



Fluid Systems Innovation

Fuel Systems | Fuel Pumps | Inerting Systems | Pneumatics |
Electronics | Fuel Specialty Products



ENGINEERING YOUR SUCCESS.



PARKER HANNIFIN:

The world leader in motion and control

Begun in 1918, Parker Hannifin's story is one of technology transformation, creating a legacy of financial fortitude, robust investment, and ongoing innovation that spans nearly a century. Today, with pneumatic, hydraulic, and electromechanical applications in both industrial and aerospace markets, Parker is the world leader in motion control. No single competitor offers a product line



as complete or extensive. Using this expertise, Parker partners with its customers worldwide to increase their productivity and profitability.

PARKER HANNIFIN by the numbers

1,100+ industrial and aerospace markets

875,000+ products offered

58,000+ employees in **50** countries

\$13 billion+ in annual sales

3,200+ product lines

13,000+ distribution/ MRO locations

1 of the **FORTUNE 300**

0 competitors with a bigger product line

PARKER AEROSPACE:

A powerful technology partner

The world's leading aircraft manufacturers choose Parker Aerospace as a technology partner and supplier, relying on our unequalled systems capability, broad product line, and talented people to help their fleets soar.

A key operating group of Parker Hannifin Corporation, Parker Aerospace is a respected innovator in the design, manufacture, and support of fuel, inerting, hydraulic, flight control, and fluid conveyance systems and equipment for aerospace and other advanced technology markets.



OUR CUSTOMERS

Military fighters, transports, and unmanned aerial vehicles

Commercial and regional transports

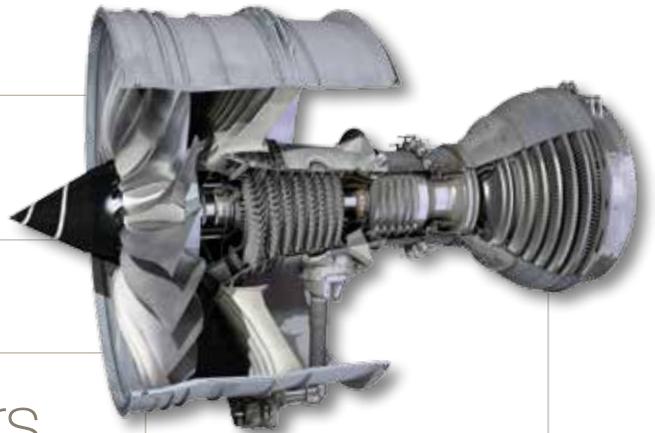
Engines

Helicopters

Missiles, rockets, and launch vehicles

Business and general aviation

Military ground vehicles



SPECIFY

DESIGN

SIMULATE

INTEGRATE

TEST

CERTIFY

PRODUCE

ENHANCE

SUPPORT



FLUID SYSTEMS DIVISION:

An all-in-one provider saving time, reducing waste, adding efficiency, and expanding output

As your partner and part of Parker Aerospace, the Fluid Systems Division works hard to improve your productivity and profitability wherever possible. To that end, we invest heavily in our capacity to design, analyze, develop, build, and test our products in support of ever-demanding certification requirements.

From design and development, through integration, manufacture, certification, and lifetime support, we add value to both the process and the product by exceeding expectations and performance goals.

OUR CORE PRODUCTS



FUEL SYSTEMS



FUEL PUMPS



FUEL GAUGING



INERTING SYSTEMS



ENGINE PNEUMATICS



AIRFRAME PNEUMATICS



ELECTRONIC CONTROLLERS



WATER AND WASTE EQUIPMENT



LIGHTNING PROTECTION EQUIPMENT

INNOVATION

Forward-thinking technology for the next generation of flight

Adding value: researching future innovations

For many companies, research and development is an avenue that leads to spending money; at the Fluid Systems Division of Parker Aerospace, it's just the opposite, as we take a much more positive approach. We look at R&D as a direct path to value, making new methods to cutting costs a top priority.

To achieve this end, we meet regularly with key customers to determine their value priorities. It's an exercise that points us towards new technology development.

By critically examining current technology, we are able to collaboratively create the needs list for the next generation of aircraft systems. These efforts result in focused deployment of our R&D efforts, providing leading-edge solutions at real-world costs.



1) The finite element analysis (FEA) mesh rendering allows the isolation of minuscule elements to calculate stresses in complex geometries.

2) FEA also helps determine whether the housing has sufficient thickness to withstand various pressures.

3) Intermediate stages are further refined.

Process strength

The Fluid Systems Division uses a standard design process for all new part development projects. This sequence shows the conversion from a cast aluminum to a molded plastic housing for a center tank fuel pump. Development began with a functional drawing that evolved as other features were added to increase strength.



4) The final molded part is depicted after analysis and optimization.

Current research and development projects

- Non-intrusive gauging solutions
- Solid state intelligent power management systems
- Hybrid energy storage modules
- Advanced electromechanical actuators
- Hydromechanical pumps and valves
- Inerting systems optimization
- Advanced high temperature materials



Silicon carbide (SiC) power module



Sensing unit



Solid state electrical distribution unit



Through wall installation for non-intrusive gauging



Sensor with fiber optics

CUSTOMERS FIRST

Program leadership with no-risk execution

From component to system level, the Fluid Systems Division (FSD) provides project management and program leadership to ensure success for our customers.

We maintain a centralized and coordinated program management office to guide, manage, and support our customers' aircraft programs.

Our program managers have broad responsibilities:

- Managing the life cycle of multi-system or subsystem contracts
- Establishing guidance across the enterprise that is consistent and effective in meeting our commitments
- Managing costs, scope, and time constraints of valued programs
- Providing alignment with industry-recognized knowledge and practices

All FSD program managers are required to be certified as Project Management Professionals by PMI®, the Project Management Institute.

This certification gives our program managers an in-depth understanding of the discipline. Certification is held by many FSD engineers, contract administrators, and functional managers, as well.



Standard design and development process

At Parker Fluid Systems, program management is also strongly supported by our standard design and development process (SDDP), which is a thorough system based on the principles of stage gate. The process helps us to drive excellence in new technology and product development.

FUEL SYSTEMS

Total fuel system integration backed by our comprehensive experience certifying components to Federal Aviation Regulation 25.981 requirements



At Parker Fluid Systems, we combine our depth of design knowledge in fuel system equipment with advanced pump technology and fuel gauging capabilities to provide the time and money savings of total fuel system integration. With a single point of contact, our reliable fuel system solution includes:

- Fuel tank pressure and vent control
- Fuel tank inerting
- Fuel level and flow control
- Fuel transfer
- Fuel pumping
- Engine feed
- Fuel measurement and management
- Refueling and defueling
- Aerial refueling
- And more



A350 fuel scavenge ball valve

Dual role on the Airbus A350 XWB

As the first supplier to be awarded both the fuel equipment and the fuel tank inerting systems on a major program, the Fluid Systems Division's contributions to this long-range, widebody family are significant. They include the fluid mechanical equipment, fuel measurement and management system, engine feed and transfer fuel pumps, and fuel tank inerting system. We also supply a wide range of lightweight, high-performance equipment and Lightning-Safe® components for the A350's composite wing design.

Aerial refueling

Our refueling couplers, nozzles, receptacles, and test kits represent today's leading edge in aerial refueling design, performance, and durability.



Fuel system and component program pedigree

Agusta A109/119, AB139 | Airbus A350 XWB, A400M | BAE Bradley Fighting Vehicle | Bell OH-58, UH-1 | Bell/Boeing V-22 | Boeing C-17 ER, F-15, F/A-18 E/F | Bombardier CSeries, Global Express XRS, Learjet 45, Q400 | Cessna 208, 525; Citation CJ4, Mustang, Sovereign, XLS | COMAC ARJ21, C919 | Embraer ERJ 135/145, 170/190, Legacy 450/500 | General Dynamics MIA1 and MIA2 Abrams | Beechcraft Hawker 4000 | Lockheed Martin F-16, F-22, F-35 | Northrop Grumman Global Hawk | Raytheon Tomahawk | Sikorsky H-92, MH-60, UH-60



Dual power actuator



Refuel coupling



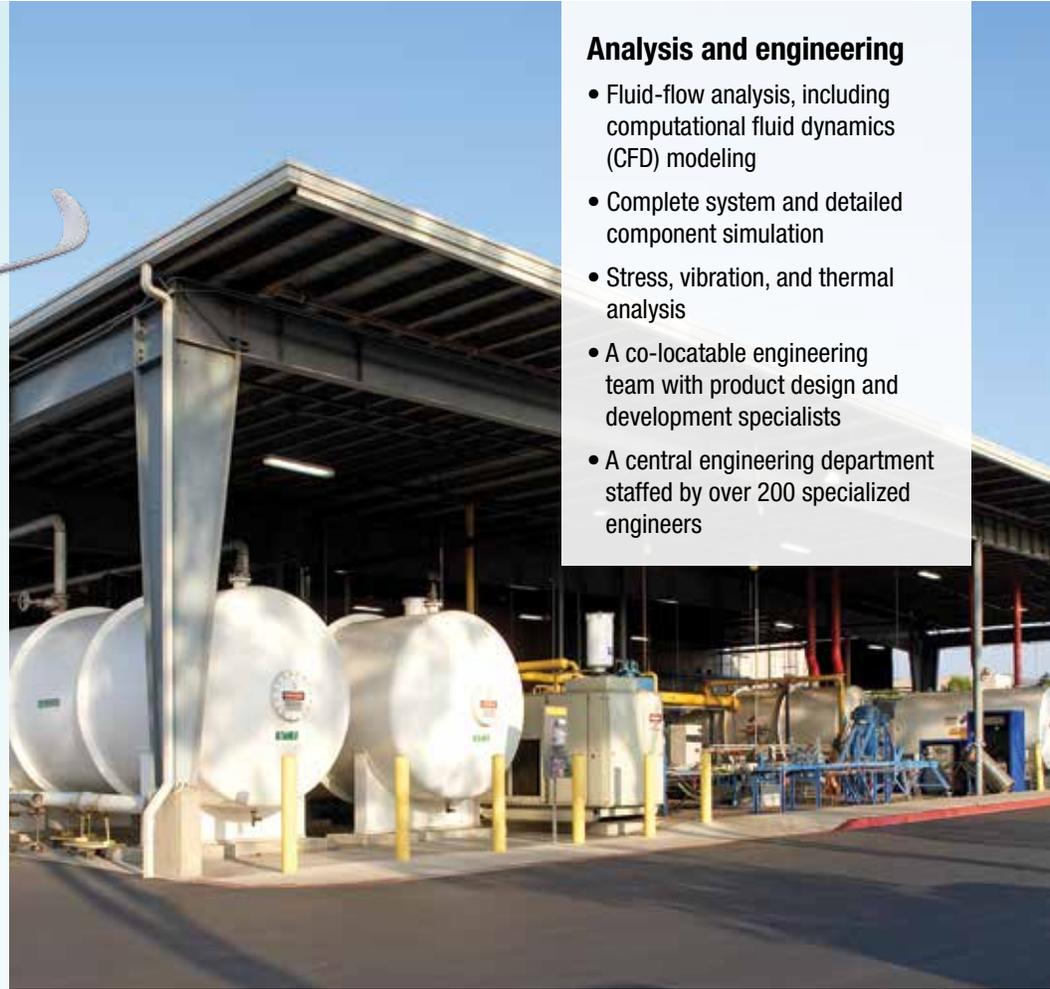
Air refueling receptacle



Scavenge shutoff valve



Scavenge jet pumps



Analysis and engineering

- Fluid-flow analysis, including computational fluid dynamics (CFD) modeling
- Complete system and detailed component simulation
- Stress, vibration, and thermal analysis
- A co-locatable engineering team with product design and development specialists
- A central engineering department staffed by over 200 specialized engineers

On-site and on the money

Parker Fluid Systems' extensive on-site capabilities and state-of-the-art fuel system testing laboratory duplicate actual operating conditions, giving us the proven capacity to test complete aircraft fuel systems and components.



Fuel laboratory capabilities

- Pump stations with a range of up to 90 psig at 1,400 gpm
- Fuel icing down to -40°F (-40°C)
Capacity: 1 million BTU/hr
- Extreme temperature testing from -65°F (-54°C) to 180°F (82°C)
- Contamination testing to 250 gpm



Dynamic vibration testing

- Shaker systems that control over 3,000 Hz
- Random and sinusoidal vibration and shock
- Simulation of accelerated vibration operating environments while simultaneously operating electromechanical, electronic, fuel, pneumatic, and/or hydraulic actuators



Full-scale wing testing

Executed at high or low temperatures using a wide range of fuels and varying altitude conditions:

- Refuel/defuel
- Icing
- Venting
- Pitch and roll

FUEL PUMPS

Pushing the boundaries of innovative technology



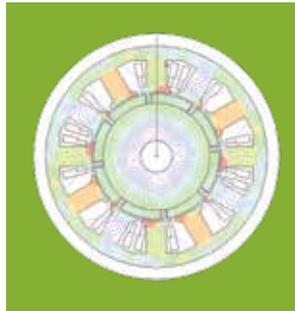
Ranging from fuel boost and transfer pumps to hydraulic brake actuation pumps, portable water pumps,

recirculation pumps, and APU pumps, the Fluid Systems Division fuel pumps add real power to both military and commercial aircraft.

Our brushless, electric, DC motor-driven pumps with sensorless or sensor-based electronic controls offer powerful advantages:

- Adjust flow and pressure in response to system demand for optimum efficiency
- Simplify system complexity, reduce weight and power consumption, enhance safety, and improve system reliability
- Interface with system control devices to monitor component health and reduce maintenance

The Fluid Systems Division is an industry leader in developing pump designs to meet the recent FAR 25.981 safety guidelines.



Magnetic analysis of brushless DC motor

The Parker Motor Design Center

Focused on advancing the science of motor technology, the Parker Motor Design Center (PMDC) allows FSD customers to leverage low costs, proven manufacturing capabilities, and rapid prototyping to produce a working motor in as little as six weeks. These motors are being used in fuel pumps, which are replacing engine-driven fuel pumps in many applications. PMDC engineers have developed a proprietary design tool used to create the best motor configuration.

- Optimizing magnetic finite element analysis (FEA)
- Applying system simulation
- Establishing the best motor geometry
- Simulating thermal performance

Fuel pump program pedigree

Airbus A340, A350 XWB | BAE Systems Bradley Fighting Vehicle | Beechcraft Hawker 4000 | Bell V-22 | Boeing 787, F/A-18 E/F | Bombardier CSeries, Global Express, Q400 | Cessna Citation, Sovereign | Embraer ERJ 135/145, ERJ 170/175, ERJ 190/195, Legacy 450/500 | General Atomics Predator | Lockheed Martin JASSM missile, F-16, F-35 | Northrop Grumman Global Hawk | Raytheon Tomahawk | Sikorsky S-92, UH-60 Black Hawk



Wing tank pump



Fuel transfer pump



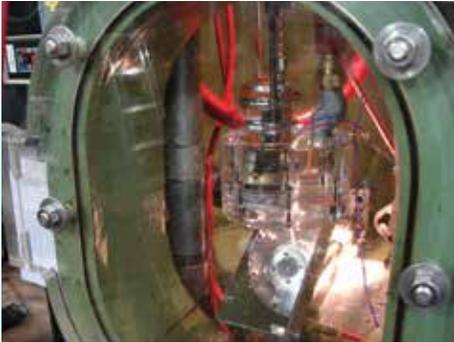
270 V BLDC fuel boost pump



Fuel transfer pump



DC fuel boost pump



Each year, FSD performs thousands of tests in its high-capacity test vessels. The analyses contribute both to pump development and certification processes.



FSD must condition test fluids, including aerating fuel prior to altitude testing.



Our 250- to 800-gallon test vessels are designed to test high-capacity fuel pumps.

Proven technology for proven performance

FSD offers customers a full range of fuel pump design, development, and manufacturing capabilities – including altitude test chambers for simulating representative capabilities at high climb rates. We are a leading fuel pump supplier to the U.S. military market.

Fuel pump laboratory capabilities

- Multi-tank test lab
- Model shop
- Rapid prototyping
- Motor dynamometer
- Electronics lab
- AC and DC digital power supplies
- Calibration test stands
- Data acquisition and control systems
- Endurance test stands
- Wet digital motor dynamometer
- High-power refrigeration systems
- Spectrum analyzer for PFC digital scope
- Temperature chambers



Visual inspections of pump components are crucial after qualification testing to determine if damage or wear is present.



FSD's multi-use model shop routinely machines parts, including pump impellers, using various cutting tools, oil, and coolants.



Production test tanks throughout FSD are used to evaluate pumps to document performance characteristics.

FUEL GAUGING

Providing gauging solutions to **maximize efficiency and address customer needs**



Long recognized as a leading provider of innovative gauging solutions and control applications, FSD

measurement and management systems and components reduce weight and save fuel while minimizing costs and maximizing efficiency.

Supplying the world's largest commercial airliners and smallest business jets, we design, manufacture, and certify all key gauging technologies, including fuel gauging systems and components compliant to Federal Aviation Regulation (FAR) 25.981.

Our systems and components can be found on fixed- and rotary-winged commercial, commuter, business, and military aircraft.

Fuel gauging program pedigree

Airbus A340-500/600, A350, A380 | Boeing 777, C-17, KC-135, MD-11, MD-80, MD-90, 717, Vertol CH-47A/B/C | Bombardier CL415, CSeries, Q400, G5000, Global Express | Cessna Citation III, CJ-4, Mustang | COMAC ARJ21, C919 | Embraer ERJ 135/145, 170/175, 190/195, Legacy 450/500, Legacy 600/650, Lineage 1000 | Gulfstream II, III, IV, 350/450, 500/550 | IAI 1124 Westwind, 1125 Astra, G150, G200 | Lockheed Martin C-130 | Sikorsky CH-53, MH-53, S-76C+/C++ | Pilatus PC-7, PC-9

Advanced gauging designs from the Fluid Systems Division

Our systems are at the forefront of safety, satisfying all applicable FAA requirements by using advanced features and technology.

- FAR 25.981 certified systems
- Fault-tolerant architectures
- Extensive automatic fault detection and isolation
- Onboard attitude-error correction
- Sophisticated microprocessors
- Application-specific integrated circuits (ASICs)
- Solid-state displays
- Active and passive densitometers



Selected equipment from a Parker fuel gauging system



FSD gets it right the first time

To test our fluid measurement and management systems and electronic controllers, we maintain all the sophisticated tools necessary to design, manufacture, assemble, and test complete system solutions that keep our customers moving at the speed of flight.



FSD tests hundreds of fuel-level sensing probes each month. Analyses for capacitance, continuity, and other factors ensure that our sensors offer the most precise degree of accuracy.



FSD's test stands for in-tank gauging components allow us to simulate a fuel tank environment. Calibration fluid is used to avoid the inherent combustion risks of using fuel.



Circuitry for FSD's fuel quantity gauging and management computers is thoroughly tested on in-house-developed equipment to verify correct input and output readings. Our components are tested to exceed all OEM specifications.

Fuel gauging and electronics testing capabilities

- 3D solid modeling for mechanical design
- Computer-aided software engineering (CASE)
- Enhanced tank analysis systems (ETAS)
- Circuit design and printed circuit board layout
- Automated in-circuit testers
- Environmental stress screening
- Reliability enhancement testing

These tools include the capability to simulate and analyze each design before its release to manufacturing. They also allow for the seamless transfer of critical manufacturing parameters to facilitate building and testing of printed circuit and mechanical assemblies.

In addition to creating our own modeling tools to enable us to achieve exact system specifications, we generate all equipment software, thereby meeting the highest industry standards as we optimize system performance.

INERTING SYSTEMS

Leading-edge fuel tank inerting experience with the most extensive pedigree in the industry



As the premier world leader in fuel tank inerting systems, Parker Fluid Systems has turned 50-plus years of

inerting technology leadership into an unequalled inerting system pedigree that translates into durable, world-class products that last, flight after flight.

We've honed our core competencies and experience in supporting fully integrated fuel, inerting, and vent systems. This combination is being employed on military fighter and commercial aircraft alike. Our unmatched expertise in the design, manufacture, integration, and support of fuel systems enables us to bring fuel tank inerting systems to market quickly and cost effectively, meeting the highest military and commercial specifications and standards.

At FSD, our people have been awarded over 300 patents for their innovation and creativity. Some of our inerting patents include technologies for:

- Three-flow architecture and method for aircraft onboard inert gas generating systems (OBIGGS)
- Air separation modules (ASMs)

Building in safety at Boeing

All Boeing 737, 747, and 777 airliners include fuel tank inerting technology provided by the Fluid Systems Division. Our proprietary inerting technology uses existing pressurized air to separate out oxygen and produce nitrogen-enriched, non-flammable air for delivery to the fuel tanks. Expert Parker Aerospace engineers and technicians worked on-site at Boeing to support the integration of our inerting technology.

FUELING INNOVATION

Our advanced and comprehensive inerting technology capabilities

- Aircraft fuel tank inerting systems
- Fire prevention and/or suppression systems
- Explosion suppression systems
- Three-flow architecture
- System health monitoring capability
- Closed-loop performance control
- Inert gas distribution systems
- OBIGGS turbocharging
- OBIGGS cooling systems
- Air separation modules
- Electronic controllers
- Climb and dive valves
- In-tank O₂ concentration modeling
- Monte Carlo analysis and certification
- Fuel tank thermal modeling

Fuel tank inerting system program pedigree

Airbus A320, A330, A340, A350 XWB, A400M | Boeing 737, 747, 757, 767, 777, C-17, Orion P8A | Bombardier CSeries | COMAC C919 | Lockheed Martin C-5, F-16, F-22, F-35 | Sukhoi Superjet 100



Gate valve



Dual-flow shutoff valve



Air separation module pallet



Inlet isolation valve



Single-aisle air separation module pallet



The technology to provide an integrated solution

By approaching fuel tank inerting from a fuel system perspective, FSD has developed extensive on-site analytical and test capabilities that allow us to provide an integrated solution. It's the kind of expertise that makes us a high-value, low-risk partner.



Inerting laboratory capabilities

- System integration testing
- Air separation module pressure-endurance testing
- Temperature-humidity testing
- Pressure-temperature cycling
- Fuel cell/inerting system testing
- Contamination testing
- Automated performance mapping
- Ozone testing

FSD's flight experience for permeable membrane inerting is unmatched by any other supplier.



FSD's system integration lab (with ASM test legs, above) combines the capabilities of our fuel and pneumatic test facilities with inerting-specific equipment and instrumentation.



The FSD team puts each ASM design through rigorous test scenarios to meet strict requirements for tolerance and resistance. An endurance test rig is pictured above.



At FSD, system development and qualification processes are closely aligned with ARP4754A methodologies. This significant experience reduces development and certification risk to our customers.

System integration lab

FSD's inerting system integration lab (SIL) puts us at the forefront of inerting technology by simulating a complete range of aircraft operating conditions, including climbing, cruising, and descent.

In addition to "flying" the system through a flight profile, our SIL equipment can perform contamination and endurance testing, as well as rapid performance mapping across a wide range of parameters.

Analytical tools that enable optimized system solutions

FSD employs a broad array of analytical tools that integrate fuel system knowledge, including Monte Carlo analysis, nitrogen enriched air (NEA) distribution, computational fluid dynamics (CFD), Matlab/Simulink® computational analysis modules, and our proprietary tank modeler tool to predict in-tank oxygen concentration.

Together, these tools allow us to properly size inerting systems while streamlining the distribution of nitrogen-enriched air. The end result is a system that can provide the required flow without the need for storage tanks, saving weight and space for better bottom-line performance.

Our fuel tank inerting capability discriminators include:

- System development processes closely aligned with industry methodologies, reducing development and certification risk for our customers
- Permeable membrane product development experience and pedigree
- Established integration experience for both air and fuel systems
- Broad experience in analyzing, testing, and fielding all major air separation module (ASM) fibers, allowing us to select the best choice of fiber for each program

PNEUMATICS

Expertly designed, **consistently high-performing** engine and airframe controls



Engine pneumatics

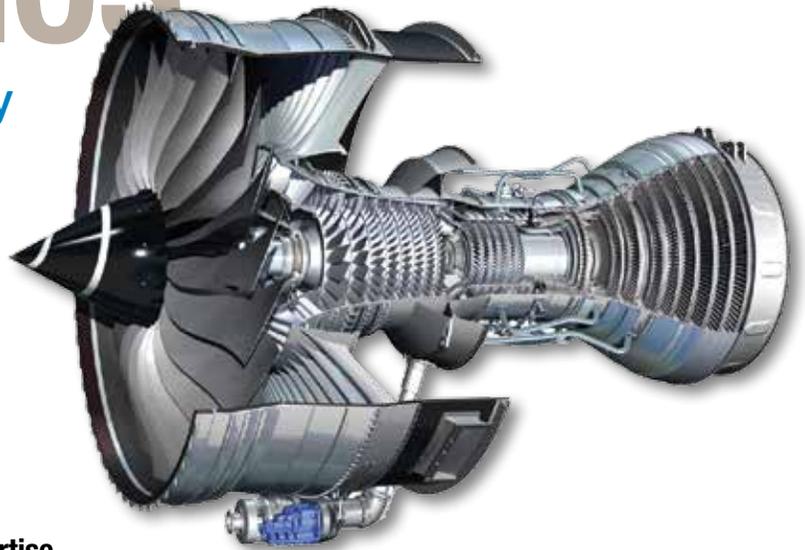
At Parker Fluid Systems, our pneumatic subsystem expertise complements our fuel subsystem and

fluid conveyance abilities in the engine environment. Available for virtually any specification or application, our cost-effective subsystems and components are well proven and reliable.

Designed for extreme engine environments, they offer a wide range of seamlessly integrated and optimized options using advanced designs, materials, and actuation technologies.

Engine controls include:

- Nacelle and wing regulating, modulating shutoff valves
- Handling-bleed systems
- Cross-bleed valves
- Secondary air system valves
- Solenoids
- Fuel, motor, and pneumatic actuation
- Turbine tip clearance control valves
- Heat management system valves



Engine expertise

FSD teamed early with Rolls-Royce to work collaboratively in the initial concept phase for the Trent XWB engine. The Trent XWB powers the Airbus A350 XWB family of aircraft. This early effort has led to integrated design innovations that bring lower costs and longer service life. The FSD team, along with other Parker Aerospace divisions, is providing the Trent XWB pneumatics suite, hydraulic engine build-up system, heat management valves, and lubrication and oil scavenge pump.



Trent XWB high-pressure turbine clearance control valve



Airframe pneumatics

Our broad portfolio of airframe pneumatic components and subsystems is the ideal

place to start for any commercial, military, or regional application. The industry experience and pedigree we offer keep our pneumatics products leading the way while offering low cost of ownership. Products include:

- Anti-ice control and de-icing systems
- Compartment and pre-cooler temperature controls

- APU load control valves
- Butterfly, coaxial, and check valves
- Bleed air manifold isolation valves
- Air turbine starter control valves
- Temperature control valves and temperature sensors
- Low-pressure regulators
- Motor-operated shutoff valves
- Pneumatic-operated shutoff valves
- Nacelle cooling/ventilation valves



Intermediate-pressure bleed valve



Turbine clearance control actuator



Anti-ice valve



Secondary air system valve



Solenoid bank



Ready to test to any requirement

For both fuel and pneumatically actuated valves, FSD is equipped for development, qualification, and production tests performed to customer specifications on multiple test legs. Computer controllers simulate mission profiles by replicating on-aircraft conditions. Tests are monitored by electronic data acquisition systems that record, reduce, and plot data results.

Pneumatics laboratory capabilities

- Heaters: 7 million BTU/hr and 5 million BTU/hr
- Compressors: reciprocating and screw
- Air flow:
 - 180 ppm (82 kg/m) up to 1,400°F (760°C) at 575 psig
 - 550 ppm (136 kg/m) up to 1,200°F (650°C) at 250 psig



Fueldraulic test capabilities

- Fuel temperatures from -65°F (-53.9°C) to 250°F (121°C)
- Fuel pressures to 757 psig



Engine pneumatic program pedigree

EuroProp International TP400-D6 (Airbus A400M) | **GE** CF34-8/10 (COMAC ARJ21, Embraer 170/190, Bombardier CRJ700/900), GE90 (Boeing 777), F404/F414 (F/A-18 E/F) | **International Aero Engines** V2500 (Airbus A320) | **Pratt & Whitney** PW2000/F117, PW4000, PW6000 (airframes) | **Rolls-Royce** Trent 1000 (Boeing 787), Trent 500 (Airbus A340), Trent XWB (Airbus A350 XWB)

Airframe pneumatic program pedigree

Bell/Boeing V-22 | **Boeing** 737, 747, 747-8, 757, 767, C-17, F/A-18 E/F | **Bombardier** Learjet 60 | **Cessna** C208 Caravan; Citation CJ4, Mustang, Sovereign, XLS, X | **Beechcraft** Hawker 4000 | **KHI** PX/CX | **Lockheed Martin** F-16 | **Piaggio** P180 | **Sikorsky** S-92 Helibus

ELECTRONIC CONTROLLERS

The **architecture** that shapes a quickly evolving industry



FSD supplies a diverse range of the highest-performance electronic controllers for the aerospace market.

This line of products continues to be a rapidly growing segment of our overall business.

Using modern architecture that meets the hardware and software requirements of RTCA DO-254 level A and DO-178 level A respectively, our line of high-performance electronic controllers is comprehensive.

- Flight control actuation systems (flaps, horizontal stabilizer, rudder)
- Landing gear systems (actuation, steering)
- Fuel pumps and valves (boost, transfer)
- Munitions and missiles (fin actuation, thrust vector control)
- Utility control systems (fuel tank inerting, fire suppression, aerial refueling, manual fuel control)

Motor drive capabilities

These controllers encompass a broad range of motor drive capabilities, including:

- 12V DC to 270V DC input supply voltage
- 115V AC input supply voltage
- Sensor or sensorless motor commutation

We drive a wide array of motor types:

- 1 hp, 28V DC, 30 amp, four-quadrant modulation
- 2 hp, 28V DC, 60 amp, four-quadrant modulation
- 14 hp, 270V DC, 40 amp, four-quadrant modulation

Architectures

Controller architectures include the following:

- Redundant channel, fail-safe design
- Control and monitoring within each channel
- FPGA/CPLD or DSP control logic technology
- System monitoring
- PID control loop
- System-performance tuning motor drive capabilities

Electronic controller program pedigree

Airbus A320, A330, A400M | Boeing KC-767 | Bombardier CSeries, Global Express, G5000 | Cessna Sovereign | COMAC ARJ21, C919 | Embraer ERJ 135/145, 170/175, 190/195, Legacy 450/500, 600/650, Lineage 1000 | Lockheed Martin F-35 | Sukhoi Superjet 100



Digital temperature control system



Pump control circuit board



Military fixed-wing flight control



Commuter aircraft flight control

FUEL SPECIALTY PRODUCTS

Durable and lightweight **water and waste equipment**



Parker Fluid Systems potable water and lavatory subsystems and components range from immediately available off-the-shelf products to highly engineered solutions, offering customers the greatest flexibility in meeting their needs. Based on more than 100 million flight hours, our design innovations result in lower cost and longer service life. These products provide durability, light weight, easy maintenance, and simple operation. They include:

Potable water

- Heated and non-heated fill valves and overfill nipples
- Liquid-level indicators and indicator panels
- Pressure-relief valves
- Pumps
- Tanks

Lavatory

- Drain valves
- Rinse/fill check valves
- Supply hose
- Leak-check tools
- Nut-plate adapters
- Anti-siphon vacuum-breaking check valves
- Composite tubing



Waste water subsystem



Lavatory fill vacuum break valve



Potable water pump



Center tank water drain valve



Waste drain valve



Lavatory rinse fill valve

FUEL SPECIALTY PRODUCTS

Reliable lightning protection equipment



Parker's Fluid Systems Division offers the most comprehensive line of safety-certified products for lightning, fire, and flammability. Our array of Lightning Safe® products has been designed to meet and often exceed the stringent lightning safety requirements of the aircraft industry. We are proud to have over 3,000 active, certified parts, including patented Lightning Safe® fuel caps and adapters.

Our technology is grounded on decades of proven on-wing time and includes:

- Fuel caps and mating adapters
- Anti-siphon adapters and fuel strainers
- Flame arrestors
- Sump drain valves
- Positive/negative pressure-relief valves
- Gravity fillers
- Lightning isolation/static-dissipation fuel tubes



Lightning-Safe® caps



Getting a charge out of composite aircraft

The increasing use of composite materials in aircraft design brings many advantages but also a key challenge: the need to address lightning strikes and their effect on this type of aircraft. Our lightning protection equipment powerfully dissipates the static charge caused by such strikes and other electrical conditions, thoroughly solving this critical problem.



Flame arrestor



Vent valve suction assembly



Pressure fuel servicing assembly



Dual flapper check valve



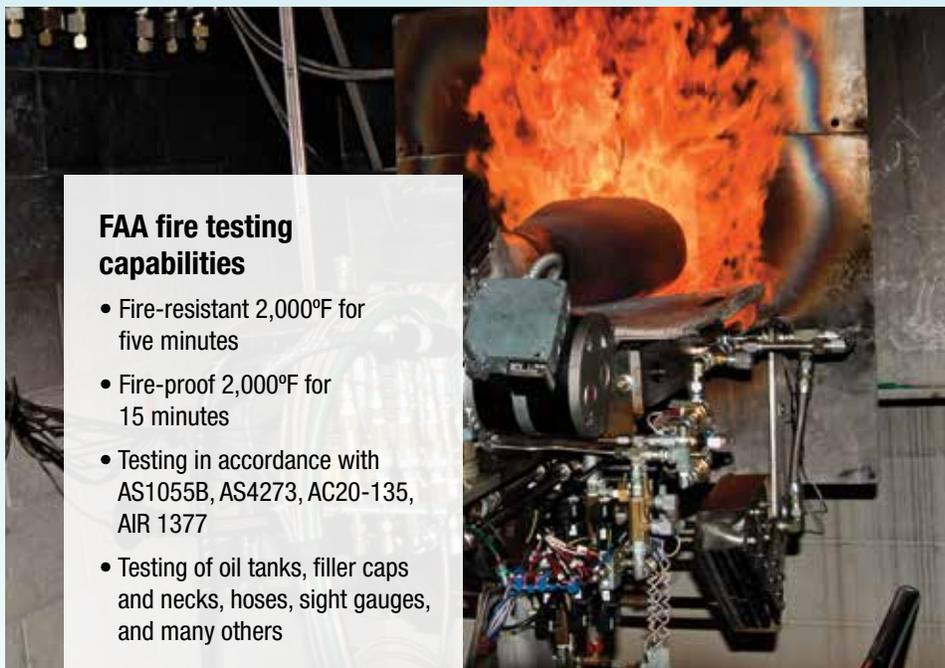
Cap and adapter with lock

Specialized on-site testing capabilities provide advanced protection

Lightning testing capabilities

- In-house, direct-effects lightning test facility meeting broad requirements:
 - MIL-STD-1757A
 - FAA AC-20-53A, RTCA
 - DO-160D, Sect. 23 ARP 5412
- Up to 200 kiloamperes oscillatory current waveform (components A, Ah, and D)
- Up to 3,000 amperes unipolar current waveform (component B)
- Photographic and explosive mixture ignition detection
- Over 2,500 mf at 5,000 volts
- Over 60 mf at 45,000 volts

FSD's lightweight, high-pressure isolator (or highly resistive union) provides lightning protection for the entire life of an aircraft, avoiding the risk of fire and serious safety incidents. It is the only long-life solution available on the market.



FAA fire testing capabilities

- Fire-resistant 2,000°F for five minutes
- Fire-proof 2,000°F for 15 minutes
- Testing in accordance with AS1055B, AS4273, AC20-135, AIR 1377
- Testing of oil tanks, filler caps and necks, hoses, sight gauges, and many others



Flame arrestor



Flame arrestor testing capabilities

The Fluid Systems Division was the first to address SFAR88 requirements with flame arrestor technology. Our facilities provide flame arrestor testing per AS1055B, AS4273, AC20-135, and AIR 1377. Our other flame arrestor tests include:

- Testing per AC 25-975
- Flame arrestor/flame holding
 - Vaporized hexane or jet fuel testing
 - Heated air/fuel mixtures up to 400°F (201°C)
 - Air and mixture flows over 10 scfm
 - Air flows up to 200 scfm
 - Data acquisition software that monitors and collects data requirements

Shining a light

The Fluid Systems Division's lightning test lab offers unique and specialized capabilities that can ensure our products deliver the ultimate in lightning protection.



OPERATIONS

Delivering on-time quality products that meet customer schedules



With six sites in North America, the Fluid Systems Division includes over 625,000 square feet of operational space.

At Parker Fluid Systems, our emphasis on operations flow is unparalleled. It is of critical importance to us, giving our customers the benefit of the highest productivity, line item yields, and optimized personal service.

Based on a practice of continuous improvement to provide 100 percent on-time delivery, we excel at all aspects of operations.

- Full in-house testing and assembly
- Production and delivery based on lean principles, implemented to build upon our existing operational efficiencies

- Consistent training of high-performance work teams, facilitating greater capacity
- Factory transformations that streamline material flow and expedite production and delivery
- Continued investment in the latest processes, tools, and testing equipment

Our operations teams work as one with our program management team to deliver quality products that consistently and reliably meet our customers' schedules.



Our technicians use a wide range of tools and resources to assemble and test components.



Andon lights within FSD facilities allow teams to monitor product flow throughout each day. Green lights indicate that all cells are operational and active.

The lean imperative

FSD continues to focus on lean practices, going beyond manufacturing to lean enterprise systems that have become a part of our culture. This translates to an overriding philosophy of being fastest to market, with the highest quality, the lowest cost, and the shortest value stream.

Lean events, held on the factory floor and in administrative offices, reduce inventories, lead times, turnaround and cycle times, and backlogs for increased productivity, faster and better customer service, and improved yield.

WORLDWIDE SUPPORT

A complete life-cycle partnership

When you select Parker's Fluid Systems Division for your program, we are committed to supporting you through its entire life cycle. Our stand-alone service organization, Customer Support Operations, is dedicated solely to providing our customers and the users of commercial and military aerospace products with premier service.

CSO service centers, specialized field service engineers, and product pools are strategically located throughout the globe to ensure rapid service and solutions. Our customer care center offers worry-free, one-stop service 24/7, worldwide.



Our broad maintenance, repair, and overhaul services are available for not only FSD products, but also those of other manufacturers as well.

Other benefits include:

- Cost-per-hour programs and fixed maintenance pricing that guarantee performance
- Global customer support, ranging from a sizeable distributor network to strategically placed service centers providing technical assistance 24/7
- An extensive performance database combined with our watchful eye to flag early or unusual problems in the field, which we then proactively address



At the ready, at your side

Our technical field representatives provide the support required to help operators boost dispatch reliability.



Parker's highly skilled repair technicians restore FSD equipment to new product performance standards.

- More frequent field engineering contact with customers, yielding measurably greater customer satisfaction

We also offer value-added services such as repairs, inventory management, rotatable exchanges, warranty administration, and technical publications.

Fluid Systems Division facilities



Irvine, California (Headquarters)



Elyria, Ohio



Hauppauge, New York



Naples, Florida



Tolleson, Arizona



Guaymas, Mexico