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Date Errors in IGC files from Flight Recorders

Background

Posts on Newsgroup Rec.Aviation.Soaring (r.a.s.) have shown that in some early models of IGC-approved Flight Recorders, the date recorded in the IGC file has suddenly started to be in error by several years. This has been noticed in, but is not limited to, older models of Cambridge Garrecht Volkslogger and Colibri FRs. The error occurs because the small internal battery inside the GPS receiver has run down and the Real Time Clock (RTC) in the GPS engine has stopped. When the GPS is re-powered, the RTC is unable to reset itself correctly for the reasons given below. It should be noted that this battery is not the same lithium battery that is used to back up the flight recorder's memory, but is a smaller battery integral within the GPS engine. Some types of IGC-approved FRs have firmware that is able to identify this condition and continue to output the correct date, while others have types of GPS engine that are not subject to this potential date error.

Technical Detail

GPS dates are expressed as a week number and a day-of-week number after the date when the GPS system first came fully on line (6 January 1980). The date system used was only able to cope with a maximum of 1024 weeks, after which it started to count from zero again. There was no problem for the next 1024 weeks from 6 January 1980 until 19 years and 8 months later, when in August 1999 the week count rolled over back to zero. It will roll over again in May 2019. Each period of 1024 weeks is called an epoch and we are currently in the second epoch. A GPS engine with a functioning RTC can cope with this rollover without problem. However, should the RTC fail because the battery backing it up fails, when it restarts it has no knowledge of which epoch it is in and reverts to the first epoch. The problem was exacerbated when GPS engine manufacturers decided to replace the relatively large memory batteries with smaller rechargeable versions. These rechargeable versions had a much smaller capacity and relied on being recharged when the flight recorder was powered up. They performed well for many years, but like all rechargeable batteries, their capacity reduced as time went by. After some 10 years or more, their

capacity was reduced to such an extent that they would fail after a few weeks if they were not refreshed by powering up the flight recorder. Early Garmin engines fitted to Cambridge GPS10, 20 and 25 flight recorders had large capacity memory batteries that, even after 20 years, are still showing 3 volts. For space reasons Garmin produced the LVC25 engine which changed the memory battery to a much smaller rechargeable version having a significantly less capacity. Without the engine being powered, it will power the RTC for about 1 year and relies on the engine being powered up to recharge the memory battery. With the passage of time, like all secondary cells the capacity of these rechargeable batteries reduces and after about 10 years will only retain its charge for a matter of weeks. If it has not been recharged during this time, it will then fail and the RTC will stop. On repowering the engine, the RTC restarts but assumes it is in the first epoch which is why it displays a date in the 1990s. Manufacturers intend to solve the problem by:

• Replacing the memory batteries and resetting the RTC to force it into recognizing the second epoch.
• Rewriting their firmware to artificially move the reported date into the second epoch, although the GPS engine is still reporting that it is in the first epoch.
• Replacing the GPS engine.

Solutions

Cambridge Instruments

It is possible to dismantle the LVC25 module and replace the rechargeable lithium battery. Using a terminal emulator, the RTC is then forced into the second epoch and all is well. ClearNav, who maintain the Cambridge instruments, carry out this service on GPS20, 25 and 302 units but at a cost of up to $350. You can add a further $100 for shipping to the US and back. Provided your instrument is fitted with a LVC25 engine, I can fit a new battery, reset the RTC and reseal the recorder for £60 (two hours work). Later 302s were fitted with a Garmin 15xL-W engine and this has to go back to ClearNav to be replaced. Very few of the later models were sold in the UK and the majority will have LVC25 engines. There is no easy way to determine which engine is fitted to your 302. Halfway through the production the cases were changed from bare ali to crackle black finish. While all the plain ali cases will have a Garmin LVC25 fitted, some of the later black cases may have the newer engine. If your case is black, then you could have an engine of either type and there is no way of finding out which one is fitted other than to remove the case and identify the engine.

Volkslogger

Very early Garrecht Volksloggers have the Japanese Koden GPS engine which is not subject to these problems. However the majority of Volksloggers will have the Garmin LVC25 engine and suffer the date problem. As I cannot reseal the Volksloggers, they have to go back to Garrecht to have the engine exchanged. Considering the age of most of the Volksloggers, this might not be a cost effective solution.

Colibri

The very early Colibri flight recorders were fitted with a Japanese GRU GPS engine. Some of these have lost count of the current epoch and reverted to the first epoch. Unfortunately the only cure is to replace the GPS engine which is not a cost effective solution. The majority of Colibri recorders have the uBlox engine which can identify the correct epoch.

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