MEMS Technology at Ridgetop

Ridgetop Group has been on the forefront of innovative sensor technology in support of advanced diagnostic and prognostic applications. This brief covers Ridgetop's capabilities in the field of microelectromechanical systems (MEMS).

Ridgetop Group has leveraged its work on several related DOD and NASA contract awards to develop a first silicon prototype of an integrated MEMS capacitive accelerometer on a CMOS die.

Using a low temperature thin-film metal deposition post-processing MEMS fabrication step, a capacitive sensor with integrated readout electronics is currently being tested (Figure 1). Capacitive sensors are ideal for ultra-low-power autonomous shock and vibration sensor applications, as they do not require a constant bias current like piezo-based designs. The low-temperature MEMS deposition step means that cost of development is very low, as no changes to the CMOS process flow are required.

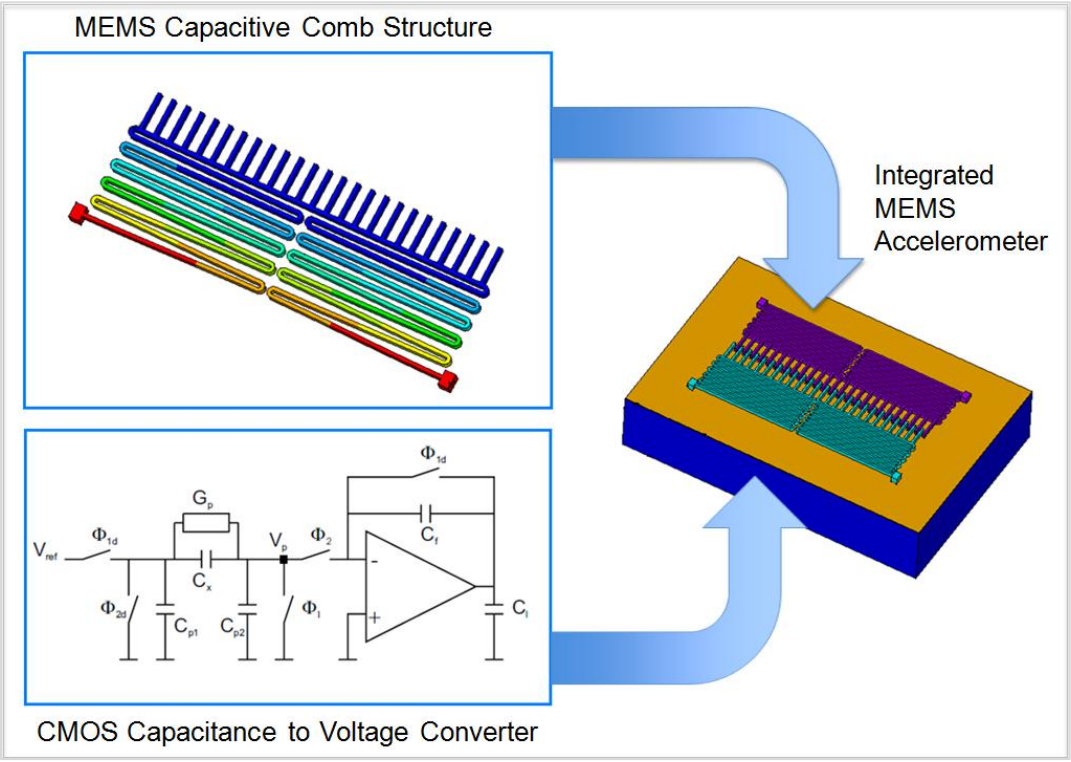

Figure 1: Ridgetop MEMS technology development in accelerometer application

The MEMS structure deposited on the CMOS die is shown in Figure 2.

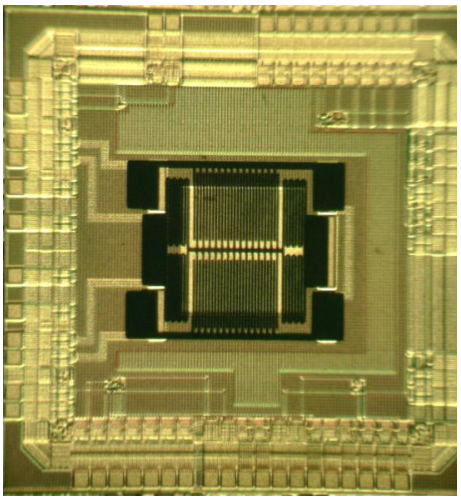

Figure 2: Physical layout of the MEMS device

The sensor is being designed as a low-cost alternative to other accelerometers that employ expensive surface micromachining or photolithographic fabrication techniques. The key specifications are as follows:

Manufacturer	Ridgetop MEMS
Part Number	RGI-MC250
Input Range (g)	±125
Max Shock (g)	500
Bandwidth (Hz)	10,000
Axis	X
Operating Temperature Range	-40 to 125 °C
Output	Frequency

The sensor is part of the broader development plan for a generic sensor interface chip (GSIC) architecture that is able to accept input from a variety of transducers. The chip comprises a smart sensor interface with on-chip signal conditioning, analog-to-digital conversion, data reduction and DSP, and wireless connectivity.

Figure 3 shows a system-level representation of the Ridgetop MEMS Sensor.

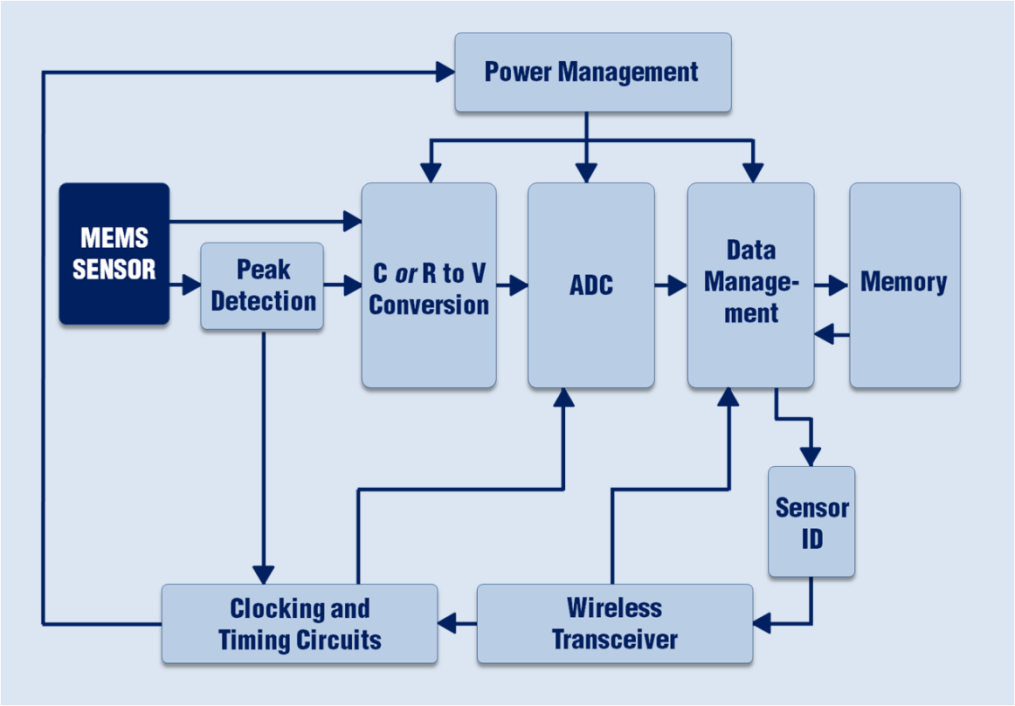

Figure 3: Ridgetop MEMS Sensor environment

DOD applications for such wireless sensors include health and usage monitoring systems (HUMS) for rotorcraft applications. In this case, energy-harvesting MEMS sensors are used to acquire the data. The data are digitized and transferred wirelessly to a central collection hub, using Ridgetop's Sentinel Network platform.

An overview of a rotorcraft application is shown in Figure 4. As with HUMS, energy-harvesting MEMS sensors are used to acquire the data. The data are digitized and transferred wirelessly to a central collection hub, using Ridgetop's Sentinel Network platform. A Sentinel Network screen capture is shown in Figure 5.

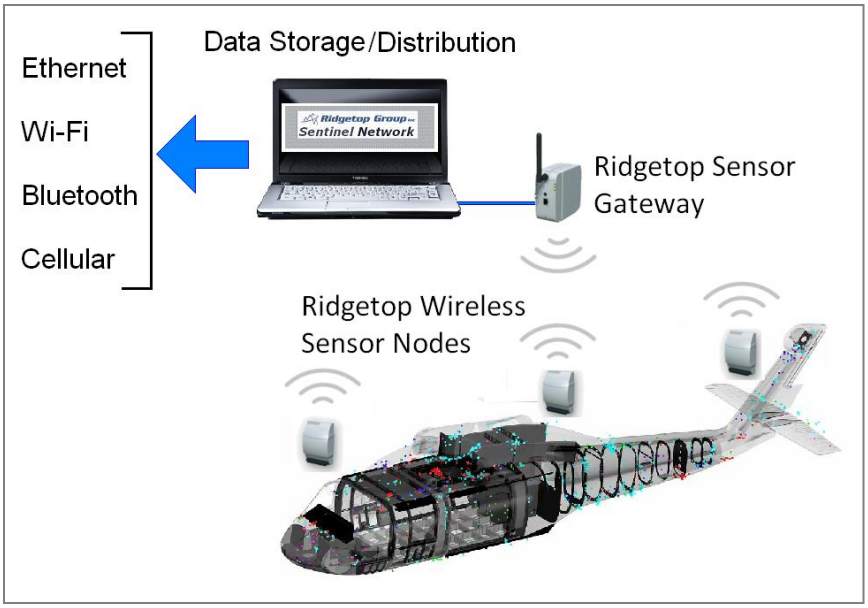

Figure 4: System-level embodiment of MEMS Sensor for helicopter

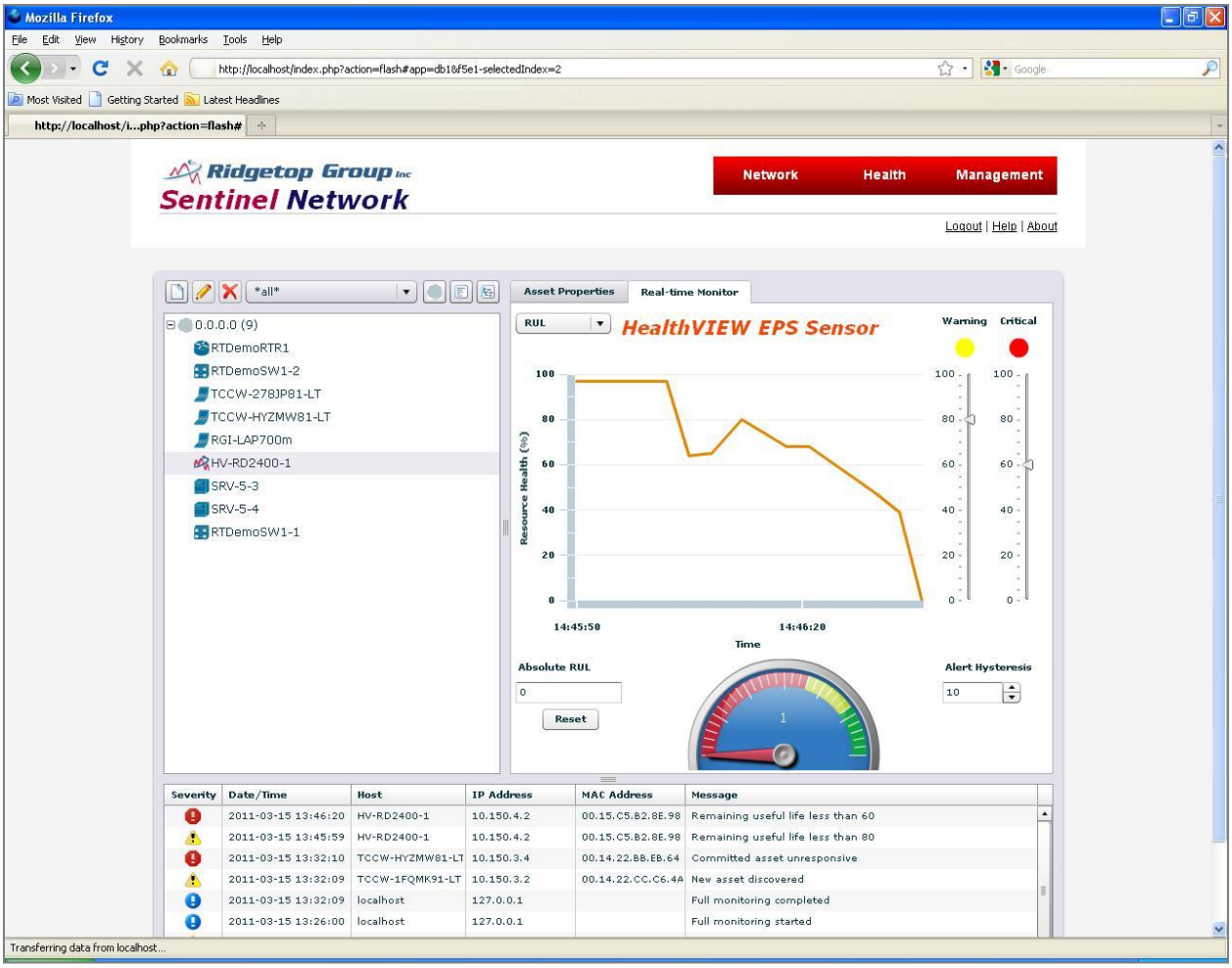

Figure 5: Sentinel Network analysis platform

Other commercial applications for MEMS technology include:

- Environmental and structural monitoring
- Asset tracking
- Industrial machine and process monitoring

Ridgetop Group has also partnered with the University of Arizona Aerospace and Mechanical Engineering Department in collaborative research and development activities.

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