**Team Experience**

**MAGNETICS:**
- Custom innovative actuators and sensors
- MEMS actuators
- Navy aircraft launcher and arrestor
- Maglev high-speed trains & rocket sleds
- Minesweeper and submarine cloaking
- Permanent magnet machine signature analysis
- Electromagnetic spacecraft launcher
- Magnetic motor resolvers

**MECHANICAL and ROBOTIC SYSTEMS:**
- Man/machine force feedback interfaces
- Zero backlash 2 DOF joints
- Active and passive noise cancellation systems
- Active center of mass controls
- Proprietary automotive system development
- Robotic drive and transmission systems for multi-DOF control

**ELECTRONIC SYSTEMS:**
- Voltage- and Current-mode controllers
- 350 HP motor controllers
- Distributed control and power systems
- Commercial switching devices
- Electric vehicle components
- Microprocessor programming for intelligent peripherals
- Electronic control systems for haptics

**We are innovation experts**

Engineering Matters has helped our clients develop:
- Force feedback devices
- Microcontroller systems
- Sensors & robotics systems
- Electromagnetic devices from MEMS to Maglev
- Motor/generators and electromagnetic drives
- Electronics for motor control
- Electromagnetic signature reduction systems

**Birth of a Joystick**

The Engineering Matters Force Feedback Joystick was developed under contract to the US Air Force. During pilot training and studies, subjects are required to make high-force maneuvers in a simulator. Existing low-force joysticks which use pulleys and cables, were constantly breaking down and interrupting the training and studies. The Air Force defined a need for a high-force, high-reliability joystick. Engineering Matters’ solution was selected as the best from a field of contenders. We have continued to develop the joystick system, making it suitable for many applications.

**Call:** 617-965-8974  
**Toll Free:** 877-202-2246  
**Email:** info@engineeringmatters.com  
**Visit our website:** www.engineeringmatters.com

Engineering Matters is a registered trademark and “Experience The Joy!” is a trademark of Engineering Matters, Inc.
Force Feedback Joystick:
High Performance, Rugged, 2-DOF

**Experience the Joy!™**

**TECHNICAL SPECIFICATIONS**

- **2 Degrees of Freedom:** ±30° each DOF
- **Long Life**
  - Extremely Rugged - One moving part
  - Hardened chrome steel ball bearings
- **Direct Drive**
  - No mechanical transmission system
  - Brushless permanent magnet motor
- **Force Feedback**
  - Very powerful
  - High torque (up to 20 ft-lbs.)
  - Rare Earth magnets
- **High Response & Sensitivity**
  - Frequency response (up to 1 kHz)
  - 0.06° sensitivity
- **Microprocessor Control**
  - Host control via RS-232
  - Java GUI available
- **Operating Environment**
  - Mechanics temp. range –50 to +125°C
  - Electronics temp. range 0 to +85°C
  - Humidity (100% saturated)
- **Power Supply**
  - 120 V AC
  - 1.5 hp motor
  - Off-line MOSFET SMPS
  - Low voltage handle (5 V)
- **Physical**
  - 55 lbs
  - 9.5 inches diameter x 6.5 inches high (exclusive of handle)
- **Other Information**
  - US Patent #6,320,284; other patents pending.
  - 0 thru 3 button-handles available
  - Safety hand sensor (“kill-switch”)
  - Ergonomic hand grip
  - Opt. strain gauge instrumentation

**Applications:**

- Aviation
- Automotive
- Entertainment
- Industrial/Construction/Agriculture machine control
- Healthcare
- Telemedicine
- Teleoperation (ROV control)
- Hazardous Environmental Cleanup
- Nuclear Facility Maintenance & Operation
- Robotics

There are many other applications, limited only by your imagination. The configuration and behavior of our joystick can be changed to fit nearly any application - Virtual environments, Human-Machine interface, Exoskeletons... etc. If you can think it, Engineering Matters can create it!