Technical requirements for CIA-approved Loggers

1. General requirements

The GPS loggers are required to record data during flight in latitude, longitude, altitude and time in such a manner that flight continuity and the flight path are shown. Also transfer recorded data after flight to a computer for further processing, analysis and flight verification; have a unique logger serial number nominated by the manufacturer and un-modifiable by the user.

2. Data requirements

2.1. Data recording

- Continuous recording with settable interval of 1 to 60 seconds.
- Setting of fix-recording frequency (constant or variable time between fixes)
- Receiver capable of processing data from at least 12 satellites at one time
- GPS clock time recording with output as UTC
- lat/long recording to the WGS 84 Geodetic datum
- Altitude recording, either GPS-calculated altitude or pressure altitude without QNH correction

2.2. Data file standard

The data recorded in the logger and transferred after flight to a PC must be capable of analysis in the form of a data file standard format readable by common software. Data may be transferred from the logger in another form (eg binary code) as long as it can then be transformed into a standard format through the programs used.

2.3. Memory used for flight data

The memory used for storage of the flight data must be of a type and design so that it cannot be accessed, combined (such as in a storage device with software partitions), altered or corrupted by other data legitimately or otherwise present in the equipment.

2.4. Preservation of memory data

The logger shall preserve memory data so that flight data is preserved with time and can be transferred to a PC during that time. The design should take into account conditions of impact (for instance, accidental dropping of the logger), damage, and crash. Wherever possible, non-volatile memory should be used that does not depend on a sustainer battery for retention of data. If a sustainer battery is used, its position and wiring to the memory unit should be made as secure as possible with respect to impact or other damage. Any write-access for mandatory flight recording information to the memory, which originates other than from secure or otherwise approved sensors (such as GPS, pressure transducer) must be detected in such a way that flight data files from the logger will fail validation tests.

2.5. Identification of corrupt, false, or inaccurate data

Any flight data that is corrupt, false, or inaccurate, either through inadvertent or deliberate causes should be positively identified and recorded as such wherever possible.

2.6. Pilot event marker

This is where an extra fix is recorded and a special PEV (Pilot Event) code appears in the flight data for the fix concerned, following a specific pilot action such as pressing a button. The PEV code on the flight data must only appear as a result of this pilot action and not as a result of any other action or function. A positive indication to the pilot that the PEV function has been activated must be provided to the pilot; this can be by an indication on a screen or by an audio tone when the PEV function is activated.

2.7. Digital Signature

A Digital Signature (DS) should be generated by the logger and transferred to the PC at the same time as the flight data. The DS will be used as a check that the data originated correctly from an individual logger and that there has been no change in the data between the initial data transfer from the logger to the PC, and the data used for final flight validation.

3. Equipment requirements

3.1. Type of seal

In case the recorded data could be altered by external action, the enclosure or data port of the logger module may have to get tamper-proof physical seal in a way to show that the seal is broken if the case is opened. The seal must have markings unique to the logger that are difficult to replicate. Seals with holographic symbols are preferred. The seal material must be such than it breaks when it is peeled off and it must not be possible to remove intact in the presence of heat or solvents.

3.2. Wiring

Only the following wires may pass through the boundaries of the sealed enclosure:

- Electrical power: Wires carrying electrical power to the GPS logger.
- External antenna: GPS receiver antenna (aerial) cable if fitted.
- Cable to navigation device: A cable for transmitting data to a navigation device.
- Cables for approved functions: A cable or cables for the approved functions (PEV or others) provided that no alteration of GPS fixes, the flight log or the Geodetic Datum, is possible by signals sent through these cables.
- Connector cable for data transfer from logger to PC.

3.3. Possibility of re-programming in flight

It must be shown that any in-flight transfer of data to or from the logger, or the use of an un-approved connection for data transfer, will either be apparent on the after-flight data or can be shown to be impossible because of the design.

3.4. Stowage out of reach of flight crew

The equipment design may be such that stowage out of reach of the flight crew is required. Such stowage may be at the top of the basket or directly at the balloon envelope.

3.5. Unique Serial and Version Numbers

Each logger should have an alphanumeric Serial Number (S/N) unique to that manufacturer, marked physically on the case and also in the electronic memory so that it is included on all output data. Output data should include the S/N, the version number of the hardware and firmware (or software) standard. The case of the logger should be permanently marked with the name of the logger manufacturer, type/model and S/N. Where a display is available, the logger make, type, S/N and version number(s) should be shown on that display for at some seconds before it changes to another presentation.

3.6. Use of Computers with a Logger

There must be security mechanism which prevent a computer that is connected to the logger being used for unauthorised changes to the internal programming of the logger or of data stored in the logger, both on the ground and in flight.

3.7. Changes and upgrades - maintenance of security

Changes and upgrades may involve replacement of components, including GPS receivers, processors, boards, ROMs of various types, and microchips. These may only be carried out at the logger Manufacturer's facility or that of an authorised agent, so that the physical and electronic security of the updated logger is re-set to the standards required by this document and of the CIA-approval for the logger concerned. Where firmware can be re-programmed without component replacement by using tools external to the logger (such as where EEPROMs, flash PROMs are used, and any equivalent systems), this may be done using a special software in a way that the standards required by this document and the CIA-approval for the logger concerned will remain guaranteed.

3.8. Calibration

In case the pressure altitude is recorded, the pressure altitude sensor adjustments must be set so that the output as recorded in the data file corresponds closely to the FAI pressure altitude criteria.