



P R E S E N S
Pressure Sensor Technology

6th ESA Round Table on Micro & Nano Technologies for Space Applications

8th of October 2007

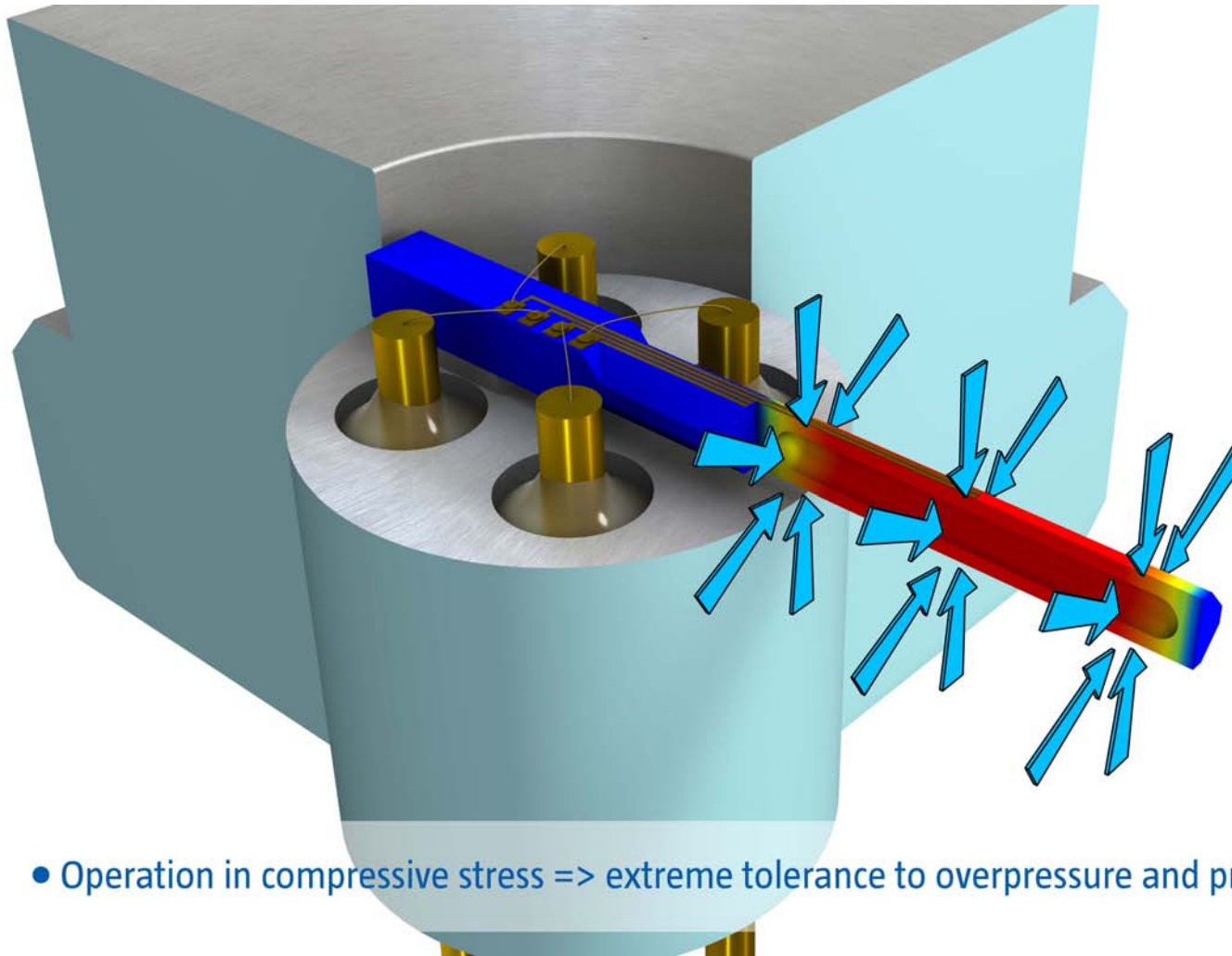


Bjørn Erik Seeberg and Peder L. S. Staubo
www.presens.com



- ❑ **Founded 1996**
- ❑ **Spin-off from the Foundation for Scientific and Industrialised Research (SINTEF)**
- ❑ **Patented technology, MEMS pressure sensing element with tubular design**
- ❑ **Significant venture capital since 2006**
- ❑ **22 employees today**

Truly different!

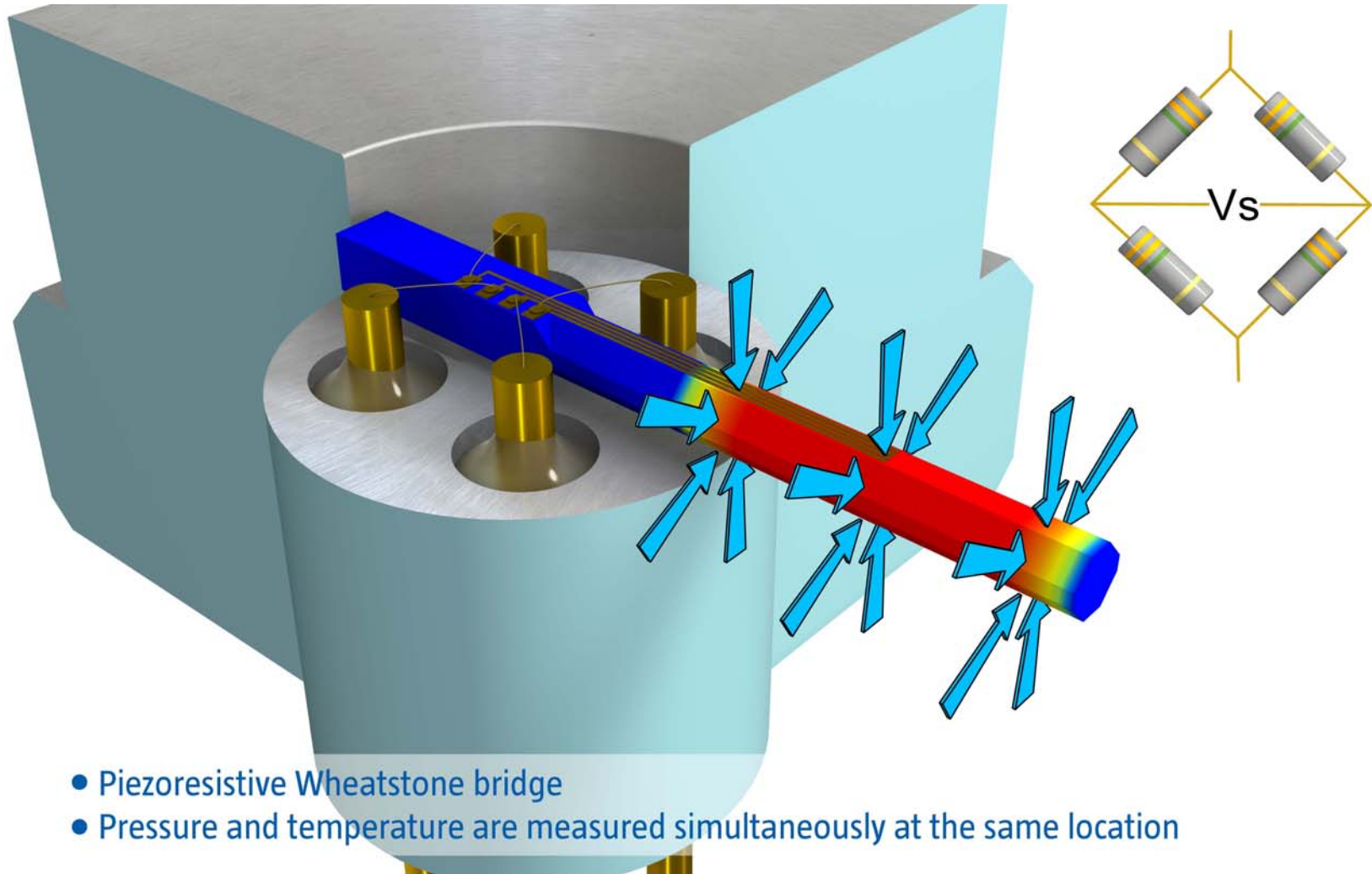


- Operation in compressive stress => extreme tolerance to overpressure and pressure spikes

Truly different!



MEMS technology



- Piezoresistive Wheatstone bridge
- Pressure and temperature are measured simultaneously at the same location

Truly different!

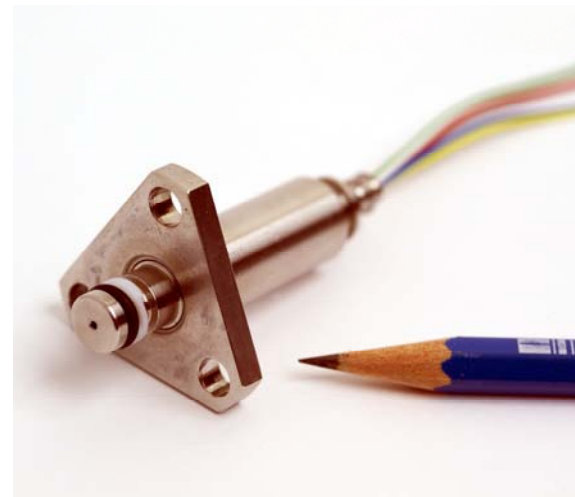
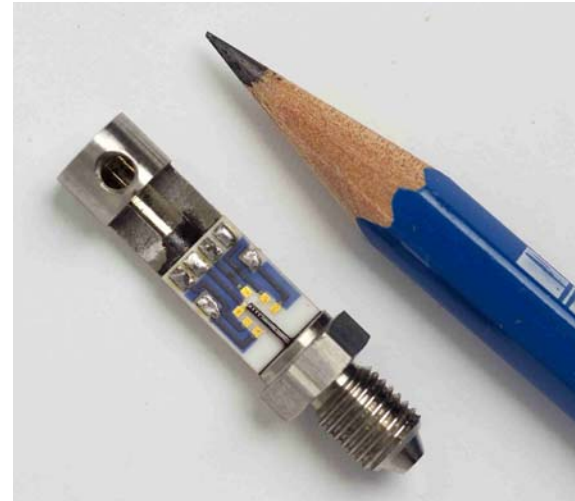


- ❑ **Tubular design, operation in compressive mode.**
- ❑ **Extreme stability, repeatability and accuracy**

Truly different!



MEMS technology

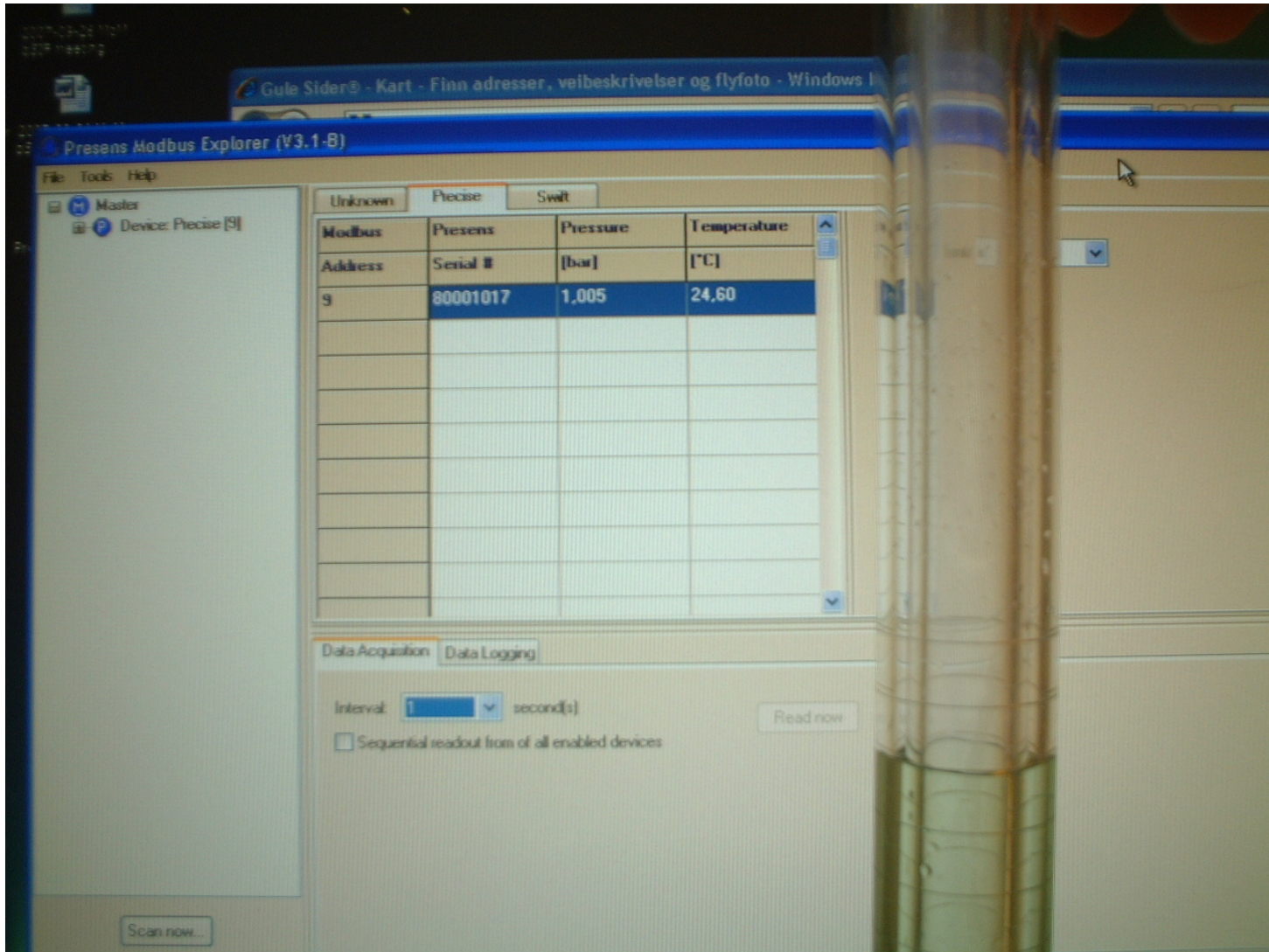


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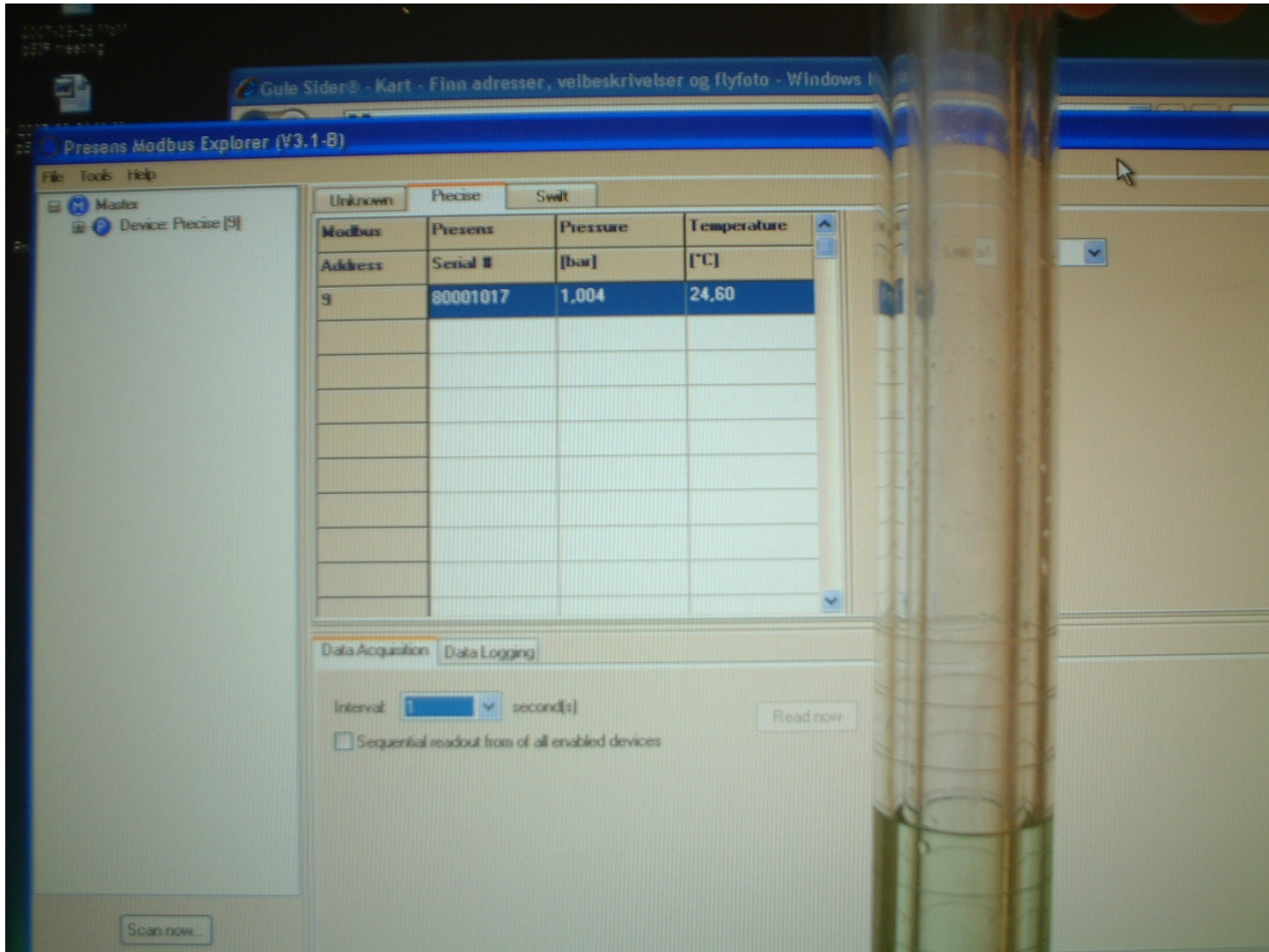


- ❑ **Designed for high pressures**
 - Mainly compressive stress
 - High overpressure capability
 - Possibility to get high raw signal
- ❑ **Long time stable**
 - Down to 0,01%FS/y
- ❑ **Radition hard**

Truly different!



Truly different!



Truly different!



□ Traditional markets

- Oil and Gas
- Aerospace
- Testing and calibration
- Water



□ Spin-on

- Space market opened in 2002

□ Spin-off

- High temperature oil and gas (down-hole)
- High temperature automotive
- ...

Radiation hardness -> high temperature devices

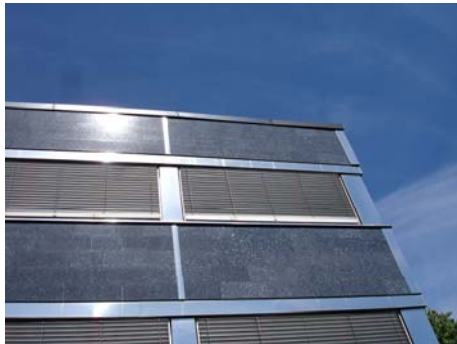
Truly different!



□ Investments:

- New facility including clean room
- Production equipment, e-beam welder, laser-beam welder, dead-weight testers and more
- 22 employees, most are engineers developing new products
- Space business segment with dedicated personnel.

Truly different!



□ Achievements

- New products in marked
- PRESENS sensor delivered and integrated into PRISMA
- 14bit digital interface for space developed with greek institute DUTH on ESA contract
- Extensive analysis of applicability of PRESENS products and processes for space flight.

Truly different!



PRESENTS
Pressure Sensor Technology

Since 5th round table



Truly different!



PRESENTS
Pressure Sensor Technology

Since 5th round table

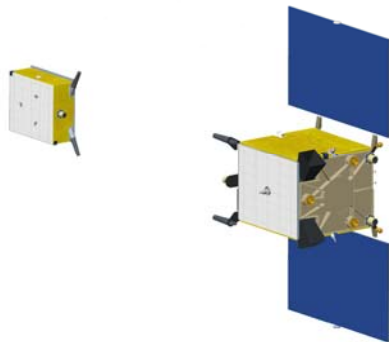


Truly different!



□ Close collaboration with Nanospace and DUTH

- First real flight opportunity.
- PRESENS goal to deliver 14bit digital pressure sensor.
- ASIC development delayed, PRESENS redesigned and delivered analogue sensor at own cost.
- Successfully qualified. 2FM + 2EM delivered.
- High pressure sensor, 350bar full scale. Weight 70g. Rough medium compatible.
- Welded to space-craft Q3 2007.



Truly different!



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PRISMA



Truly different!



- **Digital pressure sensor**
 - Current program to deliver protoflight models including recently processed ASIC (EM)
 - This sensor to replace US low-pressure sensor already installed.
 - DUTH has tested chip to 1Mrad (TID) with no performance degradation.
 - ASIC testing is currently running.

Truly different!



- ❑ **Work done under ESA contract "Reliability of MEMS pressure sensors"**
- ❑ **DPA performed on chip-level and on assembly level**
- ❑ **Scope is to establish processes and qualification routines for MEMS space pressure sensors**

Truly different!



- ❑ **DEMOCRITUS UNIVERSITY OF THRACE (DUTH)**
 - SPACE RESEARCH LABORATORY

- ❑ **Development of digital front-end chip**

- ❑ **Radiation hard**
 - EM models tested to 1Mrad

- ❑ **0.25μm CMOS process**

- ❑ **Tests running at DUTH and PRESENS**

Truly different!



Planned new developments

- **SOI version (high temp)**
 - SOI transducer
 - SOI ASIC

- **Low pressure/differential**
 - Diaphragm based
 - FS down to 300mbar
 - Using all know how from high pressure transducers

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