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Validation/Pre-Qualification of MEMS-Based high-pressure sensor for Space applications

In collaboration with ESA the Norwegian MEMS-based pressure sensor supplier PRESENS has previously developed a pressure sensor technology for Space, which is spun-out of a development performed for oil-drilling applications. PRESENS has already delivered a pressure sensor for the PRISMA satellite (launch in Nov 2009-Feb 2010), a technology demonstration satellite developed by Swedish Space Corporation. Right now PRESENS is working on finalising and optimising a previously defined sensor design to make it applicable to more demanding Space missions. After finalising the design an evaluation for Space will be performed. The duration of this validation/pre-qualification programme is 24 months, kick-off August 2009.

PRESENS core technology is favourable in space applications due to several key properties such as long-term stability, small size, high accuracy, fast pressure response, negligible acceleration sensitivity and robustness. The main Space application is the monitoring of the pressure in the propellant tanks/lines for chemical propulsion systems and the gas/line pressure for electric/cold gas propulsion systems.

The sensor is a MEMS-based analogue high-pressure sensor for Space applications. The max expected operational pressure is 320bar and burst pressure 1280bar. It is small and light with a total error band of $<\pm 0.2\%$ FS. Long-term drift at 25ºC is $<\pm 0.02\%$ FS/year. The sensor has an operating temperature range from -40ºC to +75ºC and low power consumption. The typical requirement for the life time of the high-pressure sensor is more than 15 years in geostationary orbit.

The housing and all welded parts are made of titanium. Among other things, titanium was chosen for compatibility with hydrazine and because it simplifies assembly welding. PRESENS' own patented MEMS sensing element is used.

The objective of the activity is to raise the TRL, Technology Readiness Level, of PRESENS analogue absolute high-pressure sensor in order to limit the effort needed for future Spacecraft qualifications. To achieve the objective PRESENS shall first finalise the design of an analogue absolute high-pressure sensor and then perform an evaluation for Space. The present programme includes investigation of Space end-user needs and definition of performance needs. A risk analysis will be performed and the selected design verified. After the design of the component is frozen an Evaluation Test Plan (ETP) will be prepared. The final programme activity is the performance of the evaluation testing. The space evaluation activity will be done according to ESCC (European Space Components Coordination) specifications. However, it will not be a formal ESCC evaluation, as there is no specification for this type of components. Part of the work is therefore to define the best evaluation approach.