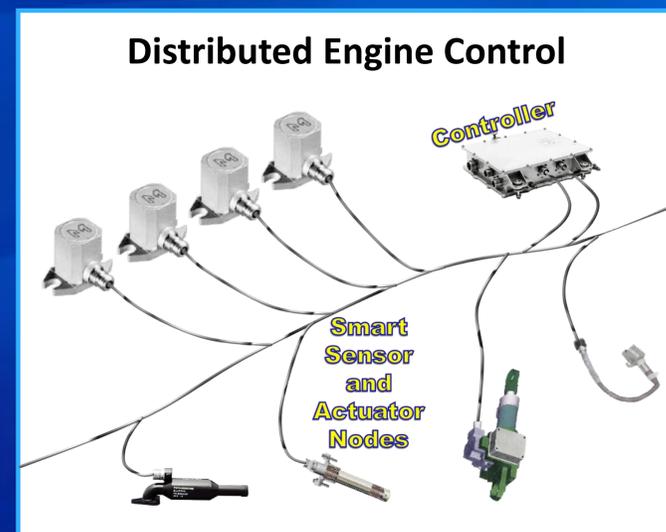


Description

NASA Glenn Research Center is developing a Hardware-in-the-Loop (HIL) facility intended to be a center of collaboration for engine controls technology. The HIL will assist new development by improving information sharing as control technologies progress from concept, through simulation, hardware development, and system integration.

Benefits

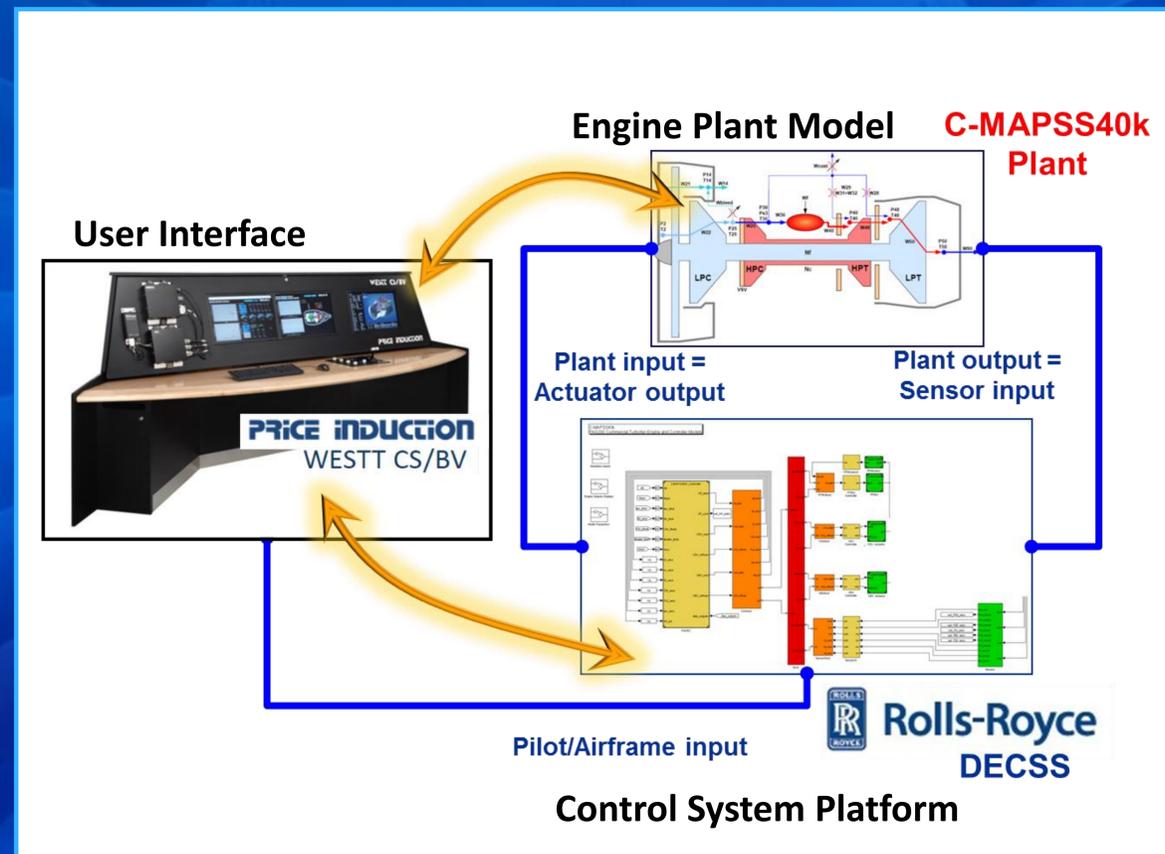
Quantifying the impact of new technology on engine system metrics is a fundamental issue for stakeholders in control system development. The HIL platform is a tool that enables those analyses while also improving the understanding of the constraints imposed on control hardware by the engine system.



Approach

The advent of Distributed Engine Control (DEC) represents a revolutionary change in engine control architecture. It decentralizes the control system components and their development among a wide spectrum of technologies and organizations. Integration becomes the key activity in producing a cohesive, high-performance system. It is highly desirable to develop methods and standards that enable these entities to cooperate with each other simply and efficiently.

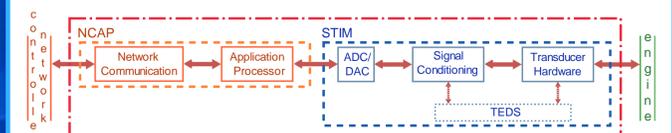
The approach used in the HIL system is to focus on the interfaces; this is the essence of integration and the concept of distributed systems. The structure of the HIL is modular. It is not reliant on form, but on function, and an understanding of how information flows through the interfaces. This modular structure of the HIL enables advances in all areas of control technology while minimizing the interdependencies of the parts.



Recent Results

- Ethernet network used to synchronize and connect major HIL components; Engine Plant Model, Control System Platform, and the User Interface
- The C-MAPSS40k based engine plant model runs independently on separate hardware; virtual engine.
- Demonstration of C-MAPSS40k controller on low fidelity network
- C-MAPSS40k control element models formatted as "smart" elements.

Structured Element Models IEEE-1451



Compatibility between Simulation and Hardware

Future Work

Modification of the C-MAPSS40k control system as a distributed implementation and demonstrate its interaction with the engine plant model. Additional steps will be taken to improve the fidelity of control effector models and the network simulations. Potential also exists to incorporate parallel processing methods for the simulation of distributed systems.

