



**SOLVING COMPLEX  
CHALLENGES THROUGH  
MARKET-LEADING INNOVATION**

Woodward teams with you early in the development cycle to provide innovative technology solutions and shorten the time to market. We optimize our integrated systems and components so you achieve the highest performance and reliability levels at the lowest possible weight and cost.

To deliver complete control systems, we combine our technologies and component capabilities with those of our partners and suppliers. Our integrated systems offerings will help you consolidate component testing, decrease development engineering resources, and simplify supply chain and system-testing activities.

# VALUE THROUGH INTEGRATION

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## AIRCRAFT ENGINE SYSTEMS

### SYSTEMS INTEGRATION

As a systems integrator, Woodward offers unmatched analytical capabilities, experience, and expertise. Understanding component interactions optimizes our designs, and analytical models can be used to predict or troubleshoot engine-level performance. System rig testing in our world-class environmental facility verifies predicted results. Supply chain management, logistics, and kitting simplify our customers' supply management and build-line interfaces.

### FUEL SYSTEM

- ▶ **Fuel Metering:** Scalable platforms serve thrust ranges from 1,000 to over 100,000 pounds. We develop customized designs with standard components to reduce development time.
- ▶ **Pump:** Main fuel pumps, stand-alone or integrated with engine controls. Integration can reduce cost and weight and improve thermal management, reliability, and performance.
- ▶ **Actuation:** Broad range of platform configurations, strokes, and performance requirements.
- ▶ **Air Valves:** Fuel-driven actuators often operate air valves for engine to airframe interaction.
- ▶ **Specialty Valves:** A wide variety of valves: flow dividers, shutoff, bypass, fuel return, and motive flow, meet unique engine requirements.

### COMBUSTION SYSTEM

- ▶ **Fuel Injection:** A full range of main engine fuel nozzles and augmentor spray manifolds provide industry-leading technology and optimum performance. Our integrated approach for the combustion system includes specialty valves (ecology, splitting), fuel manifolds, and combustion/case liners.
- ▶ **Ignition:** Exciters, igniters, and leads comprise the ignition subsystem. Relying on our fuel spray and ignition strengths, we are developing advanced combustion systems to optimize fuel burn and control, increasing engine efficiency and reducing emissions.
- ▶ **Manifolds:** Development has included designs both internal and external to the combustor.
- ▶ **Combustion Sensors:** Feedback from the combustion chamber can be used to optimize performance or to diagnose maintenance needs.

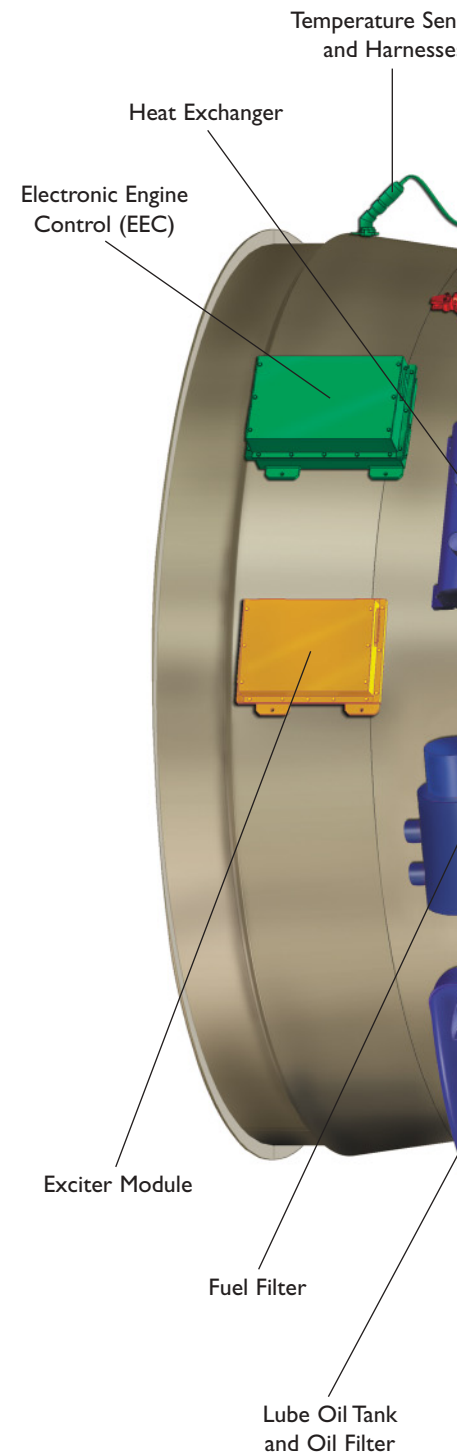
### HEAT MANAGEMENT

- ▶ **Heat Exchangers, Lube and Scavenge Pumps, Filtration System, and Fuel/Oil Sensors:** These components comprise the heat management system. The role of the main fuel pump in generating heat during operation makes its design critical to the heat management solution.

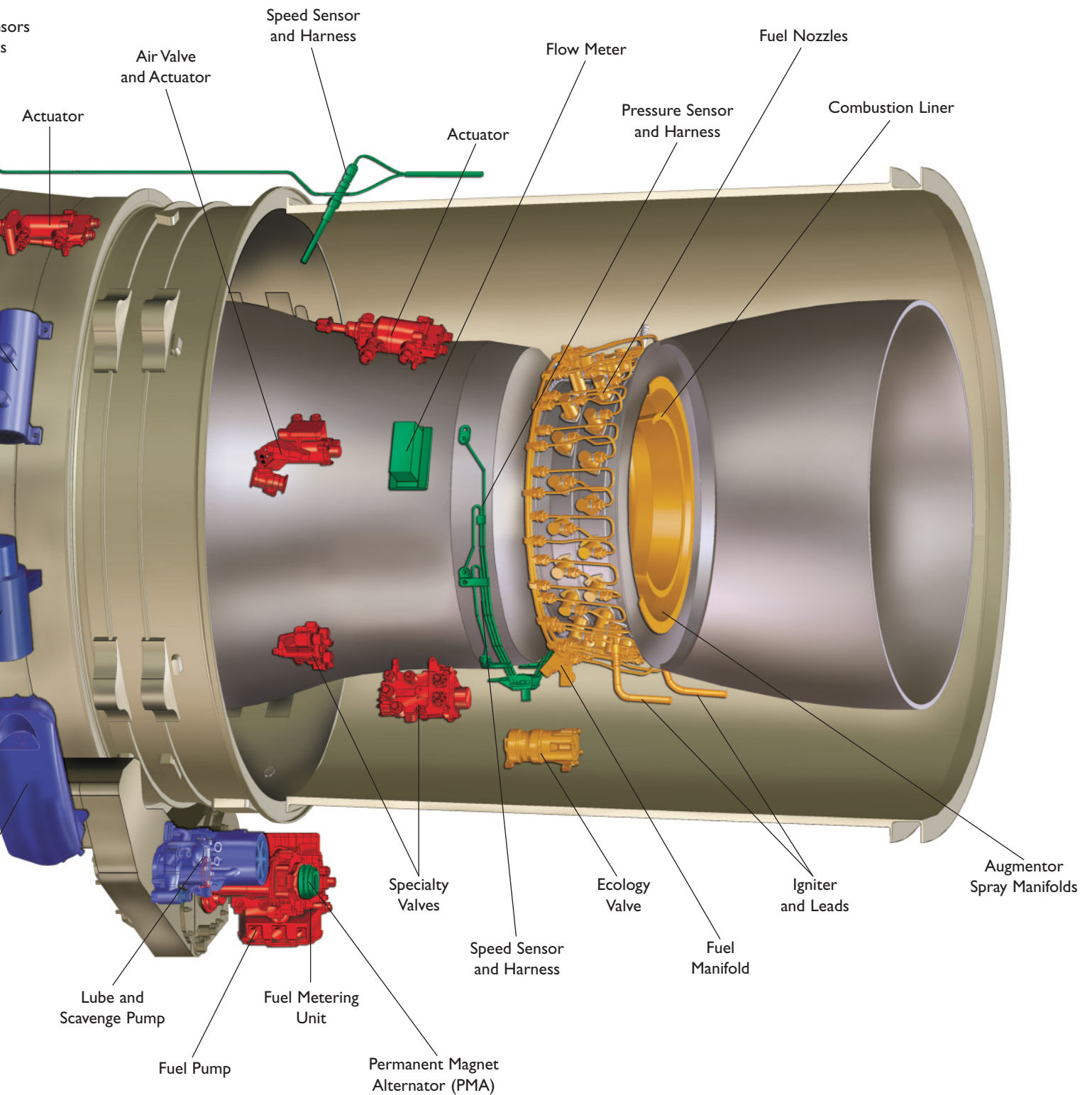
### ELECTRICAL SYSTEM

- ▶ **Electronic Control, Sensor Suite, and Power System:** The electronic engine control; starters; temperature, speed, and pressure sensors; harnesses, and permanent magnet alternator comprise the electrical subsystem.

## TURBINE



# THE ENGINE CONTROL AND COMBUSTION SYSTEMS (TECCS) INTEGRATION





## OUR SYSTEMS STRATEGY OPTIMIZES PERFORMANCE

### OUR BROAD-BASED APPLICATIONS

#### COMMERCIAL

Our engine control and combustion system components help power nearly all commercial aircraft – from regional jets to narrow- and wide-body airliners.

#### MILITARY

While serving the military market for decades, we currently provide engine components for helicopters, fighters, bombers, and mission support aircraft.

#### BUSINESS/GENERAL AVIATION

We provide comprehensive engine control and combustion systems for the business jet and general aviation markets.

#### AERODERIVATIVE

By combining our aerospace and industrial gas turbine technologies, we offer fully-integrated turbine control and combustion systems for aeroderivative platforms such as power generation, marine, and mechanical-drive machines.

### OUR COMMITMENT TO YOU

With our carefully planned strategies – advanced energy control technologies – and latest manufacturing capabilities, we deliver value-added systems solutions. Our engineers team with you early in the development cycle to define, verify, and validate your requirements.

Using Six Sigma methodologies and lean manufacturing principles, our members speak a common language and use common processes to solve complex technical problems.

With our customer and supplier e-Business Center website, we provide 24/7 access to order status, invoices, real-time schedule/demand scorecard performance, specifications and drawings, corrective action requests, and shipment triggers.

As a systems integrator, we develop and deliver innovative fuel delivery, heat management, and combustion systems so you can operate cleaner, more cost effective and more reliable engines.



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