TEXAS SPACE GRANT CONSORTIUM
DESIGN CHALLENGE

TOPIC # - TDC - 69 – S22

RADIATION-TOLERANT GRAPHICS PROCESSING UNIT (RGPU) ARCHITECTURE INVESTIGATION

BACKGROUND

Beyond Earth Orbit (BEO) missions will require the extensive use of graphics processing. From safety-critical cockpit displays of vehicle controls and status and medical imaging to recreation to help keep the astronauts mentally alert and healthy. Presently, there isn't a space Radiation-tolerant Graphics Processing Unit (RGPU)that can operate successfully in the radiation environment BEO. To keep development cost and schedule to a minimum, the RGPU effort should use readily available software and hardware products. The Human Interface Branch at the Johnson Space Center has done some work investigating alternative RGPU. A radiation test/evaluation of 5 different COTS GPU cards was performed at Indiana University high energy proton facility. Testing occurred to 200 MeV. An open-source commercial GPU benchmark program was used to test each GPU. Once the beam was turned on, the GPU would stop operating. Testing occurred for all five units. The only approach was to run a static display to permit computing the meantime to functional interrupt. For Mars missions, the electronics will need to be tested to LET=75 at 1E7 particles/cm2 for critical parts such as an RGPU (TBD).

PROBLEM/DESCRIPTION

Develop a proof-of-concept (POC) prototype RGPU architecture that permits the use of readily-available software and hardware products that results in a functional RGPU. The RGPU architecture should use open source graphics processing software such as OpenGL/SC. The architecture should also be scalable permitting lower power usage for small applications such as EVA suit displays or Rover displays as well as higher power usage such as medical imaging or entertainment for the crew. A benchmark graphics software should be used to demonstrate the RGPU prototype and compare to using the benchmark in a regular COTS GPU. Also, use of COTS components that have a path to a space flight system is highly desired.

A stretch goal is to find an opportunity to test the POC prototype in a radiation environment.

DELIVERABLES

Proof of concept hardware and software. Includes block diagrams and flowcharts, test data, schematics, bill of materials, any known issues/bugs.

DESIGN TEAM PROFILE

NASA MENTOR:	George Salazar
LEVEL:	Upper Division Students [JR/SR]
MAJOR / DISCIPLINES:	EE/CE/CS
TEAMS:	Mentor may accept more than one team
DURATION:	Two-Semester Project

Design Project Topic Offered By:
NASA JSC, EV3 Human Interface Branch