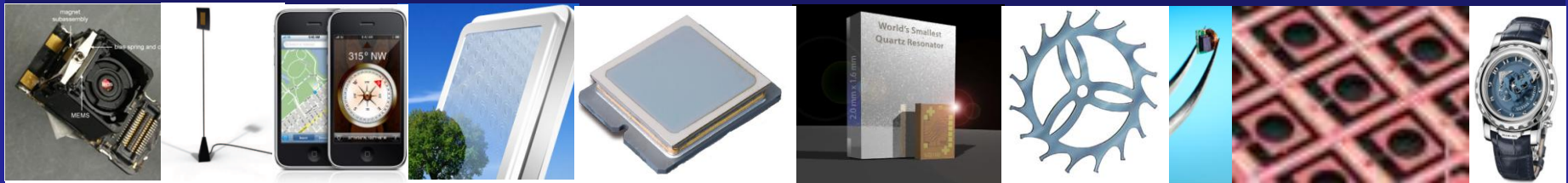


# MEMS Market Overview

## *Future Growth Areas*

MicroTech Anaheim June 2010

*Jeff Perkins: perkins@yole.fr*



YOLE DÉVELOPPEMENT

# Yole Développement

- **Yole Développement is a market research and strategy consulting company, founded in 1998 with headquarters in Lyon, France.**
- **Our fields of competence include:**
  - MEMS
  - Microfluidics
  - Compound Semiconductor (SiC, GaN, AlN, ZnO)  
LED & HB LED, RF devices
  - Power electronics
  - Advanced Packaging (3D IC, TSV, SoC, WLP)
  - Photovoltaic
  - Nanomaterials
- **Our market research is performed by in-house personnel conducting open-ended discussion based interviews.**
  - 20 full time analysts with technical and marketing degrees
  - Primary research includes over 2,500 interviews annually
- **We have a global customer base and a global view.**

# Yole Développement

## *What we do...*

### **Yole Media & Communication**

- *Free newsletters, news portal, webinars and briefings*
- *Providing information to tens of thousands of users worldwide.*

### **Publication of Market & Technology Reports**

- *20-25 reports published each year*
- *Timely topics selected by our analysts, rich in technical detail, extensive in scope, in graphic format.*

### **Market & Technology Consulting Services**

- *Custom research, analysis and evaluation*
- *We help you quantify & qualify markets, evaluate & understand technologies, develop strategies, discover opportunities and solve challenges.*

# MEMS MARKET EVOLUTION

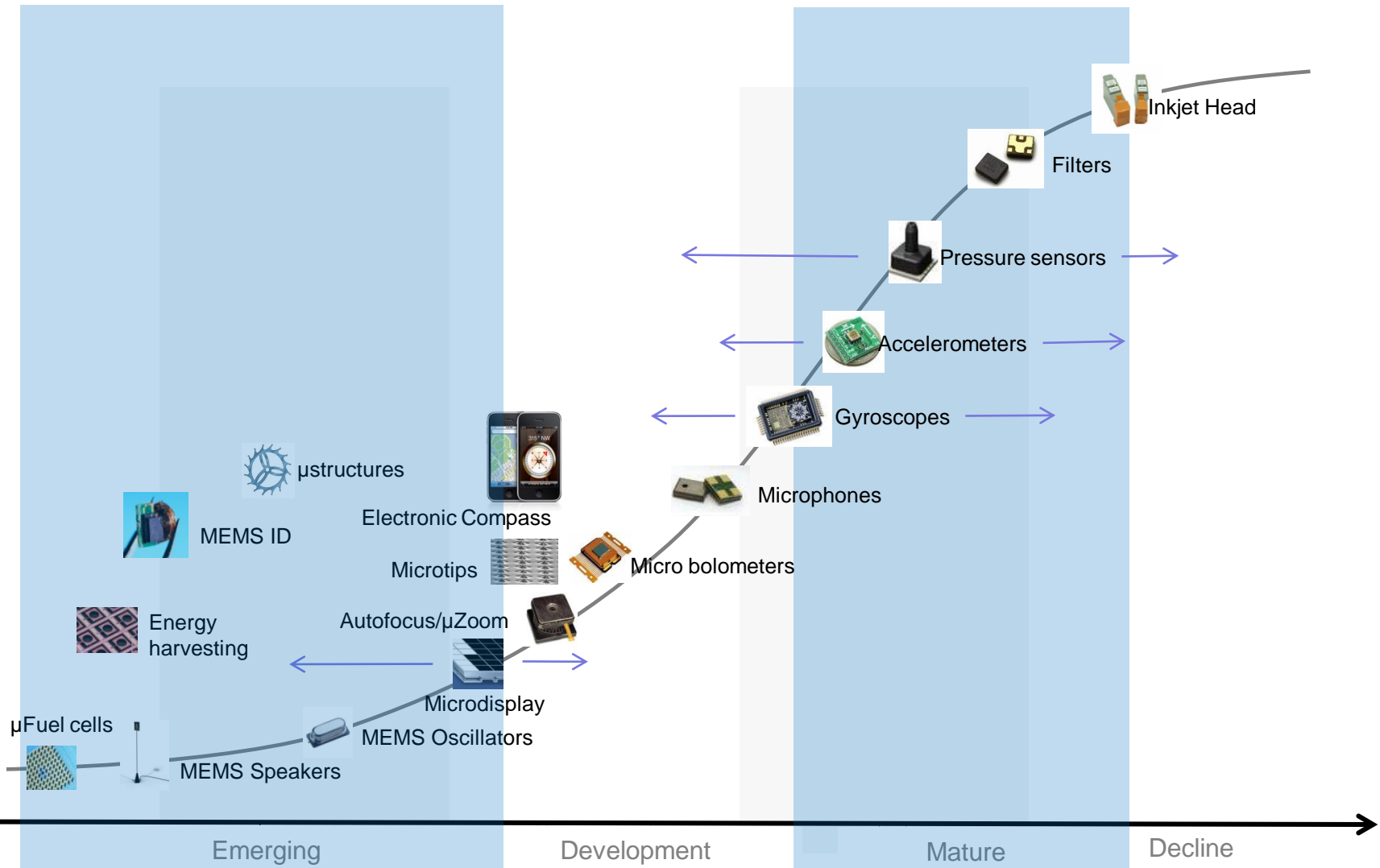
# A MEMS Primer

- **Micro-Electro Mechanical Systems = MEMS**
  - Closely related to Integrated Circuits
- **When I say “MEMS” it means MEMS Device**
  - The device is critical to systems, but we exclude system value
- **MEMS deliver mission critical, value adding functionality**
  - MEMS devices are ubiquitous and touch our lives every day
- **MEMS is a highly fragmented market**
  - Few applications have a market size above \$200M
- **Manufacturing tends to be unique**
  - There are no “standards” like you will find in CMOS
  - The MEMS law “One product, one process, one package” rules
  - MEMS packaging is clearly an “added value step”

# MEMS Primer Cont...

- **Development of new MEMS applications is taking fewer years to be commercialized**
  - Earliest products like DLP took over a decade and hundreds of millions of dollars from first developments to first product
  - Latest products
    - Best case 4 years, average \$45M... and 3 to 4 CEOs...
- **The industry is in transition from companies with their own MEMS fabs to use of external foundries**
- **8'' manufacturing infrastructure is needed for companies targeting consumer electronics**
  - The MEMS manufacturers not involved in consumer electronics are facing a very strong risk to lose competitiveness

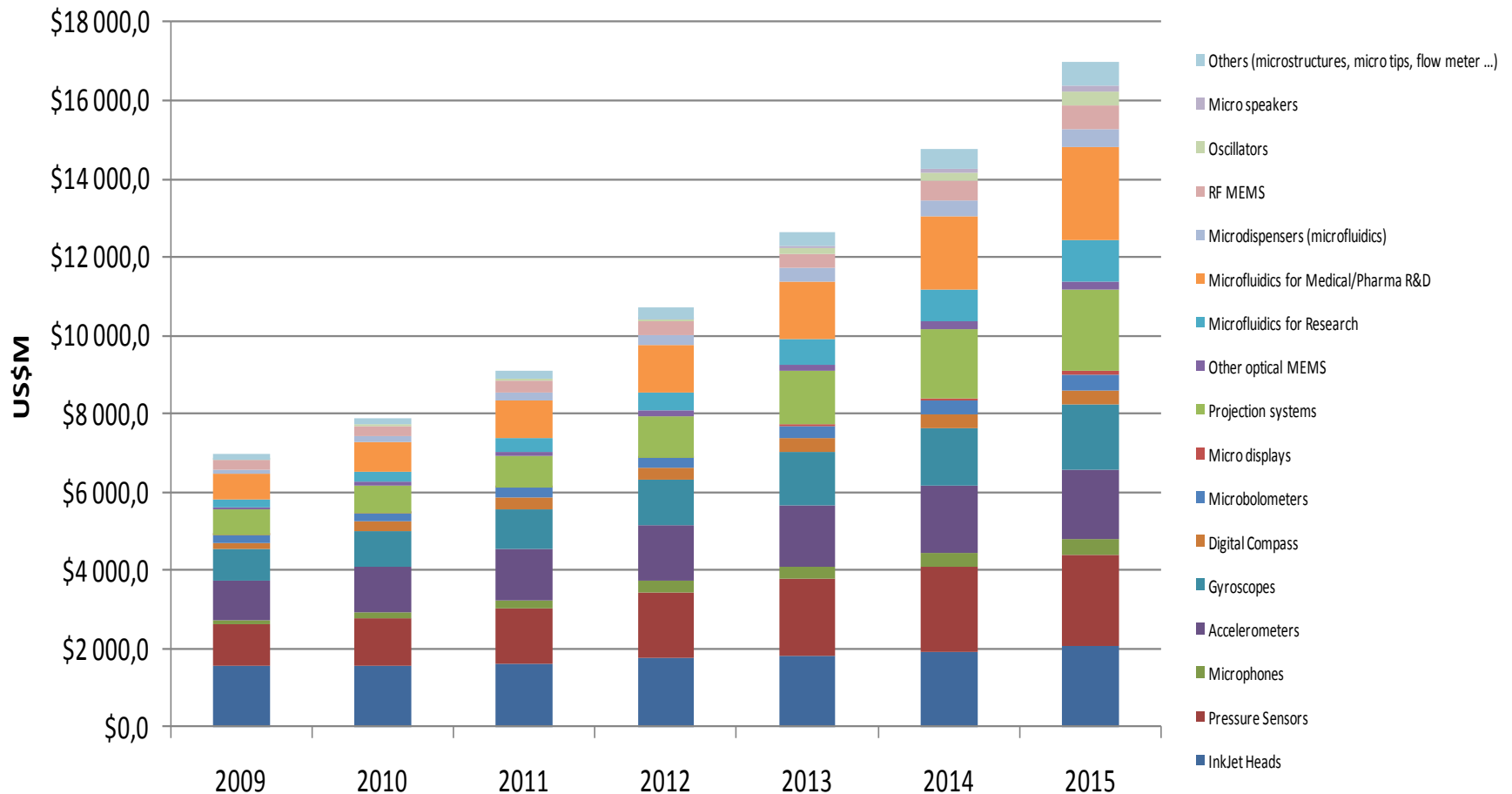
# MEMS Product Evolution



# MEMS Market Forecast

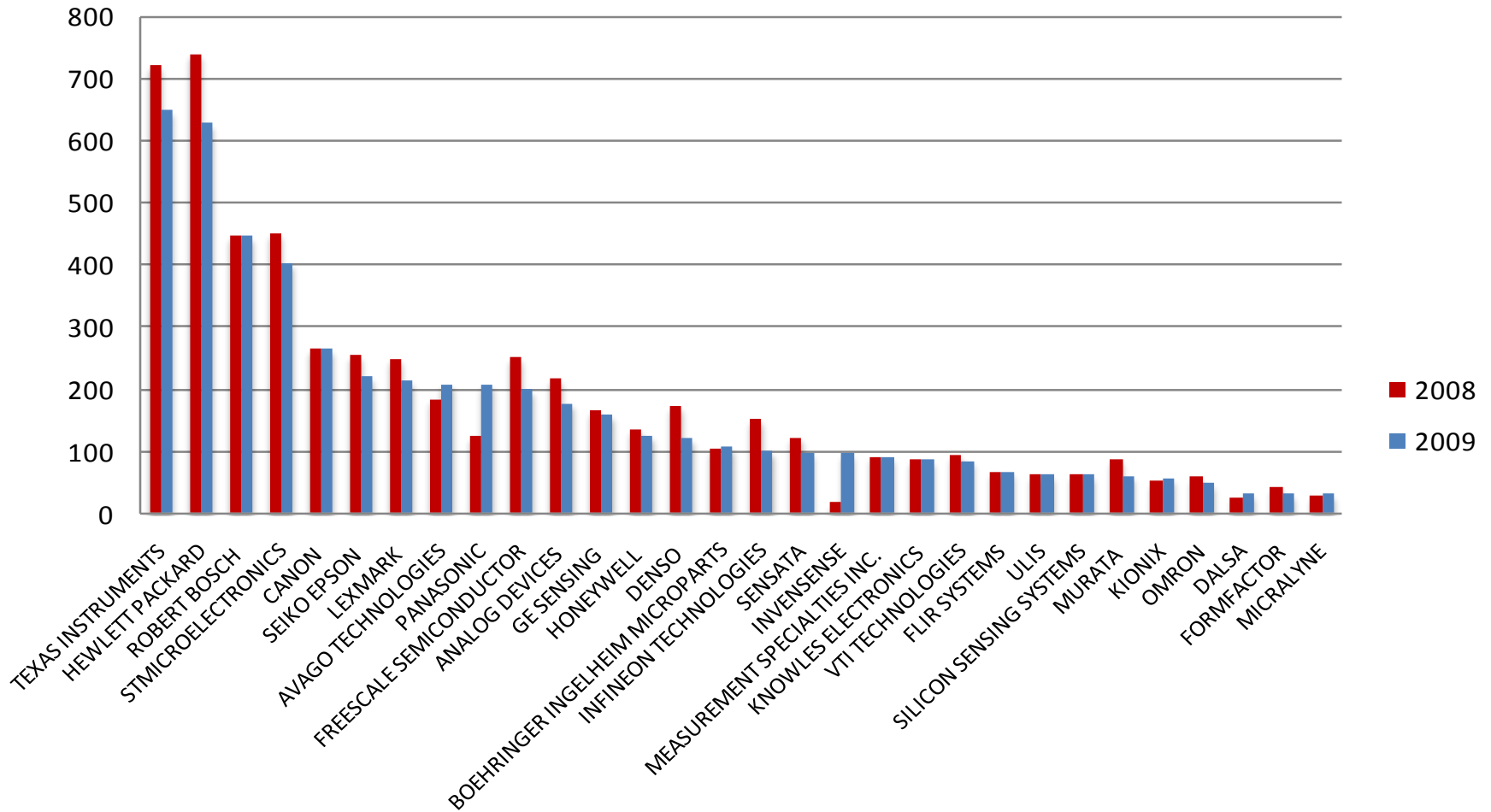
released May 2010

## MEMS Device Value \$M by Application



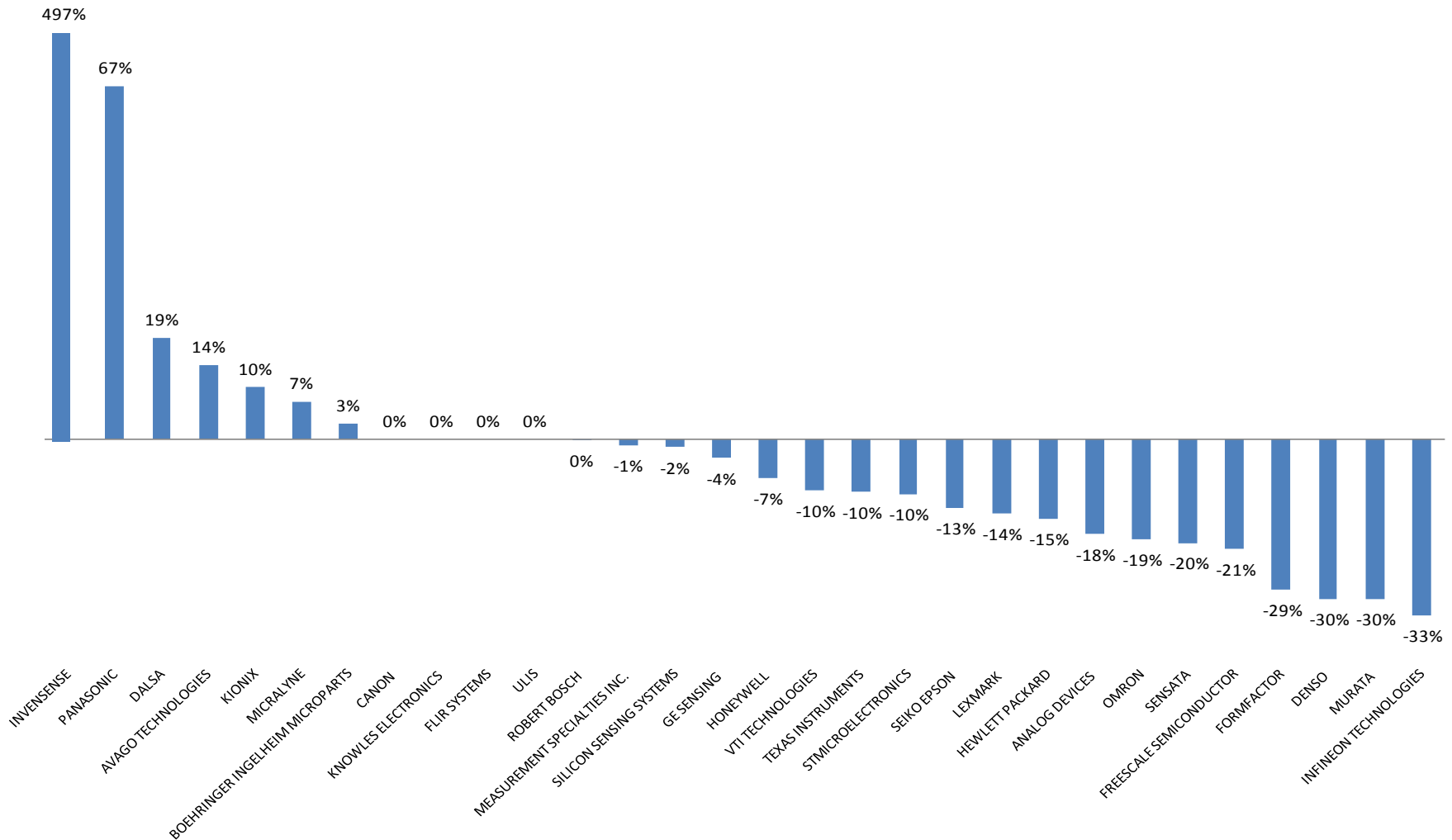
# 2009 MEMS Ranking

## TOP 30 MEMS Company ranking 2009 - 2008



# Annual Growth Rate 2009 / 2008

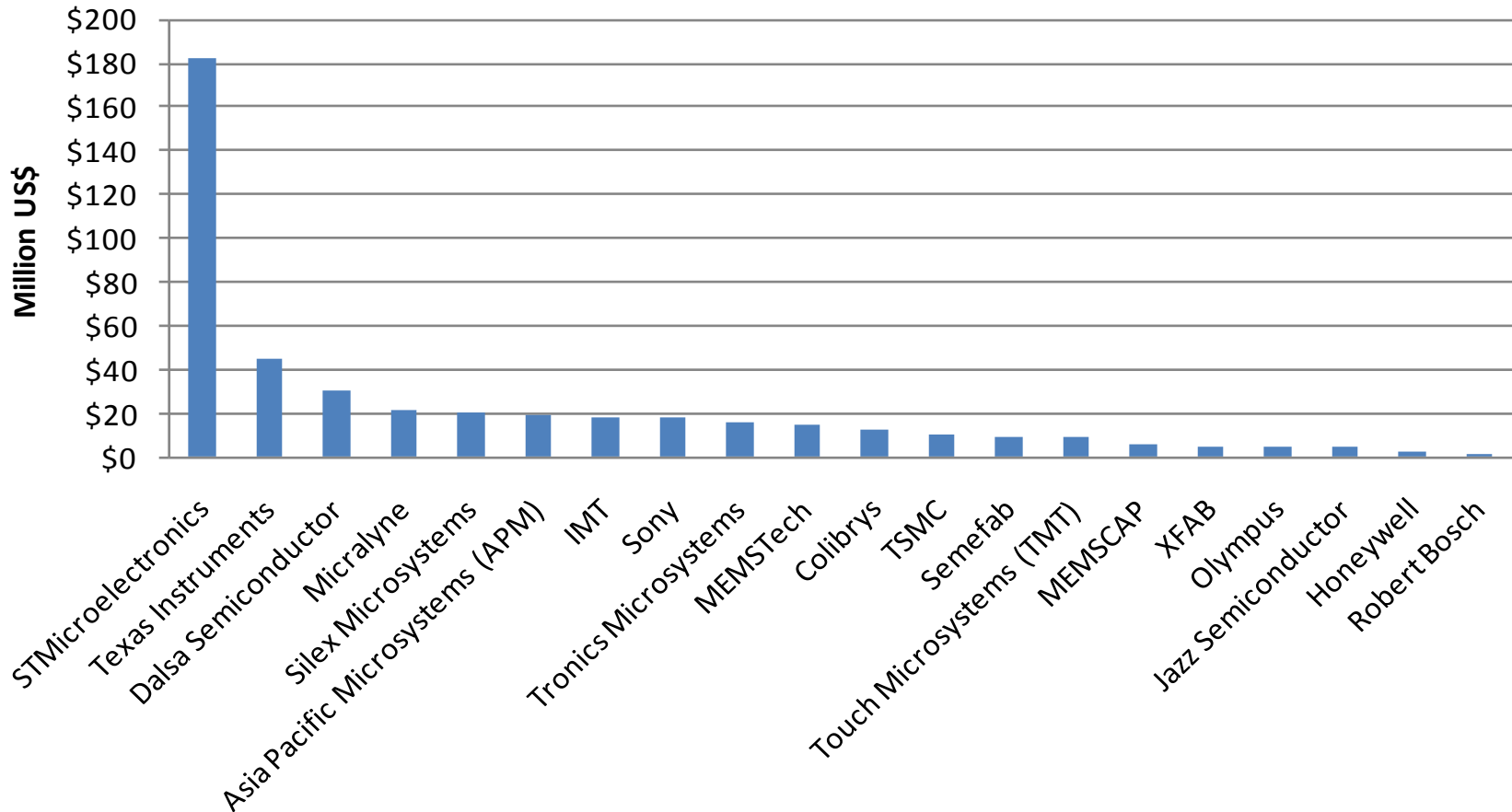
Annual growth rate 2009/2008 (on USD basis)



# MEMS FOUNDRY MARKET

# TOP 20 MEMS Foundries 2009

## TOP 20 MEMS Foundries - 2009 revenues

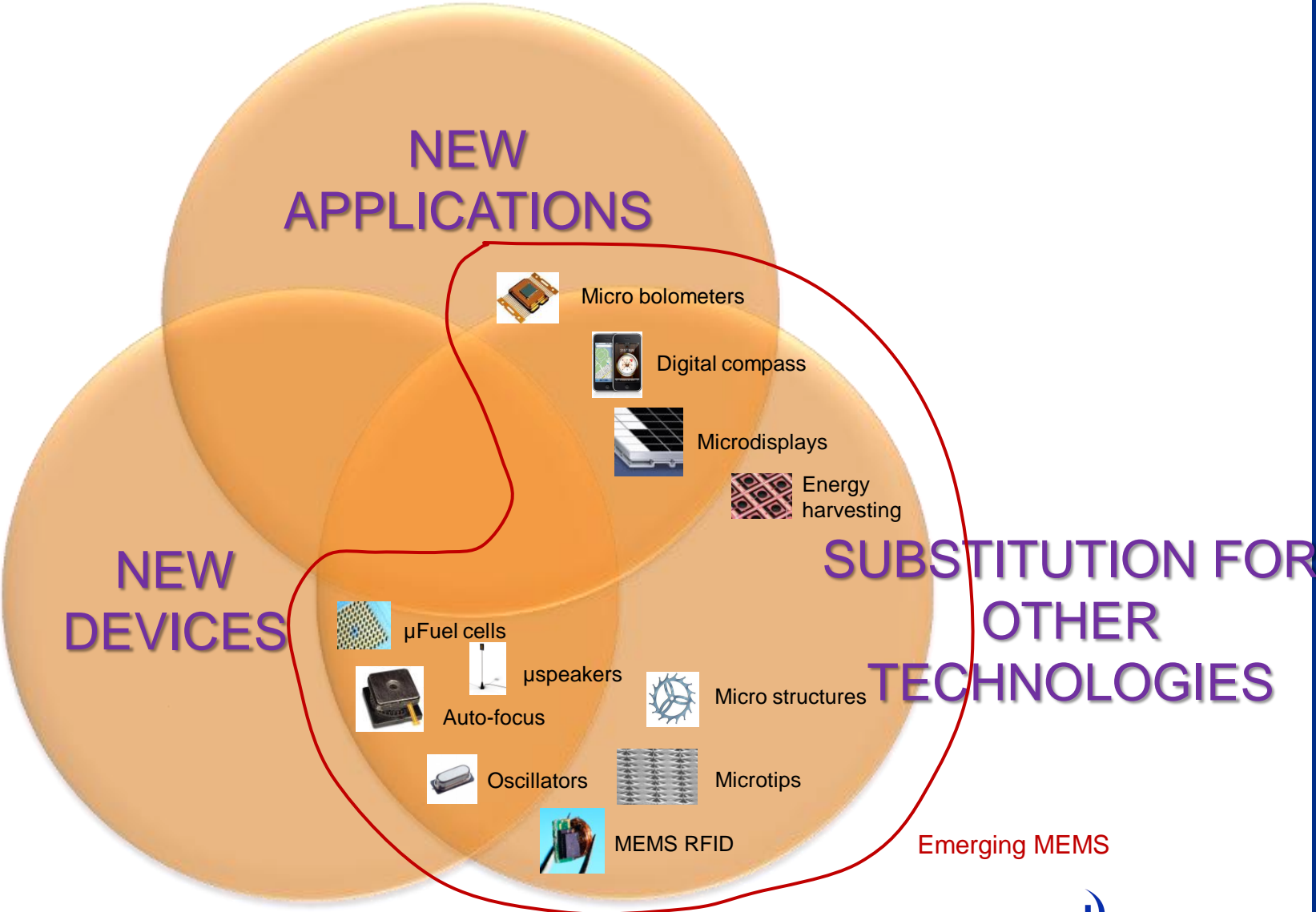


# EMERGING MEMS APPLICATIONS

# Innovation in MEMS has changed

- **To understand the evolution of MEMS markets we need to understand the source of innovation**
- **Few new functions are proposed by MEMS:**
  - **The functions being delivered today result from old developments: energy harvesting, oscillators, speakers, micro-motors, autofocus, micro fuel cells... have been around more than 10 years.**
- **Innovation is coming from the usage of the existing devices... and new ways to package and integrate the devices in systems**
- **All the important successes in the MEMS industry the past 5 years are linked to these 2 innovations paths: usage and packaging**
  - **The success of ST with accelerometers is linked to usage of well known accelerometer**
  - **The success of InvenSense is linked to packaging innovation**
  - **The success of the silicon microphone is linked to the packaging innovation**
  - **The success of pico projector is link both to a new usage and packaging**

# Emerging MEMS

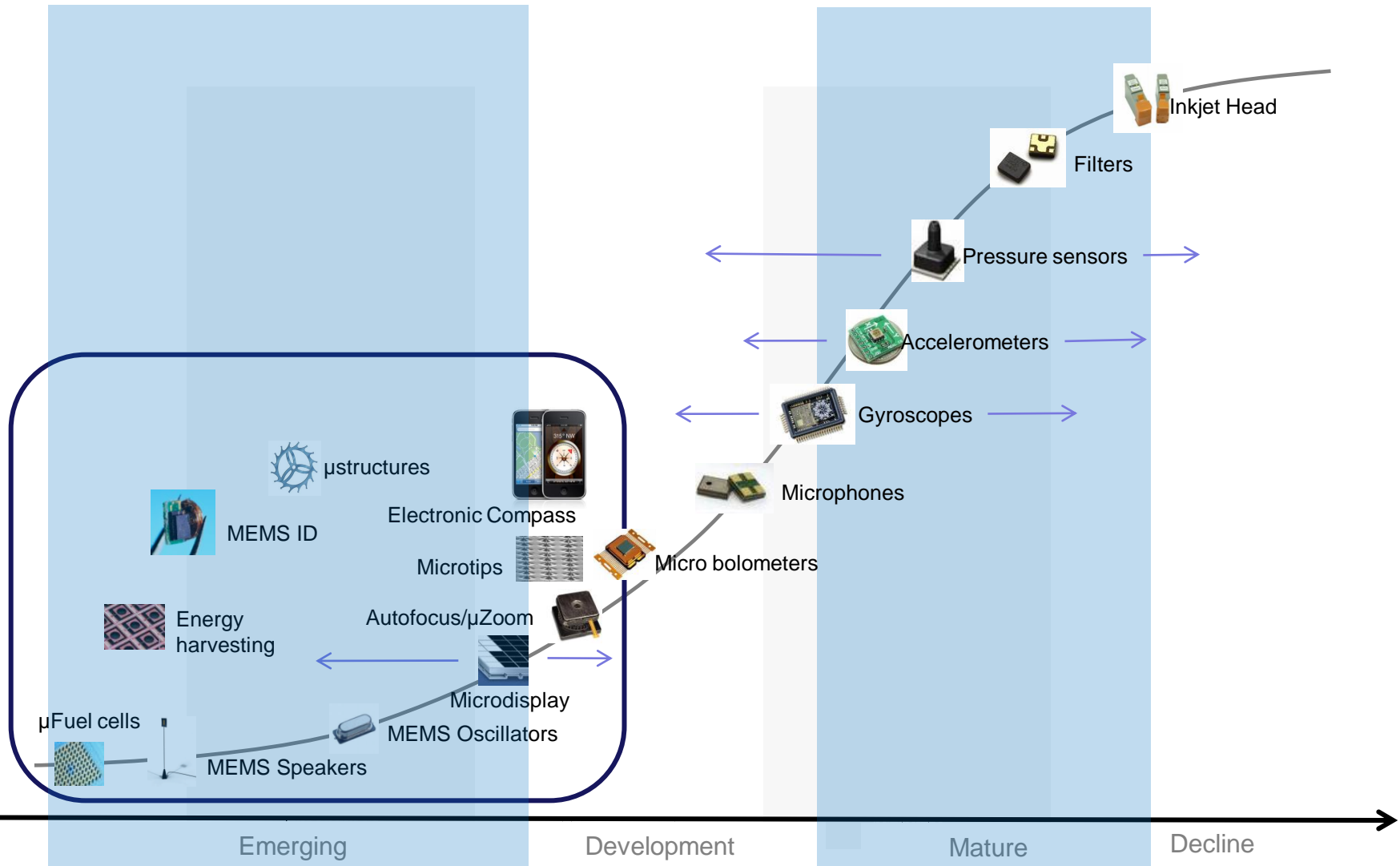


Emerging MEMS

# Emerging MEMS

- **Auto focus:**
  - System relying on one or more sensors to determine correct focus. MEMS used provides high precision control of a moving lens barrel to provide auto focus functionality.
- **Energy harvesting (or “energy scavenging”):**
  - Process by which energy of the environment is captured and stored
- **Magnetometer (“electronic compass”):**
  - Scientific instrument used to measure the strength and/or direction of the magnetic field
- **MEMS RFID:**
  - Wireless communication system that stores data about items allows information to be extracted using radio waves.
- **MEMS speakers:**
  - Electroacoustic transducer that converts an electrical signal into sound.
- **Microbolometers:**
  - Microbolometer is an uncooled - low cost - thermal sensor. A microbolometer consists of an array of pixels, each pixel being made up of several layers.
- **Micro displays:**
  - Display screens for portable applications (cell phones).
- **Micro fuel cells:**
  - A micro fuel cell is a portable power source for low power electronic devices that converts chemical energy into useable electrical energy
- **Microstructures:**
  - Micro components (gears, spring, anchor) used in mechanical watches and made with MEMS micromachining technologies (DRIE, UV-LIGA).
- **Micro tips:**
  - The end of a pointed object attached to a surface or a cantilever.
- **Oscillators:**
  - Electronic circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency

# MEMS Product Evolution

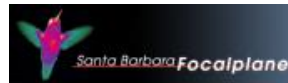


# Startups Continue to Drive Emergence

New companies developing emerging MEMS devices



FAUN INFRARED

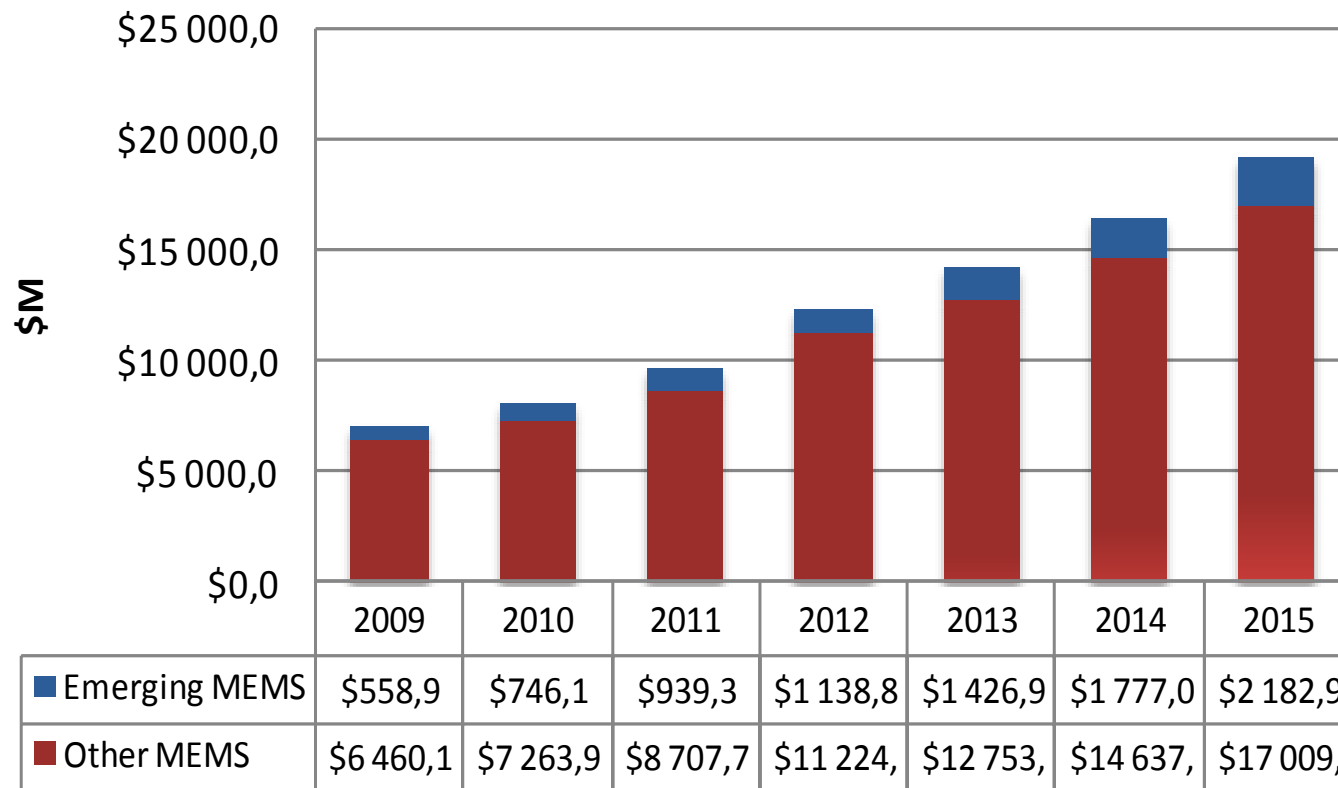


BAE SYSTEMS



# MEMS Market Forecast 2009-2015

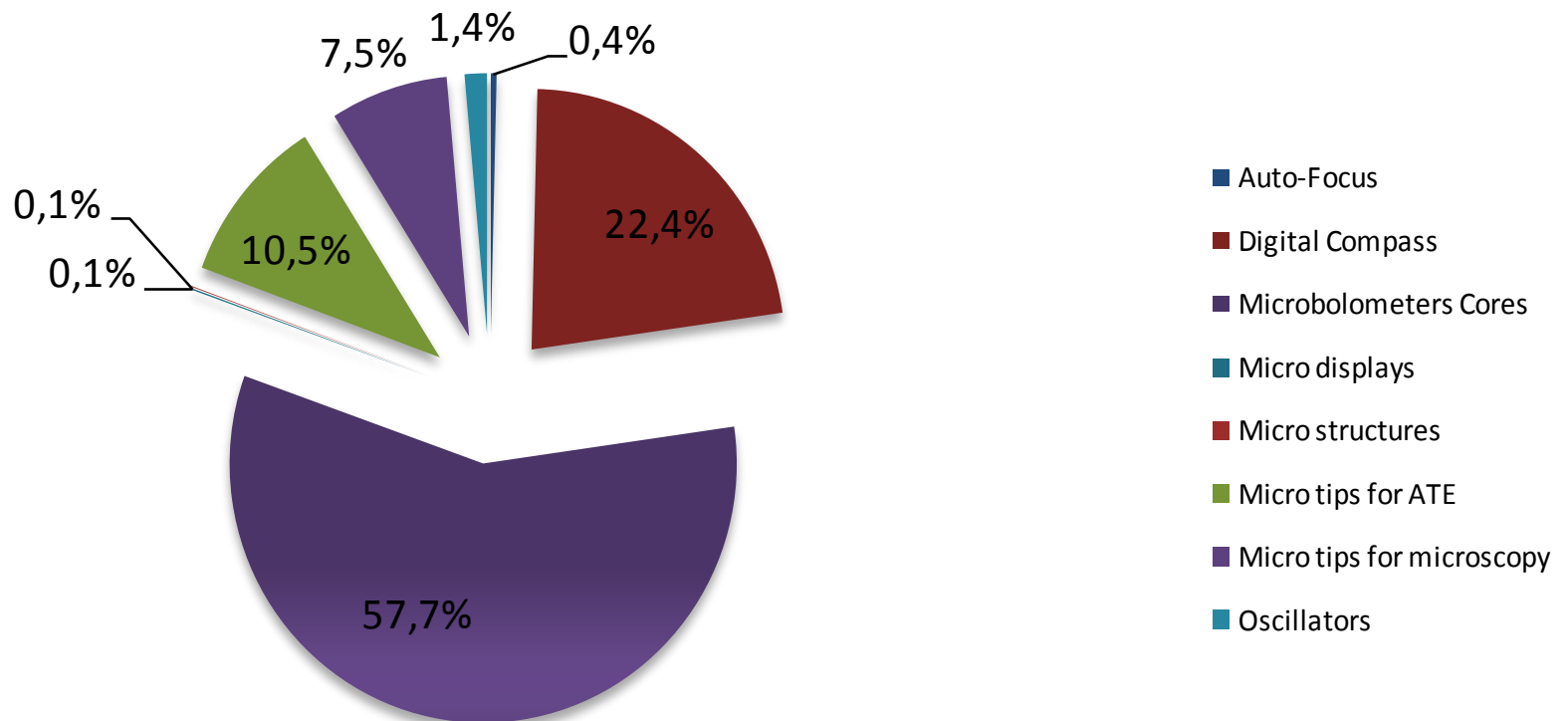
**Emerging MEMS vs. MEMS market forecast 2009-2015**



**By 2015, Emerging MEMS will account for more than 10% of total MEMS market.**

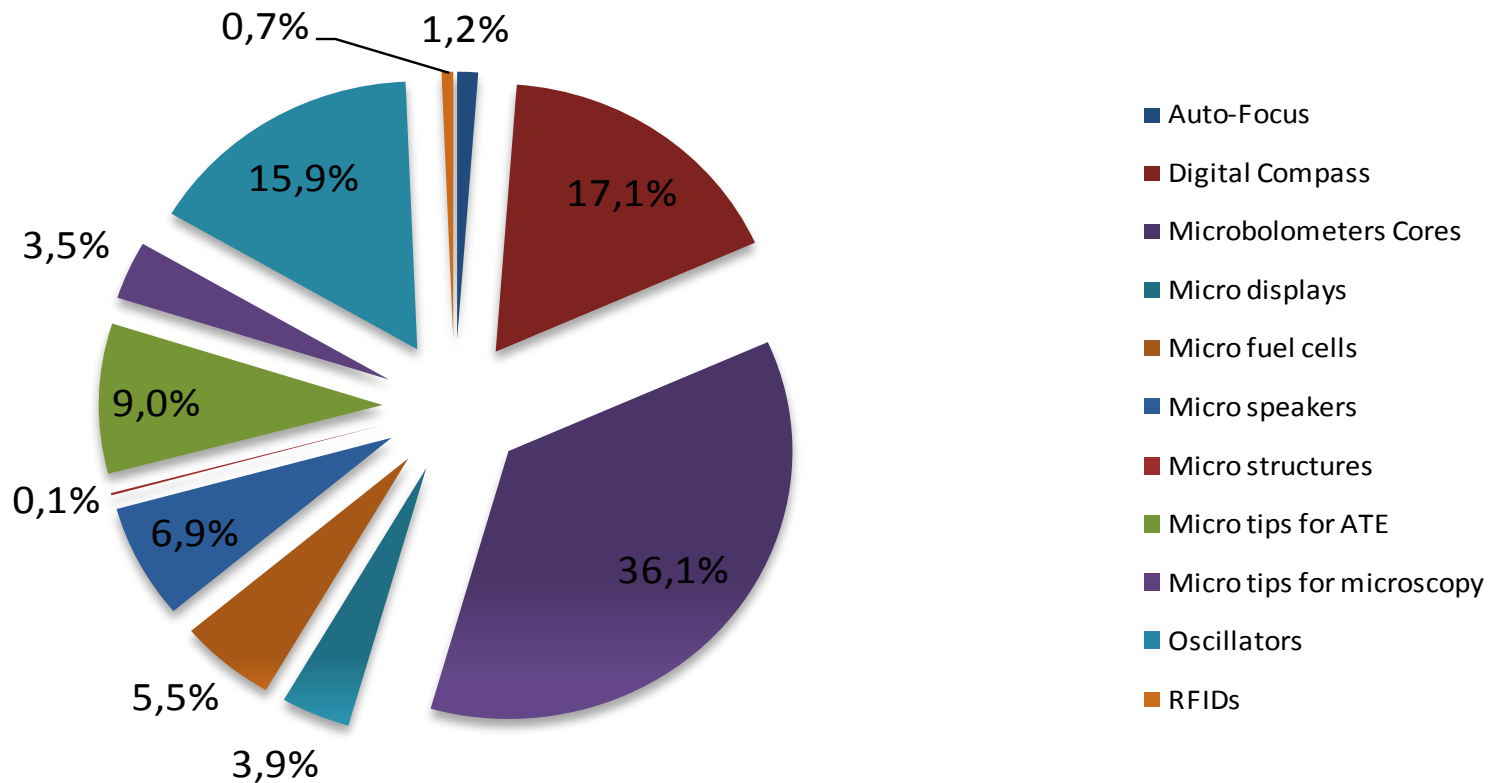
# Emerging MEMS Market 2009

Emerging MEMS market share (in value, total \$559M) 2009



# Emerging MEMS Market 2015

Emerging MEMS market share (in value, total \$2,2B) 2015



# Final Points...

- **MEMS remains a vibrant market and most new MEMS developments are under the roof of startups.**
  - The situation is quite similar to what happened in the 1998-1999 years, when many new MEMS developments were on the edge of crossing the chasm and are today mature MEMS products with large volume market: **gyroscopes, microfluidics.**
  - We have identified more than 30 startups involved in these developments.
- **Among the emerging MEMS, microbolometers, digital compasses and oscillators will represent the most promising market.**
  - Out of these, only microbolometers are mature (but still subject to innovations to lower cost and increase integration).
    - Sales are expected to be close to \$800M in 2015.
  - MEMS oscillators are ready to take a significant share of the timing market.
    - Sales are expected to be about \$350M in 2015.
  - Digital compass is soaring in 2010 and it has really taken off in 2007 thanks to the first monolithic 3-axis devices.
    - this market is growing from \$125M in 2009 to \$374M in 2015.

**For more information ...**

**Visit our websites**

*and subscribe to receive MEMS' Trends magazine free*

**[www.i-micronews.com](http://www.i-micronews.com)**

**[www.yole.fr](http://www.yole.fr)**