At Parker’s Control Systems Division (CSD), we know how important intelligent solutions can be. Our team can help you evaluate the technical and business options needed to engineer your success in the marketplace.

Parker CSD can provide:

* **Total system solutions** for more efficient design and integration that can lower development cost through single-point procurement
* **Advanced control electronics and actuation technology**, enhancing performance in demanding operating environments
* **Proven electrohydraulic, electromechanical, and electrohydraulic experience**, allowing us to provide the technology that best suits your application
* **Successful partnerships** with customers and suppliers, providing the cost advantages of a seamless supply chain
* **A broad range of engineering talent**, offering you optimal designs with the highest possible efficiency
* **Technology insertions**, improving the reliability of your current system by integrating the latest technology
* **Lifetime product support**, including innovative programs that share the risk and reduce life-cycle costs
A PROVEN SYSTEMS PEDIGREE

Our flight control experience extends across both military and commercial platforms, and embraces a wide range of industry-changing programs. Our roles within those programs have been equally varied. Whether functioning as a subcontractor, a recognized partner, or the contracted team leader, our experience has taught us how to identify and minimize risks effectively, create better solutions, and add value to both the product and the process.

**SUBCONTRACTOR**

**Actuation technologies**
- Hydromechanical
- Electrohydraulic
- Electromechanical
- Electrohydrostatic
- Electrical backup hydraulic

**Electronics expertise**
- Motor control
- Remote actuator control
- Centralized actuator control

**Applications**
- Primary flight controls
- Spoilers
- Speed brakes
- Control surface trim
- Horizontal stabilizer trim

**Full qualification testing and documentation**

**Programs:**
- Parker’s Control Systems Division is proud to provide a significant bill of material on most military and commercial aircraft flying today.

**TEAM LEADER**

Parker’s CSD is an experienced systems team leader. In that capacity, we have helped our customers through all critical development stages, including definition, implementation, integration, certification, and support. We have identified and managed subcontractors that support our high standards. And we have performed the following:

**Lead system architecture development**

**Lead system integration testing**

**Support failure hazard assessment development**

**Support certification plan development and approval**

**Programs:**
- Lockheed Martin F-35 Lightning II
- Bombardier Global Express
- Raytheon Hawker 4000
- AVIC I ARJ21

**PARTNER**

**Full integration of control electronics and actuation**

**Creation of simulation models and reports**

**Creation of system safety assessments**

**Verification and validation**
- Hardware
- Software

**Creation of sub-system requirements and architecture documents**

**Programs:**
- Embraer 170/190
- Bombardier Q400
- Boeing P-8A Poseidon

Working as a team leader, partner, or subcontractor, we have the experience to assume any level of responsibility.
Total System Solutions

A unique and proven seven-step process that results in improved integration efficiency, lower system design and development cost, and enhanced system performance.

At Parker’s Control Systems Division, our approach to motion control is systematic, going from idea to reality – and on through lifetime support – with a proven, seven-step process that facilitates in-depth understanding and performance at every level. It’s a process that allows us to provide the impeccable quality, reduced lead times, on-time delivery, and ongoing cost control our customers deserve and appreciate.

1. DEFINE
   - Joint development
   - Requirement discovery and allocation
   - System architecture and tradestudy
   - Physical and functional interface definition
   - System safety assessment

2. ENGINEER
   - System design
   - Modeling and simulation
   - Reliability and maintainability analysis
   - Risk reduction planning and prototyping
   - Performance analysis and specification

3. MANUFACTURE
   - Component design and development
   - Make vs. buy determination
   - Supply chain management
   - Lean manufacturing
   - Assembly and testing

4. INTEGRATE
   - Mechanical and electronic integration
   - Component design verification
   - Interface verification
   - System integration rig testing
   - Aircraft iron bird integration and ground test

5. CERTIFY
   - Flight test support
   - FAA/EASA/ANAC/TC Regulatory Agency support
   - Certification documentation support

6. DELIVER
   - Hardware
   - Certification documentation
   - Product support and technical publications
   - Maintenance and fault isolation training

7. SUPPORT
   - 24/7 AOG repair and overhaul
   - On-site and online training
   - Performance-based logistics
   - Cost-per-hour programs

IN FLIGHT CONTROL SYSTEMS

Every Option for Every Advantage

CSD can provide a wide range of system options for actuation and control electronics, including:

For Fixed Wing Aircraft:
- Horizontal stabilizer systems
- Rudder systems
- Flap systems
- Aileron systems
- Spoiler systems
- Elevator systems
- Slat systems
- Speed brake systems
- Stability augmentation systems
- Trim actuation systems
- Mechanical drive systems

For Rotorcraft:
- Main rotor actuation systems
- Tail rotor actuation systems
- Force augmentation systems
- Stability augmentation systems

For Launch Vehicles/Missiles:
- Fin control systems
- Thrust vector controls

With these options, CSD provides you with critical advantages such as:
- Improved integration efficiency
- Lower system design and development cost
- Improved system performance
Electrohydrostatic actuation (EHA) and electrical backup hydraulic actuation (EBHA) are power-by-wire systems that eliminate the need for central hydraulics. EHAS and EBHAs are self-contained hydraulic systems controlled by high-power electronics, which allows the use of traditional, proven hydraulic actuation configurations for fault tolerance. The product of two decades of research, development, and flight-tested reliability, Parker EHAS offer significant advantages:

- **Reduced system weight.** This is due to the elimination of hydraulic distribution systems.
- **Reduced power consumption.** Power is used as required, yielding a more efficient system.
- **Improved maintainability.** Hydraulic disconnections between actuation equipment and the vehicle system are eliminated.

**ELECTROHYDROSTATIC ACTUATION SYSTEMS**

Electrohydrostatic actuation (EHA) and electrical backup hydraulic actuation (EBHA) are power-by-wire systems that eliminate the need for central hydraulics. EHAS and EBHAs are self-contained hydraulic systems controlled by high-power electronics, which allows the use of traditional, proven hydraulic actuation configurations for fault tolerance.

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**Electrohydrostatic Actuation Systems**

Power-by-wire control that delivers less system weight, enhanced avionics integration, and reduced life-cycle costs.

**OUR PAST**

- **Boeing 757:** Developed and successfully demonstrated electrohydrostatic elevator actuator.
- **Lockheed Martin HTTB:** Demonstrated aileron EHA on C-130 test aircraft.
- **Lockheed Martin J/IST:** Replaced conventional F-16 flight controls with complete EHA system.

**OUR PRESENT**

- **Lockheed Martin F-35:** All primary flight control surfaces.
- **Gulfstream Advanced Flight Controls Demonstrator Aircraft:** Electrical backup hydraulic actuator (EBHA).

**OUR FUTURE**

- EHA and EBHA research and development efforts continue to maximize thermal management and power efficiency.

**SPIRITWORKS**

How do you capture the spirit of innovation?

At Parker’s Control Systems Division, the answer is SpiritWorks™, a multi-disciplinary team of engineers and technologists charged with reddefining the future of flight control. Focused on research and development, these innovative thinkers look at flight control and actuation in new ways. SpiritWorks is chartered to determine future technology directions and link CSD’s research and development projects to the needs of our customers.
ELECTROMECHANICAL ACTUATION SYSTEMS

Today’s marketplace demands unique and innovative applications for electromechanical actuation systems, and CSD continues to be part of the EMA revolution. Our emerging EMA technologies are leading the way in the manned and unmanned aircraft, missile, and launch vehicle markets.

By integrating our proven EMA pedigree with a strong team-based environment, we’ve created a customer-focused organization dedicated to technical innovation and continuous improvement at all levels of operation.

We combine building blocks of mechanical actuation and electronic controls into an integrated system. Our interdisciplinary approach includes electronic, mechanical, software, testing, and system integration. Our adaptable and scalable architecture results in system solutions that are both affordable and quick to deliver. Which is why we have been able to go from contract award to delivery of first hardware for some programs in under six months.

Our pedigree continues to grow

Today we continue to perfect our technology through programs like Lockheed Martin’s FALCON, RATTLRS, and Polecat, Embraer’s Phenom 100 and 300, and Boeing’s P-8A Poseidon.

There first with early EMA wins

The Standard Missile. The Advanced Cruise Missile. The Javelin. And the Pegasus Launch Vehicle. These early EMA wins were just the beginning. From the early seventies onward, our EMA innovation has earned us an increasing bill of material on a wide range of programs and platforms.

Access to the best in motor design

Our customers have access to the world’s most advanced motor design facilities through Parker’s Motor Design Center. This Parker center of excellence offers the capabilities needed to produce a working motor under even the most aggressive development schedules.

Proven Pedigree

- Boeing P-8A Poseidon
- Bombardier Global Express
- Bombardier Q400
- Embraer 170/190
- Embraer ERJ-145
- Embraer Phenom 100
- Embraer Phenom 300
- Gulfstream AFCS
- Gulfstream G200
- Lockheed Martin FALCON
- Lockheed Martin JASSM
- Lockheed Martin Polecat
- Lockheed Martin RATTLRS
- Orbital Science Corporation GMD
- Orbital Science Corporation Pegasus
- Orbital Science Corporation Minotaur
- Orbital Science Corporation Taurus
- Raytheon Tactical Tomahawk
- Raytheon/Lockheed Martin Javelin

Intelligent electronic and motor-driven actuation systems that offer efficient, light-weight, reliable, and low-cost solutions to reduce overall power consumption and program cost.
EMA Innovation

Whether in primary or backup mode, the world’s new aircraft are increasingly adopting electric flight control actuation – and Parker CSD is supporting the charge.

Our Pedigree

Traditionally, electrically powered actuation has been used to control the flaps, as well as the trim on the primary flight surfaces and horizontal stabilizers. Parker’s pedigree is well established, supplying all or some portion of the electrically powered actuation systems on Embraer’s ERJ 135/145, Phenom 100/300, and the Embraer 170/190.

Our Leadership

In addition, we have taken a leadership role with our system of electrohydraulic actuators (EHAs), used to power primary flight control surfaces on the F-35 Lightning II. Jointly developed with our teammates Moog and Hamilton Sundstrand, EHAs contribute significantly to performance improvements and weight reduction at the aircraft system level.

Our Commitment

As the more-electric trend continues, Parker is committed to staying at the forefront of the demand by making the necessary investment now to ensure our more-electric technology is production-ready when needed.

Electronic Control

Intelligent electronic controllers

At the center of every more-electric system is the electronic unit that provides intelligent command and control through closed-loop feedback networks. That’s why we’ve developed a family of adaptable, scalable controllers.

Technologies:

• DSP and FPGA digital microprocessors
• High- or low-power control
• Failure mode detection and internal BIT functions
• Prognostics and health monitoring
• Motor-drive electronics using four quadrant control space vector modulation and trapezoidal drives
• Active/active or active/standby designs to meet redundancy requirements
• High- and low-temperature capability
• Discrete and integrated power modules
• Regenerative energy management systems

Design standards:

• Mil-Std-1553, RS422/485, ARINC 429, IEEE 1394, and CAN communication and interface busses
• Mil-Std-461/DO-160 EMI filtering and protection
• Software for RTCA DO-178B, levels A through C
• Hardware/firmware for RTCA DO-254 levels A through C

More EMA options

Whatever your EMA needs, Parker Control Systems can meet them. Our wide range of applications allows us to create systems that are Mil-standard compliant and FAA certifiable. We design and develop highly efficient linear and rotary actuation for primary and secondary control applications. Our pedigree allows us to scale our qualified designs to meet a variety of power requirements ranging from 0.25 Hp to 50 Hp.

Optional features include:

• Patented jam-tolerant designs
• Robust control electronics
• High-temperature applications for harsh environments
• Torque-summed or velocity-summed configurations
• DC brushless, AC induction, and switch reluctance motors
• Resolvers for motor-position feedback
• Position and velocity sensors

Gulfstream AFC motor-control electronics

Horizontal stabilizer trim actuation system

Adaptable high-horsepower linear actuator

F-35 flap rotary actuator

Gulfstream remote electronic unit

INNOVATION IN ACTION
For over five decades, Parker innovation has provided customers around the world with advanced flight control actuation systems for commercial and military aircraft. Our control actuation technology for primary and secondary flight control systems provides proven high reliability and fault-tolerant performance. Our flight control systems offer precise position control through mechanical, electrohydraulic, linear, and rotary actuation solutions that are optimized for system performance.

Our hydromechanical and fly-by-wire components and systems are the products of advanced material selection and efficient system packaging to provide you with the following advantages:

- Proven fault-tolerant and fail-safe design configurations
- Improved reliability through innovations in sealing and coating technologies
- Robust and reliable Jet-Pipe® EHSV and direct drive valve technology for precision motion control
- Dedication to low-cost solutions through lean manufacturing and processes
- Battle-tested ballistic tolerant designs
- Light-weight design solutions

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ELECTROHYDRAULIC SERVOVALVES (EHSV®)

Highly Respected Jet-Pipe® Technology

Parker CSD is proud to design, develop, and manufacture the highly reliable Jet-Pipe®-based EHSV®s.

All of Parker’s servovalves provide unparalleled performance due to their highly reliable Jet-Pipe® first-stage and second-stage spool design. The result is an exceptionally stable, contamination-resistant, and erosion-tolerant servovalve that’s designed to last.

Our EHSV applications can be found on both commercial and military aircraft in primary and secondary flight control actuators, main gear and nosewheel steering systems, and autobrake modules. Currently Parker EHSV®s are in production or qualified for use on most military and commercial aircraft being produced today. We also manufacture a line of EHSV®s for the industrial power generation marketplace that includes FM- and CE-certified valves.

Proven Pedigree

- Airbus A380
- AVIC I ARJ21
- Bell Boeing V-22
- Boeing 737
- Boeing 747
- Boeing 777
- Boeing AH-64
- Boeing C-17
- Boeing F-15
- Boeing F/A-18E/F
- General Electric 404/414
- Gulfstream G550
- Lockheed Martin F-16
- Lockheed Martin F-22
- Northrop Grumman X-47
- Pratt & Whitney F119
- Raytheon Hawker 4000
- Rolls-Royce LiftFan™
- Sikorsky H-60
- Sikorsky S-92

Gulfstream G550 rudder flight control actuator
Boeing 777 rudder power control unit
C-17 rudder control module
F-22 fly-by-wire horizontal tail actuator
F119 divergent nozzle actuator
Hawker 4000 rudder actuator
The CSD difference
No matter what site you work with at CSD, our team members are committed to engineering your success through:
- Unparalleled teamwork
- Strong program management
- Innovative technical solutions
- Operational excellence
- Creative problem-solving
- Off-the-shelf solutions
- Lean processes and continuous improvement
- Risk-sharing partnerships
- Lifetime product support

Whether you’ve come to us for the design, development, testing, and manufacture of subcomponents, assemblies, or systems, you can count on Parker CSD to offer you the intelligent solutions you need in today’s competitive marketplace.

INTELLIGENT SOLUTIONS TIMES THREE

Three sites – one great team
Headquartered in Irvine, California, Parker’s Control Systems Division is organized to enhance synergy between our three sites and maximize flexibility to solve your most difficult technical challenges. Together our three manufacturing facilities employ more than 1,500 people dedicated to meeting your needs and providing quality products on time.

Our team members in Dublin, Georgia, Ogden, Utah, and Irvine, California, are dedicated to providing premier service to our customers through components, systems, or engineering services.

Teaming at CSD promotes creativity, maximizes quality, and speeds time to market.

Lifetime product support. Parker field service engineers provide worldwide technical support and training on a 24/7 basis.

Innovative technical solutions. The TEC develops the actuation innovations you want with the low cost of ownership you need. Our TEC team includes a multi-disciplinary workforce of talented mechanical, electrical, and systems engineers complemented by:
- Experienced designers, modelers, drafters, and writers
- Analysts skilled in such areas as stress, thermal, dynamic modeling, and reliability
- A qualification lab with environmental testing capabilities
- A systems integration lab
- Advanced testing equipment and consoles
- An engineering model shop for rapid prototyping
- SpiritWorks for research and development support

In addition, regular online and in-house education programs through Parker Engineering University, and partnerships with local universities in all three CSD locations encourage continuous learning and knowledge-based engineering. The end result is a flexible, collaborative, technically superb organization with the skills, experience, and drive to push the performance envelope.

Cellular manufacturing streamlines operations and achieves one-piece flow by allowing team members to complete multiple operations.

Strategic partnerships. We build relationships with our customers and key suppliers to ensure long-term, risk-sharing partnerships.

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The CSD Technology and Engineering Center
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Whether manned or unmanned, in the air, on land, or at sea, Parker’s Control Systems Division offers you a full range of options that can be used to your advantage. If you’re looking for systems, or advanced control electronics and actuation technology, we have the experience to create the intelligent solutions you need.

As part of Parker Hannifin and the Parker Aerospace Group, we’re able to draw upon the resources of the Corporation to engineer your success and ensure that our solutions give you the competitive edge.

Working with Parker CSD can be a sizeable advantage. If it’s one you’re interested in pursuing, please contact us.