TECHNICAL DATA OF THE ASH 30 Mi:
In 2013 the German Academy for Aviation and Travel Medicine purchased a research aircraft (ASH 30 Mi) produced by SCHLEICHER Co. Germany. The intention for that was to ameliorate the training process of aeromedical examiners and to promote aeromedical research. The research aircraft is equipped with a medical monitoring system, which was specially designed for the special conditions of the ASH 30 by the Karlsruhe Institute of Technology. This system enables simultaneous recording of both flight and physiological data.

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Methods
For medical inflight measurements the ASH 30 Mi [Fig. 1] possesses a data logger (careMon DL) made by Corvolution Co. in Karlsruhe. It is a miniaturized data recorder of matchbox size which is attached to a chest belt [Fig. 4]. Integrated in the belt are six electrodes for ECG and thorax impedance recording [Fig. 5]. The data logger records raw data such as ECG, respiratory parameters, accelerations in all three spatial axes and the temperature. Subsequently, the software calculates a number of further physiological data such as heart rate, heart rate variability (LF/HF and RMSSD) and the respiratory rate.

Via Google Earth the flight path can be depicted in a 3-dimensional image to which the physiological data can be allocated [Fig. 8]. In addition, and by using another software, the measured parameters can be assigned to special flight phases (i.e. takeoff, normal flight and landing) and, similar to a multichannel chart recorder, displayed and compared [Fig. 7].

RESULTS

I. COMPARISON OF SINGLE FLIGHT PHASES

A comparison of single flight phases revealed that the highest values were reached during takeoff (99.3 ± 16.31 bpm). During normal flight, HR decreased significantly (89.0 ± 12.81 bpm) and increased again during the landing phase (90.67 ± 14.20 bpm). The respiratory rate behaved similarly.

Mean HR for all flights was 90.19 ± 12.98 bpm (max. 153 bpm, min 56 bpm). Inflight LF/HF ratios were higher than the standard values derived from literature indicating an increased sympathetic tone in pilots. In contrast, the root mean square of successive differences (RMSSD) tended to rise with increasing flight duration, arguing for an incremental parasympathetic influence.

Discussion
In conclusion, the measuring technique proved to be user-friendly and easy to operate. Even during long flights the data recorded were plausible with only a few artefacts. The system should be completed by sensors enabling a detection of possible inflight oxygen deficiencies.