Assessment of bachelor's thesis as external examiner

Title: **Synchronized Control of Group of Helicopters Using Direct Communication**
Author: **Jiří Fiedler**
Supervisor: **Ing. Martin Saska, Dr. rer. nat.**

The work presents a new protocol for the communication between Micro Aerial Vehicles (MAVs) and between MAVs and base station. The student's task was to design this protocol and to implement it on MAVs and on the base station.

After a introduction that appears to me to be too long, the student cites solely the MAVLink protocol as state of the art. Although the reasons for developing a new protocol are well described, it would have been interesting to compare with other protocols.

The protocol appears to be well designed and open for future extension. The student describe the protocol thoroughly in Chapters 7 and 8, which constitute a large part of the thesis. Experiments prove that the protocol is already complete enough for several uses such as telemetry monitoring, position drift compensation, and trajectory uploading. However, a few details are missing in the protocol description, e.g. the description of the time format and the float format used. A reference implementation on MAVs and on the base station would have been welcome on the attached CD to compensate for such lacks and to show the amount of work produced by the student.

The experimental part of the work describe how the newly-defined protocol can compensate for position drift. It appears to me that the position drift cannot be compensated with the used setup. Position drift compensation can only be eliminated by using an absolute exteroceptive sensor. The position drift may be reduced by combining measurements from two or more MAVs but according to the current description, only the position oscillations can be reduced. An assessment is missing here about the frequency of coordinate system distribution compared to the frequency of the position oscillations, which are also approximately two seconds.

Furthermore, it would have been interesting to test the limits of the protocol, e.g. how much information can be sent.

The work is well presented and has a clear structure. The references are adequate. The student made the noticeable effort to write his thesis in English. The text is well understandable although some grammar and style mistakes could have been avoided by thorough proofreading, especially its title.

As a conclusion, I advise the commission to evaluate the presented bachelor's thesis with the grade

B - very good

Prague, May 27, 2015

Dr. Gaël Ecorchard
ČVUT, CIIRC