced on the "IGC-discuss" email list and the international newsgroup Recreation Aviation Soaring (r.a.s.). It is published on the IGC web site: [www.fai.org/gliding/system/files/tech\\_spec\\_gnss.pdf](http://www.fai.org/gliding/system/files/tech_spec_gnss.pdf)

6.1 Annex B to the Sporting Code. Chapter 1 of SC3B is based on Chapter 1 of the Technical Specification, and vice-versa. A revised Annex B Chapter 1 based on TS2 is an appendix to this document and it is proposed to IGC that it has effect immediately after the 2011 Plenum. This is so that the Chapters 1 in SC3B and TS2 will be based on the same material, otherwise they will differ until 1 October, which could be confusing to FR manufacturers, OOs, pilots and owners of electric and jet MGs, NACs, etc.

6.2 The present position - early January 2011. Three FR manufacturers are designing MOP systems with the sensor connected by wire to the FR. All are designing acoustic-based systems where a microphone is to be placed near the jet pipe of a jet or under the propeller of an electric engine. One other system is based on a clamp around the main electric supply cable to an electric engine, recording current flow.

One particular concern of GFAC is to ensure that systems are in place that minimise the possibility of interference with the wire and sensor both inadvertent and otherwise. Like the internal security systems for the FR case, the exact nature of such systems is confidential. However, as an example, signals generated by the FR can be used to electronically check the characteristics and continuity of the wire and sensor. Any anomaly would lead to a signal that the MOP system is insecure and an appropriate message being placed on the IGC file.

Results from testing MOP systems will be reported to the Plenum.

6.3 Use of Existing FRs positioned near the engine or propeller. There is nothing to prevent an existing IGC-approved FR with ENL recording being positioned near the jet pipe of a jet or near the propeller of an electric engine, and being used to obtain the IGC file with the primary evidence for the claim.

For IGC-approval for use in electric or jet MGs, test results of any such installations should be sent to the GFAC Chairman in the form of IGC files plus a short description of the layout. Engine runs must be made under OO supervision and include power for low but positive forward thrust as well as high power.

A table of of IGC-approved recorders with ENL facilities is on the IGC web pages.

[www.fai.org/gliding/system/files/igc\\_approved\\_frs.pdf](http://www.fai.org/gliding/system/files/igc_approved_frs.pdf)

Sizes and weights are given in the IGC-approval document for each type of recorder. The smallest is the LXNAV Nano, and other relatively small FRs include, in alphabetical order, the Cambridge 20 & 25, EW microRecorder, Garrecht Volkslogger, LXN Colibri & LX20, and SDI PosiGraph.

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**Appendix:** Updated SC3B Chapter 1, based on TS2 Chapter 1

#### **References:**

##### **Low-ENL Motor Gliders (electric or jet):**

Sporting Code Annex B: [www.fai.org/gliding/sporting\\_code/sc3b](http://www.fai.org/gliding/sporting_code/sc3b)

ENL system general: para 1.4.2. Critical ENL cases: para 1.4.2.2. Low ENL Mgs: para 1.4.2.4.

**IGC FR Technical Specification, Second Edition:** [www.fai.org/gliding/gnss/tech\\_spec\\_gnss.asp](http://www.fai.org/gliding/gnss/tech_spec_gnss.asp)

**List of IGC-approved FRs:** [www.fai.org/gliding/system/files/igc\\_approved\\_frs.pdf](http://www.fai.org/gliding/system/files/igc_approved_frs.pdf)

**IGC-approval documents:** [www.fai.org/gliding/system/files/igc\\_approved\\_frs.pdf](http://www.fai.org/gliding/system/files/igc_approved_frs.pdf) These web pages also contain a brief history of the US GPS system and early developments of FRs for gliding. New or revised approvals are also announced on newsgroup r.a.s. and on the IGC-discuss list.

**Free programs for IGC-approved FRs:** [www.fai.org/gliding/gnss/freeware.asp](http://www.fai.org/gliding/gnss/freeware.asp) These are for downloading data from a FR to a PC, and checking the IGC file as being valid and the same as that downloaded from the FR. They include the appropriate IGC-XXX.dll file (XXX is the IGC code for the particular manufacturer) that works with the standard IGC Shell program for download and validation functions.

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