ICTC Committee Report

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1. Information and Communication Technology Committee

Ringo Massa, NED (chairman)

Eduardo Bolster, ARG

Kari Kemppi, FIN

Vladimir Machula, CZE

Chris Sills, GBR

2. Official judging video

Quality varied across competitions, with Chief Judge reports providing details. In summary

- EAC; video quality and stability were marginal, but sufficient after adjustment.
- At the time of publication of this document, the Chief Judge reports of W(A)GAC and WAAC have not yet been published.

The quality of the judging video remains an issue of concern. In relation to this, the appearance of high-quality and affordable aircraft tracking systems (Item 4) may be very interesting. In theory, the entire video recording could be abandoned and replaced by the virtual "video" obtained from the tracking system.

3. HMD

The Glider HMD system unfortunately presented various problems at the W(A)GAC, as described in 7.3 CIVA Glider Aerobatics Committee Report.

A new system is under design in the Netherlands and will be presented at the plenary by Pekka Havbrandt. A preliminary datasheet can be found in Appendix A.

4. Aircraft tracking systems

Two different aircraft tracking systems were recently presented to the ICTC by their developers. Short descriptions can be found in Appendix B. These systems can provide highly accurate registration and virtual presentation of attitude, position, and other parameters, with up to 10 millisecond sample intervals. They may provide opportunities for transformative change and improvement of the sport, including but not limited to:

- Remote judging
- Replacement of judging line video by a virtual video
- Improvement of coached training and self-training
- Public engagement

Both designers will give a 3-minute presentation of their systems. The many possibilities can be discussed at the plenary.

5. CIVA championship scoring software

The ACRO system is updated regularly and now runs on modern 64-bit Windows systems. A more detailed report is published in 7.9 Contest Scoring System Report.

6. OpenAero sequence design software

The software is stable, with regular improvements. Besides the existing French translation of the interface, a German translation of both interface and manual was made by Dirk Maslonka.

The code has been reviewed for clarity and updated to take advantage of modern browser features. Several functionalities will be added to improve figure manipulation and other parts of the interface. This will all be included in the next release, expected to be completed in December. This release will also include rules and sequences as decided upon at the Plenary.

Development of an online interface for submitting aerobatic sequences for Category 1 events, as indicated in the 2022 report, is still considered. Such a system could provide ease of submission and additional checks for pilots, and improved administration for competition officials. Additionally, it could provide a means to build up a comprehensive database of (anonymized) sequences for pilot training and historic reference. However, there are several potential security issues with such a system which must be resolved before it can be implemented.

7. Appendix A: Preliminary HMD data sheet

Introduction

The HMD-100 Height Measurement Device is an advanced and versatile device designed for accurate and efficient height measurement for contest aerobatic flying. With a combination of cutting-edge features, including smart battery management, redundant transmitters, GPS capabilities, an OLED display, redundant sensors, long-range communication, and secure data encryption, the HMD-100 offers a reliable solution for every competition.

A yellow triangle is shown for parts of the manual which should be read very carefully and are important for operating the system.

Notes with a red triangle describe procedures which are critical and may result in serious damage or any other critical situation.

A bulb icon is shown when a useful hint is provided to the reader.

Information in this document is subject to change without notice. Airwin Avionics reserves the right to change or improve their products and to make changes in the content of this material without obligation to notify any person or organisation of such changes or improvements.

Before using any part of the system, please read and understand this Installation and Operating manual.

There are no serviceable parts within the unit, hence the unit must be taken to the dealer or factory for service. Opening The HMD-100 Height Measurement Device by the user will void all warranty!

Never plug any unauthorized devices into the usb connectors! These will certainly cause serious damage to HMD-100

Terminology

HMD - *Height Measurement Device*

Transmitter – *The 2 way encrypted data communication via a radio frequency between the HMD-100 and ground receiver station at the judge line.*

Device overview

Technical Specifications:

Battery:

- Capacity: 2500mAh
- Battery Life: Up to 4 days (depending on usage) with intelligent battery management.

Transmitter:

- Frequency: Dual-mode setup with 433MHz and 868MHz redundancy.
- Enhances signal reliability and coverage in various environments.

GPS:

- Accuracy: 0.5 meters
- Update Frequency: 10Hz
- Provides precise positioning data for accurate height measurements.

Display:

- Type: OLED
- Information Display: Displays all essential measurement and device status information.
- User-friendly interface for easy operation and data reading.

Transmitter Range:

- Range: Up to 20km (dependent on environmental factors)
- Frequency either 433Mhz or 868Mhz (depending on law of country)
- Enables remote measurement capabilities in various scenarios.

Barometric Pressure Sensors:

- Redundant Setup: Equipped with redundant sensors for enhanced accuracy and reliability.
- Accuracy: 0.25 meters
- Ensures precise height measurements even in challenging conditions.

Communication:

- Two-Way Communication: Enables interaction with the receiver for data exchange and commands.
- Verified Encryption: Utilizes secure encryption protocols to ensure the confidentiality and integrity of transmitted data.

Other:

- MicroSD card with saved data (work in progress)
- WiFI for downloading flights (work in progress)

Key features

Experience the precision, reliability, and convenience of the HMD-100 Height Measurement Device.

Features

Smart Battery Management: The HMD-100's intelligent battery management system optimizes power consumption, extending device operation up to 4 days on a single charge.

Dual-Mode Transmitter: The device employs both 433MHz and 868MHz frequencies, providing redundancy and reliable signal transmission in diverse environments.

High-Precision GPS: With a remarkable accuracy of 0.5 meters and a refresh rate of 10Hz, the GPS system delivers accurate positioning data

Clear OLED Display: The OLED display offers clear visibility of measurement results, device status, and other relevant information, enhancing user experience and usability.

Long Communication Range: The HMD-100's transmitter boasts a range of up to 20km, offering flexibility and versatility in height measurement tasks across varying distances.

Redundant Barometric Sensors: Equipped with redundant barometric pressure sensors, the device ensures accurate height measurements even in challenging conditions. The device features two barometric pressure sensors with an accuracy of 0.25m and with a refresh rate of 500Hz

Secure Data Communication: The two-way communication system facilitates encrypted data messaging, safeguarding the integrity and confidentiality of transmitted data.

Functional description

Startup and Self-Test:

- Upon powering on the device, the HMD-100 initiates a self-test procedure to ensure all components are functioning correctly.
- The device measures barometric pressure at ground level to establish a baseline for height calculations.

- A startup beep confirms that the device's buzzer is operational.

Communication Check:

- The device attempts to establish communication with the main receiver to perform a functional test, and receive all contest settings (height thresholds etc.)
- If successful, a confirmation message is displayed on the OLED screen.
- In case of communication failure, an error message is displayed, indicating the absence of communication with the receiver.

Sensor and Functionality Testing:

- The HMD-100 tests all its critical functions, including transmitters, barometric sensors, and GPS accuracy.
- These tests ensure the device's readiness and accuracy for subsequent measurements.

Sleep Mode:

- After completing the self-test and communication check, the device enters a low-power sleep mode.
- The device actively searches for a stable GPS signal during this time.
- The sleep mode can extend for an extended period, with over a year's worth of battery life, conserving power until movement is detected.

Automatic Activation:

- Upon detecting movement, the device automatically wakes up from sleep mode and activates its measurement functions.
- The HMD-100 starts sending height, position, heading, and battery percentage data to the main receiver.

Height Indicators (Default setup, all values are adjustable):

- The device emits a single beep at 150 meters to indicate system activation and functionality.
- At 200 meters, the same beep is repeated, reaffirming proper device operation
- Continuous beeping commences above 1200 meters, providing a clear signal of height progression.

Descending Altitude:

- While descending from 1200 meters, the continuous beeping stops at the 1200-meter mark.

Descending to Lower Altitudes:

- Between 200 meters and 150 meters, continuous beeping resumes, indicating the device's proximity to the ground.

After landing

- After landing the device will recalibrate all sensors, and will return in the sleep mode
- Logs all data on the Micro SD including GPS data.

Functional Benefits:

- **Self-Assessment:** The device performs comprehensive self-testing to ensure accurate and reliable measurements.
- **Communication Assurance:** The communication check confirms operational links with the main receiver, providing real-time status feedback.
- **Power Conservation:** The sleep mode conserves battery life until movement is detected, optimizing device longevity.
- **Automated Operation / Calibration:** Automatic calibration eliminates the need for manual intervention, enhancing user convenience.
- **Height Progression Alerts:** Audible beeps at specific altitudes offer pilots clear and continuous height status updates.

8. Appendix B: Flight tracking and coaching systems

8.1. AeroCoach

AeroCoach is an Aerobatics Coaching System. Flight data is produced by a low cost flight recorder and, after uploading this information to the system, pilots can view realistic 3D animations of their flights. Manoeuvres can be viewed from any angle including from the judges' position; from above; or close-up in "chase" mode. Various view modes can be selected including realistic skies, slow motion and a smoke trail.

Helping to improve a pilot's performance is a key requirement for AeroCoach, so the system manages the scoring of sequences by the pilot, his peers, judges or instructors. The results are presented to the pilot in a format very similar to competition scoresheets. Score data can be aggregated over multiple flights, answering questions such as "What has been my average performance on my last 20 Loops". In addition, AeroCoach automatically produces analysis reports for the flight including entry/exit speeds, heading and height for all manoeuvres, further helping aspiring pilots achieve their training goals.

8.2. ACROWRX

ACROWRX is a visualization software for aerobatics. It allows you to visualize your flight from many different angles, including a virtual judge's perspective and a chase perspective. The judge's perspective (left handside) is probably the most important one, because that is how you would be graded. But the chase (top right handside) perspective is also very helpful to understand and develop the best strategy for presenting your flight.