



CARDIOMED

An integrated system to monitor the cardiovascular system in space

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Space flight induces a cardiovascular deconditioning syndrome and requires cardiovascular monitoring during the mission and after return to earth. One of the most serious symptoms of cardiovascular deconditioning is represented by a decrease in orthostatic tolerance, along with a significantly reduced capacity for exercise and an increase of heart rate. The Cardiomed system (CNES-IMBP cooperation) records and analyses, in a non invasive way, the main cardiovascular parameters for medical monitoring and physiological studies.



LBNP (Lower Body Negative Pressure) Test with Chibis suit

CARDIOMED records and transfer to ground all cardiovascular parameters necessary for real time medical monitoring during LBNP session:

- ECG
- Blood pressure (continuous and holter)
- Blood flow



On board LAPTOP functions:

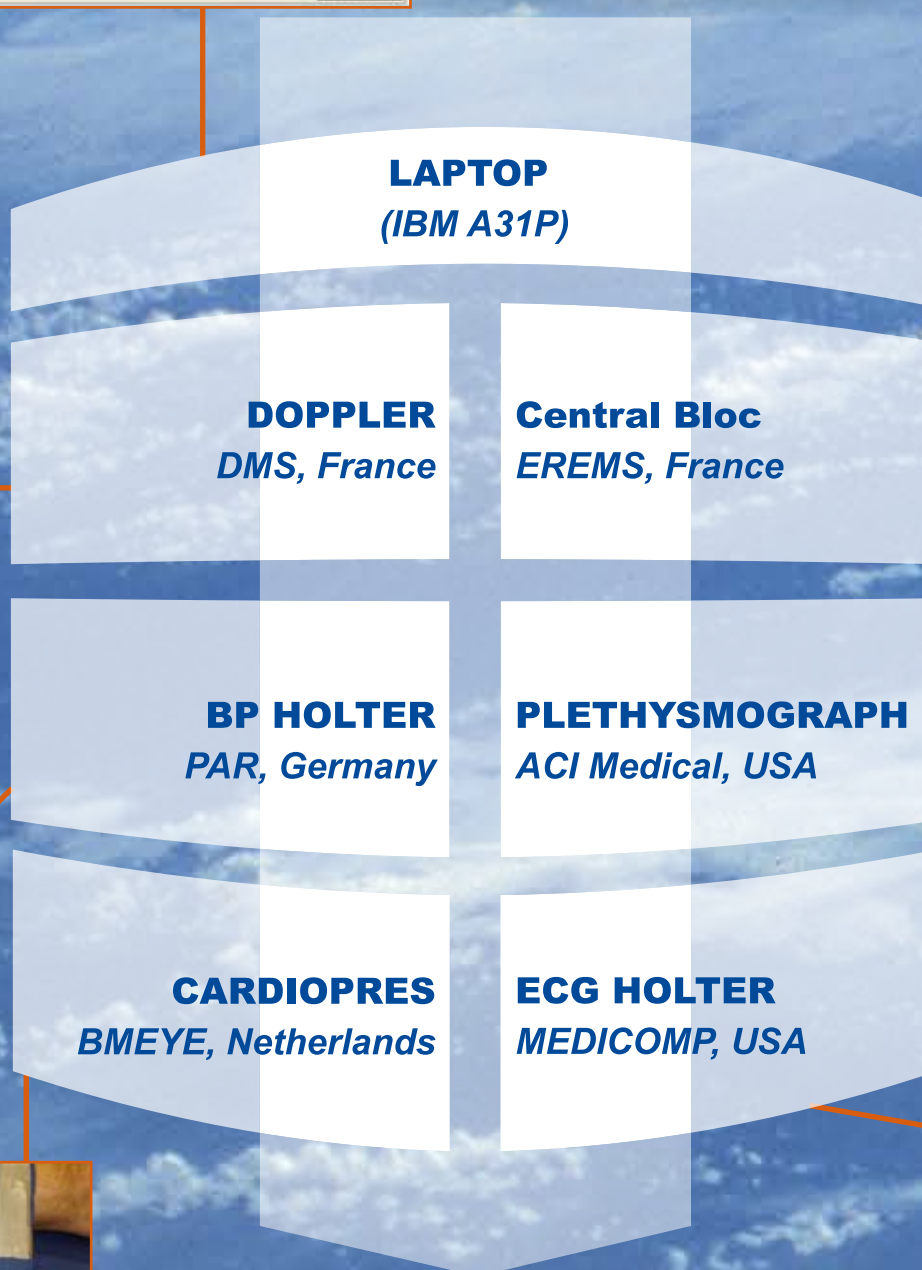
- Operating medical instruments
- Implementing medical protocols
 - Detailed procedure description
 - Specific protocols (Mental stress, ...)
- Display and monitoring of instrument measurements
- Data transmission to ground (real time telemetry)
- Data stowage



Physical exercise

CARDIOMED follows cardiovascular responses to physical effort during ergometer bicycle test:

- ECG
- Blood pressure (holter)
- Breath



The DOPPLER measures the blood flux variation in 3 arteries simultaneously. Different probes (Cerebral, Carotid, Aortic, Femoral, Superficial) are fixed on the subject via dedicated harness



Blood Pressure HOLTER is a device for the long term (up to 24h) ambulatory recording of the arterial blood pressure with oscillometric method. It is also used in stationary mode during LBNP test (linked to the Central Bloc). The measured parameters are: systolic, diastolic and mean blood pressures, heart rate.



CARDIOPRES is a device with 3 measurement functions:

- continuous finger blood pressure wave using a finger cuff (200Hz)
- surface ECG, using a combination of electrodes on 1 up to 12 derivations at different sampling rates (200Hz-500Hz-1000Hz)
- change in chest circumference using 1 or 2 respiration belt

It measures and records waveforms for the mentioned functions and derives:

- from pressure waveform: beat to beat systolic, diastolic and mean pressure, pulse rate...
- from ECG derivations waveforms: the R-peak time, RR Interval, QRS and ST segment parameters
- from chest circumference waveform: index of onset expiration and inspiration phase and respiratory rate



CENTRAL BLOC has 3 different functions:

- Communication hub between the laptop and the medical instruments.
- Power for CARDIOPRES, PLETHYSMOGRAPH and DOPPLER
- Telemetry to russian space segment and ground



AIR PLETHYSMOGRAPH allows vascular diagnostics (venous compliance) of upper and lower body extremities measuring absolute volume changes under venous occlusion



ECG HOLTER is a device for the long term (up to 24h) ambulatory recording of the ECG. The ECG signal is recorded for two channels in parallel and analysed with Epicardia software



TsOUP Ground PC functions:

- Display and monitoring of instrument measurements during LBNP sessions (real time telemetry)
- Replay of medical sessions
- Post-computations on medical measurements
- Data stowage

The combined recording of the main cardiovascular signals allows a complete monitoring of the cosmonaut and is necessary to study the multi-factorial cardiovascular deconditioning. This system has been validated on ground and was used during long term bed rest (the WISE- 2005 experiment). It will reach the ISS in 2008 to be integrated in the russian medical rack.

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