# The role of rapid prototyping technology in the development of electromaterial demonstrator projects

Stephen Beirne[1], Cormac Fay[2], Brian Corcoran[2], Noel E. O'Connor[2], Geoff Spinks[1], Dermot Diamond[2] and Gordon G. Wallace[1]

[1]Intelligent Polymer Research Institute, ARC Centre of Excellence for Electromaterials Science, University of Wollongong, NSW, Australia
[2]CLARITY: Centre for Sensor Web Technology, Dublin City University, Glasnevin, Dublin 9, Ireland

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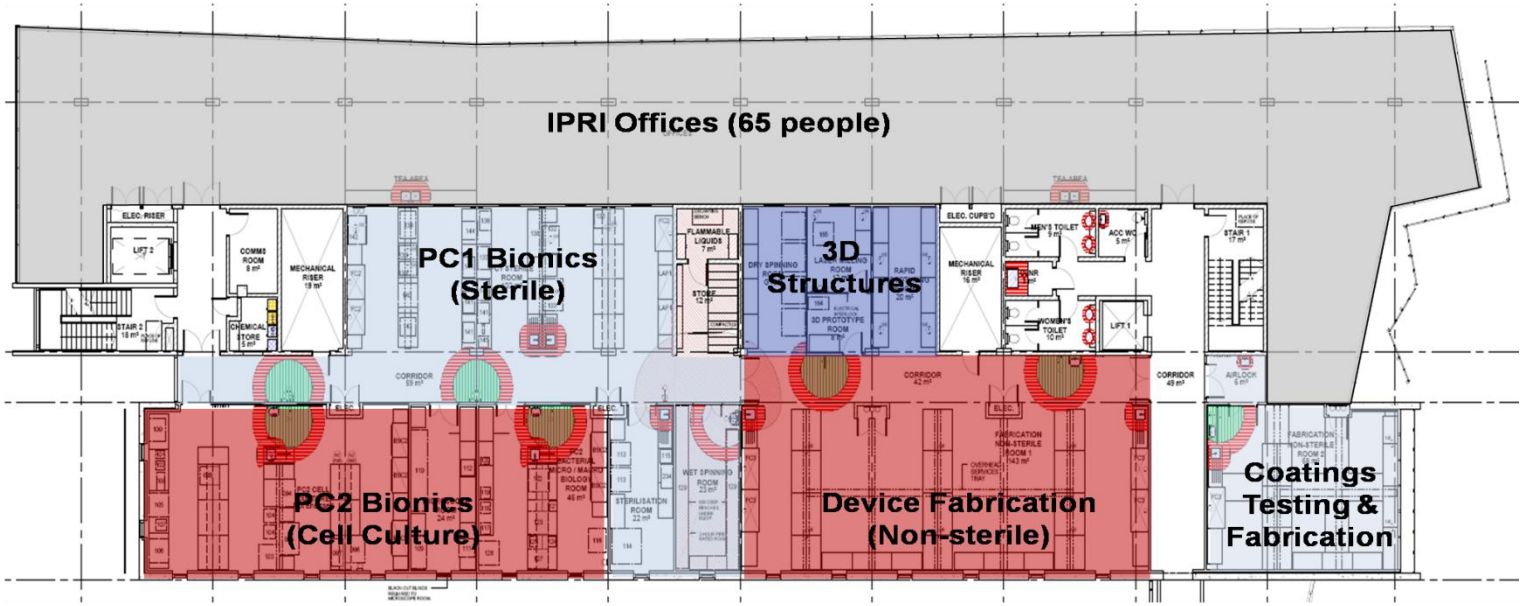
# Outline

- ANFF Funded Rapid Prototyping Systems
  - Dimension uPrint Plus
  - Objet Connex 350
  - Realizer SLM-50

- WANDA Project
- Design and Fabrication
- Current Challenges

# A.I.I.M Processing and Devices

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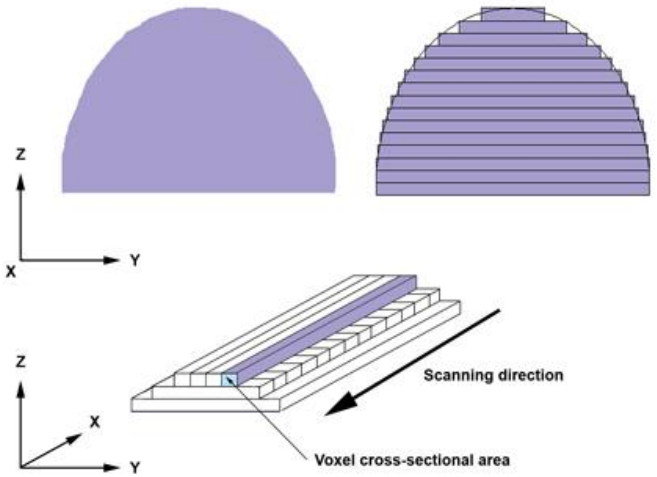
# Rapid Prototyping

- **Rapid prototyping** is the automatic layer-by-layer production of physical objects using additive manufacturing technology.
- Differs from **conventional machining**, i.e., mill or lathe, which are subtractive processes.
- First RP systems emerged in 1986
- New systems and techniques are being continually developed to include a greater range of "printable" materials with increased resolution.
- Parts are designed in 3D CAD software, saved as .stl files, which can be processed by machine specific software.



# IPRI Rapid Prototyping Systems

| Dimension uPrint Plus | |
|---|---|
| Build size | 203mm x 203mm x 152mm |
| Print Resolution | 0.33mm / 0.254mm layers |
| Machine Dimensions | 635mm x 660mm x 953mm |
| Technique | Fused Deposition Modelling |
| Materials | ABS Plastic (varied colours) |
| Status | Commissioned Nov 2010 |

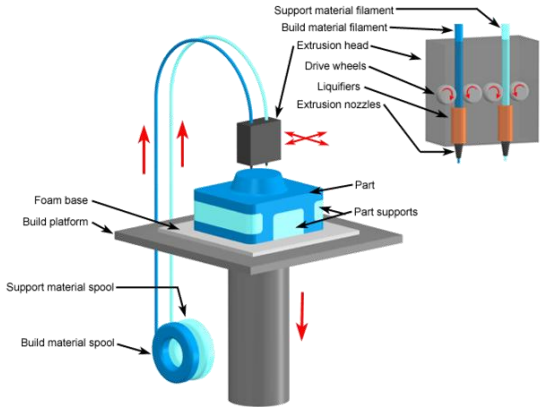



Image from http://www.dimensionprinting.com

# IPRI Rapid Prototyping Systems

| Objet Connex 350 | |
|---|---|
| Build size | 342mm x 342mm x 200mm |
| Print Resolution | 600 x 600 x 1600 dpi |
| Machine Dimensions | 1420mm x 1120mm x 1130mm |
| Technique | Polyjet printing |
| Materials | Multi-modulus photo curable acrylics |
| Status | Commissioned Nov 2010 |

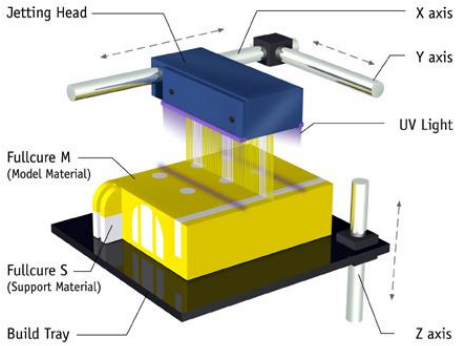
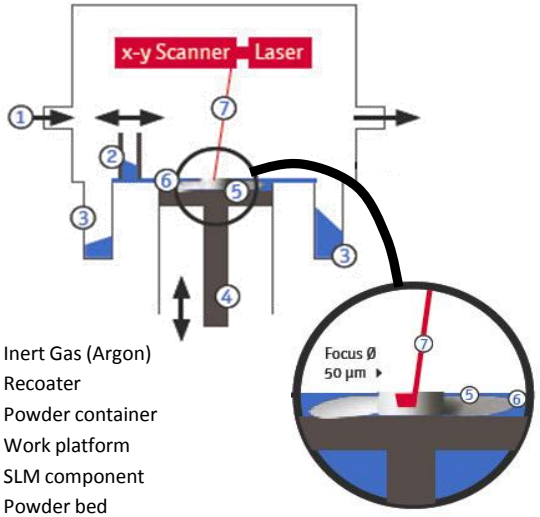




Image from http://www.objet.com/Misc/Gallery/

# IPRI Rapid Prototyping Systems

| Realizer SLM-50 | |
|---|---|
| Build size | Ø70mm x 40mm |
| Resolution | 20-50µm Layers |
| Machine Dimensions | 800mm x 700mm x 500mm |
| Technique | Selective Laser Melting |
| Materials | Initially - Stainless Steel & Titanium<br>Possible - Tool steel, Gold, Cobalt Chrome, Aluminium |
| Status | To be delivered July 2011 |



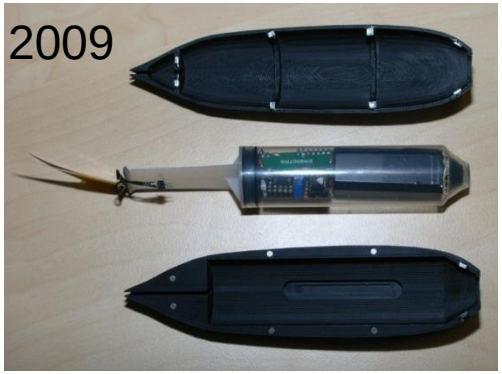

1. Inert Gas (Argon)
2. Recoater
3. Powder container
4. Work platform
5. SLM component
6. Powder bed
7. Minimum laser focus


Images from http://www.realizer.com/en/

# WANDA (Wireless Aquatic Navigator for Detection and Analysis)

- Demonstrator mobile sensing platform
- Propelled by conducting polymer actuators (bending)
- Low-cost distributed sensor interrogation method (optical).
- Current limitations include
  - Restricted internal volume – tricky assembly
  - Limited operating lifespan – electrolyte leaching



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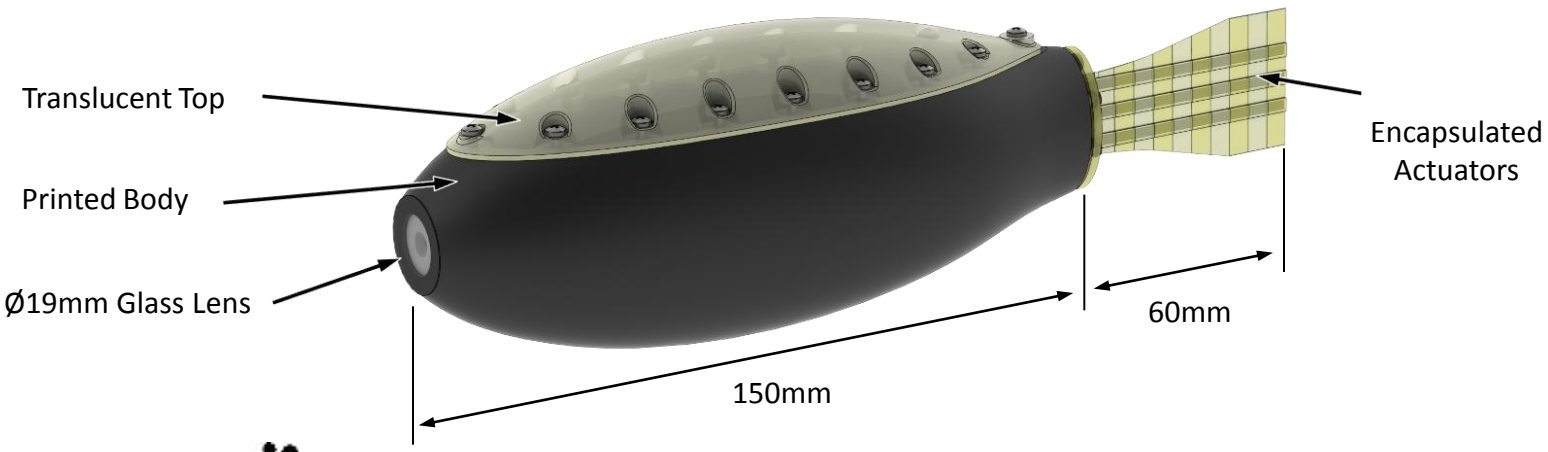
# WANDA (2010 Redesign)

- Replace syringe with watertight printed body (elliptical cross section)
- Maintains existing dimensions but increases useable internal volume.
- Modular design allows for interchangeable tail components.
- Different tail styles and configurations can be examined.
- Potentially printed tail to encapsulate actuators, retain electrolyte and extend operating lifespan.

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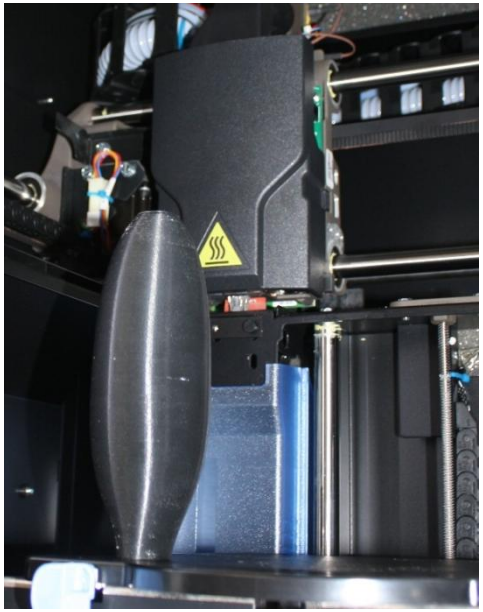
# WANDA (2010 Fabrication)



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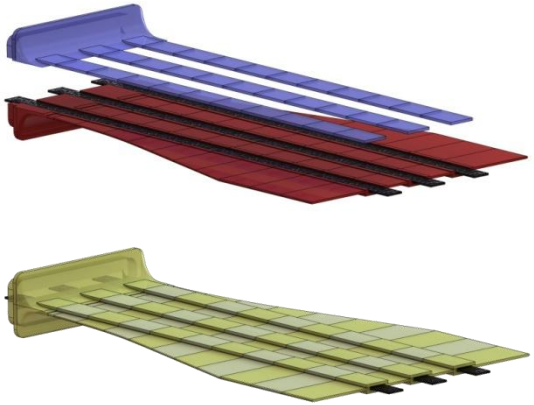
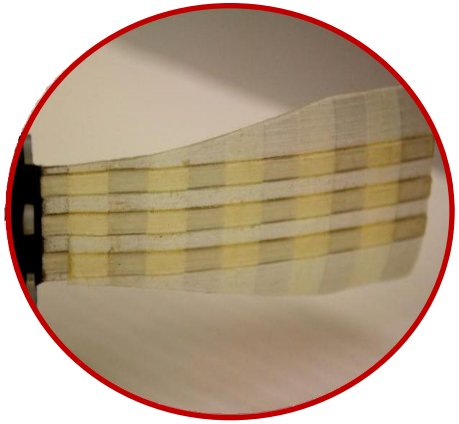
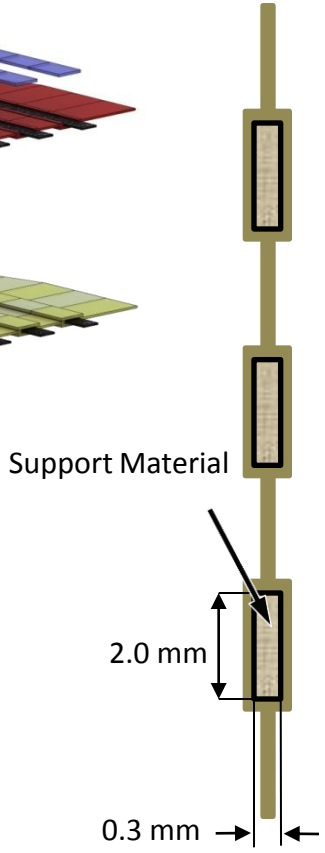
# Present Challenge (Tail Design & Fabrication)

- Target - Reliable encapsulation of actuators within tail structure
- Manual removal of support material – Not practical
- Structure to be printed around actuator – interrupt printing routine





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# Thank You

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