

Topic: N181-005

Mainstream Engineering Corporation

Power Factor Correction

Mainstream's power factor correction (PFC) unit is a passive, low-loss system that increases the lifetime and reliability of generators suffering from leading electronic loads. Mainstream is a solutions-oriented research, development, and manufacturing company that has been providing innovative solutions to the U.S. government since 1986. Mainstream's low SWaP-C (Size, Weight, Power and Cost) design enables integration on military aircraft with minimal impact on the overall system weight. The passive architecture is a low-cost, high-reliability option that doesn't generate additional electromagnetic interference. With Phase II prototyping verifying the functionality of the PFC, our goal is to work with government/prime contractors to integrate the PFC into legacy military aircraft and shipboard systems to increase reliability, readiness, and service life while reducing life-cycle costs.

Technology Category Alignment:

Air Platforms

Energy & Power Technologies

Advanced Electronics

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SYSCOM: NAVAIR

Contract: N68335-19-C-0328

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0328

 Tech Talk: <https://youtu.be/zGWXW5HAdx0>

WHO

SYSCOM: NAVAIR
Sponsoring Program: Multiple PMAs
Transition Target: Legacy Naval Aircraft
TPOC:
(301)342-0365
Other transition opportunities: Other Military and Commercial Aircraft; Shipboard Long-Range Discrimination Radar (LRDR) systems
Notes: Mainstream Engineering plans to implement their lightweight power factor correction (PFC) unit into legacy aircraft systems to increase aircraft readiness, improve generator life and reliability, and reduce life-cycle costs.



Courtesy of the Navy:
<https://www.dla.mil/News/Images/igphoto/2002097951/>

WHAT

Operational Need and Improvement: NAVAIR desires to develop lightweight and compact equipment to improve the leading power factor in aircraft power distribution systems. The goal is to improve the lifetime and reliability of generators on legacy aircraft systems. NAVAIR is interested in solutions that will improve the leading power factor to a lagging power factor or unity. The power factor correction (PFC) unit must be compact and optimized for Size, Weight, Power, and Cost (SWaP-C) to have minimal effect on currently existing legacy aircraft systems. Additionally, the PFC unit must also be able to sustain high temperatures, shock, vibration, and produce minimal electromagnetic interference (EMI). Mainstream's low SWaP-C solution will improve generator service life and reliability – resulting in significant increases in aircraft readiness and reduced life-cycle costs.

Specifications Required: The PFC system is rated to correct 115VAC, 400 Hz, three phase 0.98 leading to 0.98 lagging power factor loads to an ideal power factor range of 0.75 lagging to unity. Comply with Military Standards 461 (EMI), 704 (Aircraft Electrical Power), and 810 (810 is modified for shock and vibration by MDC3376 spec). The PFC must be capable of operations at 71 degrees C ambient temperatures using an integrated Thermal Management System (TMS) and weigh less than 20 lbs.

Technology Developed: Technology Developed: Mainstream Engineering has developed a high-power-density PFC unit that is designed to calculate the power seen by the generator and adjust its inductance to keep the load power factor between 0.75 lagging and unity at all times. The PFC uses a low complexity, high reliability, low EMI design which is also designed for maintainability.

Warfighter Value: Integration of Mainstream's PFC system increases generator reliability and service life, reduces logistic costs, maintenance actions/costs, and life-cycle costs. Increased generator reliability, service life and reduction in maintenance actions will result in significant increases in aircraft availability and readiness.

WHEN

Contract Number: N68335-19-C-0328 **Ending on:** August 30, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase II Base: Revise, Design, and down-select material for Inductor	N/A	Measured power loss of material options	TRL 3	June 2020
Phase II Base: NAVAIR Test Bench Second-Generation PFC Design	Med	Successfully demonstrate thermal and electrical performance with generator at NAVAIR facility	TRL 5	December 2020
Phase II Base: Build and test pre-production hardware	Med	Achieve thermal and electrical performance, power density, and efficiency goals	TRL 6	July 2021
Phase II Option: Produce and Test production level hardware	High	Full power operation on Naval Aircraft	TRL 6/7	August 2022

HOW

Projected Business Model: Mainstream Engineering will manufacture the PFC units for low-volume custom orders with a timeline of 12-16 weeks. The PFC unit will be sold as a comprehensive stand-alone unit for integration within prime contractor's systems/subsystems. With high volume orders, Mainstream plans to outsource the custom inductors to a magnetic manufacturer while fabricating the rest of the components in-house to avoid long lead times.

Company Objectives: Mainstream Engineering intends to establish transition/commercialization partnerships with prime contractors such as Boeing, Lockheed Martin, and Northrop Grumman for the PFC system. Mainstream's secondary objective is to investigate a capacitive based PFC system.

Potential Commercial Applications: Commercial applications for the PFC system include industrial generators and large inductive / capacitive loads where intelligent power factor correction is beneficial. Mainstream's PFC system is an alternative to capacitor-based PFC used on individual loads found in industrial / commercial facilities. Our system can handle single or multiple loads and maintain the power factor within a desired range.