MEMS Industry Overview

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9-1-2012 MEMS_Industry.ppt
MEMS Industry Overview

**MEMS INDUSTRY OVERVIEW**

<table>
<thead>
<tr>
<th>MEMs Market Size (US$ billions)</th>
<th>1995</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Inertial Sensors</td>
<td>0.45</td>
<td>0.8</td>
</tr>
<tr>
<td>Fluidic controls</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td>Data Storage</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Displays</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Biochips</td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>Communications</td>
<td>0.01</td>
<td>1.0</td>
</tr>
<tr>
<td>Other</td>
<td>0.03</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>2.0</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Many new areas are developing and this mix will change dramatically. Source: Micromachines Devices R&D Magazine, Vol.1, No.2, Oct 1996, chart May 2001
MEMS top 30, according to 2006 revenue. HP suddenly gives us a lot of revenue to Canon.

“MEMS Market Trends”, Chang Liu

“MEMS Market Trends”, Chang Liu
SINGLE CRYSTAL SILICON

Thickness
10 µm

Wafer Diameter
75 mm
GEARS AND ACTUATORS
ADVANTAGES

Structures as small as 0.1 µm
Thickness as small as 5 nm
Electronics on chip with MEMS
Inexpensive (<$1)
Arrays of sensors as easy as one sensor
Chips with up to a few Billion devices available today
Mature technology
MEMS DEVICES

Accelerometers
Gyroscopes
Microphones
Pressure Sensors
MEMS Switches
Mirrors
Gas Flow Sensors
Energy Harvesting
Spectrometers
Temperature Sensors
Viscosity Sensors
Chemical Sensors

Microbolometers
RF MEMS
MOEMS
Micro Fuel Cells
Bio MEMS
### DEVICE FORECAST

#### Market Forecast by Device Application

- **High growth segments:** Accelerometers, Gyroscopes, Microfluidics
- **Emerging segments:** RF MEMS, Si Microphones, MOEMS, Microbolometers

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>08'-12' CAGR</th>
<th>09'-12' CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total MEMS Market</td>
<td>7,002</td>
<td>6,833</td>
<td>6,893</td>
<td>7,969</td>
<td>9,874</td>
<td>13,202</td>
<td>18%</td>
<td>24%</td>
</tr>
<tr>
<td>IJ Heads</td>
<td>1,867</td>
<td>1,658</td>
<td>1,462</td>
<td>1,610</td>
<td>1,820</td>
<td>2,327</td>
<td>9%</td>
<td>17%</td>
</tr>
<tr>
<td>Pressure Sensors</td>
<td>1,116</td>
<td>1,046</td>
<td>990</td>
<td>1,041</td>
<td>1,141</td>
<td>1,314</td>
<td>6%</td>
<td>10%</td>
</tr>
<tr>
<td>Accelerometers</td>
<td>883</td>
<td>893</td>
<td>940</td>
<td>1,122</td>
<td>1,377</td>
<td>1,747</td>
<td>18%</td>
<td>23%</td>
</tr>
<tr>
<td>Microfluids</td>
<td>677</td>
<td>787</td>
<td>898</td>
<td>1,052</td>
<td>1,546</td>
<td>1,947</td>
<td>25%</td>
<td>29%</td>
</tr>
<tr>
<td>Gyroscopes</td>
<td>814</td>
<td>833</td>
<td>841</td>
<td>945</td>
<td>1,100</td>
<td>1,474</td>
<td>15%</td>
<td>21%</td>
</tr>
<tr>
<td>Microdisplays</td>
<td>804</td>
<td>699</td>
<td>658</td>
<td>746</td>
<td>1,007</td>
<td>1,495</td>
<td>21%</td>
<td>31%</td>
</tr>
<tr>
<td>RF MEMS</td>
<td>250</td>
<td>261</td>
<td>314</td>
<td>499</td>
<td>748</td>
<td>1,154</td>
<td>45%</td>
<td>54%</td>
</tr>
<tr>
<td>MOEMS</td>
<td>188</td>
<td>198</td>
<td>244</td>
<td>270</td>
<td>272</td>
<td>369</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>Microbolometers</td>
<td>161</td>
<td>187</td>
<td>228</td>
<td>254</td>
<td>301</td>
<td>356</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Si Microphones</td>
<td>117</td>
<td>135</td>
<td>159</td>
<td>193</td>
<td>238</td>
<td>325</td>
<td>25%</td>
<td>27%</td>
</tr>
<tr>
<td>Micro chips &amp; Probes</td>
<td>125</td>
<td>127</td>
<td>113</td>
<td>134</td>
<td>155</td>
<td>166</td>
<td>7%</td>
<td>14%</td>
</tr>
<tr>
<td>Micro FuelCells</td>
<td>0</td>
<td>1</td>
<td>26</td>
<td>65</td>
<td>104</td>
<td>448</td>
<td>360%</td>
<td>158%</td>
</tr>
<tr>
<td>Emerging MEMS (auto)</td>
<td>0</td>
<td>8</td>
<td>20</td>
<td>38</td>
<td>65</td>
<td>80</td>
<td>78%</td>
<td>59%</td>
</tr>
</tbody>
</table>

Source: Yole, 2009/10

**Figure 12:** Market analysis by Yole.  
“MEMS Market Trends”, Chang Liu
SMART PHONE

i-phone – 9 Axis of Freedom

MEMS accelerometer market, iSuppli.

“MEMS Market Trends”, Chang Liu
INK JET PRINT HEADS
DIGITAL MIRROR LIGHT PROJECTION

Rochester Institute of Technology
Microelectronic Engineering
MIRRORS

[Images ofmirror structures and their components, labeled with terms such as 'Mirror -10 deg', 'Mirror +10 deg', 'Hinge', 'CMP oxide', 'Metal 3', 'Yoke', 'Spring tip', and 'CMOS substrate']
COMMERCIAL MICROPHONES

Akustica
Analog Devices
Boesch
Emkay Sisonic
Futurlec
Infineon
Knowles
Motorola
STMicroelectronics
TI
Others
AKU1126 MICROPHONE

1mm x 1mm MEMS Chip
MEMS Industry Overview

ON-LINE JOURNALS

March 2012
MEMS JOURNAL

WEEKLY NEWSLETTER - 03.30.12

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## UNIVERSITY CONSORTIUMS

http://mail.mems-exchange.org/mailman/listinfo/mems-talk

<table>
<thead>
<tr>
<th>MEMS-talk -- General MEMS discussion</th>
</tr>
</thead>
</table>

### About MEMS-talk

English (USA)

The mems-talk mailing list is for the exchange of MEMS related information, views, and general discussion. It is also intended to build a freely accessible body of MEMS knowledge via the list archives. The list is sponsored by the MEMS Exchange as a service to the MEMS community, and is a continuation of the MEMS mailing list originally hosted by ISI.

The list is currently moderated.

Inquiries about finding and comparing vendors of MEMS-related equipment, supplies and services are better directed to mems-business.

Before asking a question, see if it's already been answered by searching the archive of past postings from the MEMSnet MEMS-talk page, and use Google to search the Web.

### Privacy Policy

The MEMS Exchange will not disclose information about subscribers, including names and email addresses.

### Note On Mailing List Etiquette:

Before posting to the list, please familiarize yourself with the conventions of Internet mailing lists by reading the Mailing List Etiquette FAQ.

Mailing list postings are copyrighted by the respective poster. List postings and the list archives are not intended for commercial or any other activity.

To see the collection of prior postings to MEMS-talk, visit the Durusmail Archives.

### Using MEMS-talk

To post a message to all the list members, send email to mems-talk@memsnet.org.

You can subscribe to the list, or change your existing subscription, in the sections below.

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Subscribe to MEMS-talk by filling out the following form. You will be sent email requesting confirmation, to prevent others from gratuitously subscribing you. Once confirmation is received, your request will be held for approval by the list moderator. You will be notified of the moderator's decision by email. This is also a hidden list, which means that the list of members is available only to the list.
MEMS Industry Overview

YOLE CONSULTING REPORTS

**Akustica AKU230**
It uses a free-floating diaphragm, and a capacitive sensing based on a silicon circuit combining the MEMS process on the ASIC process in a single die. This microphone targets high-end consumer applications: notebooks, laptops...

**Epcos T4060**
Manufactured in the EPCOS “Chip Size MEMS Package” technology, the component targets high-end consumer applications: mobile phones, MP3 players and digital cameras.

**Knowles SPU0410LR5H**
It uses free floating diaphragm with capacitive sensing. It is the 4th generation of MEMS microphones from Knowles. This device is found in high volume consumer applications: cell & smart phones (iPhone4)...

**Analog Devices ADMP421**
It uses a free floating diaphragm and a capacitive sensor and offers a full integration of a MEMS microphone & ASIC. It targets high-end consumer applications: tablets, smart phones.

**AAC Acoustic iPhone 4**
This MEMS Microphone uses a free floating diaphragm & a capacitive sensing and offers a full integration of a MEMS microphone and ASIC, both provided by Infineon. It is for consumer applications: cell & smart phones...

**STM MP45DT01**
The MP45DT01 microphone uses a MEMS die manufactured by Omron using a free floating diaphragm, and a capacitive sensing. It is for high-end consumer applications: notebook, tablets...

Yole Developpement
**David Jourdan - jourdan@yole.fr**
Le Quartz, 75 Cours Emile Zola - 69100 Villeurbanne - Lyon - FRANCE
2012 Status of the MEMS Industry

Fueled by consumer applications, MEMS market keeps growing, while mems players acquisitions values are rocketing!

Register today!
Join our webcast to learn more about the 2012 status of the MEMS industry.

Yole Développement & MIG will present:
- MEMS device markets
- Key players’ strategies
- Main industry changes and trends
- MEMS financial analysis
- As well as an update on the “emerging” MEMS devices markets.

MEMS will continue to see steady, sustainable double digit growth for the next six years, with 20% compound average annual growth in units and 13% growth in revenues, to become a $21 billion market by 2017.

Speakers:
Dr Eric Mounier
Yole Developpement

Karen Lightman
MIG

Emmanuel Cohen-Laroque
Yole Finance

Moderator:
Jeff Perkins
Yole Inc.
REFERENCES

HOMEWORK – INDUSTRY OVERVIEW

1. How big is the MEMS industry in sales in billions of dollars per year? How big is the entire semiconductor industry in billions of dollars per year?
2. What companies make MEMS in New York State?
3. What MEMS sensors do you have in your smart phone? Can you access the sensor output signals using a free (or almost free) app? Provide details about the type of phone and the app.