National Aeronautics and Space Administration

Software Graphics Processing Unit (sGPU) for Deep Space Applications

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OVERVIEW

A graphics processing capability will be required for deep space missions and must include a range of applications, from safety-critical vehicle health status to telemedicine for crew health. However, preliminary radiation testing of commercial graphics processing cards suggest they cannot operate in the deep space radiation environment. Investigation into an sGPU comprised of commercial-equivalent radiation hardened/tolerant single board computers, field programmable gate arrays, and safety critical display software shows promising results. Preliminary performance of approximately 30 frames per second (FPS) has been achieved. Use of multi-core processors may provide a significant increase in performance.

INNOVATION

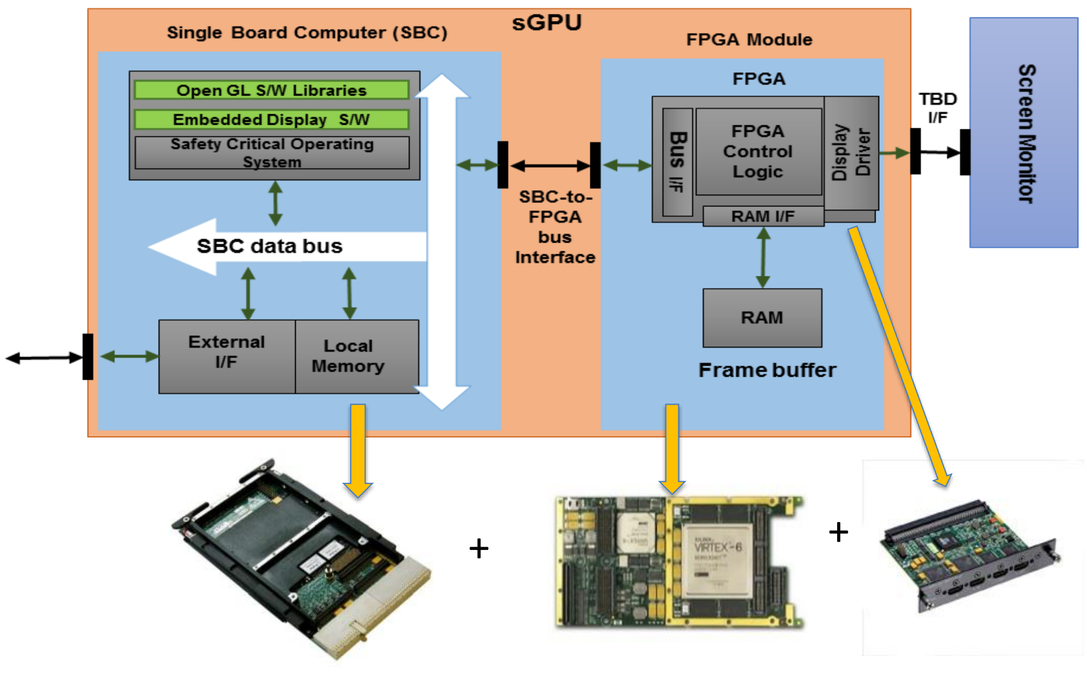
This technology would provide graphics processing capability for the deep space environment.

OUTCOME

To date, approximate performance of 30 FPS has been achieved.

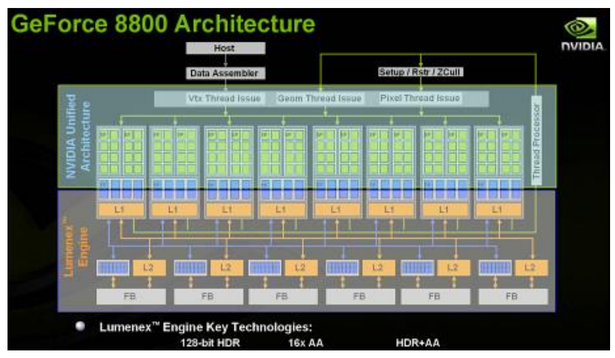
INFUSION SPACE

This technology can be used for both safety-critical and non-critical applications.



Current sGPU Architecture

GeForce 880 GTX GPU



GeForce 8800 Architecture

Commercial GPU Architecture Example

Display screen before GPU exposed to radiation beam

Display screen after GPU exposed to radiation beam

Commercial GPU Radiation Test

PARTNERSHIPS / COLLABORATIONS

Partnering with Center for High-Performance & Reconfigurable Computing (CHREC) using a promising multi-core processer designed for the space environment, support from EA, and potential support from STMD.

FUTURE WORK

Explore a customizable multi-core architecture.

- Investigate and procure a multi-core processor with a path to a High Performance Space Computer (HPSC).
  - CHREC Space Processor (CSP)
- Utilize open source graphics software to keep display graphics development cost low.
- Design an FPGA architecture for a multi-core implementation.
- Test using various graphical display types.
- Explore use as image processor.