SG200 Space Computer Selected as Semifinalist for NASA iTech Cycle 3

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For immediate release

BI Tech (Business Integra Technology Solutions), and our partners, are pleased to report that our SG200 Space Computer has been chosen by NASA as one of the top 25 most promising ideas by innovators across the U.S. are we are now part of the semifinalists for NASA iTECH Cycle 3.

https://www.nasa.gov/directorates/spacetech/itech/feature/Innovation_Semifinalists

The SG200 technology will build on our highly successful SG100 product line. Aerospace customers interested in hearing more about our currently available space rated, radiation tolerant computers should contact us at

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Applicability to NASA Earth and Space Science and Exploration:

Current and future spacecraft require much more robust and affordable space-rated computers than are currently available on the market. The Business Integra Technology Solutions (BI Tech) SG200 project will leverage experience and hardware design from heritage systems (existing ISS Flight Hardware and TRL-9 ISS payload hardware, as described later in the Technology Approach section) to build a deep-space environment capable radiation tolerant single board computer for use on Low Earth orbit (LEO) and geosynchronous spacecraft as well as deep space missions. The SG200 white paper will deliver the next generation of high reliability, high performance, low cost radiation tolerant single board computer avionics infrastructure that can be used across many applications. With demonstrated processing speeds of 1.5GHz, using multicore processors, and its modern "blade-based" modular and expandable design, it is ideal for non-critical, data processing intensive applications. This will be done in such a manner that it will not be cost-prohibitive for commercial, institutional and government space-flight engineers and researchers, as is the currently available less capable older technology computers.

This new on-board data processing capability will increase the accessibility and utility of science and technology data, enabling new observations and information products that cannot be realized with current technologies.

Description of Proposed Technology

The SG200 will be specifically designed to give engineers, scientists and researchers the ability to perform significant amounts of in-situ analysis prior to downlink. In this way, they can take advantage of modern technology architectures and scientific instruments, while minimizing downlink requirements. The SG200 technology will provide a low risk solution to launch vehicle, satellite and experiment developers in all aerospace sectors. This upgraded technology will be provided at a cost lower than the current much less capable systems. Currently, the available flight systems are so cost prohibitive that most developers simply do not spend the money to buy identical ground testing systems. This does not allow them to test like they fly until much later in the development process, which introduces unnecessary risk. If they do choose to buy flight units for their ground systems, it often adds unnecessary cost to the programs.

The currently available radiation hardened single board computer technology uses shielding at the component level that makes the technology inherently expensive, and is also based on old processor technology that does not have the processing speed or power to support today's science and engineering endeavors. The SG series of single board computers, and the predecessor AMS computers, are based on processors that are Silicon on Isolator (SOI) technology using 90nm lithography. This technology is effectively single event free and highly latch-up immune. All of the remaining parts are selected from carefully screened off-the-shelf components over more than 15 years in the development of over 650 computer boards that are successfully flying on the AMS. As this technology is radiation tolerant, not hardened, and may require occasional restarts to recover, it is not intended for critical mission systems (i.e. spacecraft management, life support, etc.). However, with demonstrated processing speeds of 1.5GHz, and using multicore processors, it is ideal for non-critical, data processing intensive applications, as summarized in Table 3-1 below.

Table 3-1: Hardened / Tolerant Comparisons

Characteristic	Radiation Hardened	Radiation Tolerant
Class of Service	Mission or man safety critical (Crit 1)	Science or computational critical (Crit 3)
Tolerance to faults	Little or none. System failure is not tolerated.	Occasional. System failure is not easily tolerated but occasional system restarts are.
Performance capability	Performance is limited due to concessions made to hardening. Not readily expandable.	Much higher performance available. Readily expandable.
Performance development drivers	Most requirements for mission critical needs (mission management, life support, communications, GN&C…) are met with lower performance systems. No significant driver to significantly improve performance.	Many, likely most, science payloads and instruments are design limited by computing or communications. Many, likely most, such payloads would benefit from in-situ processing of data.
Typical Applications	• Mission/Vehicle management and control • GN&C • Life support	• Payload data processing, experiment management and control, data reduction. • Non-critical system operations applications. • Personal applications like crew entertainment, training, communication (email and video home) • Computing instrument and experiment results for in-situ crew interaction (needed for missions where two-way time is large) • Optical navigation, LIDAR, and other image processing

The block diagram for SG200 single board computer architecture, is provided in Figure 3-1. Photos showing flight hardware from the predecessor SG100 are provide in Figures 3-2 and 3-3.

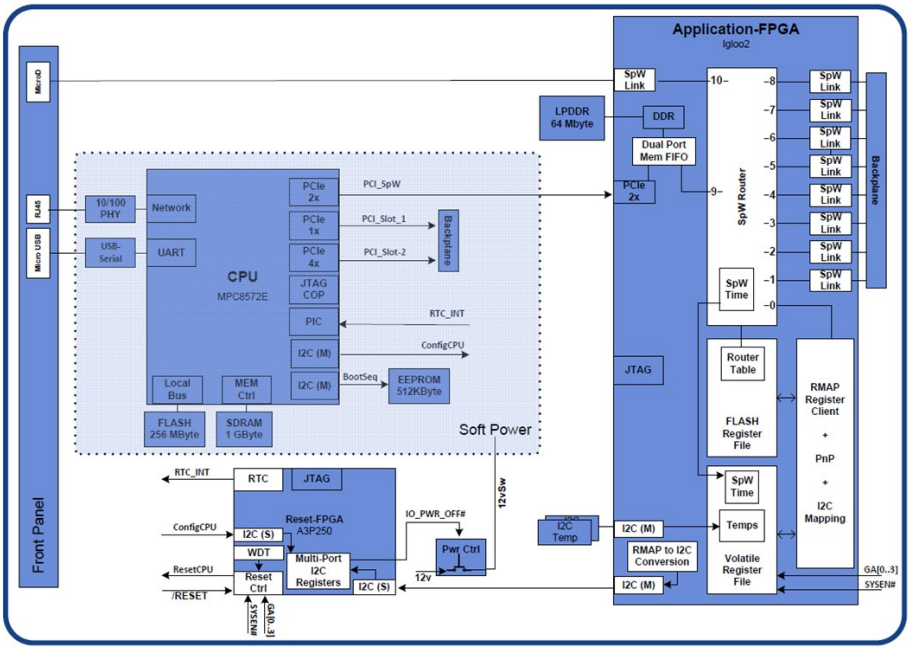

Figure 3-1: The SG200 Single Board Computer Block Diagram

Figure 3-2: The SG100 Cloud Computer ISS Payload Hardware

Comparative Technology Assessment:

Based upon our experience with the heritage systems and market surveys performed over the last year, BI estimates that a per-unit price point for the SG200 would be approximately half the price of existing lower performance technology. Additionally, SG200 ground development units would be available at approximately half the cost of the flight unit.

The SG200 single board computer will open both LEO and deep space research opportunities by providing scientists and researchers an affordable approach to ground development and flight implementation for high-end computing. It will make commercial launch more cost effective by lowering avionics costs while improving reliability and performance over the currently available technology. The return to the government will be lower cost infrastructure systems for government programs, and increased efficiency and utilization for commercial launch vehicles and spacecraft.

Currently available technologies use a single 250 MHz processor, while the SG200 will use 1.5 GHz multi-core processors, and the SG200 single board computer can be enhanced by adding more units in a chassis that has already been designed and certified, and can be expanded and modified as required.

TRL Assessment:

This new advanced radiation tolerant SG200 single board computer is an evolution of the highly successful Alpha Magnetic Spectrometer main data computers that have been operating successfully externally on the International Space Station since 2011. Because AMS employs four of these processors that have been operating continuously since May 2011, we currently have the equivalent of 20 years of on-orbit operations.

Over the last five years, BI Tech worked with our consultants and COTS vendors from the AMS effort to build an upgraded version of the AMS computer. This has culminated in the SG100 Single Board Computer. This technology has reached Technology Readiness Level 9 as defined by NASA. BI Tech, has tested the SG100 onboard the ISS as a Center for the Advancement of Science in Space (CASIS) payload under User Agreement UA-2016-215, and has established the SG100 to a TRL 9. We are currently marketing this product to aerospace companies and institutions.

The SG200 design, like its predecessors, will be inherently conductively cooled, and the integrated design can be adapted for either internal or external space applications. It will utilize the same or similar processor lithography, as well as the same or similar circuit, software and firmware design as the heritage systems. This, along with the same approach to component selection, component testing, system architecture and assembly and system testing will evolve the high-performance, high-reliability heritage technology into the next generation deep space single board computer low cost avionics system. As the similar architectures and design implementations from these earlier endeavors will be used for the SG200, it a **TRL 4 technology**. This technology can be to market within 2 years, as we currently have the SG100 on the market. The SG200 will change the paradigm of processors in deep space or high radiation environments.