CIVA HMD

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1. Introduction

In Glider Aerobatics the available altitude to perform the given sequence is a crucial element.

Every competitor has to stick to the available maximum and minimum altitudes given by the box to be compliant with the rules and this needs active monitoring.

In Gliders to be able to fit all figures of a sequence into the 1000 m altitude space is, beside being able to fly the figures as precise as possible, a key element. There is no possibility to regain altitude aka energy.

Therefore the supervision of this available energy is a fairness and of course also a safety factor in Glider Aerobatics. A competition, especially on a World Class Level as in WAGAC or WGAC without a working Height Measuring Device (HMD) with live transmission, should not take place anymore.

2. History

For many years, WAGAC and WGAC, have been held with an HMD system that was developed by Vladimir Machula. Before Vladimirs system there have been others used in Glider Aerobatics. All of them have come into age and are not usable anymore. There have been no alternates at the time when Vladimirs system went out of service.

The systems used in the past have been for many years available to CIVA free of charge. Costs may have applied to organisers to host the necessary operating staff on site. CIVA was always using the system based on goodwill from their developers to keep it alive. Hundreds of hours of volunteer work have been invested in the development, upkeep and support. The systems were mostly closed source. Some of them even had to be sent back to the developer for an altitude change.

3. Replacement

For many months, not to say even years, the GAC has investigated on how to get a new HMD into service. A device like this is not buyable off the shelf. The GAC has received quotes from developers for up to and even more than 100'000 Euros.

After some filtering and analyzing the situation, the remaining system favored by the GAC is a German developed HMD which fulfills the basic requirements defined in a separate document. The key element is the live transmission to the CJ position. On the market are nowadays many loggers which are able to record an aerobatic flight with sufficient frequency/resolution. None of these systems has the key element of live transmission.

The live transmission is especially important for the judging board to be able to decide on LO's or even LO-LO's, so that the flight can be closed on the spot at the line. Except if there are problems in the signal transmission, which can be solved by reading out the onboard data in the HMD after the flight. Sadly this happens often and poses quite a workload in conjunction with the official video from the judge line to make sure a penalty is justified. The by far bigger part of questionable situations is, thanks to the live transmission, solved on the spot right away as the judges are informed by an acoustical signal if the flight is LO or even LO-LO.

4. Best Candidate

Cost wise and also function wise the favored system by the GAC comes from am active German Glider Aerobatics pilot, Steffen Engel. He developed it driven by the explanations given above: no more comps without it!

The system consists of onboard transmission boxes and a ground station with antenna and software running on an Android tablet or laptop.

The down side of this system is, that it uses publicly available frequencies that are also used with FLARM. This can result in frequency congestion and signal drop out. This is backed by onboard registration of all data to an SD card for readout after the flight. An option to have a reserved frequency is expensive and would most probably go beyond the possibilities of CIVA in terms of financial involvement.

Steffen has also agreed to maintain the system for the next 5 years in between the competitions. This includes hardware and software maintenance and possibly additional development.

5. Action plan

- The GAC is convinced that the best solution is to buy a stock of onboard transmitters and a base station for the CJ position.
- The selected system is fully based on Open Source Software and well available hardware components (see https://github.com/Steffen-Engel/SoftRF/tree/HMD).

- It fits the existing mounting brackets in many aerobatic glider aircraft used for the old systems (see appendix)
- The developer is ready to support his product in between championships if updates or even bigger repairs are necessary.
- CIVA aims for a minimum life span of 5 years.
- There should be enough transmitters owned by CIVA to equip every competing aircraft on WAGAC/WGAC with a dedicated box, to avoid exchange work and to limit necessary staff at the flight line.
- The operation of the HMD during competition should fully be in CIVA hands. We create a new officer for competitions: The HMD Officer. He should be attached to the International Jury (IJ) and get the same travel allowance (TA) provided by CIVA and hosting services provided by the organizer as a judge or the IJ.
 - The HMD Officer's tasks are:
 - Responsible for a working and ready to use HMD at the venue (preparation work and logistics included)
 - Operation of the ground station at the CJ position during competition flights
 - Supervision of the initial installation of the transmitters in the aircraft
 - Replacement of failed transmitters
 - Data read-out and analysis if requested by the CJ or the IJ
 - Small maintenance of hard- and software of the HMD on site
- A CIVA owned HMD should not impose additional costs to the organizer, beside the hosting for the HMD Officer. The current sanction fee by CIVA has space to cover the additional costs on CIVA side.
- The selected system by CIVA should define a de-facto standard for other, possibly interested
 developers. The IGC Logger standard, which was introduced many years ago for distance gliding, is
 an example of how the GAC thinks of the new HMD.

6. Rule changes

At this point in time we do not see any necessary addition or change to the existing rules in the Sporting Code Section 6 Part 2 (SC6P2). The HMD is mandatory for competition flights in WAGAC/WGAC. It's on the CJ's discretion to abort any competition flight by radio call if the flight does not provide the required signal during tow until the release of the glider on top of the box or if there are safety concerns during the performance.

The responsibilty for charging his box is with the aircraft owner/pilot with the idea in mind: no working box, no flight. This means that the competitor is responsible for taking the box to the charger (provided by CIVA) and back to the aircraft the next flying day.

Further amendments of SC6P2 can result from experience during WGAC/WAGAC which will go the normal rules change procedures and decision by plenary.

7. Short Term planning

The system must be ready for the 2026 competition season, or in other words the WAGAC/WGAC in Fayence, France. According to Steffen it should pose no problem to have the requested amount of transceivers ready by then.

For the first use we nominate Eugen Schaal, CIVA Alternate Delegate Germany and successful former Glider Aerobatics competition pilot for many years to take the key function of the HMD Officer. Eugen has already agreed to be available for this job.

Afterwards, the HMD Officer will be nominated by the GAC for WGAC/WAGAC each year.

8. Financial Part

The system costs are as followed:

A. One time investment out of CIVA reserves (to be included in CIVA Budget for 2026:

Base Station Receiver	
including:	450
Network node, configured pp. Android Tablet pp.	150 200
Base Station Receiver pp.	200
Transmitter Unit pp.	200
Charging Unit for 10 systems pp.	200
Additional Supporting Software pp.	15

All prices in Euros

We suggest to buy 25 transmitters which should be suitable to equip all competing aircraft plus to have spare transmitters.

Complete price including:		
1 Naturalis and	150	
1 Network node	150	
2 Android Tablets	400	
2 Base Station Receivers	400	
25 Transmitters	5000	
3 Charging Unit for 10 units	600	
1 Additional Supporting Software	15	
TOTAL excl. German TVA 19%	6565	

German TVA 19%	1247.35
TOTAL incl. German TVA 19%	7812.35

All prices in Euros

B. Running costs financed by event sanction fees (300 CHF pp. atow):

TA for the HMD officer	according to the TA "price list" used for CIVA officials
Additional costs for logistics and preparation of the system for competition	as required
Spare parts (eg. connectors, cases)	as required

9. Future

Please note, that the below is currently nothing more than ideas. There has been no decision up to now to realize any of the mentioned possibilities.

We could imagine, that the complete system would be available for rental by NAC's for national competitions. A fee structure is not yet ready.

It is our firm believe that an HMD should also be used, sooner or later, in Power Aerobatics in CIVA. This would clearly raise the level of credibility of LO and even LO-LO penalties given by judges. There have been no tests with powered aircraft with this HMD. But it looks quite clear that due to the materials used in powered aircraft the signal transmission might be an issue without an external antenna.

Additionally it might be necessary to certify the device used to be compliant with EASA rules regarding built-in equipment. This is for sure the point as soon as the HMD is connected to any aircraft system (eg. the pressure system).

Necessary EASA Change Standards (CS) references:

- CS-SC004b: External antenna
- CS-SC051d: FLARM
- CS-SC061a: Tracking
- CS-SC062a: Awareness device
- CS-SC110a: Beeper

One of the future expansion could be, rule changes provided, to monitor the g-load during competition flights which would clearly add to safety. The sensor is already present in the current version and the value is transmitted to the base station.

The system also has the potential to be expanded into a personal training tool. We could imagine pilots to buy their personal box and use it as a monitoring tool for training.

A possible "opening up" of the whole specification for other developers to produce alternate systems. This would definitely require some data protection and validation algorithms to make it proof against manipulation (eg. GPS satellite position recording, encryption, certification procedure).

10. Appendices

- A. Quote from Steffen Engel √
- D. Minimum system specifications for an HMD $\sqrt{}$
- E. HMD 2025 SUMMARY SHEET √