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Endicott Interconnect®
Technologies, Inc.

**Advanced Microelectronics Packaging
Solutions for Miniaturized Medical Devices**

Advanced Microelectronics Packaging Solutions for Miniaturized Medical Devices

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2013 IMAPS *Device Packaging*

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Outline

- **Motivations**
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 - ICD & Pacemakers
 - Ultrasound devices
- **Implantable substrates**
 - Stretchable Flex
 - Rigid-Flex
- **Summary**

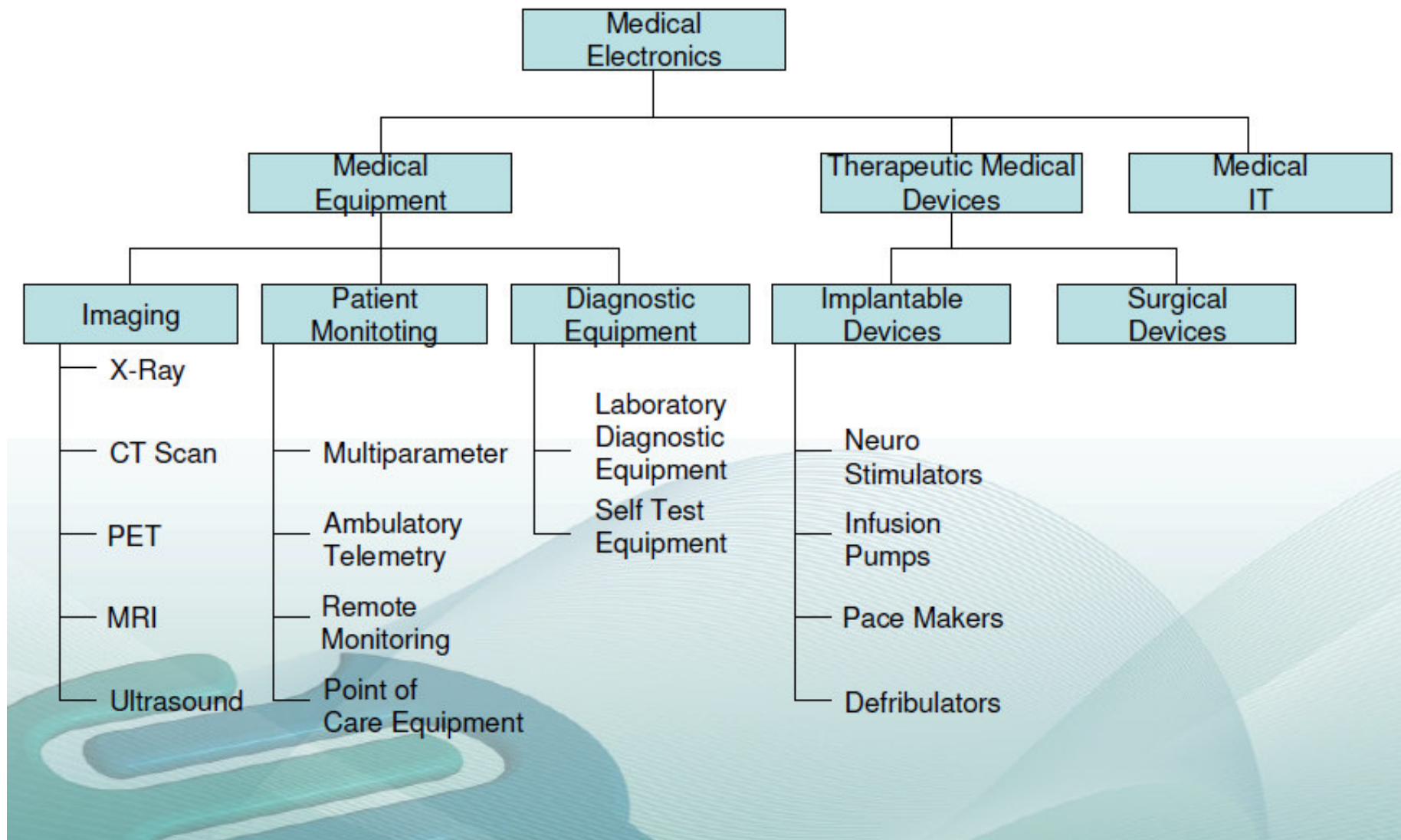


Medical Device

A medical device is a product used for medical purposes in patients, in diagnosis, therapy or surgery

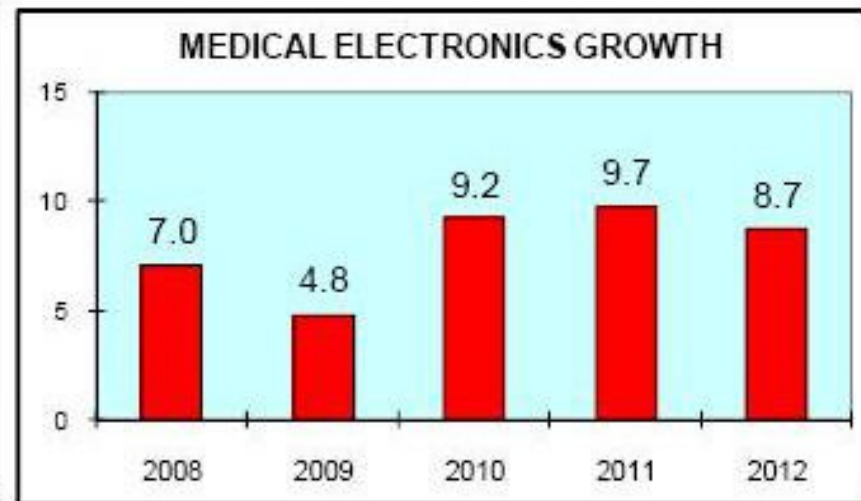
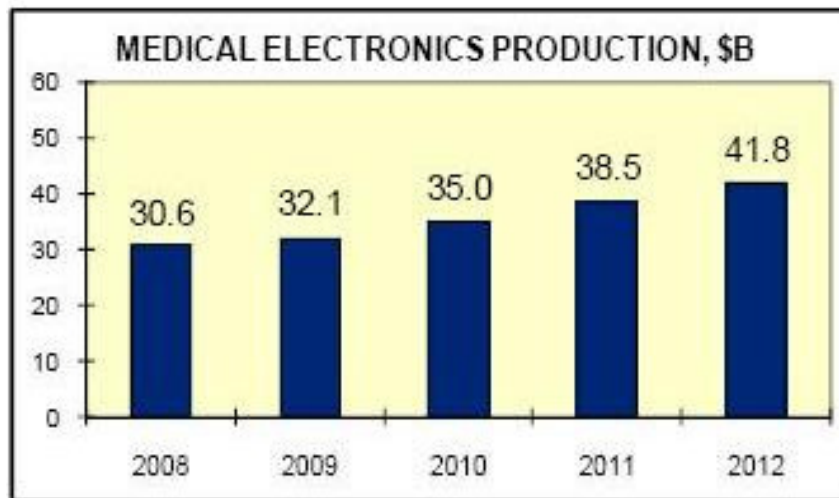


Medical Electronics/Devices



Medical Electronics Industry

- Gradual production growth.
- Healthy growth of over 8-9% for the next several years.
- Recession affected growth slightly. Not to the extent it hurt other industries.



Source:
<http://www.ems007.com/pages/zone.cgi?a=60051&artpg=1>

US Implantable device market is on pace to exceed \$50 billion in 2015.

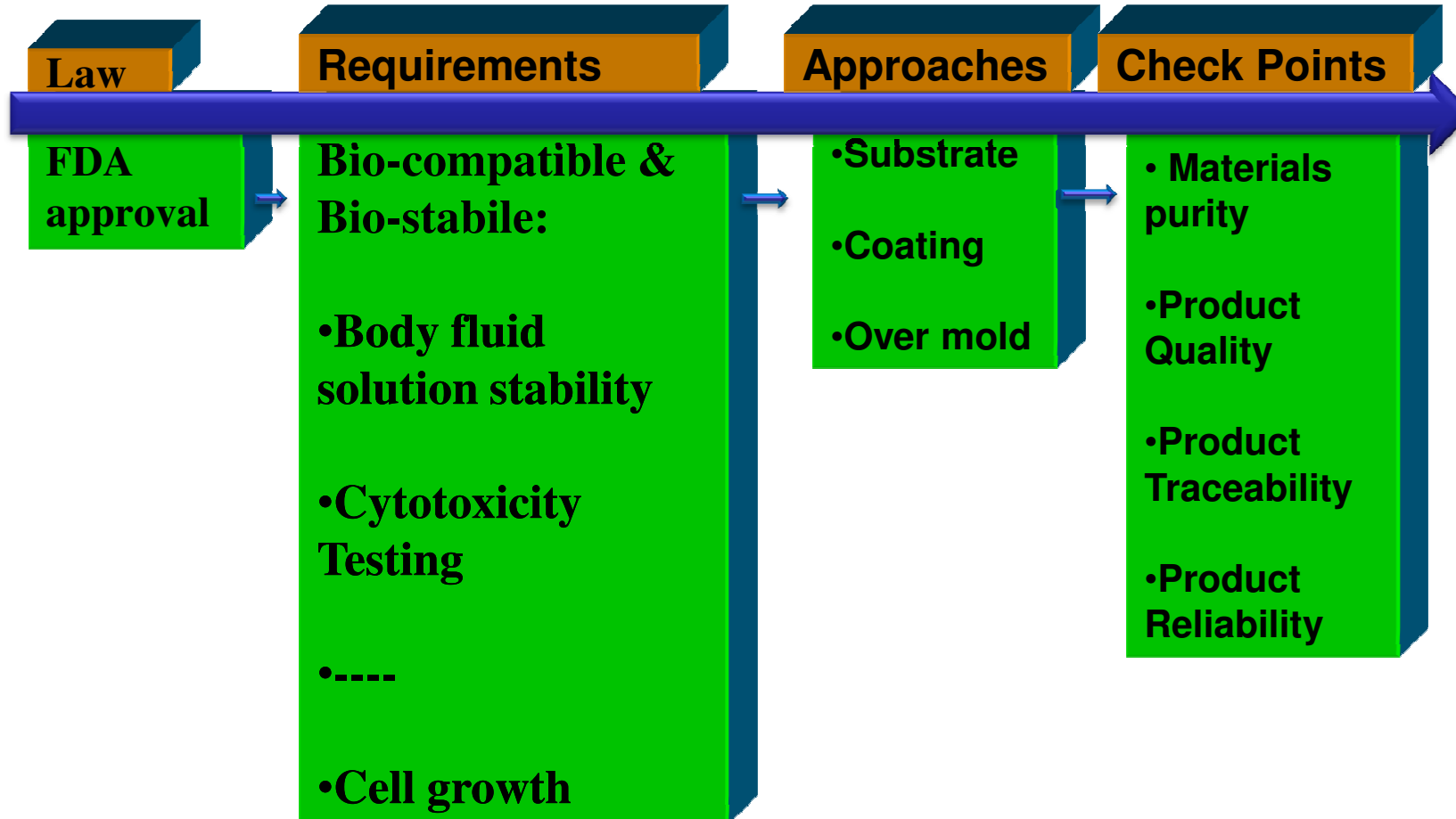


Objectives

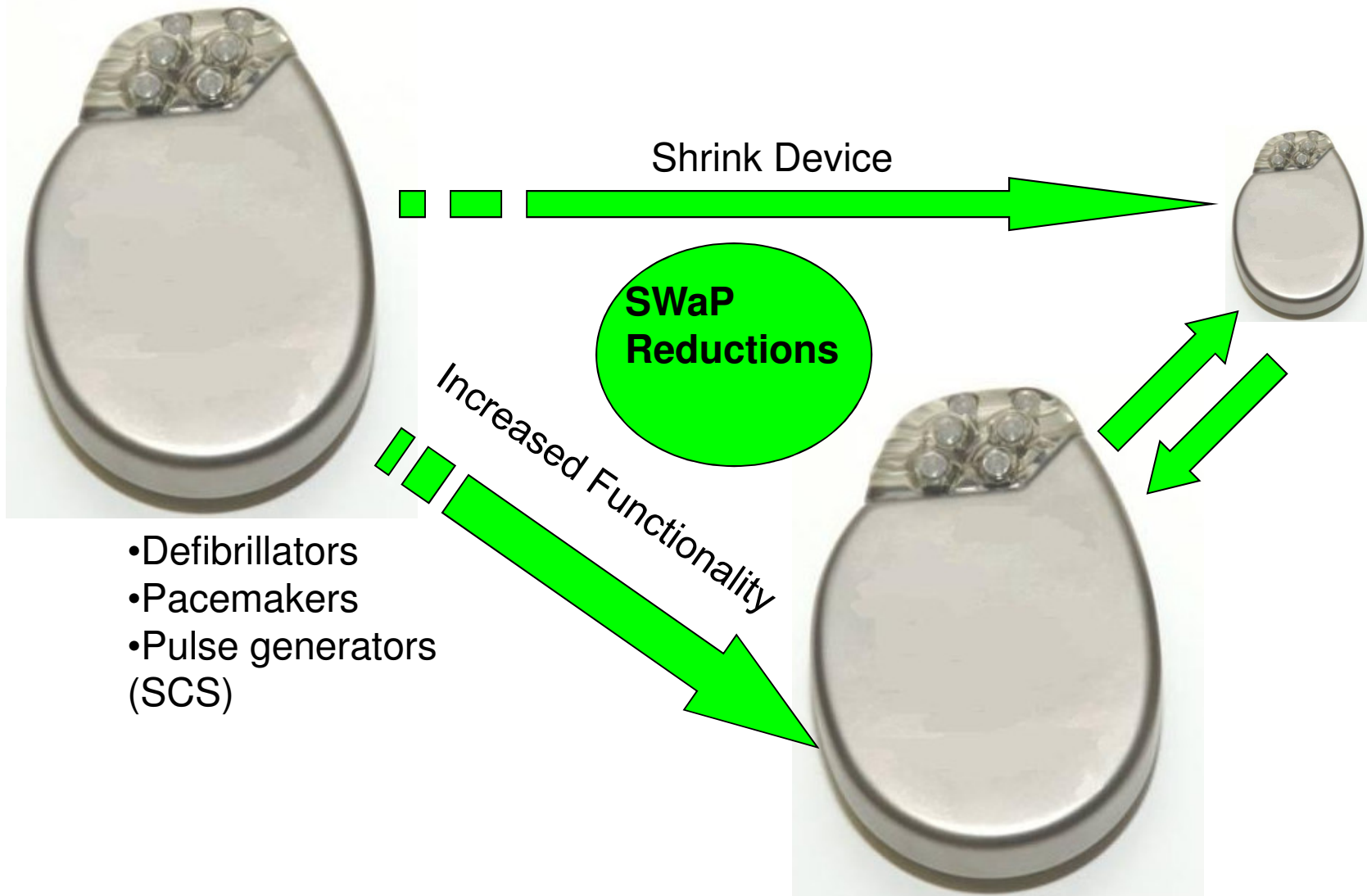
-  **Develop bio-compatible and or bio-stable shapeless substrates for Conformal Electronics**
-  **Develop flexible Substrates to satisfy space requirements for medical imaging and health monitoring devices**
-  **Develop miniaturized rigid substrate for *SWaP* (size, power and weight) advantage**



Implantable Electronics



Miniaturized Rigid Substrate



IVUS Catheter

- **Intravascular ultrasound (IVUS) is a medical imaging methodology using a specially designed catheter with a miniaturized ultrasound probe attached to the distal end of the catheter.**
- **The proximal end of the catheter is attached to computerized ultrasound equipment to see from inside blood vessels out through the surrounding blood column, visualizing the endothelium (inner wall) of blood vessels in living individuals.**
- **The arteries of the heart are the most frequent imaging target for IVUS. IVUS is used in the coronary arteries to determine the amount of plaque built up at any particular point in the epicardial coronary artery.**
- **The progressive accumulation of plaque within the artery wall over decades is the setup for vulnerable plaque which, in turn, leads to heart attack and stenosis (narrowing) of the artery (known as coronary artery lesions).**
- **IVUS is of use to determine both plaque volume within the wall of the artery and/or the degree of stenosis of the artery lumen.**

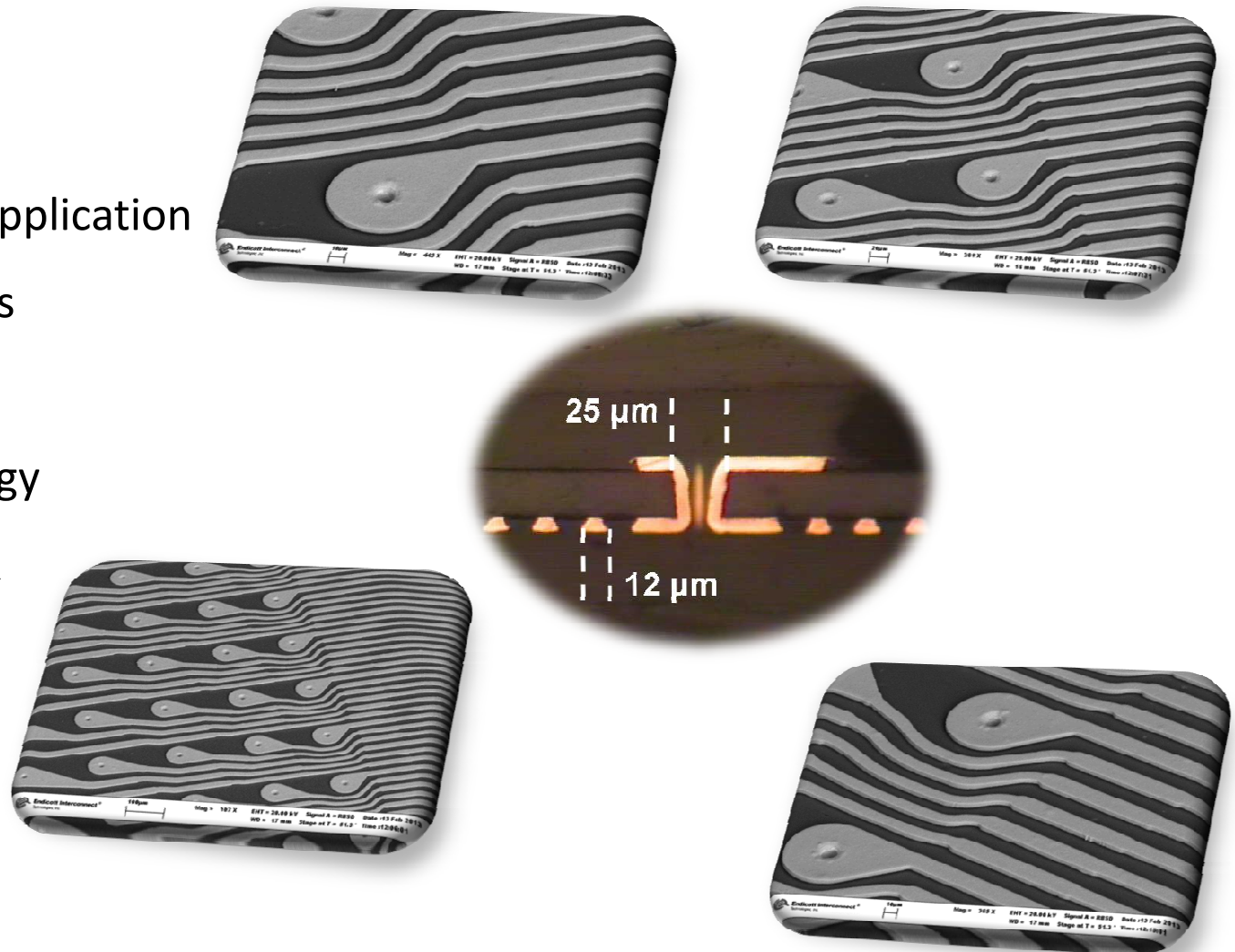
http://en.wikipedia.org/wiki/Intravascular_ultrasound



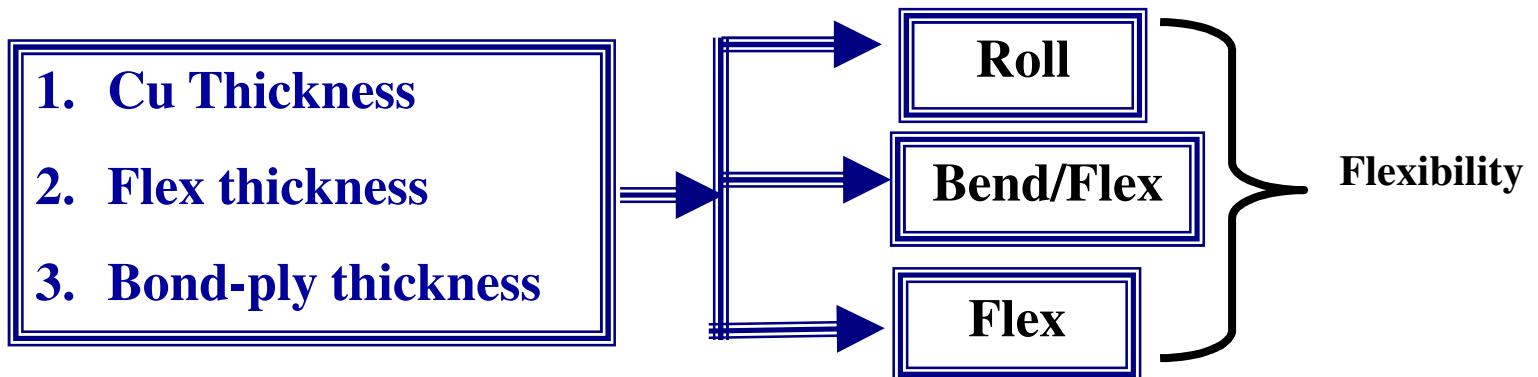
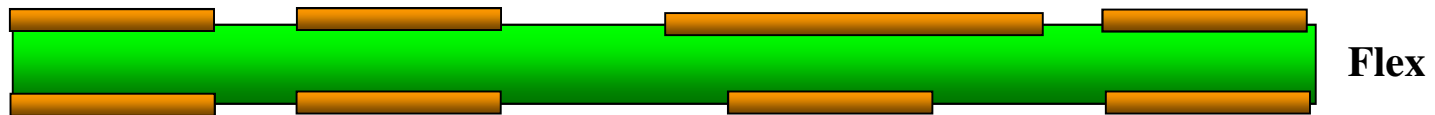
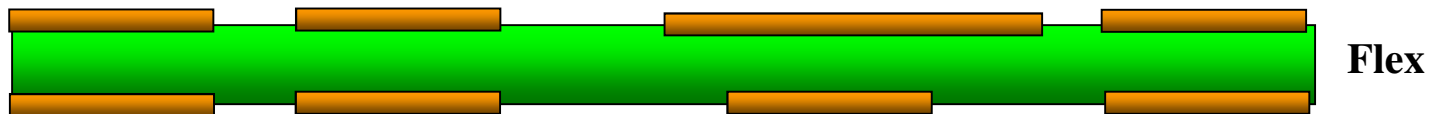
High Density Double Sided Flex

Ultrasound Medical Application

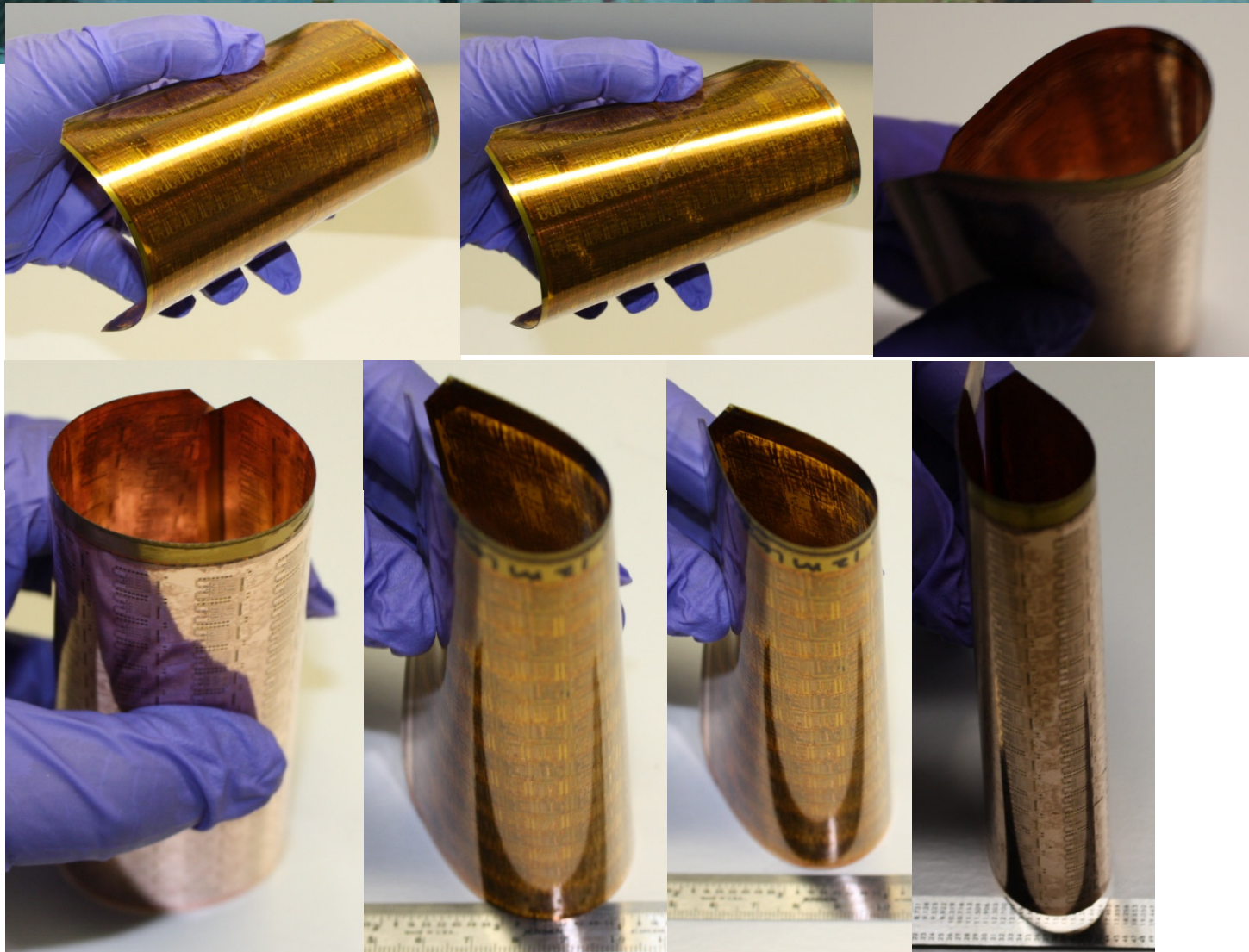
- 12 μm lines / spaces
- 25 μm vias
- 6 μm thick metallurgy
- Flexible soldermask



Multilayer Flex



Multilayer Flex



12 metal layers, 12.8-13 mils thick, bend radius 1 inch or higher





Summary

EI developed variety of Substrate technology for a host of applications including:

- Pacemakers
- Implantable cardioverter defibrillators (ICD)
- Ultrasonic catheters
- LED surgical overhead and endoscope lighting
- Digital x-ray
- Patient monitoring systems
- CT scan
- Supercomputing for life science simulation (drug design)

Extending development to other implantable applications

- Conformal and stretchable electronics
- Spinal cord stimulator
- Pulse generator

