



IP Document | Emulation of Aerospace Actuation Systems

A Real-Time Controller Hardware-in-the-Loop Platform for Emulation of Aerospace Actuation Systems

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Industry: Woodward, Inc.

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Summary

The Emulation of Aerospace Actuation Systems Project is an effort funded by Woodward, Inc. to validate an electrical drive alternative to replace the pneumatically/hydraulically operated Thrust Reverser Actuation Systems (TRAS) currently deployed on commercial and military aircraft. This project will interface a TI TMS320F28379D microcontroller with an OPAL-RT real-time processor to emulate several electrically driven aerospace actuation scenarios using a controller hardware-in-the-loop (CHIL) platform. Team members will program both the TI board and the OPAL-RT system in C to read/write synchronized digital and analog signals that reflect the behavior of real mechanical motors and drive systems located in a physical testbed at the Aerospace System Emulation and Test (ASET) Lab at the CSU Powerhouse. In addition, the team will produce a detailed system model of the code and associated testbed hardware using the principles of Model Based Systems Engineering in Cameo Systems Modeler. The overall product to Woodward, Inc. is a well-documented system model and thoroughly tested code package that can safely interface with the ASET testbed for the next phase of project validation.

Why is This Project Important?

The trend towards More Electric Aircraft (MEA) is expected to revolutionize the aerospace industry in the coming years, with promises of reduced weight, maintenance, and additional data analytics for real-time system prognostics compared to traditional drive systems. To verify these claims without incurring tremendous R&D costs to the customer, a CHIL platform allows for emulation of an expensive physical system using inexpensive software to test the behavior and benefits of an electromechanical TRAS.

Types of IP:

Type of IP	Brief description
Patent	A patent is an exclusive right granted for a product/process which provides a new way of doing something or serves as a new solution to a problem. There are three types of patents – utility, design, and plant. Utility patents are granted to a new process, machine, materials composition, etc. Design patents are granted to original designs for items that are manufactured. Plant patents are literally patents for discovering a new type of plant. Patents typically last for 20 years.
Trademark	A trademark is any word, phrase, symbol, design, or a combination of these things that identify specific goods or services. Trademarks are useful for products that have a specific marketing or branding image. Trademarks can last forever but they have to be renewed every ten years.
Copyright	Copyright is a type of intellectual property that protects original works of authorship as soon as an author fixes the work in a tangible form of expression. For example – paintings, photos, drawings, songs, recordings, programs, books, poems, movies, code, etc. Copyright protection lasts for the life of the author + 70 years after their death. Works made for hire/anonymously are 95 years from publication or 120 years from creation, whichever is shorter.
Trade secret	Trade secrets are rights on confidential information which may be sold or licensed. Information must be commercially valuable, be known only to a limited group of people, and be subject to steps taken to keep it secret using confidentiality agreements. For example, a recipe or manufacturing process could be a trade secret. Trade secrets are protected forever unless they are discovered or legally acquired by others.

Intellectual property related to our project:

Copyright is the only type of IP that could apply to this project. There was a small amount of code written to perform the hardware in the loop functionality of this project that has not been written for specific interfacing with this TI microcontroller and this OPAL-RT machine (to our knowledge). Therefore, copyright would protect the code written by our team and ensure that the authors are recognized appropriately for their contribution to the design of the hardware-in-the-loop system. If this project is extended to specifically support the Woodward EM-TRAS test cases, the code would also be eligible for protection under copyright belonging to Woodward.