AMFitzgerald develops innovative MEMS and sensor solutions for specialty applications.

We collaborate with our customers to create high value products enabled by customized micro-technology.

With integrity, expertise, and attention to detail, we deliver what has never been done before.
Company background

• Top MEMS product development firm in the USA

• Founded 2003 by Alissa M. Fitzgerald, privately held

• Locations:
  – Office: Burlingame, CA, near SFO and Silicon Valley
  – Fab: 15,000 sq. ft. fab at UC Berkeley

• Over 160 clients served to date: startups to Fortune 100 companies

• Customers and suppliers around the world
Our work is at the leading edge in many markets

**Typical Revenue Breakdown, by Market**

- **Industrial & Scientific**: 20%
  - Atomic clocks, commercial print heads, quantum computers
  - Fiber optic networking, laser system components, infrared detectors

- **Medical (Devices, Biotechnology & Diagnostics)**: 28%

- **Consumer**: 14%
  - Microphones, pollution detectors

- **Aerospace**: 12%
  - Aircraft, spacecraft sensors

- **Cardiology**: guidewires, pacemakers, pumps; diagnostic chips
AM Fitzgeral’s role in MEMS technology development

NASA Technology Readiness Level (TRL)

In MEMS, where the work is done

Production Foundry, Assy/Test House

AM Fitzgeral bridges the development gap: TRL 3-7 “translational engineering”

Universities Research Labs

Source: NASA KSC
MEMS Innovation Services
Novel designs and IP creation

LWIR Bolometer Pixel Array, MEMS fabricated over CMOS
Designed and fabricated by AMFitzgerald
Innovation: examples of our work
Full development services from concept to production

- Advantages of working with us:
  - Multi-disciplinary, expert engineering team focused on MEMS development for volume production
  - Rapid prototyping on state-of-the-art tools common to foundries
  - Own all the design and process IP
  - Bring a mature, de-risked design to the foundry to get better pricing and faster time to production
MEMS core competencies

• Transducer physics
  – Piezoresistors, piezoelectrics, capacitive, magnetic, thermal, resonant

• Sensor types
  – Motion, pressure, acoustic, infrared, magnetic, radiation, resonators, chemical, gas, particles

• Actuator types
  – Motors, switches, valves, pumps

• MEMS fabrication expertise:
  – Mask layout
  – Full multiphysics simulation
  – Process integration and all fabrication processes
  – Design for manufacture

ANSYS Multiphysics simulation saves money and time in the fab

In-house prototyping by our expert engineers
Our innovation process: phased development

**Strategy, Feasibility “What to Build”**
- First, we study the competitor and patent landscapes to create a strategy for innovating your product. Then we develop concept designs and check their feasibility using basic calculations.

**Design, Analyze, Plan “How to Build”**
- We always begin design work with a plan for manufacturing in mind. Using 3D multiphysics simulation and fab short loops, we test and validate our designs before attempting a full prototype.

**Prototyping and Iteration “Build”**
- Our expert MEMS engineers fabricate advanced prototypes efficiently, while harvesting valuable process and design data in order to build your IP portfolio and inform future designs.

**Transfer to Manufacturing “Build in Volume”**
- With an advanced, debugged prototype, whose IP you own, you’ll get the best offers from foundries. We’ll tailor a supply chain for your specific business and technical needs and shepherd your product through manufacturing ramp-up.

*Client owns all work product*
MEMS Solutions Services
Paths to manufacturing and market
Integrated MEMS sensor solutions

Using a sensor designed by us or by others, we deliver the data you need.

Elements of an integrated sensor solution
MEMS-enabled medical solutions

• Pressure sensor integration for invasive medical applications
• Lead attach, catheter, guidewire, encapsulation
• ISO-13485 contract manufacturing with our partner, Millar
• Sensor testing

Source: Millar OEM
RocketMEMS®: Semi-custom sensors for OEMs

- Leverage existing AMFitzgerald sensor designs for faster time to market
- ISO-certified foundry production
- Pressure sensors available now
  - More sensor types in future

RocketMEMS® engagement process:

1. Customer provides desired sensor specification
2. AMFitzgerald tailors reference design to meet customer’s spec
3. Silex (SE) manufactures wafers
4. AMFitzgerald tests and delivers sensors to customer
Custom MEMS production solutions

We transfer to the optimal foundry partner(s) for your technology and business needs

- Custom design, low volume
- Custom design, high volume
- Fast time to market with foundry-specific design
- Faster time to market with semi-custom sensors

Open search for foundry partner

Process flexibility

Speed to market
Our global ecosystem of trusted partners

As capable as a vertically integrated company, with the efficiency of a small team
Technology Strategy Services
Key insights from MEMS experts
Technology strategy services

- Competitive intelligence
- Make vs. buy analysis
- Patent landscaping
- Operations & management consulting
- Workshops
Customer success stories

**LAWRENCE LIVERMORE NATIONAL LABORATORY**
We have been working with LLNL to develop a novel three-axis micro-mirror with tip, tilt, and piston capability since 2011. The mirror is being developed for high-performance adaptive optics applications such as LIDAR and maskless lithography.

**INTERNATIONAL MEDICAL DEVICE COMPANY**
We designed a custom MEMS single-axis accelerometer for a cardiac pacemaker application, leveraging a motion sensor platform technology. Sensors were fabricated by a high volume foundry on 200 mm wafers.

**POLYOPTIC TECHNOLOGIES, INC.**
We designed two custom in-plane electrostatic switches, one having linear drive and the other rotary drive, for a micro fiber optical switching application.

**PUBLIC SEMICONDUCTOR FOUNDRY**
We helped a foundry expand its core CMOS foundry business to MEMS, by conducted a gap analysis of their existing tool set and identifying new tools needed to capture strategic MEMS customers.
Public client list (partial)

Startups and Small-Medium Businesses:
- Aclima
- Advanced Diamond Technologies
- Bay Materials LLC
- Edge Embossing LLC
- Endotronix
- Fluxion Biosciences
- Ascendance (fka Hepregen)
- Microfabrica
- Micralyne
- NovaSpectra
- SemQuest
- Silicon Light Machines
- Silicon Microstructures
- Tactus Technologies
- Wave 80 Biosciences
- Yole Développement

Public Companies:
- Agilent Technologies
- Applied Materials
- Caliper LifeSciences
- Cypress Semiconductor
- Finisar
- Maxim Integrated
- Measurement Specialties
- Micrel
- Mirion
- Panasonic ACOM-TC
- Sorin Biomedica
- Symmetricom (now part of Microsemi)
- Ricoh Innovations

Research Institutions:
- Alfred E. Mann Foundation
- DARPA
- MIT
- Stanford University
- Stowers Institute
- UCSF, Ophthalmology
- Weill Medical College of Cornell Univ.
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