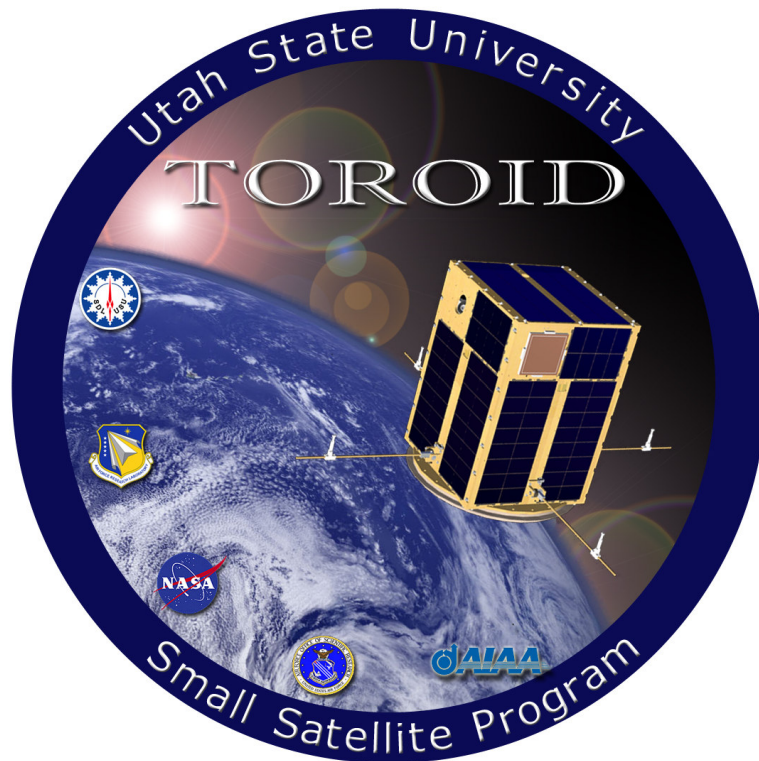


# USU<sub>sat</sub> III TOROID

## Request for Proposals

### Telemetry Board FPGA



## University Nanosat IV Program

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## **1.0 Introduction**

Utah State University, in conjunction with the University Nanosat 4 Program, is currently designing, testing, and fabricating a small satellite named TOROID. This spacecraft will be designed, assembled and readied for launch within a two-year period. The proposed science mission is one of interest to both NASA and the Air Force and involves a study of disturbances in the Earth's ionosphere. The proposed spacecraft, TOROID, is an evolutionary design from the USUSat, Combat Sentinel, and USUSat II programs. The primary science instrument, TOROID - TOMographic Remote Observer of Ionospheric Disturbances, is a photometer to measure the airglow due to electron and oxygen ion recombination. The data will be gathered in such a way that tomographic techniques can be used to construct an altitude profile of ionospheric density along the spacecraft trajectory. This project will not only be used to develop, explore and demonstrate new small satellite technologies, but it will also be able to gather meaningful scientific data on the fundamental parameters of ionospheric density irregularities that effect radio wave propagation for communications, navigation, and the Global Positioning System.

The University Nanosat 4 Program is a national competition sponsored by the AFRL Space Vehicles Directorate (AFRL/VS), NASA Goddard Space Flight Center (GSFC), and the American Institute of Aeronautics and Astronautics (AIAA). This program is intended to promote the education of future spacecraft systems engineers, at the university level, motivate and sustain related research on targeted technologies by focusing on the development of small satellites (nanosats) or flight experiments, and inspire the interest of students, below the university level, for careers in space. The primary outcome of individual projects funded under this program is the design, fabrication and functional testing of a Nanosat. Secondary objectives are to foster research in enabling technologies for nanosats and the design of experiments that can be performed by nanosats in orbit

## **2.0 Eligibility**

This request for proposals is limited to students currently enrolled in the Mechanical and Aerospace Engineering and Electrical and Computer Engineering departments at Utah State University. Collaborations among the different disciplines are encouraged.

## **3.0 Objectives**

### **3.1 Description**

The Telemetry board provides an interface between for data downlink between the Communications subsystem and the C&DH subsystem. This board is controlled via

an FPGA. This FPGA currently needs to be redesigned to allow for greater capabilities for the spacecraft. Currently, downlink rates are capped at 115.2 kbps, while radios and other equipment used can handle rates much greater. A redesign, and test of the current FPGA and board are required to increase the USUSat II bus's capabilities.

This project will be conducted under the supervision of the communications subsystem lead and the C&DH subsystem leads to maximize capabilities. This project must also successfully integrate the new Telemetry board into the C&DH system and interface it to the Software subsystem. All drivers for this board must also be provided. By FDR, the board, all software and designs must be delivered.

### **3.2 Cost**

There is no defined cost cap for this project, but all expenses shall be approved by the USUSat Program Manager. However, costs must be kept to a minimum.

### **3.3 Educational Objectives**

This RFP is intended to solicit proposals from students in the MAE and ECE departments at Utah State University, in order to meet requirements for a senior design project. As such, all proposals, reports and presentations shall adhere to MAE and ECE department policies regarding senior design projects.

### **4.0 Program Overview**

All senior project associated with the Small Satellite Program are divided into four stages. First is the proposal stage, where interested parties submit proposals for each potential project. This stage is followed by the Preliminary design stage. This stage reviews the projects concept and feasibility, as well as adherence to requirements established in this document. The Critical Design Review follows next. This stage reviews the design, checks adherence to this document and to TOROID design guidelines. The final stage is the Final Design Review, where all deliverable requirements must be met. Should hardware be part of an accepted proposal, it must be delivered at this time. Below is chart showing this schedule

<b>Design Review</b>	<b>Data/Hardware Item</b>	<b>Delivery Requirement</b>
Proposal	<ul style="list-style-type: none"> <li>▪ Preliminary schedule</li> <li>▪ Resource and personnel budget</li> <li>▪ Overall Concept of design</li> </ul>	September 28, 2005
PDR	<ul style="list-style-type: none"> <li>▪ Presentation Slides</li> <li>▪ Preliminary Drawings and Schematics</li> <li>▪ Preliminary budgets and analyses</li> </ul>	7 Days Prior to review

CDR	<ul style="list-style-type: none"> <li>▪ Presentation Slides</li> <li>▪ Budgets and analyses</li> <li>▪ Detailed Drawings and Schematics</li> <li>▪ Preliminary Test Plans and preliminary test results</li> <li>▪ Assembly Plans</li> </ul>	Drawings: 14 days prior to review All Else: 7 days prior to review
FDR	<ul style="list-style-type: none"> <li>▪ Presentation Slides</li> <li>▪ Complete Drawings and Schematics</li> <li>▪ Budgets and Schematics</li> <li>▪ Test Plans and Results</li> <li>▪ Assembly Plans</li> <li>▪ Protoflight Hardware/Simulation Results</li> </ul>	Drawings: 14 days prior to review All Else: 7 days prior to review

## 5.0 Submission Requirements

Two copies of the proposal should be emailed or submitted to:

Matthew D. Carney  
[mdcarney@cc.usu.edu](mailto:mdcarney@cc.usu.edu)

USUSat Progam  
 Office: Engineering Laboratory 206B  
 4170 Old Main Hill  
 Logan, UT 84322-4170

Additional copies may need to be submitted to supervising professor as well. Proposals should be submitted no later than September 28, 2005 at 7:00 am.

Address questions to: Matthew Carney, [mdcarney@cc.usu.edu](mailto:mdcarney@cc.usu.edu)