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BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH.

Project Number: 1

Project Sponsor:

Altria, Richmond, VA

Project Title: **Altria - Vibration Monitoring**

SME: Lynn Abbott

Customer POC: Chris Minor, Christopher.C.Minor@pmusa.com,

Throughout our Richmond Manufacturing Center, we have several modules that run 24-hours per day, 5-days per week making various tobacco products. These modules operate within tight tolerances at high speeds with multiple fail points in the form of motors, gears, and mechanical assemblies. We would like to have the Virginia Tech Major Design Experience Team design an array of vibration sensors to be connected to a central controller that has the capability to analyze patterns of vibration of the equipment in real-time and provide detailed, graphical reports of feedback from the sensor measurements. We are looking for a system that would help us to predict failures before they occur as well as determine vulnerable fail points on the equipment.

Project Sponsor:

Virginia Tech, Cyber Range, Blacksburg, VA

Project Title: **Virginia Tech - CTF In-a-Box**

SME: David Raymond

Customer POC: David Raymond, raymondd@vt.edu,

This project will analyze, design, and build a configurable, portable, wireless "network in a box" solution to host Capture the Flag (CTF) exercises. Students will develop a set of CTF exercises to demonstrate their solution. Most Jeopardy-style CTFs use packet capture files for networking challenges because many of them are remote and using packet captures is the easiest approach. The Virginia Cyber Range runs several in-person CTF competitions each year, which provides the opportunity for students to capture and analyze live network traffic as part of the CTF. At least two example problems will demonstrate live packet capture and analysis.

Mentor:
tbd

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Project Number: **3**

Project Sponsor:

Virginia Tech ECE, Blacksburg, VA

Project Title: **Virginia Tech - ECE Inventory**

SME: Paul Plassmann

Customer POC: Paul Plassmann, paulm8@vt.edu,

This goal of this project is the design and development of a mobile inventory database system for the ECE Department. The Department is currently responsible to the state of Virginia for managing over 5,000 items purchased on behalf of its behalf. An efficient mechanism for tracking this inventory would result in significant manpower savings and would allow the Department to more easily meet its audit requirements.

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Mentor:
tbd

Project Number: 4

Project Sponsor:

GM, Detroit, MI

Project Title: **GM - SIMforation**

SME: TimTalty

Customer POC: Keith Van Houten, keith.j.vanhouten@gm.com,

Simformation is a system for tracking and displaying performance metrics associated with lab testing of our active safety and automated driving embedded controls . This modular system will interface wirelessly with our hardware-in-the-loop simulation benches, and extract information from a virtual vehicle. Metrics derived from that information will be shown on an large, custom electronic display, and be available remotely through an app or website.

Mentor: tbd

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Project Number: **5**

Project Sponsor:

Army Night Vision Labs, Ft. Belvoir, VA

Project Title: **Army Night Vision - Passive Range Finding**

SME: tbd

Customer POC: Clint Farrell, clinton.j.farrell.civ@mail.mil,

Currently, Soldiers utilize Eye-safe Laser Range Finders (ELRFs) to emit pulses of short-wave light at a target of interest. By knowing the speed of light, the special receivers "gate" the pulses at which it senses the returns and displays the strongest pulses to the User as a measured distance. Students are asked to evaluate plausible passive range finding techniques that could be reasonably utilized by Soldiers, then implement the technique for use and evaluation by Soldiers. The ranges of these techniques would need to be relevant to the task the Soldier is performing – a technique for a weapon sight, may not be applicable for a technique on a far target locater system. A Soldier test event will be conducted, providing valuable feedback to the students on how the capability could be improved upon.

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Project Number: **6**

Project Sponsor:

Aerospace Corp.

Project Title: **Aerospace Corporation - Small Satellite Navigation Sensor**

SME: Greg Earle

Customer POC: John A Janeski, Howard Ge, Hannah Weiher,

Typical large satellite systems require a significant amount of calibration time to calculate a navigation solution during initialization and/or lose their navigation solution during orbital maneuvers in environments where their PNT system does not have access to Global Navigation Satellite System (GNSS) signals. As a result of not having a navigation solution, the satellite system cannot execute its mission. One solution to this problem is to develop a small, commercial grade PNT sensor that can be used to propagate the primary navigation system's navigation solution through outage periods. As a first step towards a viable solution, the purpose of this design project is to design a low Size, Weight and Power (SWaP) sensor suite that will provide a navigation solution during spacecraft orbital maneuvers and can be initially flown on a 3-6U CubeSat for technology maturation.

Mentor:
tbd

Project Title: **Zeta - Personal Locator Beacons System**

SME: Louis Beex

Customer POC: Ben Beasley, Michael Botkin, Beasley-

Personal Locator Beacons (PLBs) are used around the world to summon emergency search and rescue assistance. Design, test, and prototype a complete system architecture to support multiple beacons, each transmitting a unique ID and GPS position. This project is important because it explores techniques for integrated RF and signal processing systems subject to size, weight, and power constraints.

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Project Number: **8**

Project Sponsor:

Virginia Tech ECE, Space@VT, joint with AOE

Project Title: **VT ECE - NASA BIG Idea**

SME: Greg Earle

Customer POC: Kevin Shinpaugh, kashin@vt.edu,

The 2020 NASA Breakthrough, Innovative, Game-changing (BIG) Idea Challenge offers the opportunity to propose an innovative, low mass, and cost-effective payload targeted for delivery to the lunar surface. Project Charon's proposed payload will demonstrate a power technology system that will allow for cost-effective exploitation of resources within Permanently Shadowed Regions (PSRs) on the Moon. Equipment operating within PSRs will need a lightweight, consistent, and low-cost method of generating power to enable resource extraction and scientific operations.

Project Charon will address these concerns and enable humanity's lunar habitation by transmitting power remotely and efficiently into PSRs via Laser Power Transmission (LPT). A consistent, ranged power source capable of transmitting into PSRs will enable unprecedented mission executability.

Global Needs:

1) Identify solar panel and laser to maximize overall power efficiency and minimize mass (which wavelength, etc) (will need to minimize cost for prototyping)

2) Lander side: Power system (solar panel, EPS, etc), Rover tracking/finding system, Laser aiming system

3) Rover: Beacon (RF, optical?), Solar panel orientation system (to align with power station), charging system/monitoring, etc

4) Test and integrate subsystems. Test overall operational capability.

NOTE: One or more members of this team MUST commit to 16-week paid ($12/hr, 20 hrs/week) summer internship at Space@VT to meet timeline requirements of the NASA BIG Idea requirements.