MEMS Everywhere

Enabling a Medical & Healthcare Revolution

Magnus Rimskog, Sales Director North America, Silex Microsystems; on behalf of MEMS Industry Group

MEMS Engineer Forum – March 14, 2013

Today's Presentation

- Introduction of MEMS Industry Group
- Overview of Programs/Events
- Growing Health and Medical Markets
- MEMS Enabling a Consumer Healthcare Revolution
- *Thank you, Professor Esashi*

MEMS INDUSTRY GROUP®

MEMS Industry Group® (MIG) Introduction

- **Formed in in the US in 2001 with five companies** – outgrowth of MEMS industry executive meetings at Defense Advanced Research Projects Agency (DARPA).
- MIG is an industry trade association incorporated as a not-for-profit organization, based in Pittsburgh, Pennsylvania, USA.
- MIG is international; with over 140 member companies and partners worldwide.
- MIG managed by a Executive Director, Karen Lightman; with Governing Council composed of representatives from member companies.

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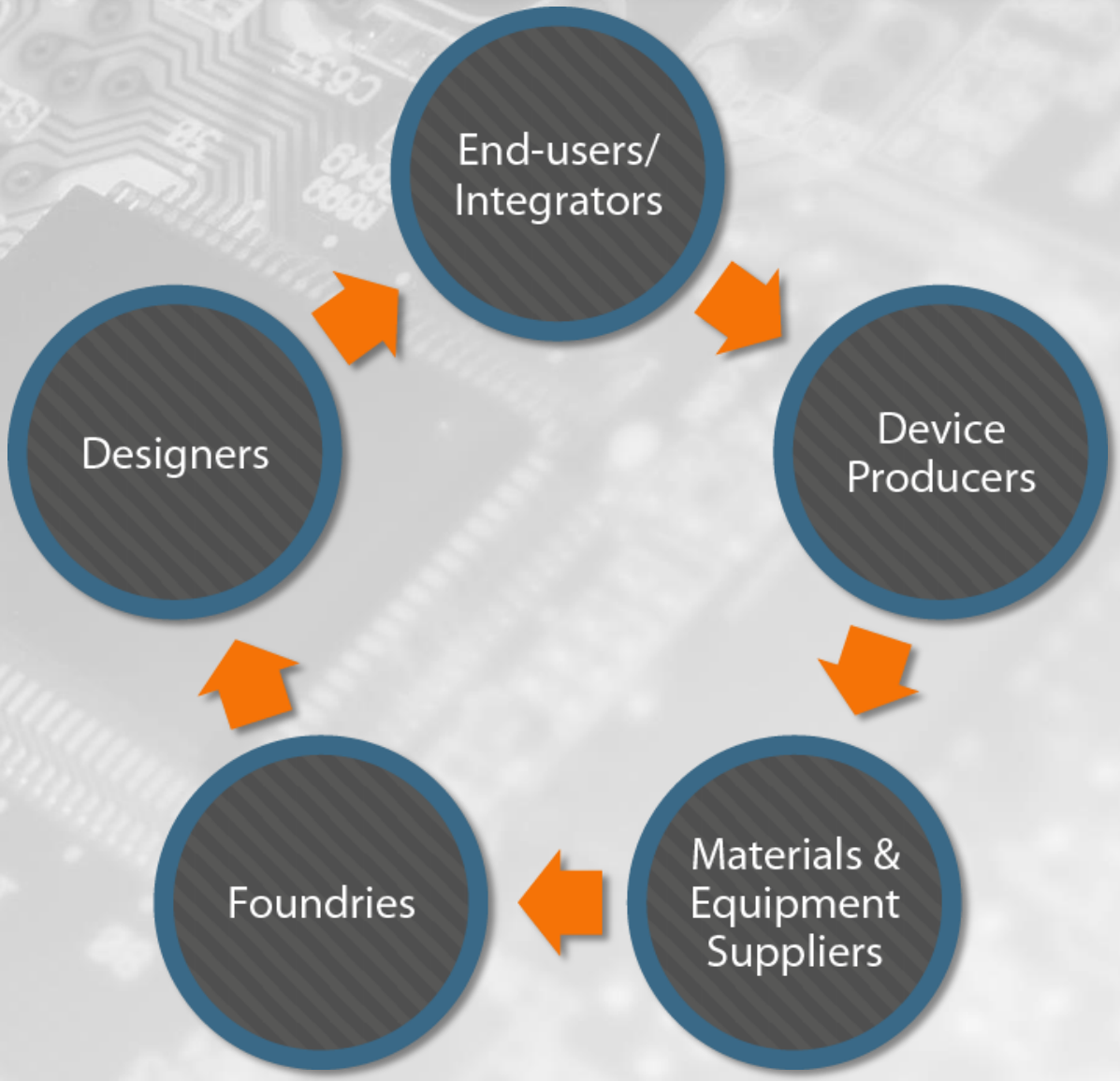
MIG is the trade association advancing MEMS across global markets.



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MIG Members


Acuity
Acutronic
Akustica
Bosch Group
AEPI
AKrion systems
Amfitzgerald
Analog Devices
Applied Materials
Applied MST
ASE Group
apm
Asia Pacific Microsystems, Inc.
Atreg
baolab
Flanders Investment & Trade
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BodyMedia
Bosch
Invented for life
Bruco
Bullen Ultrasonics, Inc.
C2MI
MiQro Innovation Collaborative Centre
csr
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Draper Laboratory
ClassOne Equipment
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Dipaola Consulting LLC
Dynaloy
A subsidiary of Eastman Chemical Company
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Exceed your vision
EVG
Expertech
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Fraunhofer ENAS
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FRT
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Honeywell
icemos Technology
imt
intelli Sense
Interlink Electronics
Sensor Technologies
InvenSense
IQE
Johnstech
Kilbrydon
Kionix
Knowles
LUMO
Maradin
maxim integrated
MEGGiTT
intel
MEMS Hitech
MEMS Vision
MEMSCAP
The Power of a Small World™
memsstar
micralyne
MICREL
microGen
Energizing the Wireless World™
micronit
MICROFLUIDICS
MicroVision
Midwest MicroDevices
movea
motion is life
MEMSTEC
MEMSTAFF
Merit Sensor
Performance Under Pressure
miRata
Mehran Mehregany
NIST
n&k
Technology, Inc.
OEM Group
OKMETIC
OMRON
OXFORD INSTRUMENTS
Plures
Technologies, Inc.
Plasma-Therm
PNI
SENSOR CORPORATION
Polytec
Process Relations
Streamlining Process Development
QUALCOMM
Qualtré
RADANT
MEMS
RITE TRACK
SPTS
sand 9
sensonor
siconnex
customized solutions
silex
MICROSYSTEMS
Silicon Resources LLC
Advanced MicroSensors
Si-WARE
SENSOR PLATFORMS
SILICON MICROSTRUCTURES
INCORPORATED
SmallTech Consulting
SolMateS
Solutions in Material Science
SoftMEMS
Bringing MEMS to the Mainstream
STC
SUSS MicroTec
Texas Instruments
TELEDYNE DALSA
Everywhereyoulook
tronics
ENVISION MEMS | DELIVER MEMS
VTT
Veeco
wiSpry
XACTIX
xsens
XFAB
MEMS FOUNDRY EXPERTS
SPT
SPP Technologies Co, Ltd.

MIG Partners

BSAC

DGFEZ

ICES

Extension MEDIA

GSA

iNEMI International Electronics Manufacturing Initiative

IHS has acquired iSuppli

IVAM.

juniper research

MNX www.mems-exchange.org

MEMS JOURNAL

MEMS Park Consortium

MEPTEC THE NEXT GENERATION

Micromachine Center Tokyo, Japan

mipi alliance

ROGER GRACE ASSOCIATES MARKETING COUNSEL

semi

QUESTEX MEDIA

SEMICO Research Corporation

Solid State TECHNOLOGY Insights for Electronics Manufacturing

WIMS2

YOLE Développement

XPRIZE FOUNDATION

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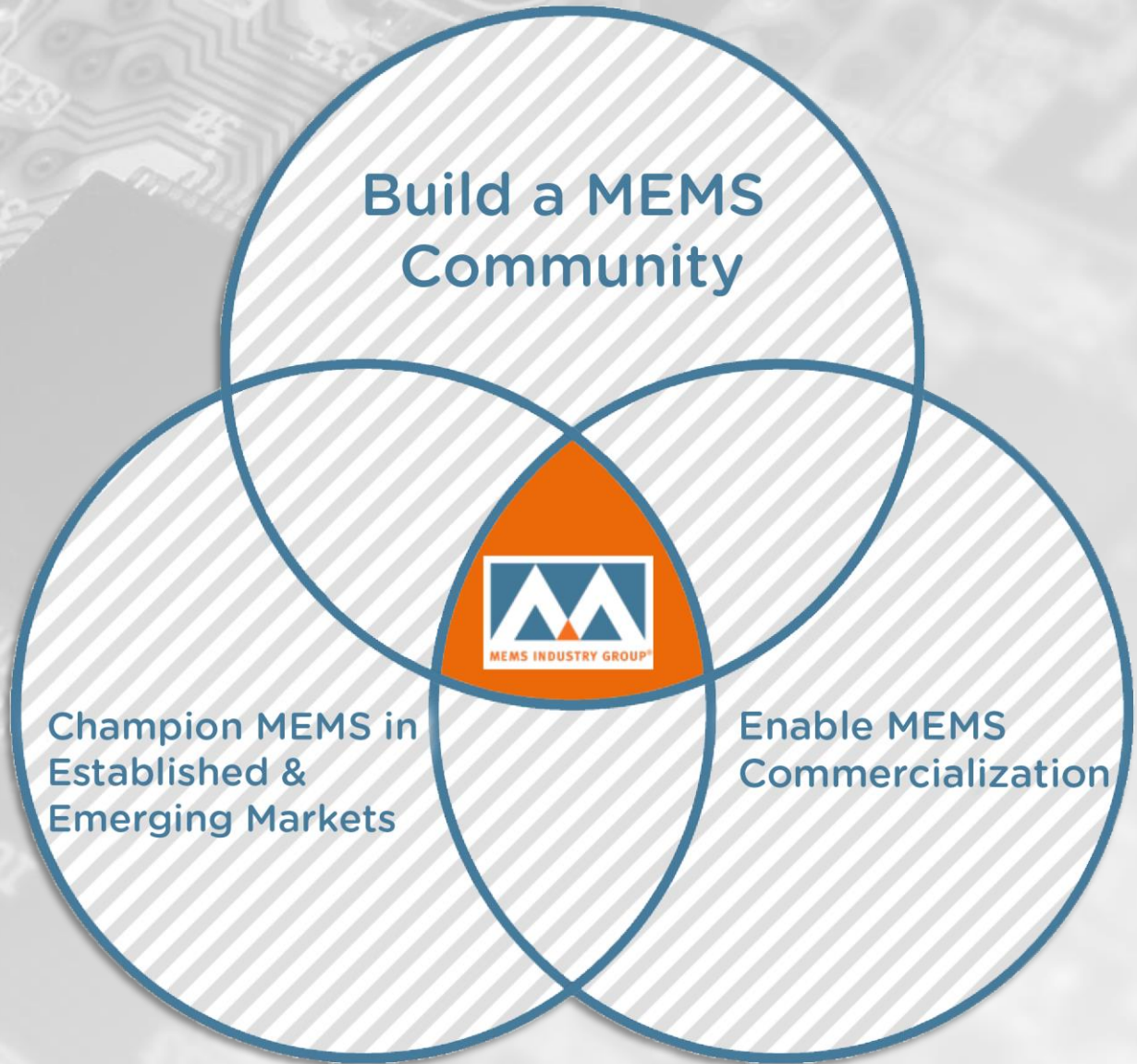
The trade association advancing MEMS across global markets
www.memsindustrygroup.org

MIG's Strategy



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M2M Forum®
May 8-9, 2013

Cambridge, MA

- Integrating MEMS into existing healthcare and medical applications
- Keynote Speakers:
  - *Marty Schmidt, MIT*
  - *Mehmet Toner, Mass. General Hospital, Harvard*
- MIT site visit

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MIG at 2013 Sensors Expo & Conference
June 4-6, 2013

Chicago, IL

- MEMS Pre-Conference Symposium & Conference Track
- MEMS Networking Lounge
- MEMS Pavilion
- MEMS Innovation Area

sensors
expo & conference
The leading sensors event in North America
Sensing Technologies Driving Tomorrow's Solutions

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MEMS Executive Congress®

MEMS Executive Congress® U.S. 2013
November 7-9, 2013

Napa, California

MEMS Executive Congress® Europe 2014
Spring 2014

Munich, Germany

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MEMS Enabling a Revolution

- Factors affecting the convergence of healthcare/medical devices
- Examples of MEMS inside healthcare/medical devices
- Remaining challenges & opportunities

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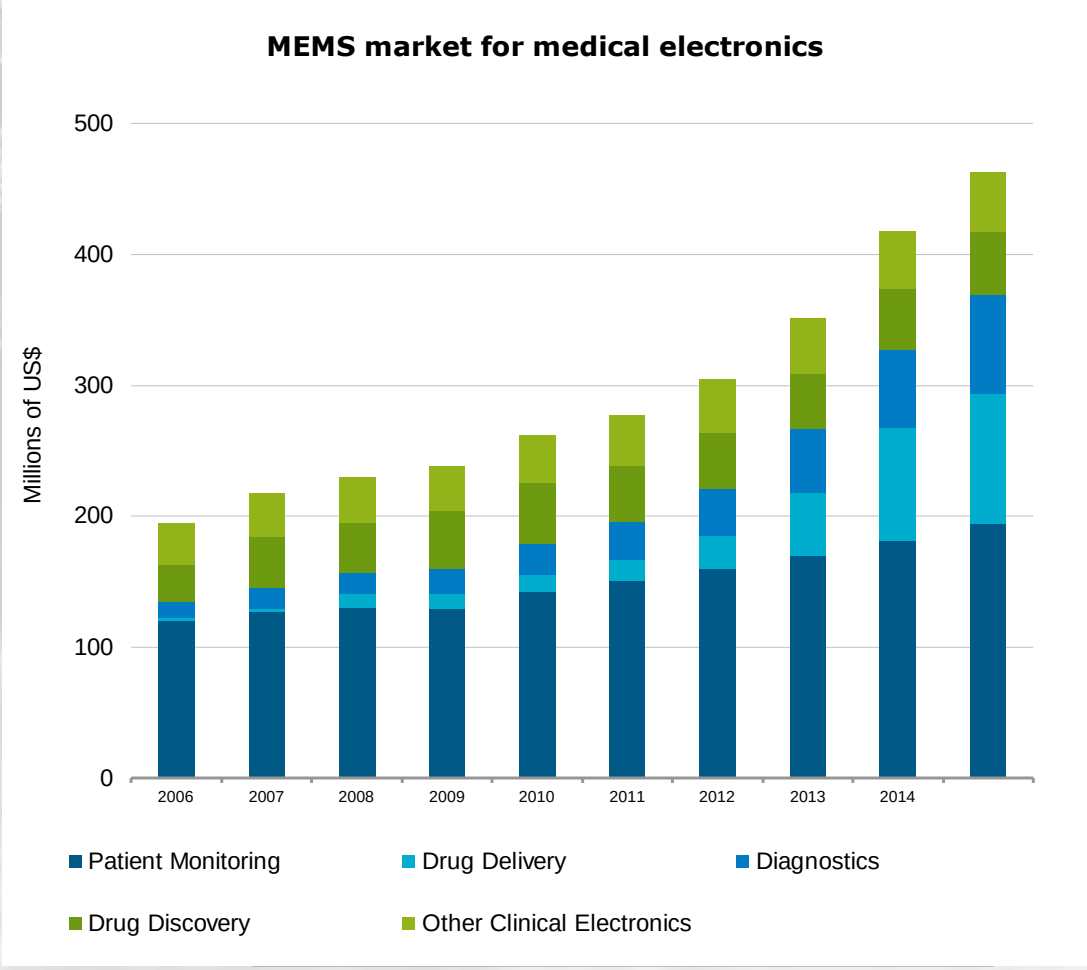
Medical/QoL - Tomorrow's Burgeoning MEMS Markets

- Patient monitoring dominates
- Diagnostics take off
- Drug delivery: next killer app?
- Drug discovery shows slow growth



Source – iSuppli Corporation *MEMS Market Tracker H1 2011*

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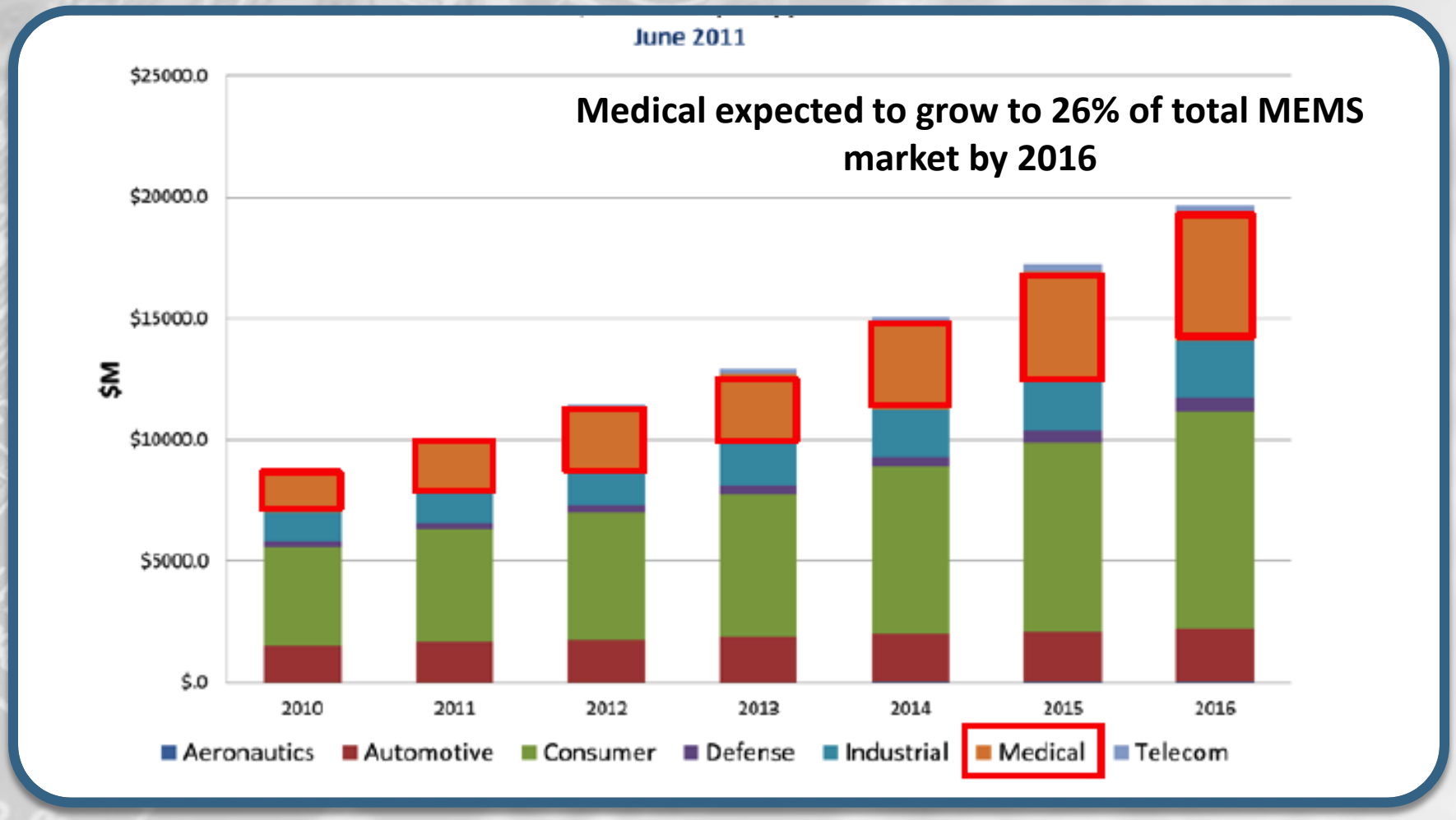
Medical MEMS 2010-16



Source: Yole Développement

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How Big is the Opportunity?

Health care is a critical global issue, for example:

Obesity:	400,000,000
Chronic disease:	860,000,000
Aging:	600,000,000
Compliance:	$300,000,000,000

PEOPLE

Source: Mehran Mehregany, Ph.D., Goodrich Professor of Engineering Innovation; Director, Wireless Health Program, Director, Case School of Engineering San Diego Programs

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Factors Affecting Convergence of Health & Consumer Markets

wireless connectivity

social networks

ubiquitous (MEMS) sensing

cloud computing

Source: Mehran Mehregany, Ph.D., Goodrich Professor of Engineering Innovation; Director, Wireless Health Program, Director, Case School of Engineering San Diego Programs

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MEMS Enables, Wireless Propels the Convergence of Health and Consumer

Source: Mehran Mehregany, Ph.D., Goodrich Professor of Engineering Innovation; Director, Wireless Health Program, Director, Case School of Engineering San Diego Programs

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Targets for Sensors/MEMS + Wireless Medicine

Disease	# Affected	MEMS/Sensors + Wireless Solutions
Alzheimer's	5 M	Vital signs, location, activity, balance
Asthma	23 M	RR, FEV1, Air quality, oximetry, pollen
Breast cancer	3 M	Ultrasound self-exam
COPD	10 M	RR, FEV1, air quality, oximetry
Depression/ Mood Disorders	21 M	Med compliance, activity, communication
Diabetes	24 M	Glucose, hemoglobin A1C
Heart Failure	5 M	Cardiac pressures, weight, BP, fluid status
Hypertension	74 M	Continuous BP, med compliance
Obesity	80 M	Smart scales, caloric in/out, activity
Sleep Disorders	40 M	Sleep phases, quality, apnea, vital signs

Table from Eric Topol, M.D.

Source: Mehran Mehregany, Ph.D., Goodrich Professor of Engineering Innovation; Director, Wireless Health Program, Director, Case School of Engineering San Diego Programs

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Nonintrusive Monitoring

- The market for wearable wireless sensors (including MEMS) is predicted to grow to 400 million devices by 2014.

Graphic from Don Jones (Qualcomm Life)

Source: Mehran Mehregany, Ph.D., Goodrich Professor of Engineering Innovation; Director, Wireless Health Program, Director, Case School of Engineering San Diego Programs

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Problem

Continuous health monitoring has been proven to reduce healthcare costs and improve care, but health monitoring is intrusive and cost prohibitive to scale.

This guy needs MEMS!

Source: Mark DiPerri, Freescale

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MEMS Enabling a Consumer Healthcare Revolution

- Why MEMS?
  - MEMS miniaturizes, improve safety & reliability
  - MEMS provides integral and integrated solution
- Why now?
  - The #1 & #2 healthcare issues in the US are ***controllable by lifestyle changes*** (Type II Diabetes & Heart Disease)
  - Since 2009, the Consumer Electronic Show (CES) has hosted a Digital Health Summit ***– CES gets it!***
  - There are more than 13,600 health and fitness apps available in iTunes as of 4/2012* ***- consumers get it!***

*according to mobihealthnews

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MIG's Vision for the Future

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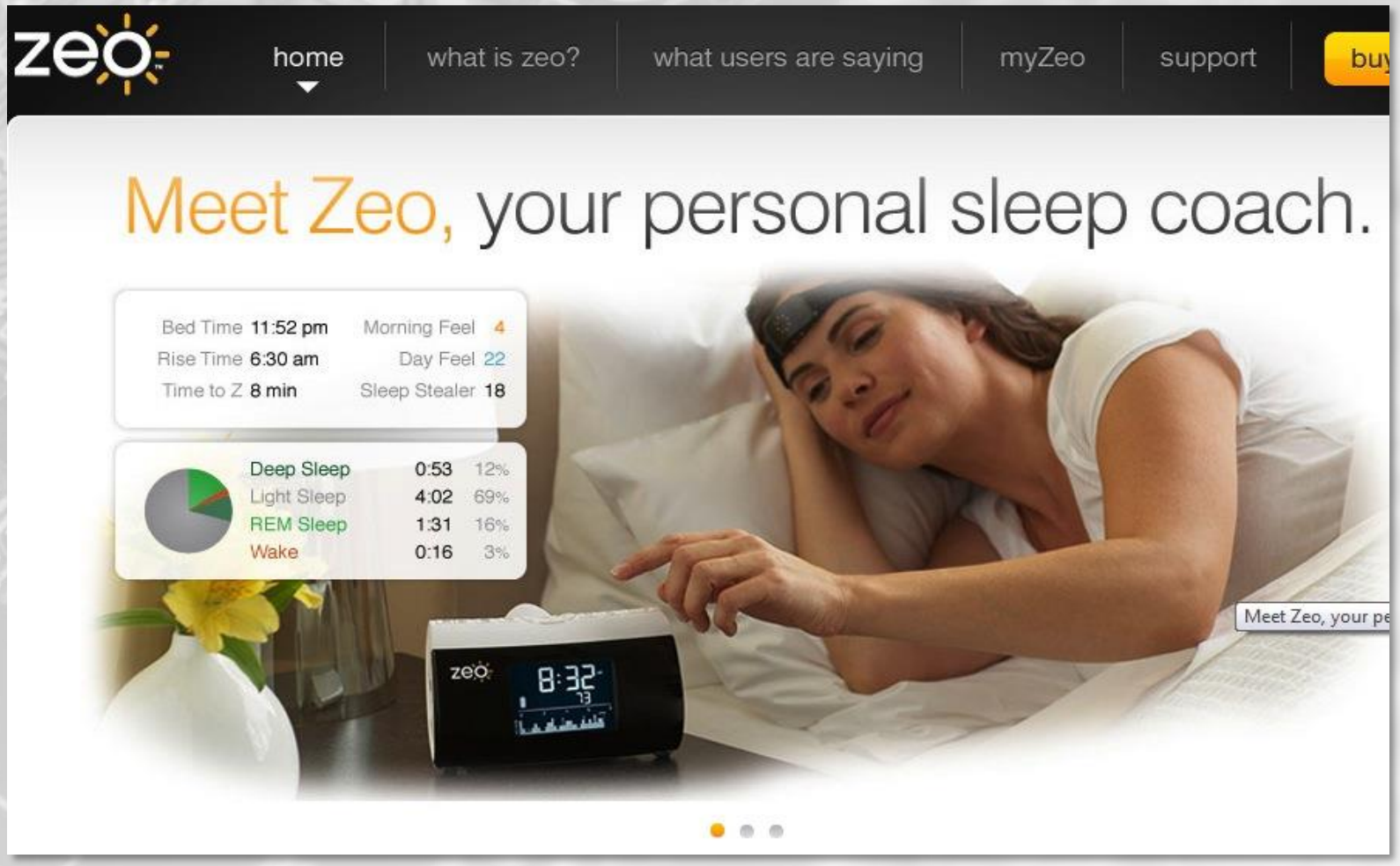
MEMS to Improve Sleep Quality



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Sit up Straight! *(thanks to MEMS)*

"Anyone can use LUMOback. It's simple and integrates into your daily routine. Live your life. Only better."

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MEMS for Baby Monitoring

technology review

Published by MIT

English | en Español | auf Deutsch | in Italiano | 中文 | in India

HOME | COMPUTING | WEB | COMMUNICATIONS | ENERGY | MATERIALS | BIOMEDICINE | BUSINESS

Maternal monitoring: A device designed by the West Wireless Health Institute measures fetal heart rate via an ultrasound monitor (lower belt) and maternal contractions via another sensor (higher belt), and then transmits the data via Bluetooth to a tablet (left).
Credit: West Wireless Health Institute

BIOMEDICINE

A Cheap, Portable Way to Monitor Unborn Babies

A nonprofit creates a new heart monitoring machine employing wireless technology.

WEDNESDAY, APRIL 20, 2011 | BY EMILY SINGER

E-mail | Audio » | Print

An inexpensive portable device could make it easy to monitor fetal health in remote locations, and it might also provide an alternative more expensive machines currently used in doctors' offices in the developed world.

Wearable, Wireless Fetal Monitoring

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MEMS your way to Personal Health and Fitness

BODYMEDIA | FIT™

MEMS INDUSTRY GROUP®

Smart Implanted Devices Enabled by MEMS

Converging now with condition-based therapeutic therapies…truly improving QoL

MEMS INDUSTRY GROUP®

Monitor & Manage Medication and Physiologic Data with MEMS

[Proteus Digital Health™ Feedback System]

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Requirements of MEMS-y Consumer Health Products

- The technology must be:
  - Proactive, not reactive; have self-contained data analysis capable of decision making
  - Reduce human intervention to lower human error
- From a business standpoint devices must be:
  - LOW COST $$!!
  - Reliable, accessible and serviceable
- For the user products must be:
  - Part of everyday life, virtually invisible & require little if any manual manipulation

Source: Mark DiPerri, Freescale

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Remaining Challenges

- Currently batteries take up size and are obtrusive –need to be smaller and efficient!
  - If medical devices go in the body, they need to last 10+ years
  - Energy harvesting (yes with MEMS) hopes to address this in the future
- Challenges unique not just to medical applications still remain (and are costly):
  - Packaging, testing and new materials
  - Standardization

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Opportunities

- Sensor Integration (hardware) and Sensor Fusion (software/algorithms) offer further opportunities in this consumer/health market.
- MEMS will continue to play a significant and growing role as more sensors are added to more devices.

Being a part of the MIG network helps you navigate all these challenges and opportunities.

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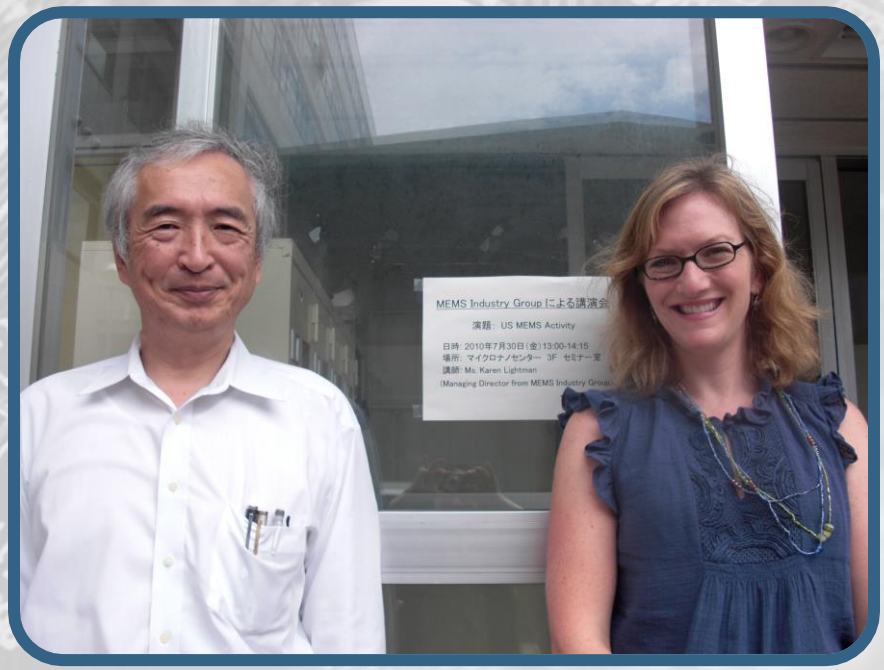
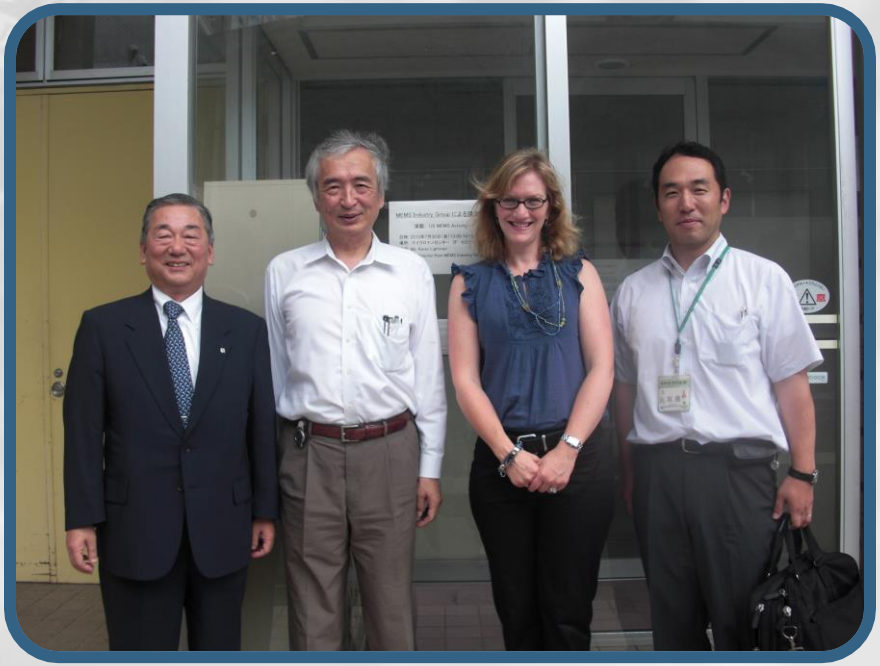
Thank you, Professor Esashi





Professor Esashi with Karen Lightman outside the MEMS lab at Tohoku University; along with Takeo Oita and Hiroyuki Miyata (City of Sendai)

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Thank you!

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