Boeing Delivers Final Designs of Powerful Next-Generation Integrated Circuits for Spaceway Satellite Payloads

Designed by Boeing and Built by IBM, Chips Will Consume Half As Much Power As Current-Generation Integrated Circuits

Boeing Satellite Systems (BSS), a unit of The Boeing Company (NYSE: BA), has completed design of nine unique types of application-specific integrated circuits (ASICs) for the Spaceway broadband satellite system. IBM (NYSE: IBM) will use BSS designs to build multimillion-gate ASICs that consume half as much power per function while delivering four times the processing capability of current-generation chips.

Spaceway is a next-generation broadband satellite system from Hughes Network Systems (HNS), a unit of Hughes Electronics, that is scheduled for North American service in 2003. This high-speed broadband communications platform will employ satellites with innovative on-board digital processors, packet switching and active phased-array antenna technology. Boeing is building three Spaceway satellites - two for the North America segment plus a spare.

The ASICs will execute key functions of the spacecraft's Digital Signal Processor (DSP), the heart of the revolutionary Spaceway payload. These functions include signal demodulation/modulation, fast packet switching, antenna control and other payload support functions. BSS performed the logic design, floor planning and timing for these extremely complex ASICs. IBM has translated those designs into a transistor-level netlist (schematic) and has already begun fabrication.

The Spaceway ASICs range in size from 136,000 to more than eight million gates (circuits) each, a record-breaking space performance milestone made possible by BSS design expertise and IBM's 0.16-micron SA 27 copper ASIC technology.

"Spaceway will employ the most powerful space-borne digital signal processor to orbit the Earth," said Randy H. Brinkley, president of Boeing Satellite Systems. "It will be capable of a mind-boggling 50 trillion operations per second. You would need more than 10,000 Pentium III-based computers to equal its processing power. That capability will enable Spaceway to succeed in its mission of providing a hubless, full-mesh broadband system delivering flexible bandwidth-on-demand to businesses and consumers."

Spaceway builds on the digital signal-processing heritage developed at BSS over the past decade. The Spaceway DSP incorporates technology similar to that used on the third-generation Boeing-built DSP, part of a narrowband satellite system that is now on orbit. By comparison, the next-generation ASICs in the Spaceway DSP will consume half as much power per function while delivering four times the processing capacity.

"We're pleased to be working with BSS and IBM on the Spaceway program. The combined expertise of our teams will bring a unique and powerful technology platform into existence. The delivery of these complex ASIC designs takes us one step closer to realizing the most advanced and innovative broadband solution ever conceived," said Mike Cook, general manager of Spaceway at HNS.

A critical part of the DSP is an autonomous 10-Gbps fast packet switch, which can be likened to an Internet router in space. Spaceway users will enjoy super-fast download speeds of up to 30 Mbps, and uplink rates ranging from 512 Kbps for individual users, to tens of Mbps, which would be provided to a business or major hub. Along with super high-speed access, Spaceway will provide full- mesh connectivity, allowing users to communicate on a single-hop, peer-to-peer basis, thereby reducing latency and enhancing collaborative interaction among work groups. This capability is enabled by the fast packet switch, which will individually route each packet of each user's transmission to the correct downlink beam to reach its intended destination.

In addition to directing the traffic moving through the fast packet switch, the DSP also dynamically controls the beam-forming function performed by the downlink antenna. This antenna technology will enable the system to deliver at least 50 percent more capacity per satellite than any other competing broadband satellite system under development today.

Integral to the DSP are two powerful computers that are based on the IBM PowerPC 750 microprocessor. Operating in parallel, these computers are together capable of 1.4 billion instructions per second. The previous most-powerful space-borne computer was capable of about 30 or 40 million instructions per second.

"This chip is a perfect example of IBM's ability to deliver high performance in an incredibly demanding environment, not only with custom products but with standard, mass-produced microprocessors," said Scottie Ginn, vice president and business line executive, pervasive computing, IBM Microelectronics.

The computers will also enable Spaceway to provide bandwidth-on-demand; the ability to flexibly transmit video, voice, audio and multimedia wherever it is needed to meet customer demand.

About Hughes Network Systems
Hughes Network Systems, a unit of Hughes Electronics Corporation, is the world's largest provider of broadband satellite

network solutions for businesses and consumers, with over 400,000 systems installed in more than 85 countries. HNS pioneered the development of high-speed satellite Internet access services, which it markets globally under the DirecPC® and DIRECWAY™ brands, and is a major supplier of mobile satellite networks and user terminals. SPACEWAY™ is a next generation, Ka-band satellite platform that will be launched in late 2002 and will enable new and advanced services for DIRECWAY customers, consumer and business alike. In addition, HNS is a leading manufacturer of DIRECTV® satellite television receivers, having shipped its 7 millionth system by mid-2001. Headquartered in Germantown, Maryland, USA, HNS maintains sales and support offices worldwide. The earnings of HUGHES, a unit of General Motors Corporation, are used to calculate the earnings per share attributable to the General Motors Class H common stock (NYSE: GMH). To learn more about HNS, please visit http://www.hns.com or http://www.direcway.com.

About Boeing Satellite Systems
Boeing is the world's leading manufacturer of commercial communications satellites, and is also a major provider of space systems, satellites, and payloads for national defense, science and environmental applications.

The Boeing Company is the largest aerospace company in the world and the United States' leading exporter. It is NASA's largest contractor and the largest manufacturer of commercial jetliners and military aircraft. The company's capabilities in aerospace also include rotorcraft, electronic and defense systems, missiles, rocket engines, launch vehicles, satellites, and advanced information and communication systems. The company has an extensive global reach with customers in 145 countries.

About IBM
As the number one supplier of ASIC (custom, "application-specific integrated circuit") chips worldwide, IBM has the design know-how to combine more circuitry on a single chip than anyone. IBM also has a unique collection of technologies to manufacture the smallest, densest circuits in the industry, using copper wires, silicon-on-insulator (SOI) transistors and improved "low-k" dielectric insulation.

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