



Company Information

Company Name	NAVAIR FRC-East	Date Submitted	May 1, 2023
Project Title	MQ-8 External Power Diode Redesign (NAV_DIODE)	Planned Starting Semester	Fall 2023

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	1	Electrical	2
Computer	2	Systems	

Company and Project Overview:



NAVAIR Fleet Readiness Center – East: Capstone Submission Form

For more than 60 years, Fleet Readiness Center East, at Marine Corps Air Station, Cherry Point, N.C., has played an integral role in our national defense. The facility's In-Service Support Center provides multi-disciplinary, engineering services in both design and maintenance. Our workforce has earned a reputation of excellence, providing worldwide support for Navy and Marine Corps aviation.



Fleet Readiness Center East has provided maintenance, repair, and overhaul support to virtually every weapons platform the Marine Corps has flown – from the inverted gull-winged F4U Corsair of World War II fame, to the Corps newest aircraft, the F-35B Lightning II. It is one of eight fleet readiness centers operated by the United States Navy. It is also the Department of Defense Vertical Lift Center of Excellence. FRC East has a workforce of about 3,800 civilian, military, and contractor personnel. It is North Carolina's largest industrial employer east of Interstate 95.

NAVAIR is an active participant in capstone projects for a variety of Colleges and uses said projects as a means for recruiting high achieving engineers.

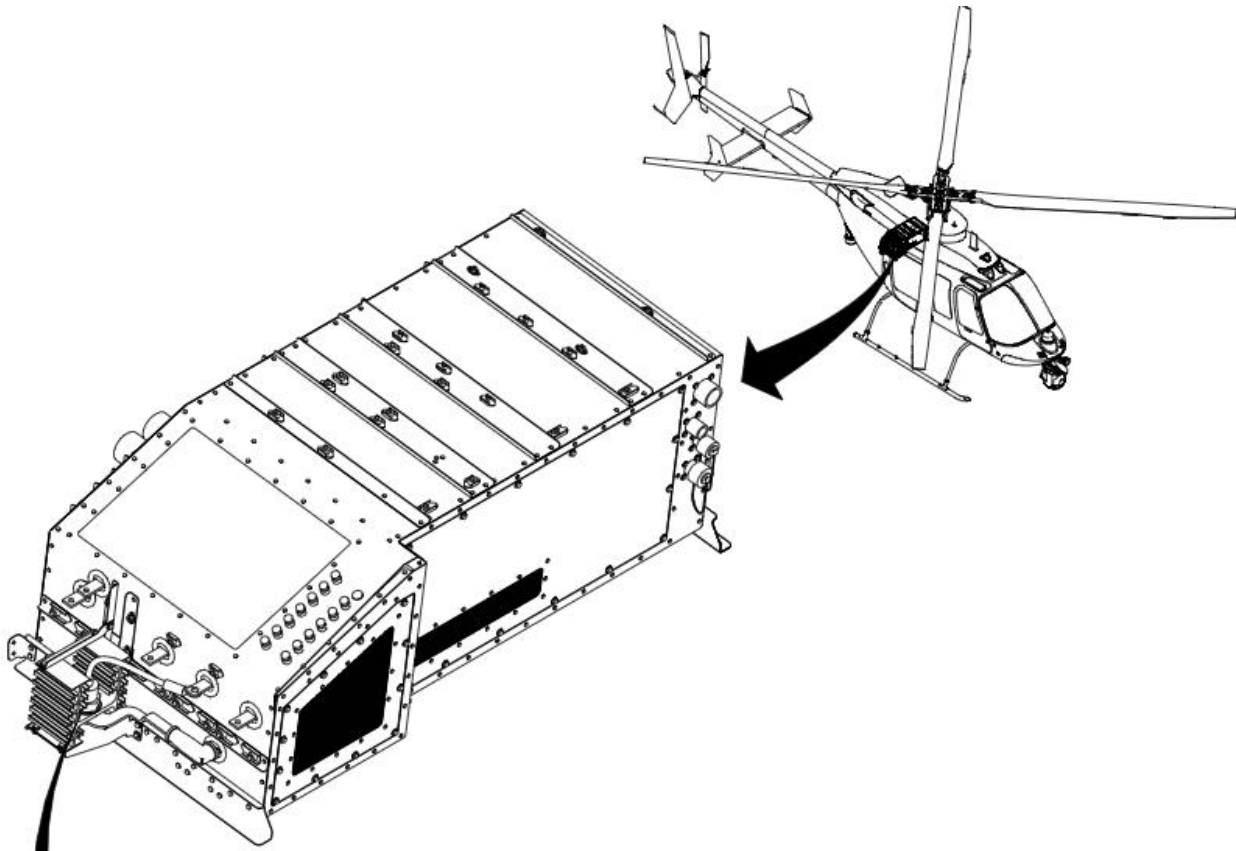
Redesign the external power diode system on the MQ-8. This redesign is needed to fix a shorting issue across the diode that creates power issues and grounds the aircraft until replaced. Due to its location, it is extremely hard to place, so failure grounds the aircraft for a significant amount of time. An external power source is used to power up the Air Vehicle (AV). This device will operate onboard the AV regulating and monitoring all incoming power to the AV. Often this external power comes from a MEPP (Mobile Electric Power Plant). The current design has resulted in several diodes heating up Teflon washers separating the diode from a heatsink to the point that they melt, turning to glass, shorting across the diode.

Redesign the system to regulate the voltage applied to the AV. The current external power monitor functions as over voltage protection but does not inform the user real time values of voltage. Redesign the system to have a real time external power monitor and regulation device to monitor the voltage applied to the AV. The redesign will also monitor temperature. All this information will be sent to the user in real time over Ethernet (RJ-45) to a router onboard the AV. The device itself will indicate receipt of voltage both higher and lower than the specified threshold providing quick feedback to maintainers. The device will be able to disperse heat preventing the degradation of any parts in the system. The device will need an onboard clock and the ability to hold and send records of voltage amps and temperature to a router for trouble shooting purposes so a maintainer can know the precise time when something happened during operation.

Current design is displayed in figures below:



INDUSTRIAL SOLUTIONS LABORATORY



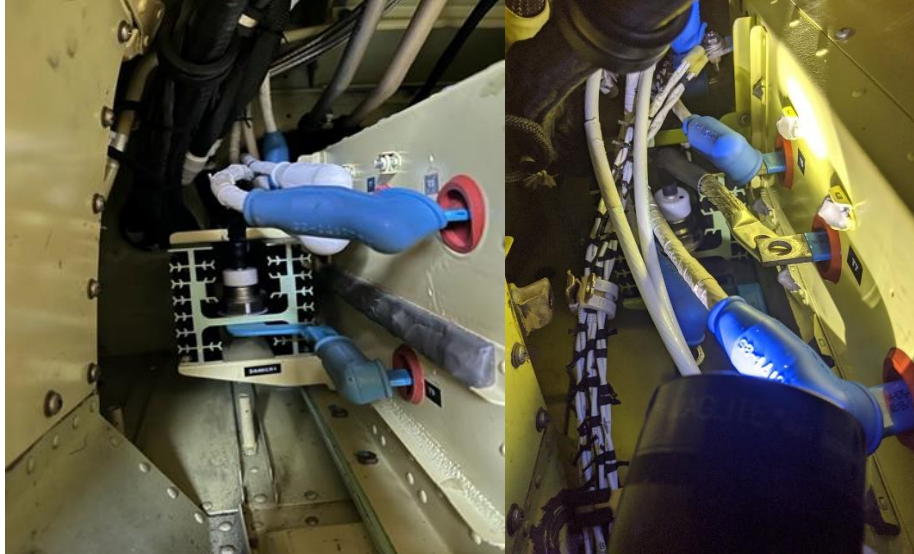


Figure 1: Installation on AV

Project Requirements:

Research and design an external power monitor and regulator that will be the first connection inside the aircraft after the external power receptacle. This device must regulate the voltage applied to the rest of the AV to 28V plus or minus 1V. This device must also be able to handle the max amount of amps applied to the aircraft by any of the MEPPs. The device will also monitor its temperature. The device will have an onboard clock that will enable the device to track the specific time that events take place. These events should include the devices temperate, voltage, and amps. This device will output all of this information through an Ethernet connection to a router onboard the AV and be displayed to the user in real time.

Expected Deliverables/Results:

- Voltage regulation and monitoring device that can be installed within the AV.
- This device will regulate the external voltage entering the AV to 28V plus or minus 1V.
- This device will prevent any voltage passing through this component outside of the previously mentioned threshold.
- This device will indicate voltage over and under the 28V plus or minus 1V limit being applied to the system through colored LEDs that will face the passenger door.
- This device will connect to currently used wire harnesses and military RJ-45 connector and airframe mounting used within the AV. No extra holes or screws can be used to mount this



device that were not used with previous solution a new bracket can be designed if it uses the current mounting hardware.

- This device will use a military RJ-45 Ethernet connection to transmit all information collected to the onboard router.

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Solid modeling
- Sensor and circuit design
- Manufacturing/Fabrication
- NAVAIR projects typically involve 1 trip to Cherry Point, NC to be able to understand the system and requirements.