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Labor Windkanal/Strömungsmesstechnik

Development of a measurement device to log the wind vector in space

Markus, Felixberger

e-mail: **markus.felixberger@gmx.de**

Mechanical engineering, Galgenbergstr. 30, D-93053 Regensburg – Germany, Head: Prof. Dr.-Ing. Stephan Lämmlein

http://www.fh-regensburg.de

1. Destination of the degree dissertation

Aim of the project was the development of a measurement device, which collects und saves data during a flight of a flying measurement platform.

The following steps have to be done during the diploma thesis:

- exact designation of the position of the flying platform (configuration of a „simple Differential GPS“ with two GPS-Receiver)
- choice of a suitable data logger to collect the measurement data
- experimental testing of the sensors, which are placed on the measurement platform, to assure the functionality of them and testing of the software, which evaluate the logged data

After the flight, the evaluated data should be finished to develop a so called Eckmann-spiral (see figure 1).

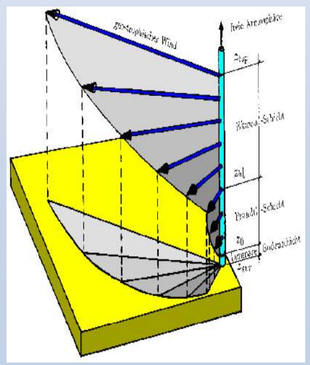

fig. 1: display of a Eckmann-spiral

2. DGPS (configuration and testing)

To test the DGPS, two GPS-Receiver were used. One of the receiver was mounted on a bike, which was moved on a tartan lane of a sports facility. The over one worked stationary , that means, that the receiver wasn’t moved during the experiment.

None of the both receiver got signals, which cause a correction of the accuracy. If one got these signals, the two receiver couldn’t compared.

fig. 2: bike with GPS-Receiver

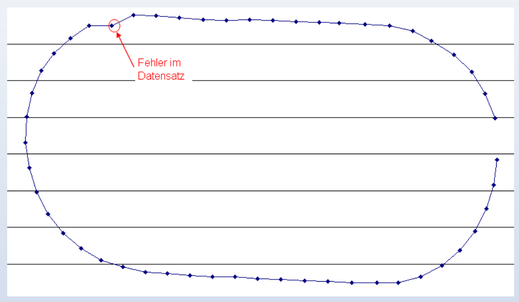

fig. 3: trimmed round

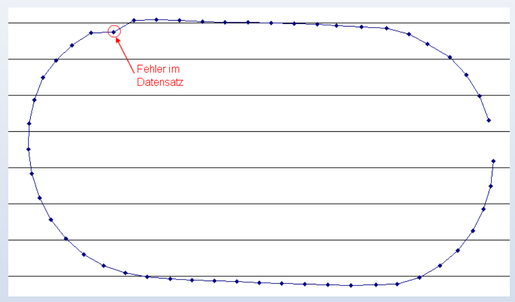

fig. 4: original round

Comparing the two figures (fig. 3 and fig. 4) and other parameters too (circumference, etc.) you can see, that building the difference between the receivers brings no advantage of the position accuracy. Reasons are:

- no identical deflection of the GPS-Signals
- no synchronous processing of the signals
- no similar satellite are used

3. Data logger

After a long and extensive research, three models became favourite:

- Comm. Eagle Tree Systems (ET)
- Comm. Wilke (WI)
- Comm. Graupner (GP)

Comparing the data logger from ET and WI, there are advantages for WI. The number of channels, resolution, measurement period and the possibility to use a SD-Card as storage medium were better. Disadvantages (for WI) are the high weight and the big size. In these points ET could score. Final criteria, which argue for ET, where weight and size. Another argument, that a GPS-Receiver could directly connect to the data logger, was a another big advantage.

GP is a good and cheap alternative for the future. That system works with an direct data transmission (send and receiver device), but the range is still a problem.

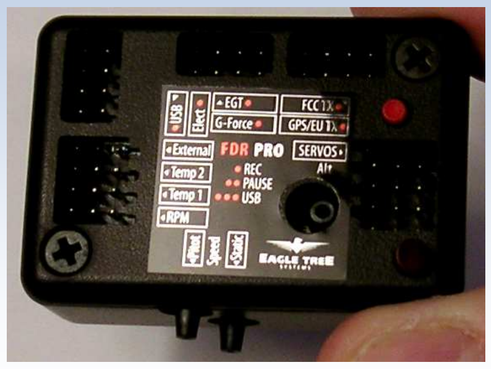

fig. 5: data logger Comm. Eagle Tree Systems

4. Conclusion/test flights

After the complete measurement device were configured, some test phases have to be passed. At least the measurement device (data logger with all sensors) were placed on the flying platform (fig. 6) and some test flights could be performed.

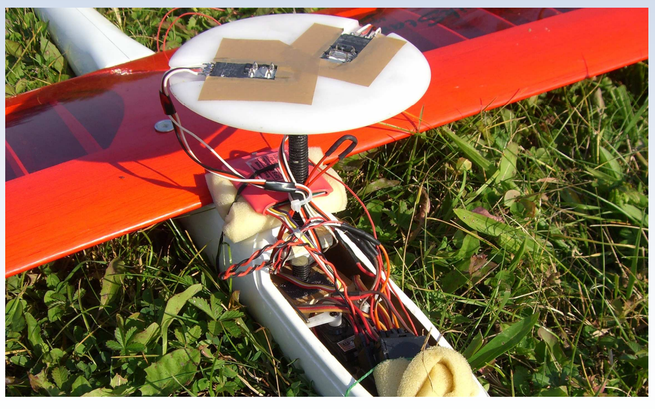

fig. 6: plane with measurement device

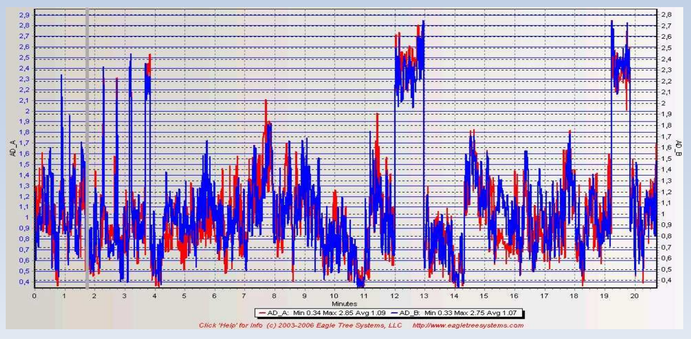

fig. 7: Voltages of the SIMAF-Sensors on the UFO

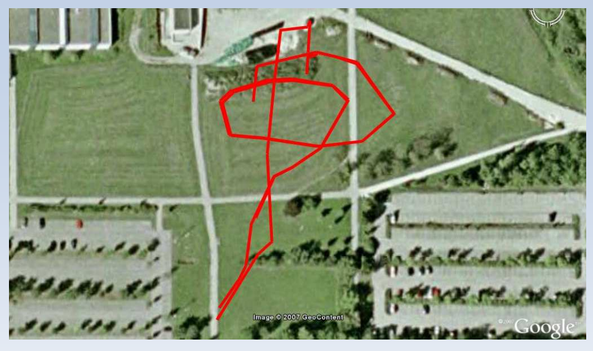

fig. 8: display of the flight path with GoogleEarth

After the testing phase, conclusions are:

- long logging period of the data logger (up to 70 min)
- sensors works without any problems (damageable SIMAF-Sensors got workable)
- Matlab-Software for data evaluation works without problems

References:

- G. Schmitz, Masterarbeit ”Messtechnische Eignung von Kfz-Luftmassenmessern als richtungsabhängige Strömungsmesssonden“ LWS-MA07/32 FH-Regensburg, 2007
- Deutsche Zentrum für Luft- und Raumfahrt, Schulinformation Raumfahrt ”Navigation“,Ausgabe 1/2005, www.dlr.de/schulinfo