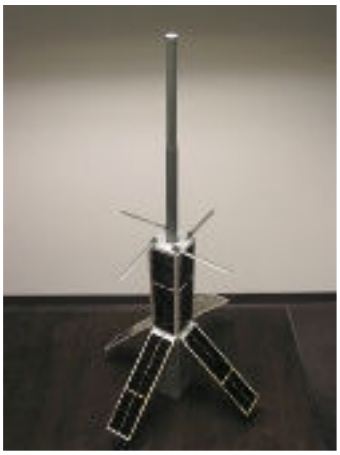


Earthquake Research Satellite Demonstrates Ruggedness of Diamond Systems

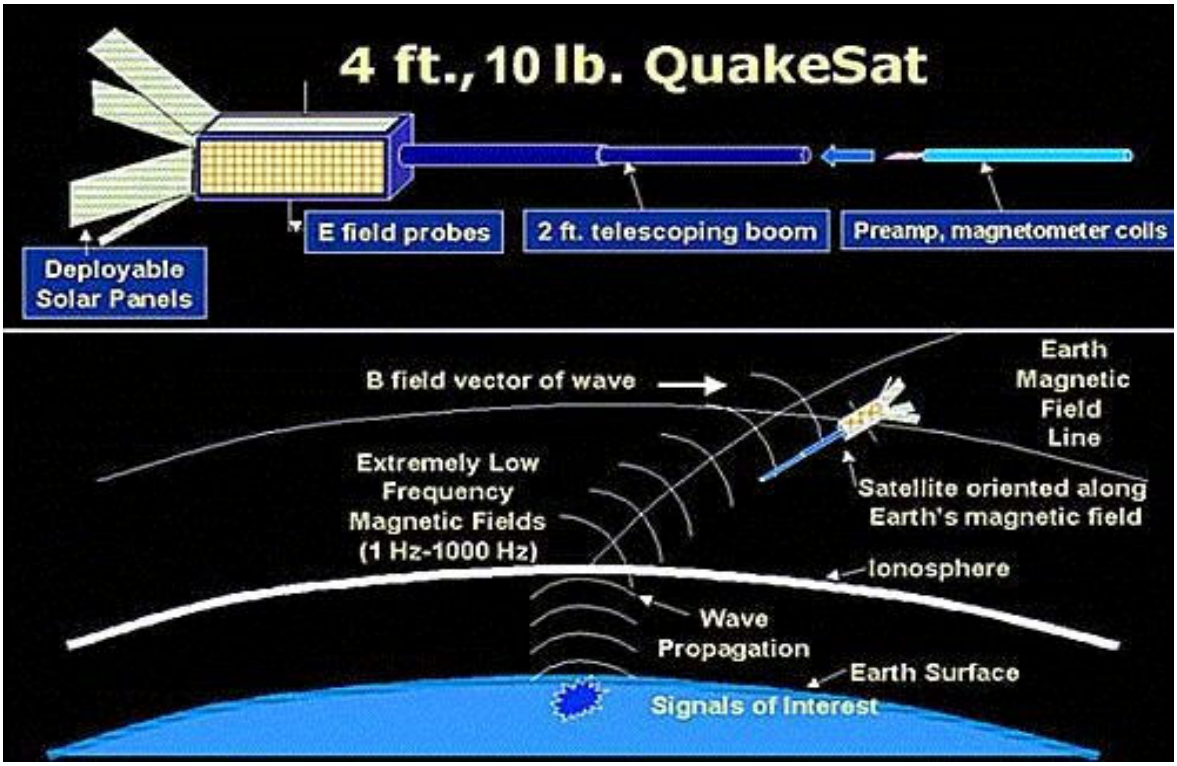
By Stephen Baginski

APPLICATION OVERVIEW

For a long time in history, people have believed that earthquakes were the sign of god's wrath. They were devastating and unpredictable. Loss of life and long term negative economic effects remanded of the urgent need to find ways to guess the next coming earthquake. Every fresh attempt to predict the coming disaster failed notoriously.
Until now that is. Scientists have felt that now there is a sufficient computer power available to crunch the complex models representing movement of earth's plates and to find where exactly the next "crunch" comes from. All that was needed was to collect data to produce and to update the model continuously. Since the disaster in Skopje 1963 when thousands died, scientific models have improved rapidly. Since then the Skopje University was compressing rocks to break them to observe how they behave under pressure. Just before the rock broke, the applying cylinders would release the pressure slightly to extend the breaking process almost indefinitely. Piezzo-electric sensors would keep an eye on the rock, all the time saving it from complete breakup.
Others have been doing similar experiments aimed at understanding the process and look for behavioral patterns. At the same time, sensors, computers and software improved rapidly. In effect at the dawn of this century, sophisticated modeling, software and knowledge of the earthquake process, allowed scientists to move to a new level, and to start collecting live data to predict future disasters and warn potentially affected in advance. Several systems have been in place across the globe and some to be put in the space to view and measure tectonic activities. Launching and operating a satellite based system, puts very trying requirements on the system, in terms of vibration, electric, mechanical and thermal stress and limited size etc.

QuakeSat, an innovative and ultra-compact Linux-powered satellite designed to detect earthquakes from space. Its primary scientific mission is to detect, record, and downlink Extremely Low Frequency (ELF) magnetic signal data, which may lead to groundbreaking techniques to predict earthquake activity. It uses the Prometheus integrated *PCIIO4* CPU board from Diamond Systems as its main control system. The satellite operated successfully in its orbit 600 miles above the Earth's surface for about 3 years, twice as long as expected.

QuakeSat measured a tiny 4" x 4" x 12". It was designed to fit inside an ultra-miniature satellite enclosure that mounts in a Russian rocket decommissioned as a result of the former START talks. This severe size restriction limited the choices for off-the-shelf CPU boards.



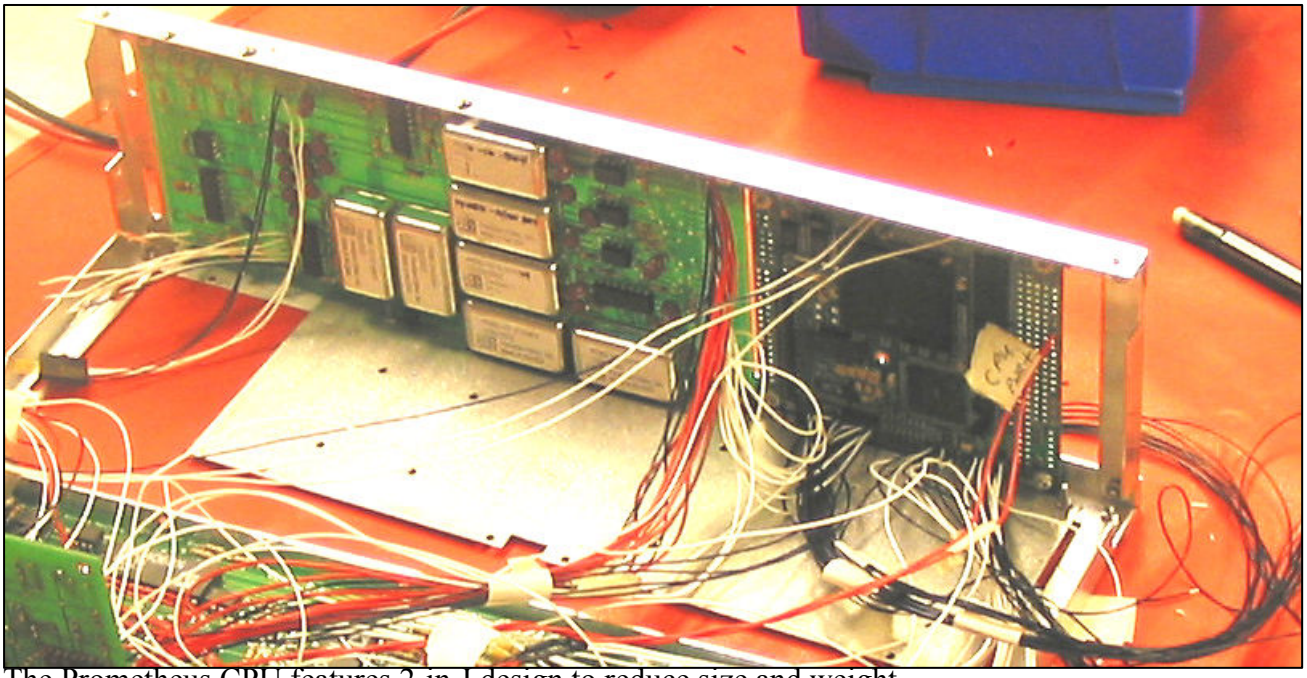
APPLICATION REQUIREMENTS

A satellite involves extreme design restrictions that limit the choices of components. Size, weight, power consumption, and ruggedness are key concerns. Only PC/1O4 was able to meet these criteria and provide a suitable computing platform for the QuakeSat electronics. QuakeSat serves as an excellent example of what can be achieved using rugged PC/104 technology.

DIAMOND SYSTEMS SOLUTION

Diamond Systems' **Prometheus** CPU is based on the ZF Micro ZFx86 low-power integrated x86 CPU-on-a-chip. The board includes processor, memory, Ethernet, serial ports, IDE, and a full analog and digital I/O circuit. Prometheus combines two boards (CPU and I/O) into one to reduce the size and weight of the embedded system by 50 percent. Prometheus was chosen for use in QuakeSat because it met these key criteria:

- **Miniature size: PC/104** (3.6" x 3.8") was the only easily expandable form factor that fit inside the small enclosure.
- **Integrated design:** Combining the processor and data acquisition functions on a single board reduced the size and weight of the CPU and enabled more electronics to fit in the satellite.
- **Low power:** Total power consumption of less than 3 watts minimized the drain satellite's limited solar-collector system.
- **Rugged** design: Prometheus utilizes soldered-on memory for extra ruggedness, and it has a tested and verified operating temperature range of **-40** to **+85°C.** Temperature and vibration immunity enabled the electronics to survive launch conditions and operate in a space environment with extreme temperature swings.



The Prometheus CPU features 2-in-1 design to reduce size and weight

ABOUT DIAMOND SYSTEMS

Diamond Systems has been a leading designer and manufacturer of highly integrated embedded single-board computers, I/O boards, power supplies, and systems for over 15 years. Today Diamond Systems is using its wide product and technology base to provide custom-tailored single-board solutions for the embedded market.

USA www.diamondsystems.com
Europe www.diamondsystems.ch

Stephen Baginski is an entrepreneur, founder, journalist, and publisher, working out of his Swiss offices. He has held positions of responsibility with such international companies, like: General Electric, NASA, Jet Propulsion Laboratory, Thiokol Aerospace, SAAB Avionics, Ontario Research Foundation and Atomic Energy of Canada. He can be contacted by writing to: s.baginski@bluewin.ch