IGC Agenda 2007 Item 6.2.8

Annex __ to the agenda for the IGC plenary meeting 2-3 March 2007

To: Recipients of IGC Agenda

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

GFAC CHAIRMAN'S REPORT

This report is dated 11 January 2007 and an update will be given at the IGC Plenary meeting. This report is longer than usual because, as well as the annual report on routine GFAC business, there were a number of occurrences during the year that should be reported to IGC

1. **GNSS FR Approvals**. A total of 33 types of recorders from 12 manufacturers have been approved since the IGC-approval system started in March 1995.

1.1 Types of recorders. Three new types of recorder have been tested and approved since the last IGC plenary agenda report dated 8 January 2006. These are as follows, with the date of the IGC-approval document:

Aircotec XC Profi (Gliders), 30 May 2006
EW microRecorder, initial approval, 10 June 2006
New Technologies Easy, initial approval, 10 January 2007

1.2 Revised approval documents. Since the last IGC plenary agenda the following approval documents have been revised, with effect from the following dates:

LXN Colibri model 4 with uBLOX GPS receiver board, 24 February 2006
LXN 7007F with uBLOX board and internal FLARM module, 17 March 2006
Zander/SDI GP941, amendment with Firmware 2.11 on time recording, 20 August 2006
EW microRecorder, addition of EW engine noise recording system, 20 November 2006

2. **Possible future IGC-approvals**. Correspondence is taking place about three new types of recorder from the Czech Republic, Germany and Poland. Three other new types of recorder that have the Flarm (Flight Alarm) proximity warning function are covered below:

2.1 Recorders with Flarm facility. Three types of Flarm equipment with a recording capability are being evaluated. This includes one from the Swiss Flarm company (www.flarm.com) and two from an existing manufacturer of IGC-approved recorders in which the Flarm module is incorporated within the sealed case. Of the two from the existing manufacturer, one is a new type and one is a Flarm addition to an existing type of IGC-approved recorder (similar to the existing IGC-approval to the LXN LX7007F with Flarm) It should be pointed out that IGC-approval is concerned with recording and security of data in the recorder and in the post-flight IGC file data, not with the operation of the Flarm proximity warning function itself which is operated at the discretion of the user, in a similar way to any in-flight navigation functions that use data from the recorder.

3. **Analysis Programs for Flight Data**. 27 programs have been notified to GFAC that are capable of analysing data in the IGC file format. For details, see the web addresses at the end under "References".

4. **Technical Specification**. Amendment 9 to the IGC Flight Recorder Specification was issued on 1 July 2006 after circulation of drafts to the IGC ANDS and GFA committees, technical advisors, bureau representatives, recorder manufacturers and potential manufacturers. This amendment included additional details on Public/Private key encryption systems, some points on Intellectual Property Rights (IPR), and some detail on the IGC file format.

5. **Anomalies found during the year**. Many IGC files have been analysed including those for recorders being tested and those forwarded by a number of organisations for comment and analysis. Advice has been given to a number of NACs on claims for badges and records and to FAI on world record claims.

5.1 Recorder Downloading in Flight. An NAC asked GFAC to analyse an IGC file submitted for a claim. The flight was incomplete and yet passed the IGC Validation check. It was found that the flight had been downloaded in flight, eliminating the end of the flight from the IGC file (which was thought to carry on into the Night Flying period). The download was probably made via the PDA (Palmtop or other small Computer) in the cockpit that was also used for navigational display. Pilots and NACs are reminded that an airborne download is not acceptable for IGC standards of evidence which require a landing to be shown, an OO-witnessed download and OO storage of the downloaded data. It is understood that the NAC concerned did not accept the claim.

5.2 Time anomaly. A time anomaly was found in some IGC files from one type of recorder during the World Championships at Eskilstuna, Sweden. Manually recorded finish times were not the same as those in the IGC file. After investigation by GFAC it was found that, in this type of recorder, it had been assumed that the GPS engine provided fixes every second and the time in the IGC file reflected this assumption. However, when fixes were missed (as they are occasionally due to high bank angle and/or poor signal reception), a time error built up. Action was taken by GFAC, and the recorder manufacturer has issued a free firmware update. Thanks are due to Pall Einarsson (Chief Scorer), Dick Bradley (Chief Steward), and the recorder manufacturer. GFAC wrote to other manufacturers and this showed that fix times for other recorders are taken directly from the GPS fix signal. Finally, the IGC Technical Specification was updated to make it clearer that the fix time in the IGC file must be taken from the time included in the GNSS signals that make up the fix.

5.3 Noise Recording in Motor Gliders with Quiet Engines. Correspondence between GFAC and Lange Flugzeugbau on the Lange Antares 20E electric-engined motor glider has been carried out since the year 2000. However, it is only in 2006 that enough IGC files from Antares flights have become available to make an analysis of the three-number Engine Noise Level (ENL) characteristic that is recorded with every fix in the IGC file. It has become clear that, at power for level flight in Antares, ENL recorded in the IGC file can be less than that recorded in non-powered flight with the cockpit ventilation and canopy panels open (for instance when thermalling in hot conditions). There is therefore not enough differentiation between power-on and power-off flight using the ENL systems fitted to current recorders. The Lange company are exploring whether the frequency sensitivity of a particular ENL system can be better optimised, for instance for the exact range of propellor RPM in Antares. However, there are a large number of different ENL systems in IGC-approved recorders and the possibility of more types of quiet engines in other motor gliders. It is therefore proposed that, in addition to ENL, a second engine-related variable shall be made available in such motor gliders, conforming to the RPM three-letter code in the Specification for the IGC file. See Appendix 2 to this report on engine recording systems.

6. **GPS Lat/Long Accuracy**. At the date of this report, GFAC tests show an average error of 11.43m for lat/long fixes recorded in IGC data files from a sample of some 2000 test points. These tests are made from a moving ground vehicle at accurately-surveyed points at about 51N 001W. These points include several with a clear horizontal horizon, one with horizon masking of about 5 degrees above the horizontal and some with nearby low-rise buildings. The average error figure using this method has been between 11 and 13m since the Selective Availability (SA) error was removed from civil GPS systems by the US Government on 1 May 2000. The overall results indicate a 99% probability of being within 27m, 95% of being within 20m, 90% within 18m, 80% within 16m, 70% within 15m, 60%within 13m and 50%within 11m. At the end of each year, the average Lat/long error measured in all GFAC accuracy tests since 1 May 2000 was as follows: end of year 2000, 12.88m; 2001, 11.57m; 2002, 11.56m; 2003, 11.52m; 2004, 11.50m; 2005, 11.50m; 2006, 11.43 m.. The gradual improvement with time is thought to be due to the better performance of more recent GPS receiver boards, which have either a 12-or 16-channel capability.

7. **Drafting of Documents and Amendments**. There was no Amendment to Annex B to the Sporting Code (SC3B) during 2006. For other documents, see paras 8 and 10.

8. **Amendments to the Sporting Code**. The report of the Sporting Code Committee and page 2 of its "year 1 proposal" for Silver and Gold badge flights mentions the possible use of Commercial Off The Shelf (COTS) GPS units for position evidence instead of cameras. The reason for not including diamonds is that the IGC-approval system that has been in place since 1995 already applies to Diamond flights up to World Records in three levels of approval. Some of the implications of using non-IGC-approved COTS units for position evidence for Silver and Gold flights are at Appendix 1 to this report.

9. **FAI Matters**. At the FAI General Conference in October 2006, Dr Peter Saundby, President of the FAI Medical Commission (and an experienced glider pilot) proposed a review and expansion of the FAI Technical Commissions, in order to co-ordinate advice on specialist technical matters to NACs and Air Sport Commissions. This was accepted by the FAI Conference. A resulting paper to FAI was produced by the GFAC Chairman in a personal rather than a GFAC capacity. This proposes a Navigation and Airspace Commission of FAI. It is understood that this concept is supported by the Chairman of the IGC ANDS committee and a Bureau paper on the subject will be submitted to the IGC Plenary. In view of the experience developed in IGC on GNSS and related matters, such a Commission of FAI would enable such expertise to be made available more widely.

10. **GFAC Work Load**. The workload during the year in dealing with the above has been at its usual high level. Investigations of anomalies such as those above were time-consuming, as was further correspondence about COTS GPS units with a representative of Garmin and John Bisscheroux of Canada that, in the event, covered old ground.

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Appendices: 1. Sporting Code - considerations for COTS GPS units
2. Engine recording in IGC files

References:

All IGC-approval documents: http://www.fai.org/gliding/gnss/approved_gnss_flight_recorders.asp This also has a brief history of the US GPS system and early developments of recorders for gliding. New or revised approvals are also announced on newsgroup r.a.s. and on the IGC-discuss list.

Free programs for all IGC-approved Recorders: http://www.fai.org/gliding/gnss/freeware.asp These are for downloading data from a recorder to a PC, and checking the IGC file as being valid and un-altered from that downloaded from the recorder. 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. For manufacturers who have not produced the *.dll file, the older DATA, CONV and VALI functions in DOS format are available but may not work with some modern PCs.

Analysis software for IGC files: http://www.fai.org/gliding/gnss/gnss_analysis_software.pdf

Technical Specification for IGC-approved Recorders: http://www.fai.org/gliding/gnss/tech_spec_gnss.asp

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