

Spring/Fall – 2023/24 Semesters eProject Proposal Request Form

Partner Contact		Project Contact (If Different)	
Company	Paragon Space Dev Corp.	Company	- Same -
Name	Dr. Daniel Becker	Name	
Email	dbecker@ParagonSDC.com	Email	
Phone	(303)328-5019	Phone	

Project Title
Wearable Electronics for Monitoring Astronaut Health
Project Summary
<p>For over 30 years, Paragon has been a key player in the development of Life Support systems. These systems serve to keep humans alive and comfortable through the careful control of oxygen, carbon dioxide, humidity and temperature. A component of this control can be the monitoring of astronaut health. Physiological monitoring of astronauts gives mission specialists insight into the health and well-being of these individuals. This is especially desirable under demanding conditions such as EVA.</p> <p>Paragon has engaged in the advancement of wearable devices that do just this. There has been solid medical research establishing the correlation between the conductivity of skin (AKA ElectroDermal Activity) and the corresponding oxygen level of an astronaut or diver.</p> <p>To date, there have been no easy devices to monitor, data log, and alarm for this type of signal. Historically, these monitoring systems have been bulky, uncomfortable, or have had to rely upon telemetry for indication and data collection.</p> <p>Paragon is developing an electronics wearable where these issues are minimized or resolved. This is a fun interdisciplinary project where a Texas Instruments MSP430 processor and analog circuits will be used to measure a physiological attribute such as skin resistance, generate alarms or display real-time indications based on this, and log measurement values for future downloading/analysis.</p> <p>The processor code will be primarily written in C and maybe assembly. It can be developed on any Windows laptop using an IAR compiler (supplied).</p> <p>In addition to the processor, there will be some analog and low power circuit design in order to maximize battery life. These circuits will be developed through a combination of circuit simulation (e.g., LTSpice) and through breadboarding.</p> <p>Finally, there will be some mechanical design work for wearable ergonomics and electronics protection. This may involve SolidWorks modeling.</p> <p>Paragon will supply the compiler, components, and guidance to integrate these pieces together into a functional product breadboard. Please refer to the table and diagrams</p>

on the last section of this request form.

The development of a wearable monitoring system is important for the implementation of Life Support systems. This project represents a commercial steppingstone towards this goal. While this might at first seem trivial, early warning for fatigue or hypoxia is essential for keeping astronauts healthy and safe.

Basic Skills Required	None	Low	Med	Hi	Basic Skills Required	None	Low	Med	Hi
Mechanical Eng	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Systems Eng	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Electrical Eng	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Manufacturing Eng	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Computer Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Material Science	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Specialized Skills Required	None	Low	Med	Hi	Specialized Skills Required	None	Low	Med	Hi
Robotics	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Automation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fabrication – Mechanical	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fabrication – Electrical	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fabrication – Electronic	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Thermodynamics	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Embedded Processing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Aerodynamics	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Biology	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CAD	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Human Factors	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Polymer Chemistry	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Additive Manufacturing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modeling and Simulation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

US ONLY

NDA Required

Travel Required

The deadline for submitting eProjects for Fall/Spring 2023& 24 to ASU Poly Engineering is ???.

eProject Proposal Request Form – Instructions

1. The focus of the eProject is “brainstorm, plan, design, make, test, [REPEAT] and document”. Please create your proposal with this flow in mind. Polytechnic School students focus on mechanical, manufacturing, robotics, automation, electrical and human factors studies. Please fill in the sections as noted.
 - a. **Project Title:** A short, illustrative project name
 - b. **Project Summary:** A 1 or 2 paragraph summary of the project to familiarize students with the project and get them excited about participating. This may include strategic intent, problem statement, scope, expectations. *The Summary should be suitable for general distribution and should not include any company proprietary information. We recommend that additional documentation is attached, or links included, to provide students a more thorough understanding of the company, problem statement, and project*
 - c. **Basic Skills Required:** Check the expected competency/experience level for mechanical, electrical, and systems engineering
 - d. **Specialized Skills Required** - Check the expected competency/experience level for each of the specialty areas. If another area is of particular importance, please use the “other” box to indicate this.

- e. **Special Requirements:** Please indicate any restrictions on student participation, IP, or security requirements.

If additional forms or paperwork is required, please attach forms with your application.

NDA's, access requirements, usage of hardware, software licenses, or other special requirements should be addressed ahead of time to avoid delays after project selection.

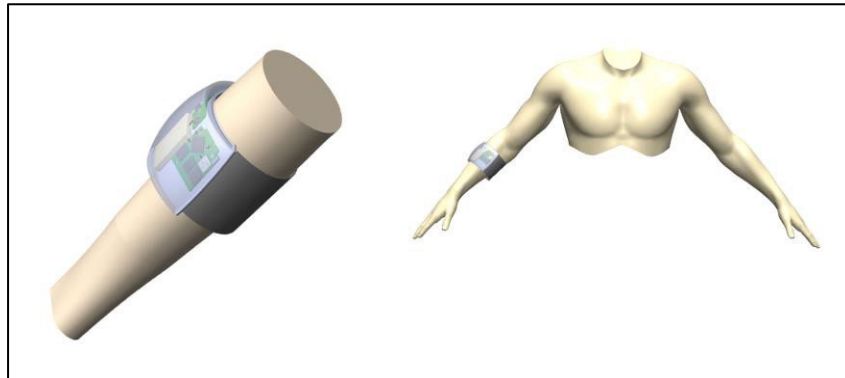
2. Fees

For the Spring/Fall 2023 academic year, project fees will be necessary to support the program and projects. Partners will be invoiced within 14 days after the eForum on January 25th. Payment is due 30 days after receipt of invoicing unless approved otherwise. Please contact Timothy Beatty @ 602-821-2146 for the project fees for 2023.

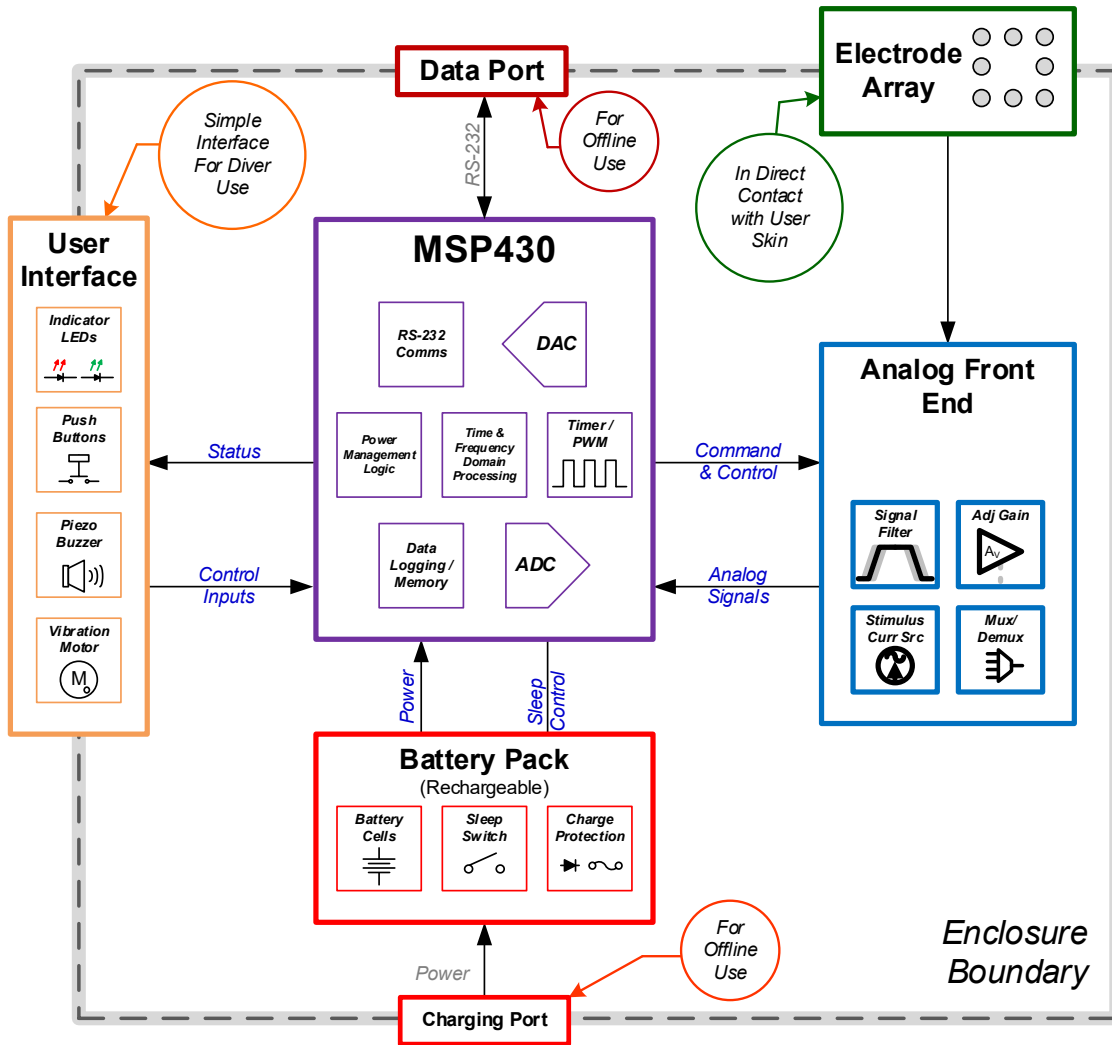
The fee will cover all of the basic eProject expenses, including materials and consumables. Projects requiring significant funds may require additional corporate support. The budget may be discussed prior to the project proposal submission.

Please email your proposal to Timothy G. Beatty @ timothy.beatty@asu.edu or call at 602-821-2146 if you have questions. If you have more than one concept to propose, please submit each idea on a separate form. For more information on the courses and project expectations, please see the **eProjects** website. <https://poly.engineering.asu.edu/eprojects/>

In addition, you can refer to an Innovation Showcase video to view some of our student's results. <http://poly.engineering.asu.edu/innovation-showcase/>



An Initial Mechanical Mockup for a Wearable



Block Diagram for a Wearable for Space Applications.

Fall & Spring 2023/24 Semester eProject Proposal Request Form

Partner Contact		Project Contact (If Different)	
Company	Array Technologies	Company	Array Technologies
Name	Thierry Marin-Martinod	Name	Ben de Fresart
Email	Thierry.marin-martinod@arraytechinc.com	Email	Benjamin.defresart@arraytechinc.com
Phone	480-573-2237	Phone	505-389-3179

<p>Project Title</p> <p style="text-align: center;">Photovoltaic Module Mechanical Load Test Device</p>
<p>Project Summary</p> <p>Array Technologies develops tracking systems for utility scale solar projects and has a need to test the load capacity of its mounting devices with various photovoltaic (PV) modules (solar panels). The goal of this project is to design, build, and demonstrate the operation of a test device that applies distributed loads across two adjacent PV modules. Students will work closely with an experienced engineering advisor from Array throughout the course of the project. The device must apply loads in opposing directions to simulate applied wind and snow loads and should have the capability of adjusting the load magnitude in various regions of the PV modules. Array anticipates that the test device will use primarily off-the-shelf components, and the project team will focus their efforts on designing the load frame and control logic.</p> <p>Similar test devices on the market are designed to test singular PV modules, rather than the two adjacent modules required by Array for validation of mounting devices. Array's existing two-module load test device (pictured in Figure 1) is used on a regular basis and utilizes weighted bags to apply loads to PV modules. When modifying loads for different modules or project site pressures, the weights must be manually adjusted. For applying uplift loads (i.e. wind pressure on the back side of the module), the module must be rotated so that the weights can act with the direction of gravity. The system also makes the application of unbalanced loads challenging, and it cannot perform cyclic fatigue tests. An automated load device will solve these issues and others; it will improve the cycle time of tests as well as the efficacy of the results, ultimately creating better and more reliable products for the solar industry.</p> <p>The system should be capable of applying distributed variable loads from 0 to 3600 Pa and should be adjustable to accommodate various module sizes. It should be programmable to apply load sequences in opposing directions for up to six hours of continuous operation. Load application devices should only interface with a single side of the PV module glass but should be capable of applying both a push and pull force. Project deliverables include the physical test device, CAD models, structural FEA simulation or structural calculations, an operation manual, a bill of materials, and control logic.</p> <p>Array anticipates using the test device on a regular basis, as module load tests are required to validate each new model of PV module for all of Array's mounting devices. Participants in this project have the opportunity to make an immediate and measurable difference in the renewable energy industry.</p>

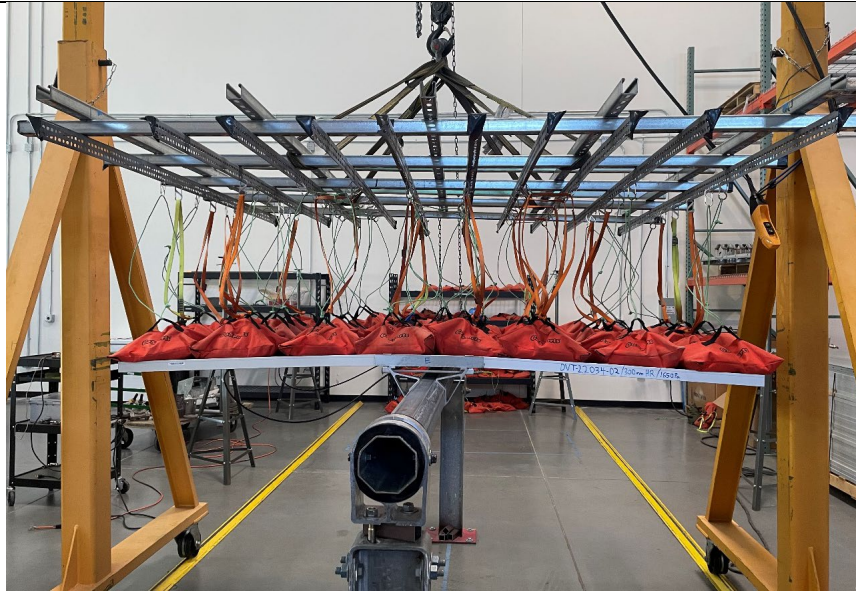


Figure 1: Array's Existing Module Load Tester

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The deadline for Submitting Fall/Spring 2023 &24 Poly Engineering eProject submission is Friday, August 11, 2023.

The in-person eProject eForum is scheduled for Monday, August 28th from 2:30 to 6PM AZ time. More details to come on the agenda.

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