

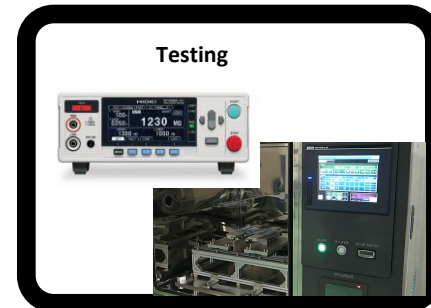
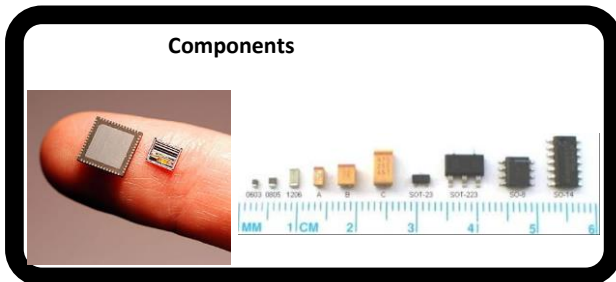
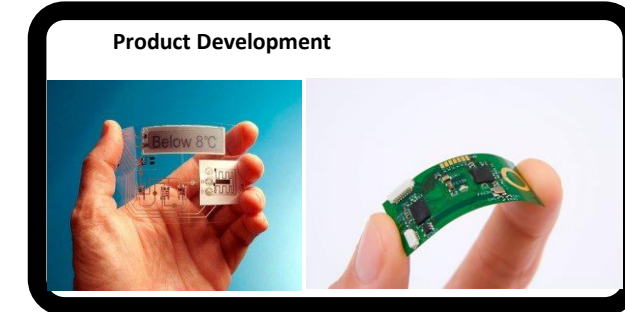
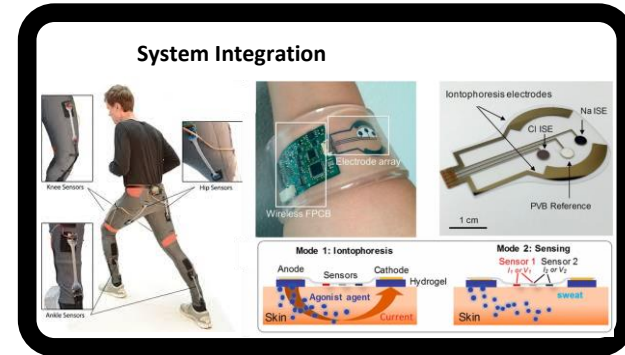
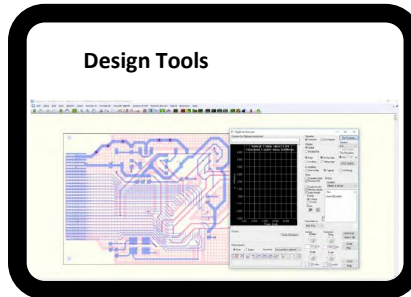


Mechanical Endurance Testing for Ultraviolet and Electron Beam Components In Flexible Electronics

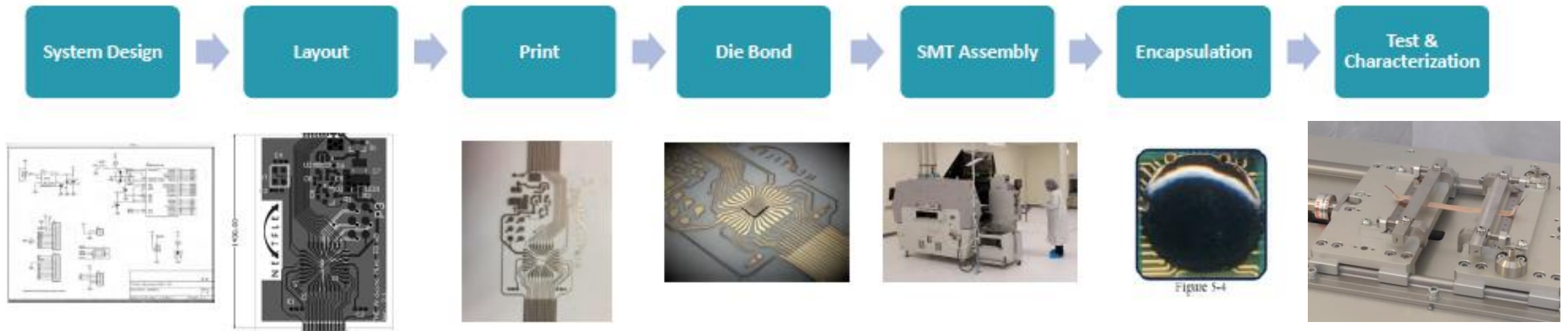
Orlando, FL

Eisuke Tsuyuzaki
BayFlex Solutions (Endurance Testing Systems)

Flexible Electronics Value Chain



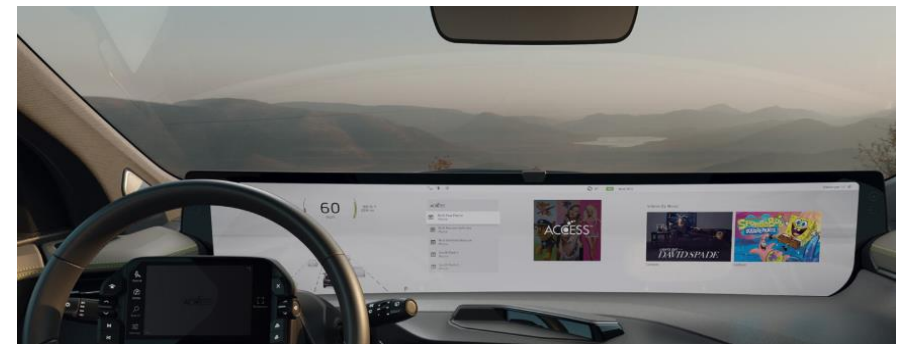
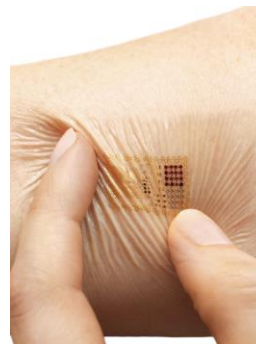
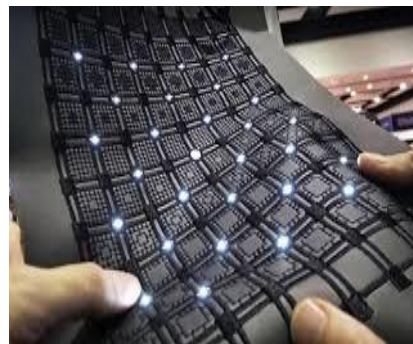
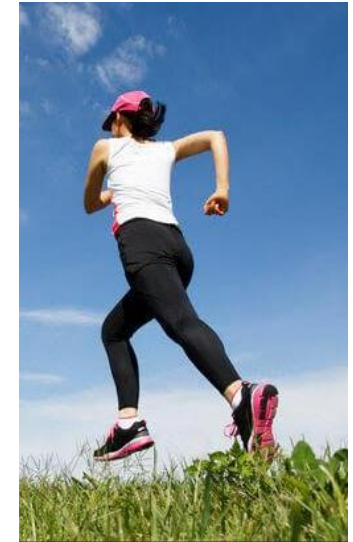
Simplified Flexible Electronics Manufacturing



Testing should not be an afterthought

- Legacy testing done at the material & components only;
- With introduction of electronics & newer functions;
- For mission critical applications;
- Pioneers in Conductive Textile Materials and Inks & Devices
- Must Design-in Confidence

Market Opportunities





Medical/E-Textile Challenges



- Need to move with Human Body
- Rigid Electronic Assemblies
- Small Components
- Cables & Wiring



Common Requirements

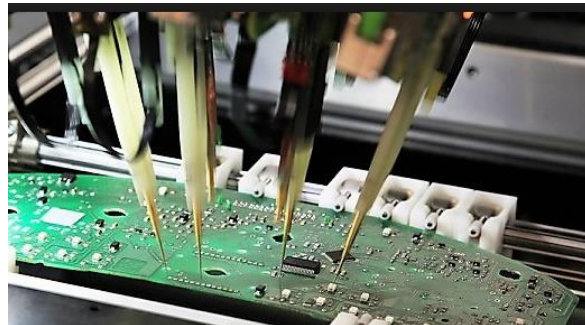
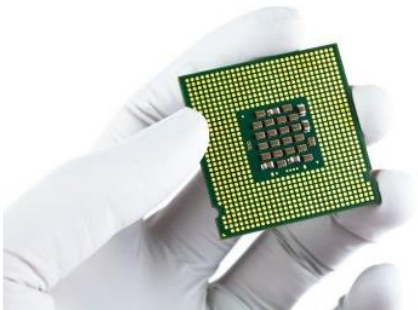
- Stretching
- Flexing
- Twisting



STRETCHING

A New World from Electronics

- **Semiconductor** (Nano, Clean, Conductivity)
- **Rigid PCB** (Conductivity, Liquids)
- **Consumer Electronics** (Mass scale, Components)



Accelerator Factors

- **Defacto Standards**
Smartphone, Wearable end device manufacturers
- **Dejure Standards**
Global / Industry e.g. IPC
- **Lack of Universal Testing Systems**

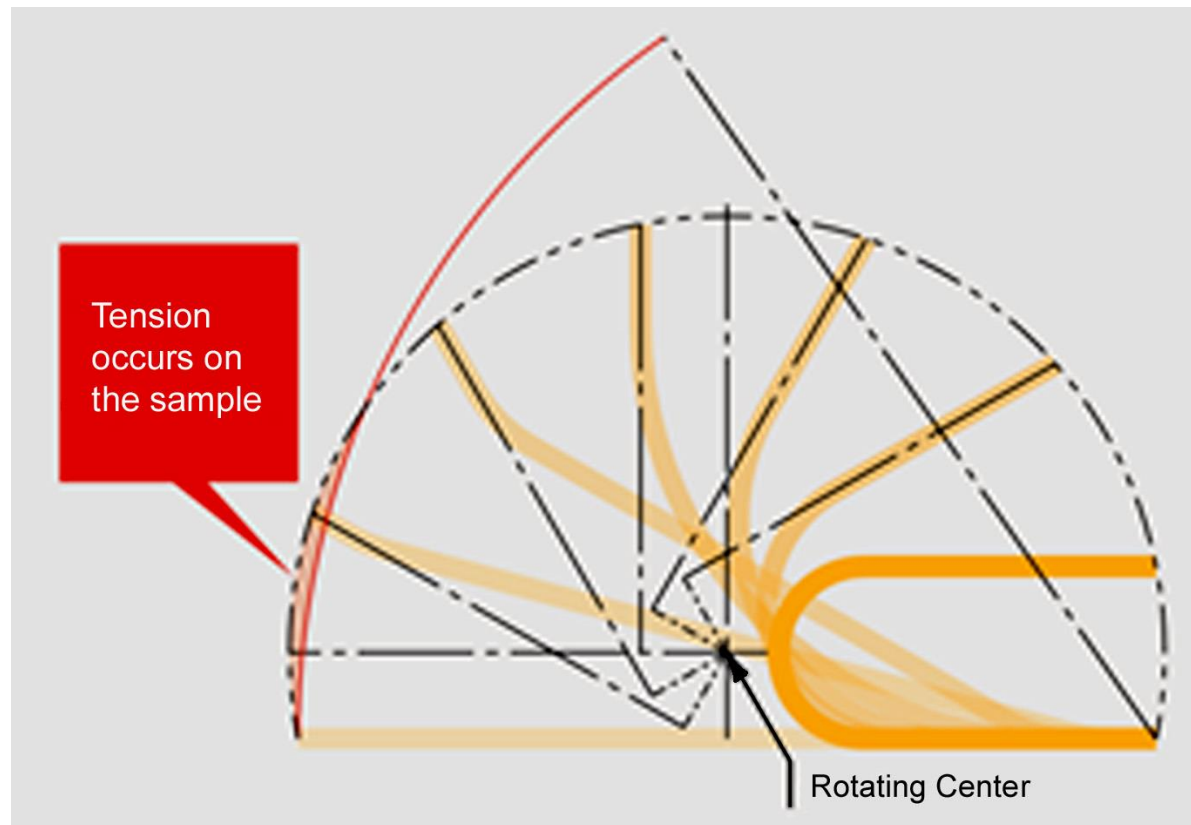


Association Connecting Electronics Industries®

Mechanical Challenge

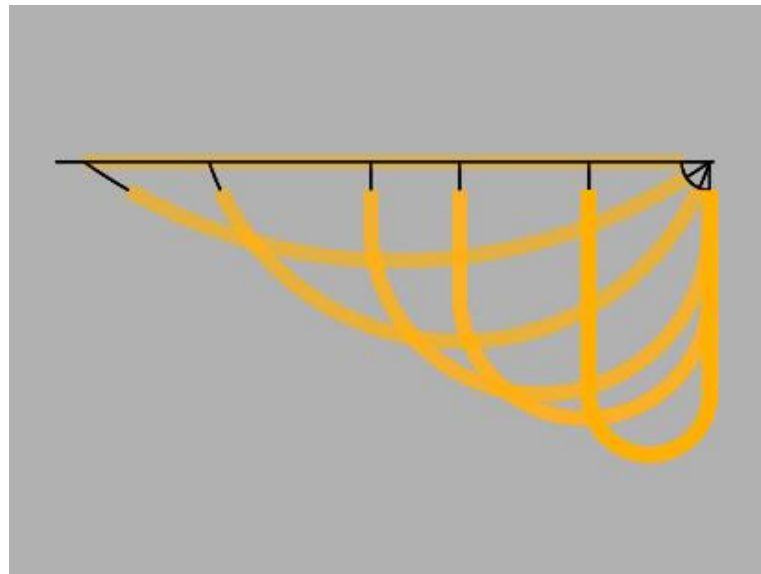
- New Design Mechanism to reduce Tension & Friction

Tension-free Technology uses mechanical system of pulleys to eliminate counter-weights



"Butterfly" Flexing Motion

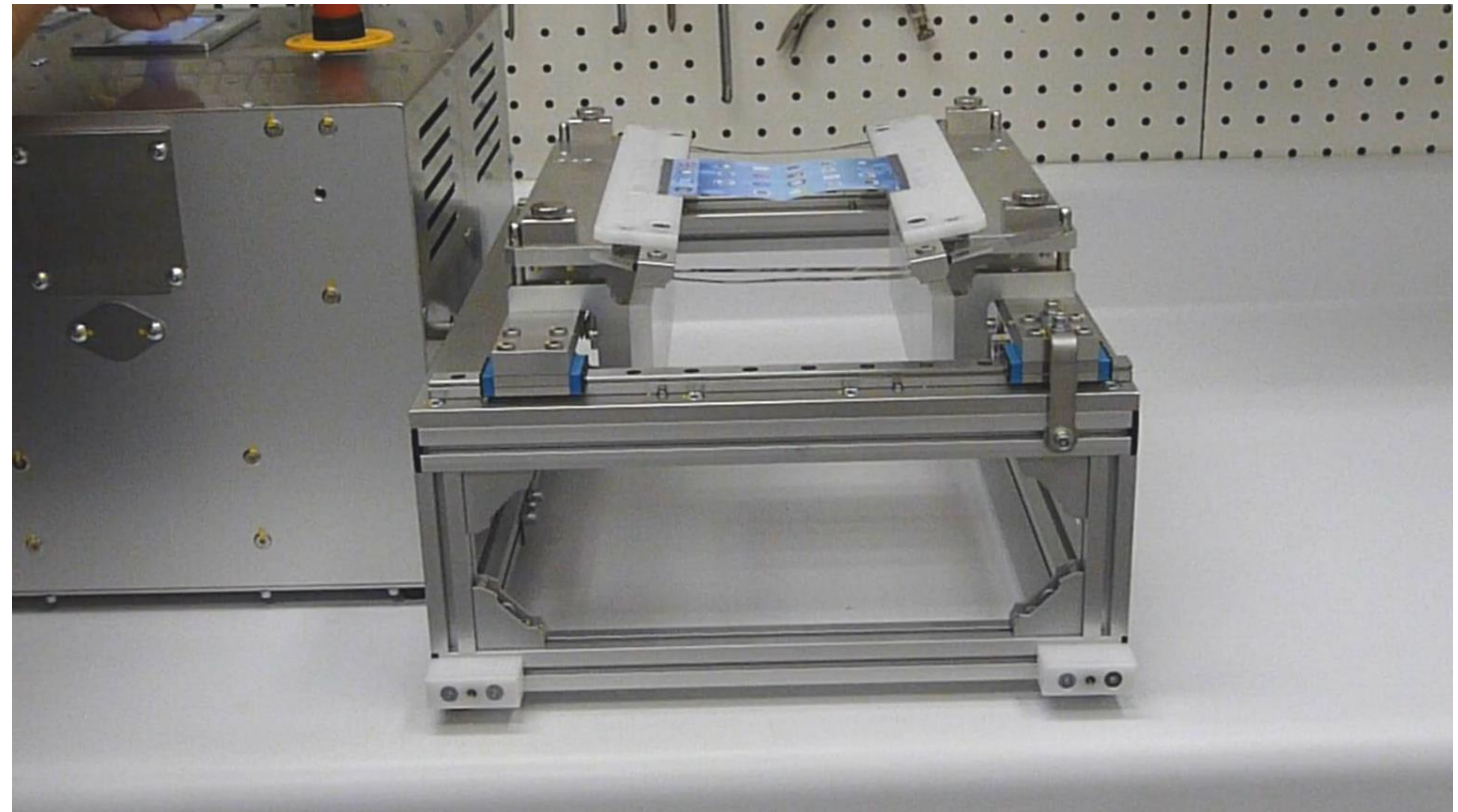
- Gradually flexes over entire length of Sample
- Flexing is concentrated in the middle
- Various configurations for size and environments
- Simulates general textile usage



FS Butterfly Flexing with Tension-free ©

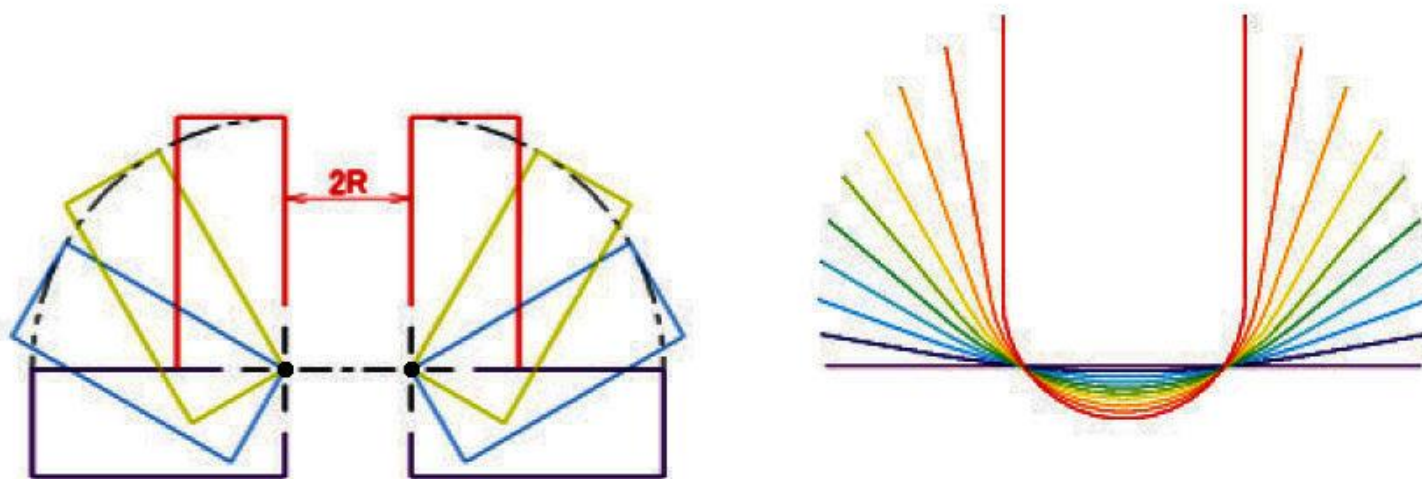
FLEXI
A W A R D

- Linear or planar objects
- Rapid, accurate testing
- Optional Data measurement
- Cartridge type for easier examination



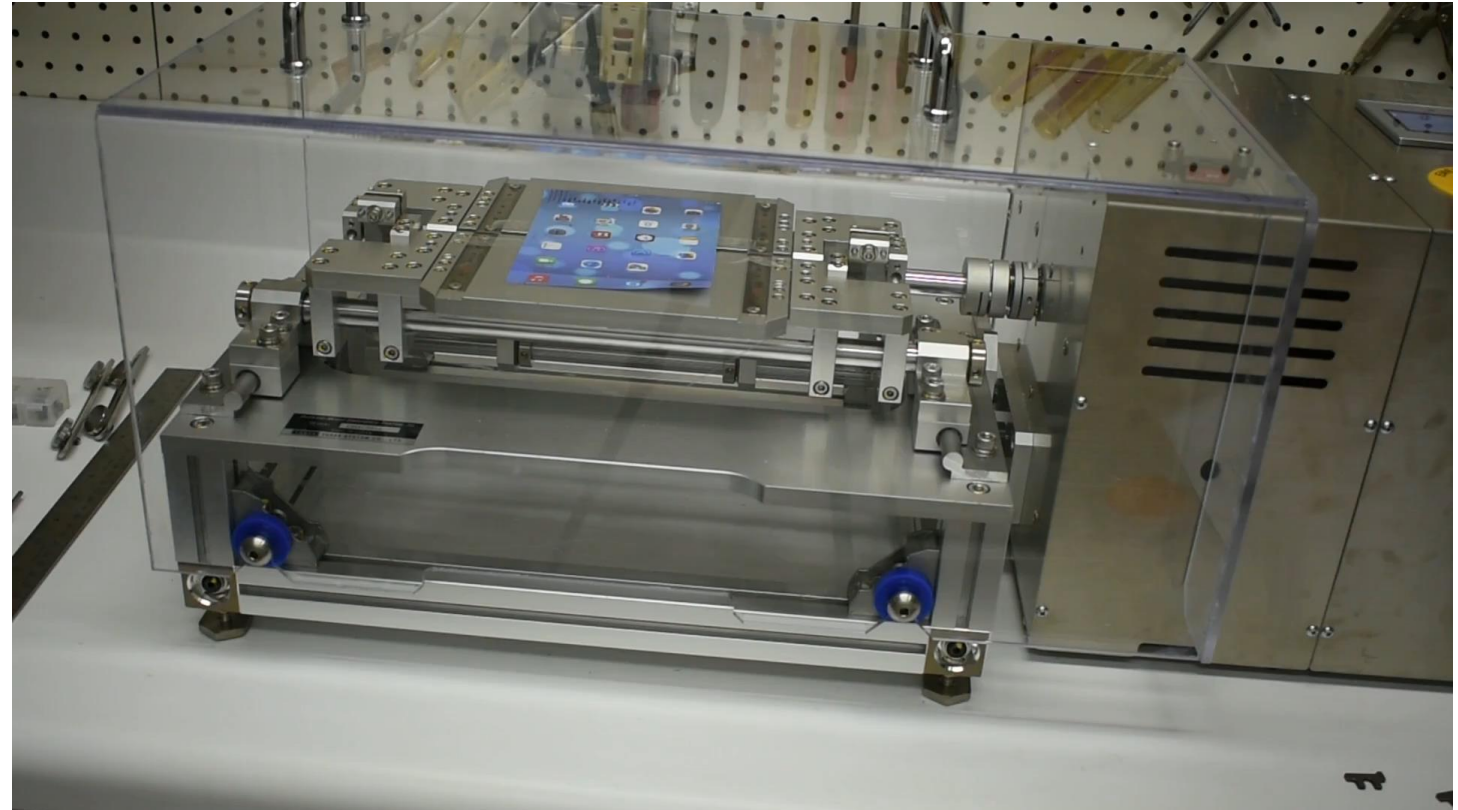
"Clamshell" Flexing Motion

- Accurate flexing at a single point of Sample
- Flexing is concentrated at determined point
- Various configurations for size and increased throughput efficiency
- Simulates elbows, knees and hinges



CS Clamshell Flexing with Tension-free ©

- Linear or planar objects
- Accurately flexed to 0.5 mm radius
- Optional Data measurement
- Cartridge type for easier examination
- Ambient/Hostile conditions

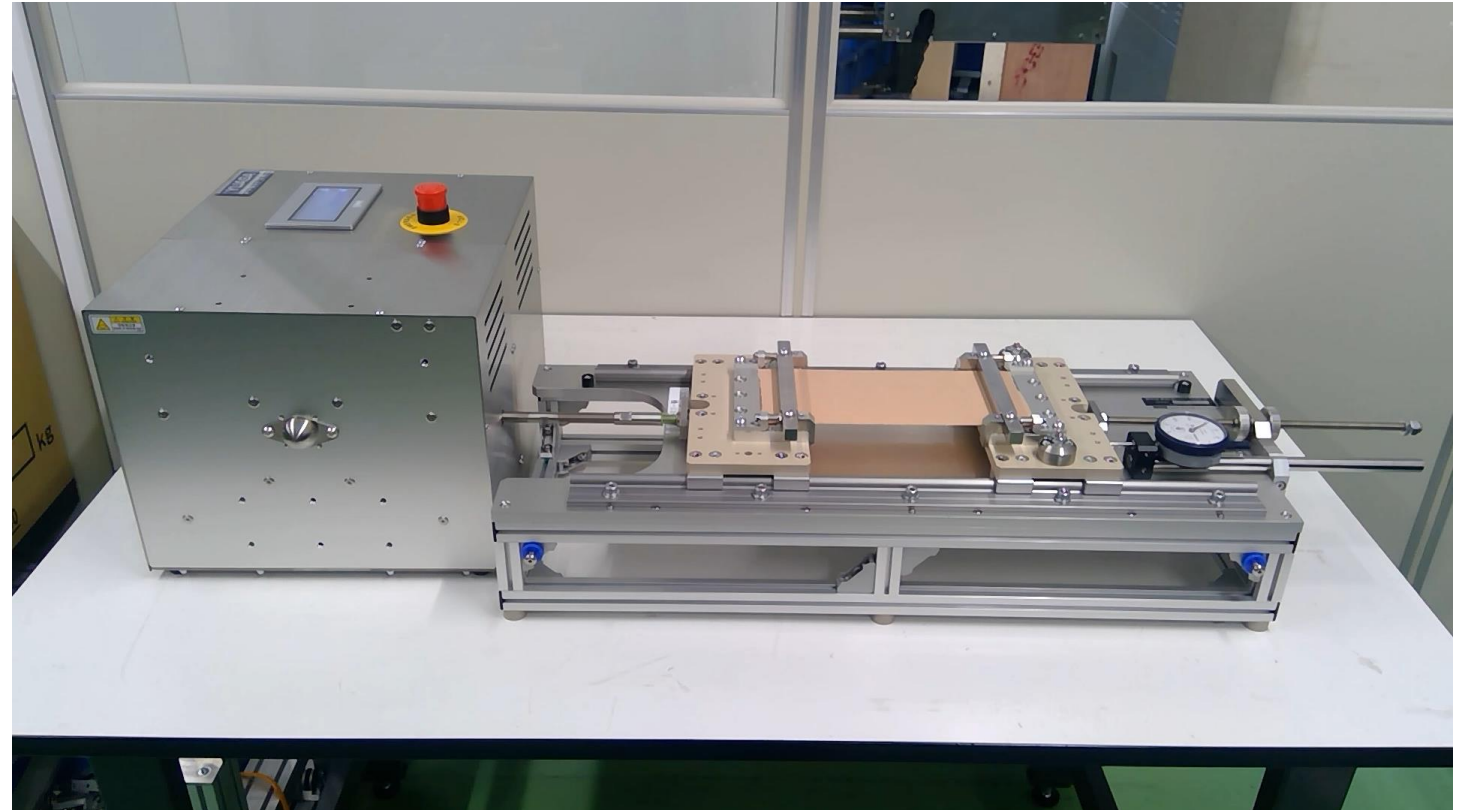


Stretching Motion

- Accurate stretching between fixed and moving point
- Position Adjuster for precise location
- Squashing to monitor pressure
- Various Pull strengths 7N to 1,500N
- Used in wearable electronic components

ST Stretching

- Linear or planar objects
- Accurately stretched to 120 mm
- Tension up to 70 N (15.7 ft lbs)
- Optional Data measurement
- Ambient/Hostile conditions



Twisting Motion

- Consistent twisting between fixed and moving point
- Springs / pulleys make twisting tension-free
- Rotating faceplate twists the Holding Clamp
- Rotating faceplate also pulls on a String
- String keeps Moving Plate correct distance from Fixed Clamp

FT — TWISTING WITH TENSION-FREE ©

- Torsion test for planar objects
- Flexible displays & OLED devices
- No tension on sample
- Clamp distance controlled exactly



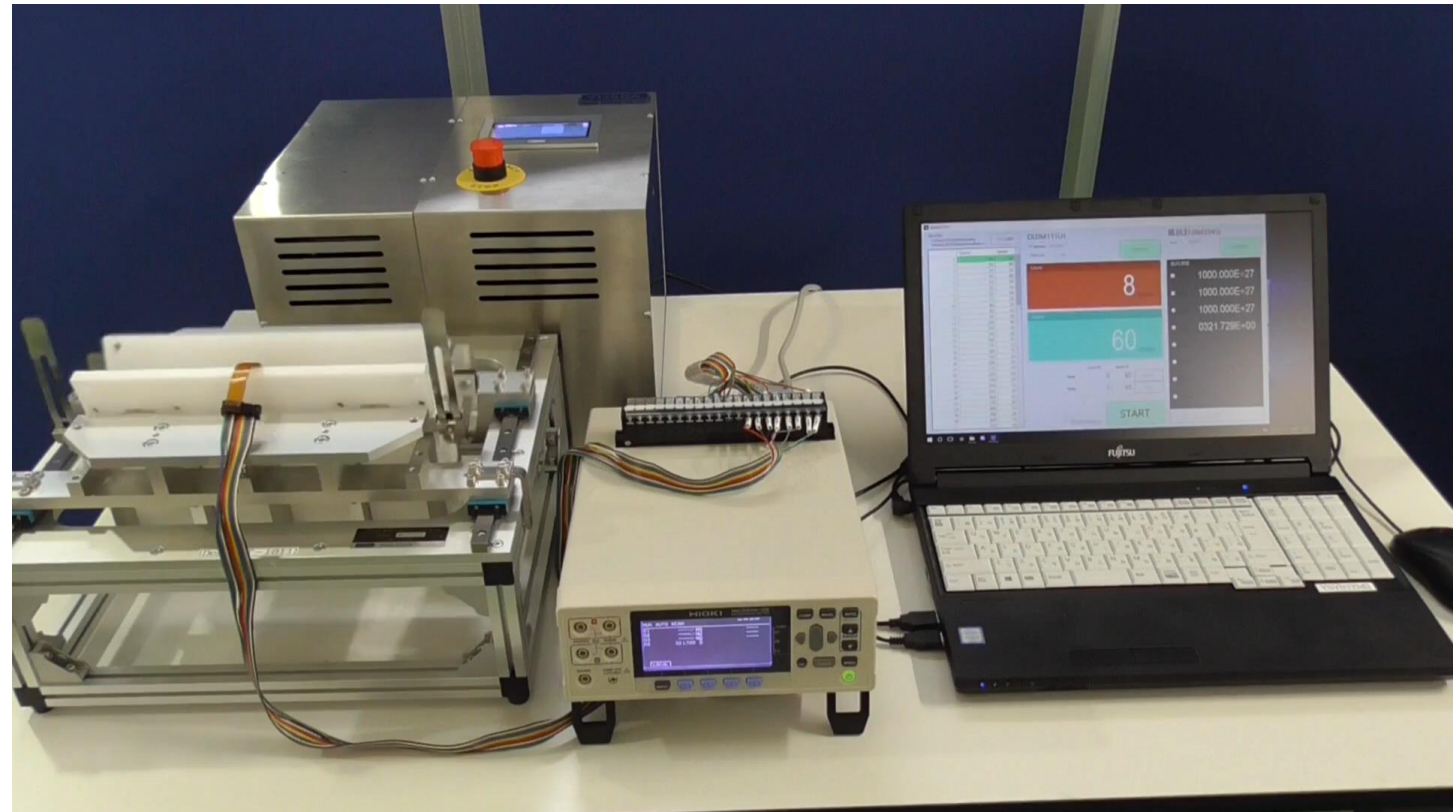
Failure Modes & Mechanical Functions

	Butterfly Flex	Clamshell Flex	Twist	Roll	Stretch	Bend
Cracked	XX	XX	XXX	X	XXX	X
Delaminated	XXX	XXX	XXX	X	XX	X
Bent Permanently	XXX	XXX		XXX		X
Stretched Permanently	X*		X		XXX	XX
Torn			XXX		X	

* Some Butterfly test machines also can be configured as a stretch machine

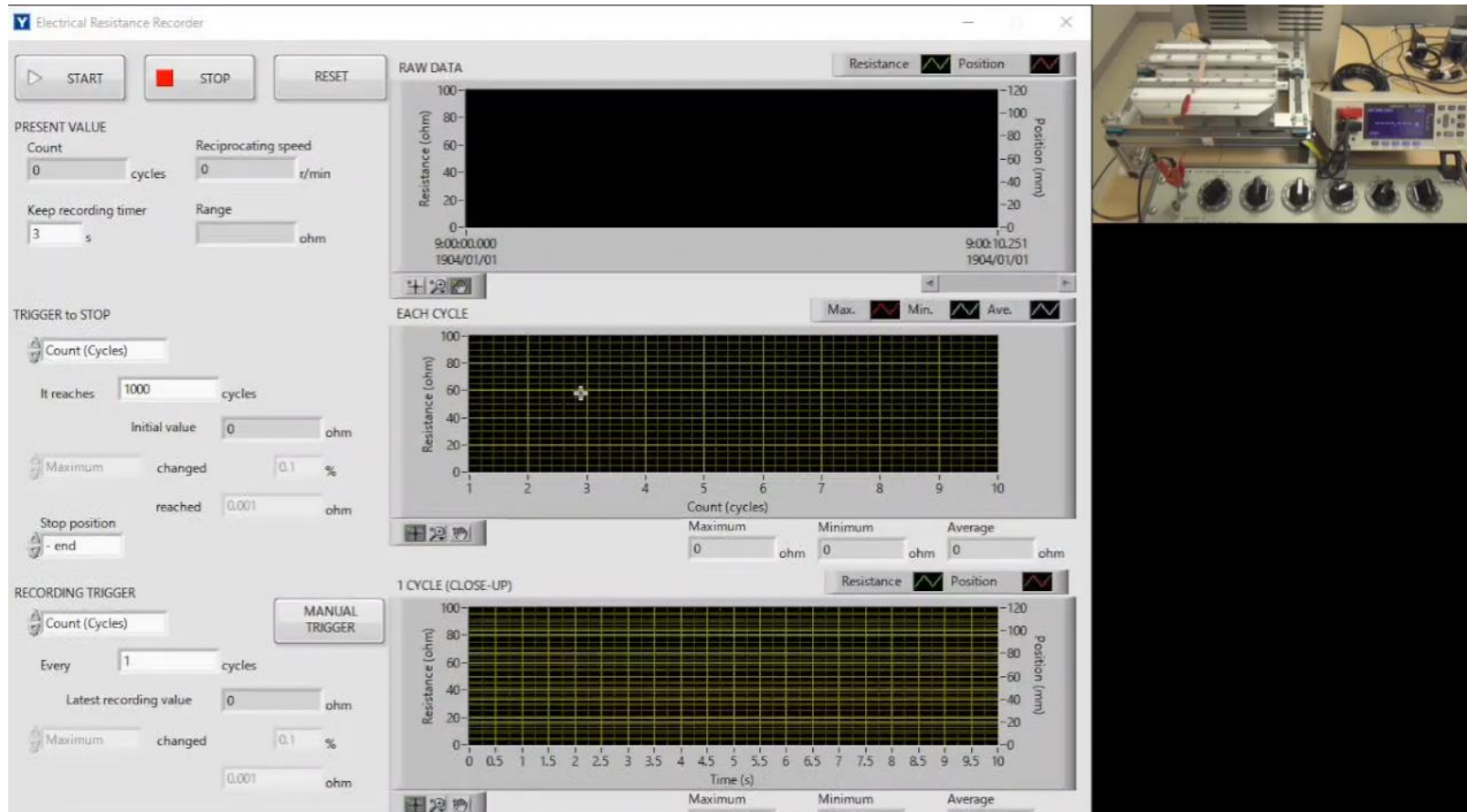
ECP2 — DATA MEASUREMENT PACKAGE

- Measures Electronic Resistance
- Set-it-and-forget it control
- Audit trail for suppliers
- Python programmed
- Temperature, Capacitance*
- IP Cameras*



ECP-PLUS

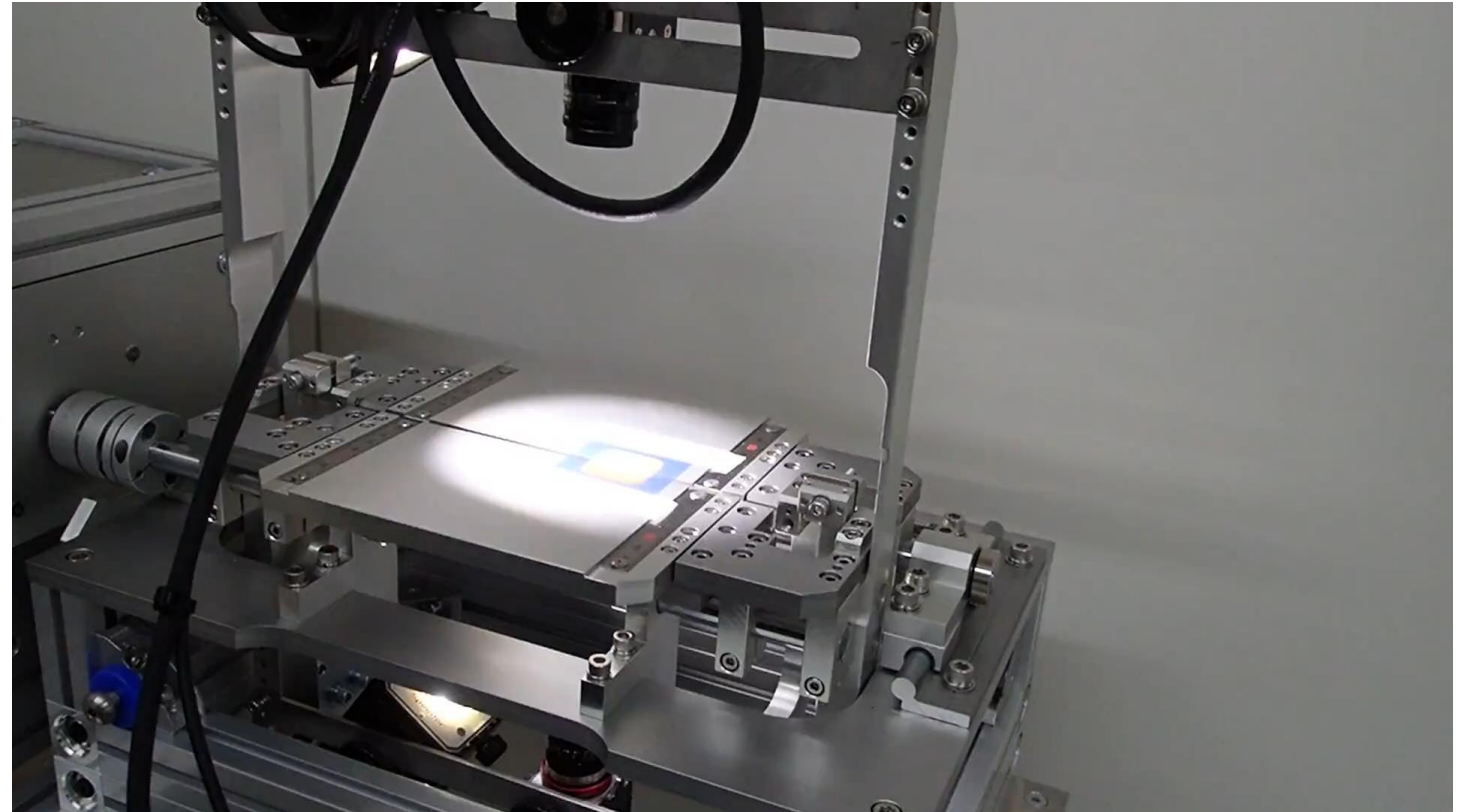
Resistance Trend Measurement



Measure resistance trend synchronized with endurance testing. Laptop Display has control buttons, graph of Raw Data, graph of each cycle, graph of continuous cycles.

CS-CAM Optical inspection

- CS-CAM Clamshell flexing
- Optical Inspection System
- Camera Output on Monitor
 - One or more Cameras mounted above sample looking at the bending point
 - Can be used to find cracks automatically



ENVIRONMENTAL CHAMBER INTEGRATION

- Existing chamber conversions
- Single control integrations
- Pico-chamber concept

- Heat/Humidity
- Atmospheres*
- Ultra-violet*
- Gasses*



BayFlex Solutions Strategic Partners



YUASA Systems

- Origins in Automobile components (crankshafts)
- Makes Configurable Modular Endurance Testing Systems (over 120 variations)
- Field Proven in Consumer Electronics, Automobile
- Multiple Patents in Mechanical Testing and Tension-free Mechanism
- Established in 1941; 450 Employees; Based in Okayama, Japan

info@yuasa-system.jp



Who we are

Paul Semenza

Director, Nextflex ; President, NPD

Dr. Bob Hopkins

SVP, Sony; GM, RCA

Eisuke Tsuyuzaki

CTO, Panasonic; SVP, Sony

Investment from Nikkei Ventures



Thank you

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