



## **Agenda Item 2**

# **Featured Start-Up – FlexEI, LLC**



**BOARD OF REGENTS**

SUMMARY OF ITEM FOR ACTION  
**INFORMATION** OR DISCUSSION

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**TOPIC:** Featured Start-Up – FlexEl, LLC (information item)

**COMMITTEE:** Economic Development and Technology Commercialization

**DATE OF COMMITTEE MEETING:** June 9, 2016

**SUMMARY:** FlexEl, located in College Park, MD, manufactures flexible batteries, biocompatible batteries, microbatteries and custom batteries for high volume applications. The company was spun out of the University of Maryland, based on thin film battery technology, and was extensively nurtured through many of the startup resources at the university, including the Maryland Industrial Partnerships (MIPS) grant program and the Maryland Technology Enterprise Institute (Mtech) incubator space.

The company recently relocated to an 11,000 SF facility, leased from the university, and has been optimizing its original thin film battery technology and expanding into adjacent battery technologies to develop solutions for wearable technology, medical devices, military applications, disposable consumer electronics, remote sensing devices, and more. FlexEl is a powerful example of the potential of university-affiliated startups in energizing the region's economy.

**ALTERNATIVE(S):** This item is for information purposes.

**FISCAL IMPACT:** This item is for information purposes.

**CHANCELLOR'S RECOMMENDATION:** This item is for information purposes.

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COMMITTEE RECOMMENDATION:

DATE:

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BOARD ACTION:

DATE:

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SUBMITTED BY: Thomas Sadowski / Suresh Balakrishnan (301) 445-2783

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# **COMMITTEE ON ECONOMIC DEVELOPMENT AND TECHNOLOGY COMMERCIALIZATION**

## **FEATURED START-UP - FLEXEL**

**June 9, 2016**

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FLEXEL

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# Who We Are

- We are a custom battery engineering company
- Our mission is to bring our customers' unique product ideas to life through battery innovation
- We are a long term journey partner, taking our customers all the way from battery idea to volume manufacture (in-house, 3<sup>rd</sup> party or customer integration)



# Our long journey together

- 2008: Spun out of University of Maryland
- 2008: UMD Office of Technology Commercialization Invention of the year award winner
- 2009: UMD \$75k Business Plan Competition winner
- 2009: join Mtech Venture Accelerator Program
- 2009: Two-year MIPS program grant
- 2010: Entered Mtech Technology Advancement Program
- 2010: Maryland Incubator Company of the Year Award
- 2013: One-year MIPS program grant
- 2015: UMD \$850k Tenant Improvement funding to enable FlexEI relocation to its new facility

Dr. Robert Proctor joined FlexEI in 2009 as CEO of the company.

He left us in May this year to focus on another Maryland based business.

Bob and UMD / Mtech have been instrumental in getting this company to its current level

Thank You



“The University of Maryland has been and continues to be integral to FlexEI’s success. FlexEI was born at UMD, nurtured by UMD, and has thrived in an ongoing partnership with UMD. We are forever grateful for their generosity and support.”

– Bob Proctor, CEO



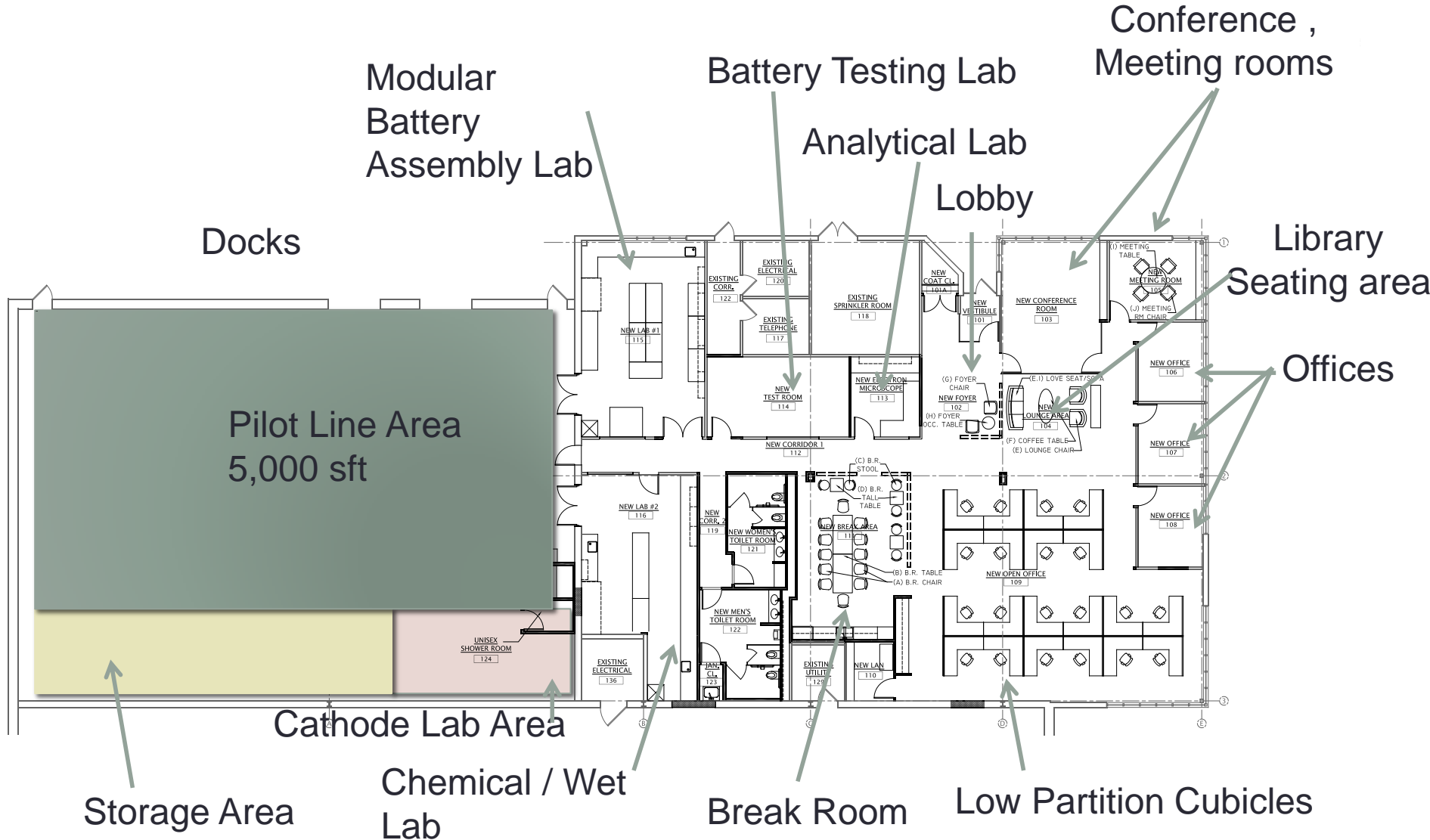
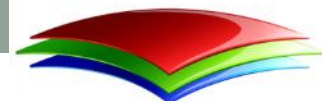


## Our team:

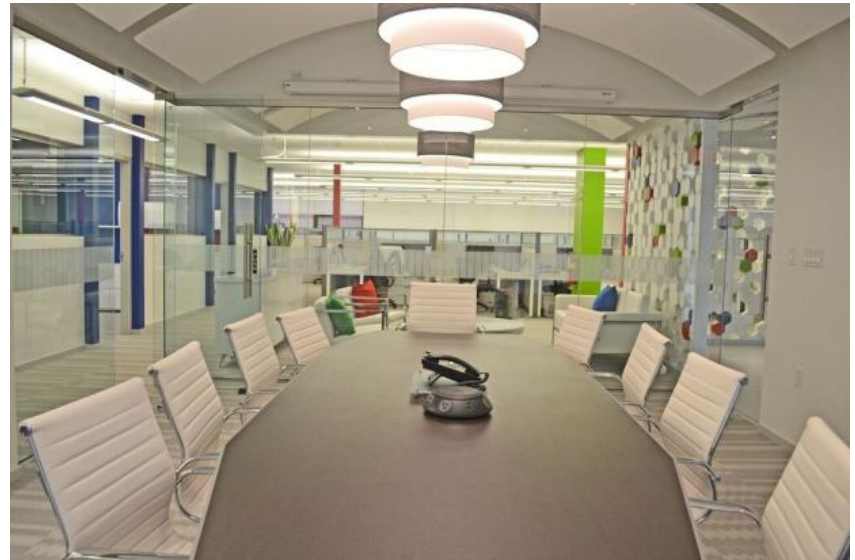
- **Demographics:**
  - 15 employees; 53% UMD Alumni; 7 countries; average 35 year old
- **Dr. Jean-François Audebert, President & CEO:**
  - previously GM of R&D for Energizer. Ran application-specific R&D and scale up to commercialization for Energizer. 25+ years experience in numerous R&D and production roles, majority with Energizer. Joined in 2013
- **Mahsa Dornajafi, Product & Operations Manager:**
  - UMD graduate in micro-electronic, joined in 2009
- **Strong cross-functional team:**
  - Ph.D.'s and Masters (collectively 90 years of battery chemistry, electrochemistry, mechanical engineering, manufacturing, data analytics and material characterization)
  - Temporary UMD under-graduate interns

Privately own (Mtech Ventures for 3.55%) - \$2M size business  
 Relocated from the UMD TAP Building, to a state of the art  
 11,000sf facility leased from UMD in December 2015 (\$1.3M in  
 State, County & UMD incentives)





We combine the process maturity and business practices of large companies with the agility and innovation of a small company



# How We Help

- Battery is often the bottleneck for many customer's new device product development,
- We work on emerging technology products, using proven chemistries with a retrofit.
- We push the limits on battery innovation to meet our customers unique battery requirements – be it higher power density, biocompatibility, unique size and shape or usability.
- We are the key enabler for market entry
- Most effective and efficient device design space solution- high volume manufacturability and critical issues up front
- Pure play custom battery company– small and nimble, focused on commercially viable custom batteries
- We use a stage gated process to mitigate project risk for our customers



# Market Opportunities - Trends

Most of our contacts are related to Internet of Things (IoT) new device development:

- Installed IoT devices to reach 40B units by 2019
- Majority of devices to be powered by primary batteries:
  - Disposable, limited operational life
  - Primary battery simplifies printed flexible PCB designs
  - Lower device cost than same made with rechargeable battery
- Device development pain points:
  - How to get battery thinner (< 1.3 mm) and get flexibility?
  - Big battery players not interested in B2B or small volume of custom sizes
- Battery development pain points:
  - Not one size fits all
  - Thin, Flexible, affordable cost (\$0.25-0.50/unit)
  - Safe



# Market Opportunities- Trends (2) FLEXEI

From website visits, potential customer call insights:

- Wearable and Smart packaging/labels:
  - Replacement of lithium coins (3V) to go thinner and flexible, to enable close fit to body parts or integration in label manufacturing and product labeling
- Medical: next generation of devices
  - Small, mini or micro battery size
  - Flexible
  - Biocompatibility
  - Intrinsic safety
- High Power Device:
  - Instant burst of power



# Flexible Battery

**Wearable applications**

**Transdermal patch**

**Smart labels & Packaging**

<b>Flexible:</b>	<b>Yes</b>
<b>Biocompatible:</b>	<b>Yes</b>
<b>Nominal Voltage:</b>	<b>1.6 Volts</b>
<b>Disposable:</b>	<b>Yes</b>
<b>Dimensions:</b>	<b>Custom</b>

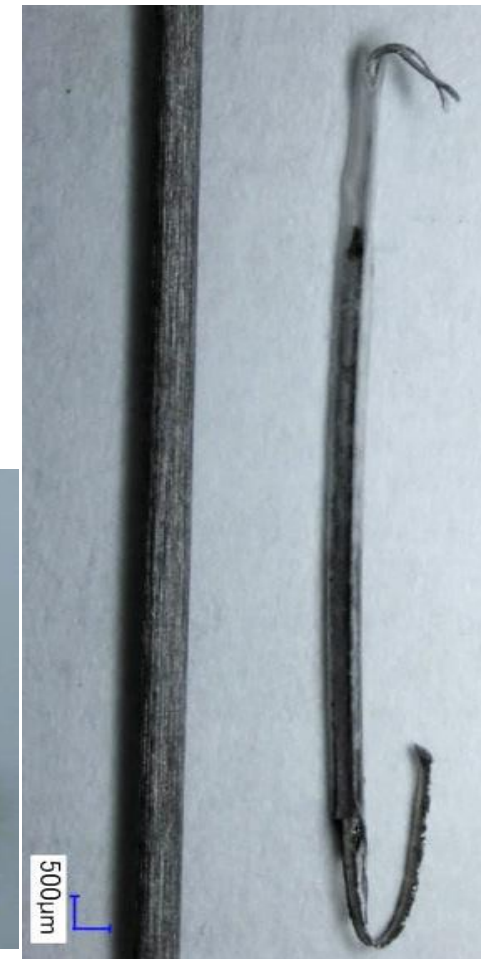
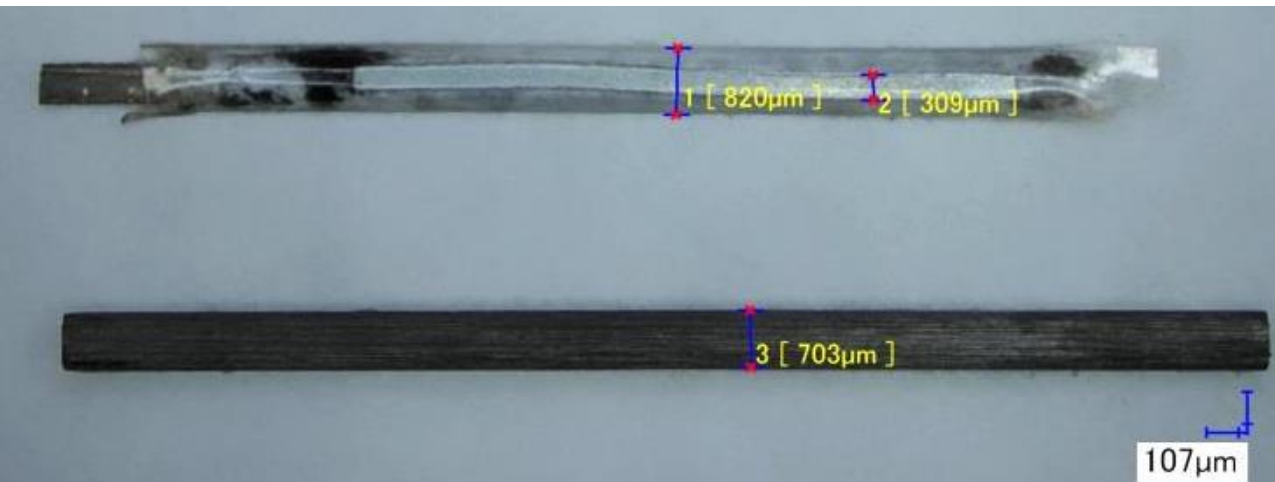


# Micro-Battery

## Medical Applications

Ultra low power micro-battery with thickness less than 3 human hairs put together.

<b>Biocompatible:</b>	<b>Yes</b>
<b>Nominal Voltage:</b>	<b>1.6 Volts</b>
<b>Disposable:</b>	<b>Yes</b>
<b>Dimensions:</b>	<b>Custom</b>



# High Power Density Battery

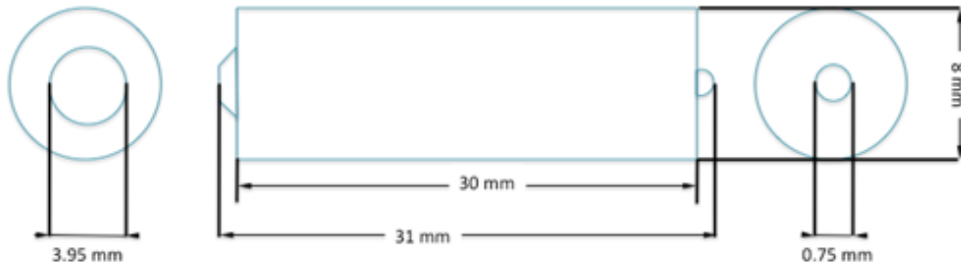
**Nebulizer**

**Cosmetic Applicator**

**Electronic Cigarette**

Smaller than a 4A size battery, but more than 3W of power (2.5 Amps)

**Nominal Voltage:** 1.7 Volts  
**Disposable:** Yes  
**Dimensions:** Custom  
**Metal container**







# FlexEl Capability Overview

Customer specifications and priorities

- Power density
- Energy density
- Cost
- Form factor
- Internal Resistance
- Contacts
- Shelf life
- Weight
- Safety/abuse tolerance
- Human toxicity
- Etc.

Material and composite particle synthesis

Electrolyte formulation

Cathode formulation and processing

Anode fabrication and processing

Packaging and sealing

Contact/feed-through design

Designed experiments /Statistical optimization

Battery load simulation and test

Custom electronic test design and fabrication

Accelerated lifetime testing

Deconstruction and success/failure analysis

Advanced Diagnostics (XRD, XPS, SEM, GC, etc)

Modeling and simulation

Theory

# Operational Capability

- Pilot scale equipment for flexible and hard shell cell packaging
- Pilot scale equipment for electrode production
- Chemical laboratory for synthesis and analytical work
- Production scale equipment for printing electrodes and packaging flat cells or cylindrical cells
- Testing laboratory with cell testing equipment and environmental chambers
- Access to top of the art material characterization equipment (SEM, XRD, XRF, XPS, DSC, DMA and many more) at the University of Maryland thanks to our **Affiliate** status
- Quality system
- Lean Operations

UMD and MTech have been great  
resources to FlexEl still...



# Small Business Pain Points:

Proper management of a business requires many more skills and knowledge than just technical or managerial. The commercial world is highly complex and regulated.

- Business accountabilities:
  - Safety – OSHA regulations
  - Payroll – Labor laws – Benefits (Human Resource)
  - Finance - Accounting – Taxes
  - Corporate laws – Legal document proofing
  - Federal Appropriation Regulations for government funding
  - Regulatory regulations (EPA, WSSC,...)
  - Marketing



To be competitive in the consumer goods market mandates that we master many Operations / Manufacturing skills upfront.

- Quality Control – Quality Assurance – ISO/ANSI standards
- Production Engineering - Maintenance
- Supply Chain - Logistic
- Sales

Time is a driving force, requiring fast action/reaction all the time: Show much goes on!

Cash is the engine of the journey and consultants / service providers are expensive (15 - 25% of annual spending)



# What can UMD do to help further?

- Considering impact of UMD internal decision(s) on these businesses (ex: sudden discontinuation of charge accounts to use UMD services and facilities (FRS) without back-up plan)
- Getting service or support faster than today
- Building a strong sense of urgency, customer service and accountability in employees involved in these activities
- Publicizing more visibly the current menu of services offered
- Adopting a calendar work schedule more compatible with private companies schedule (no “school break”)



UMD and Mtech are involved with a large pool of small companies. FLEXEL They have much better leverage to negotiate contract rate or fee for service providers of general administration activities like:

- Human resource
- Accounting & Finance
- Corporate lawyers
- Regulatory experts

Or more specific expert consulting like:

- Quality Control – Quality Assurance – ISO/ANSI standards
- Production Engineering - Maintenance
- Supply Chain - Logistic
- Sales

UMD could be in a position to lock down some “preferred” rates or fees for service and to provide interested companies access to these “preferred” rates or fees for service.

Furthermore, as demand dictates, UMD can consider integrating some of these services as core skills in their internal assistance menu and options



# Q & A