New optical microbarometer
SnT2015, Vienna Austria

Abstract
CEA DAM (designer of MB series) and PROLANN / SEISMO WAVE (manufacturer and seller of MB3) have associated their expertise to design a new optical microbarometer.

We aim at thinking that changing the electromagnetic transducer by an interferometer is an interesting solution in order to increase the dynamic and the resolution of the sensor.

We propose a future optical microbarometer which will enlarge the panel of infrasound sensors. Results with a first configuration are presented here.

Microbarometer principle

- Digital microbarometer
  - Pressure variation
  - Digital data

- Analog microbarometer
  - Movement
  - Displacement

- Digitizer

- Mechanical transducer

- Optical transducer

Interferometer principle

1. Interferometer is designed with optical waveguide
2. Optical waveguide are obtained by an ion-exchange process into a glass wafer
3. Interferometer is included into a compact package

First prototype

- Optical area
- Aneroid capsule area
- Fiber optic

Advantages:
1. Better resolution for the total bandwidth
2. No adjustment with altitude
3. Less optical adjustment compared with other optical technology

Drawbacks:
1. At present time: price
2. Fiber optics need lot of space
3. More losses compared with other optical technology

Comparison with MB2005

- One microbarometer MB2005
- Six optical microbarometers:
  - Optogeo 1, Optogeo 2 and Optogeo 3 used a MB3 aneroid capsule with the corresponding sensitivity
  - Optogeo 4, Optogeo 5 and Optogeo 6 used a MB2005 aneroid capsule with the corresponding sensitivity

PSD & coherency:
- good agreement. Optogeo sensitivity is OK
- Noise evaluation:
  - better than MB2005 for all the bandwidth

Devices under test:
- One microbarometer MB2005
- Six optical microbarometers:
  - Optogeo 1, Optogeo 2 and Optogeo 3 used a MB3 aneroid capsule with the corresponding sensitivity
  - Optogeo 4, Optogeo 5 and Optogeo 6 used a MB2005 aneroid capsule with the corresponding sensitivity

Drawbacks of the first prototype:
- Sensitivity of optical measurement to environmental parameters such as humidity

Solution:
- To insert interferometer into the aneroid capsule under vacuum

Future design

Low thermal effects on infrasound sensitivity compared to MB2005
- MB2005 thermal drift is less than ±0.1 hPa/°C

Effects of temperature

Thermal test:
- From 5 °C to 40 °C
- Step: 5 °C

Effects of altitude

Axial deformation: measurement principle
- Transversal deformation: due to symmetrical errors during manufacturing
- Risk: misalignment due to transversal deformation
- Measurement: Observation of Optical beam intensity variation with altitude

Future design

- To insert interferometer into the aneroid capsule under vacuum

This project is funded by the DGA through convention n°132906059

Anthony HUE, Nathalie OLIVIER, Serge LE M ALLET SEISMO WAVE, Lannion, France, marketing@seismowave.com – www.seismowave.com
Serge OLIVIER CEA DAM DIF, F-91297 Arpajon, France, serge.olivier@cea.fr