The STFC Micro and Nanotechnology Centre

Capabilities, current work, what we can do for you

Justin Greenhalgh

and the MNTC management team

Contents

- Who we are
- What we can do
- What we are doing
- What we can do for you
- Our situation

STFC's Micro and Nanotechnology Centre

- Part of STFC's Technology Department
- Sited at RAL, on the Harwell Science and Innovation Campus
- About 20 scientists and engineers
- 700 sq m clean rooms
- Deposition, lithography, etch, inspection, special processes
- 9 tenant companies, 4 spin-outs

MNTC at RAL

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MNTC capabilities – 1

Substrates:

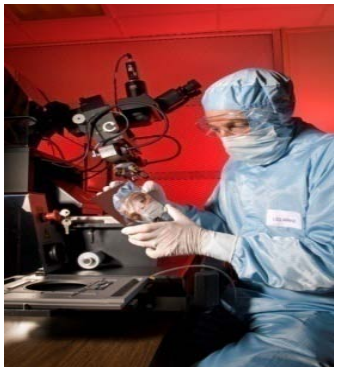
- Si, glass, Ge, GaAs, DLC, others possible eg polymers)

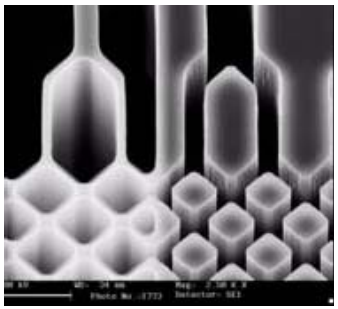
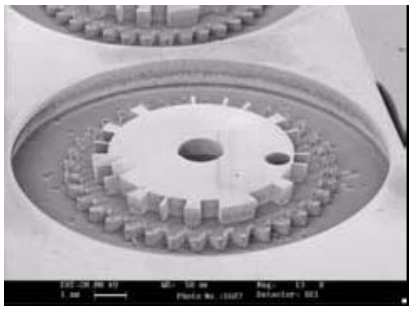
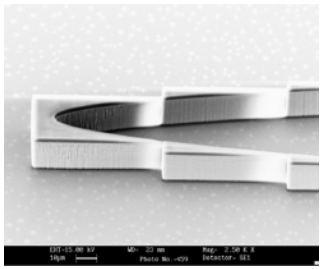
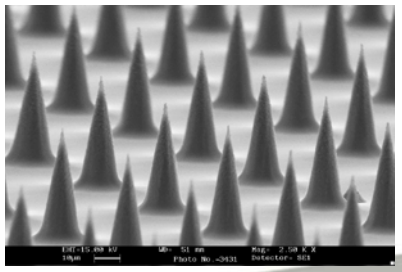
Deposition

- Spin coating (resists and polymers, HSQ "spin-on-glass")
- Sputtering (metals and some oxides)
- PVD: E beam deposition (metals and oxides)
- Resistive evap (metals)
- Thermal wet and dry oxidation (Si→SiO2);
- PECVD (SiO2, SiN, SiON)
- CVD: W, TIW, Al, Cr

Lithography

- E-beam (VB6 line widths down to 15nm)
- Optical 5x reduction (365nm i-line) MA6 g-line 204nm)
- Wide range of Ebeam and optical resists, +ve and –ve, fully characterised).
- (X-ray lith experience)
- Nanoimprint lithography



MNTC capabilities – 2

Etch

- wet etch
- RIE, DRIE: two STS systems
- Plasma etching (de-scumming)

Inspection

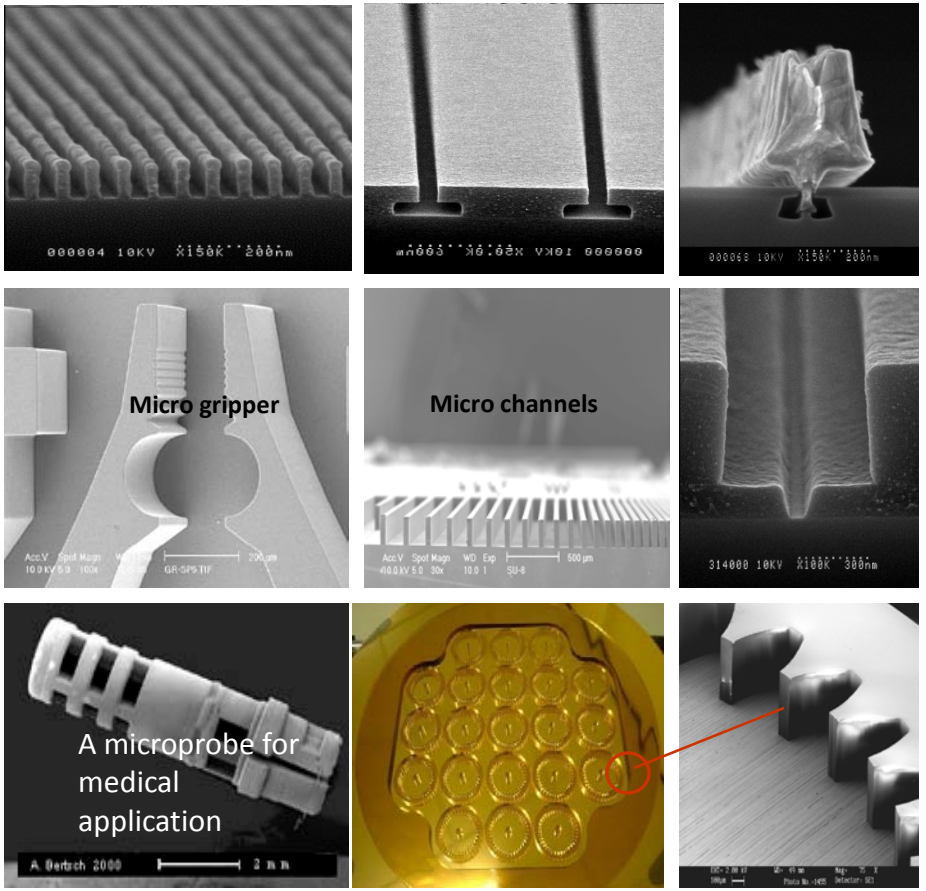
- Four SEMs; AFM; SAM; Interferometers; Raman system
- Line widths; film thickness; surface structure; step heights; wall angle; atomic composition; defect inspection
- Elipsometer

Special processes

- Wafer bonding
- Electrospinning
- Electroplating
- MNT powderblasting
- Indium bump-bonding
- Laser micro-machining

Other capabilities in STFC/Campus

Huge variety: TEM, STEM, XPS, micro machining, up to DLS and Isis.



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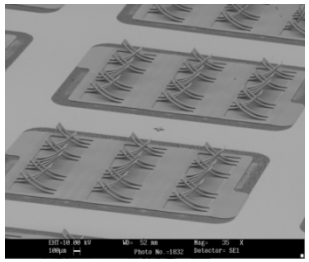
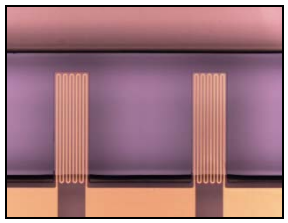
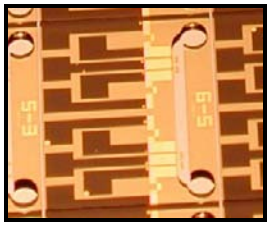
Cantilevers

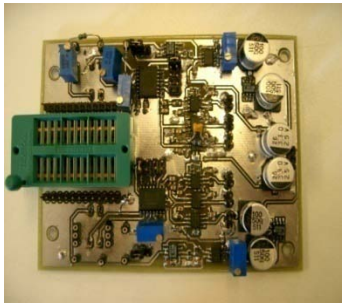
Blood viscosity:
Microvisk spinout

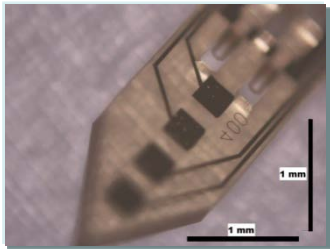


Biosensor for proteins

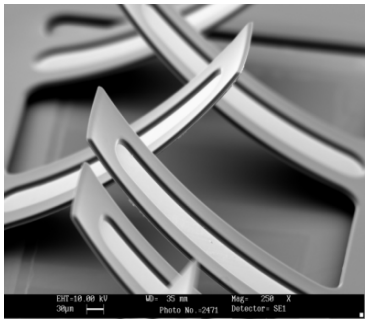




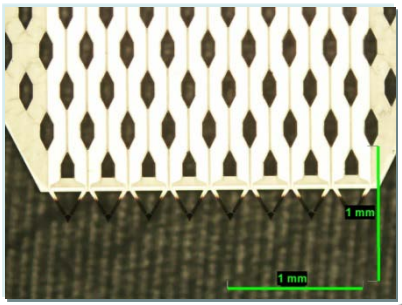


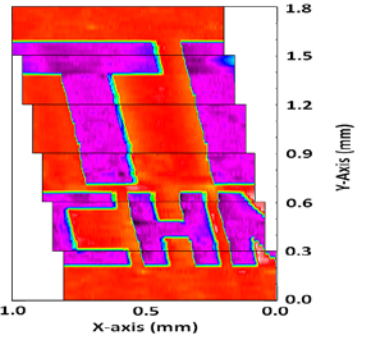


Micromirror array



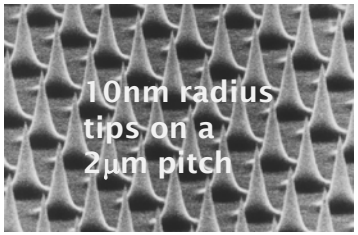
Massively parallel SPM

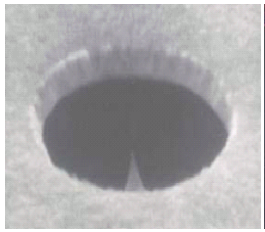
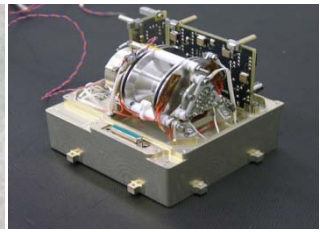




Microneedles for Space and Healthcare

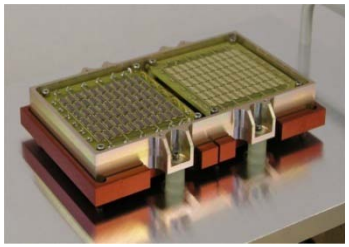
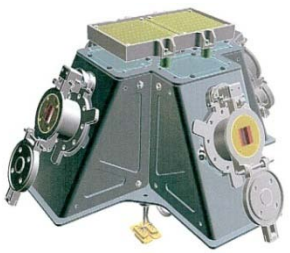
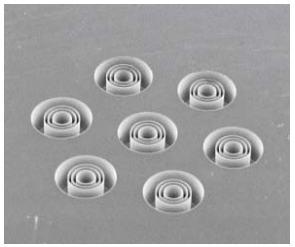
Field emission based mass spectrometer
(ESA's Rosetta Mission)



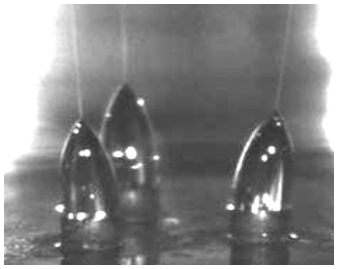
ESA Rosetta Mission

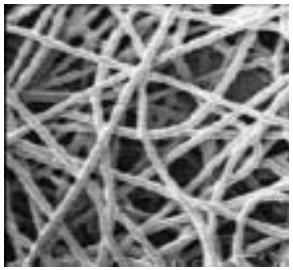
Charge neutralisation for microthrusters

ESA FEEP Neutraliser

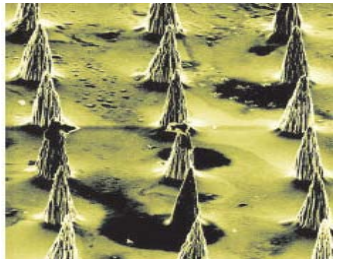
Electrospinning
(Spinout)



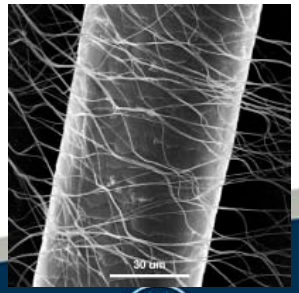


Electro spinning

Microneedles for medical applications



Nano needles for immunisation



Hair + ES fibres (Marburg)

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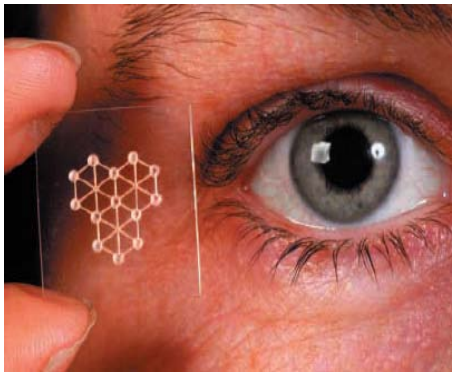
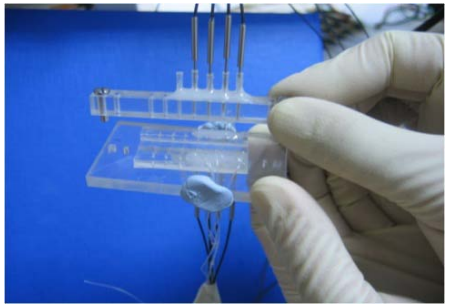
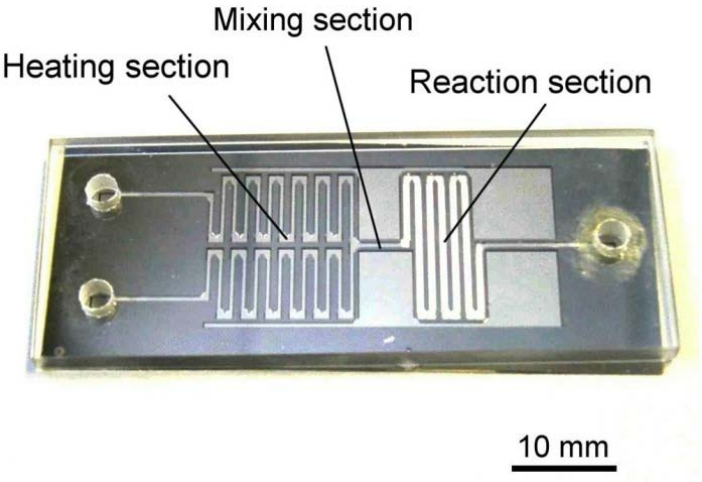
Microfluidics

Microliver – toxicity testing in vitro

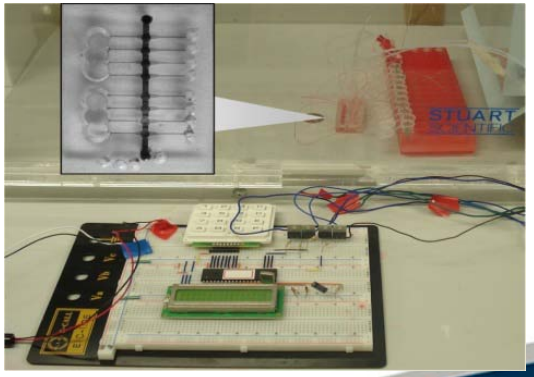


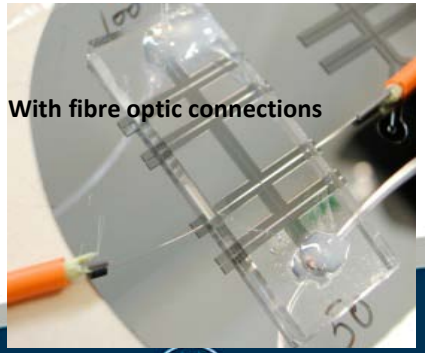




Lab on chip
Pneumatic and piezo pumps; microreactor

Useful platform for bionano…





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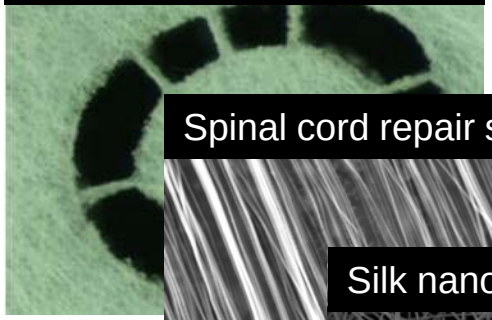
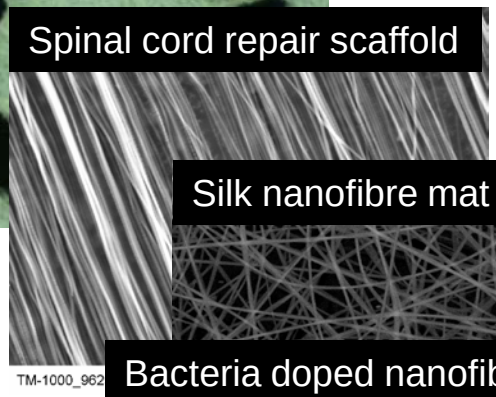
Nanofibres and electrospray

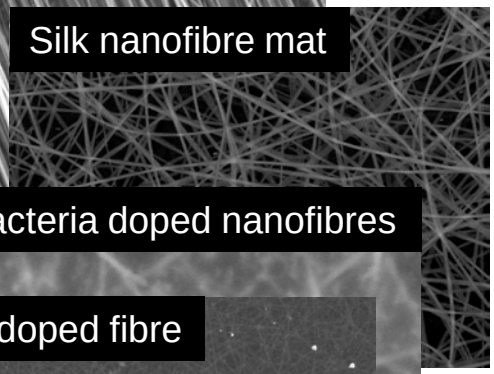
Millimetre scale scaffold



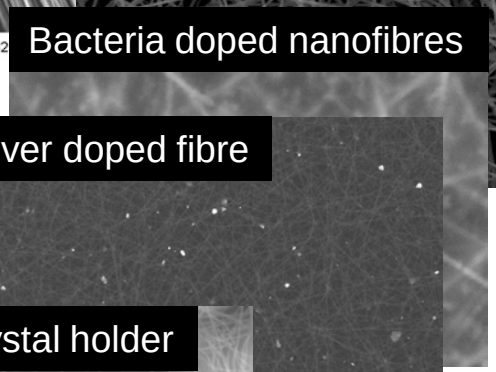
Spinal cord repair scaffold



Silk nanofibre mat

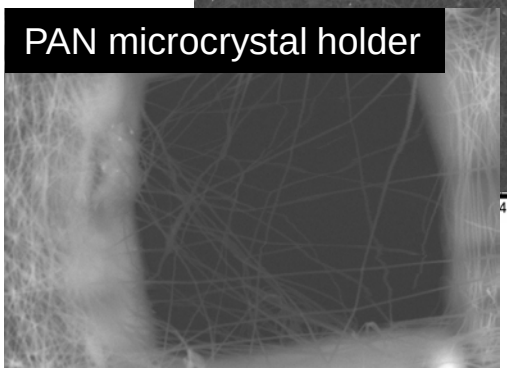


Bacteria doped nanofibres



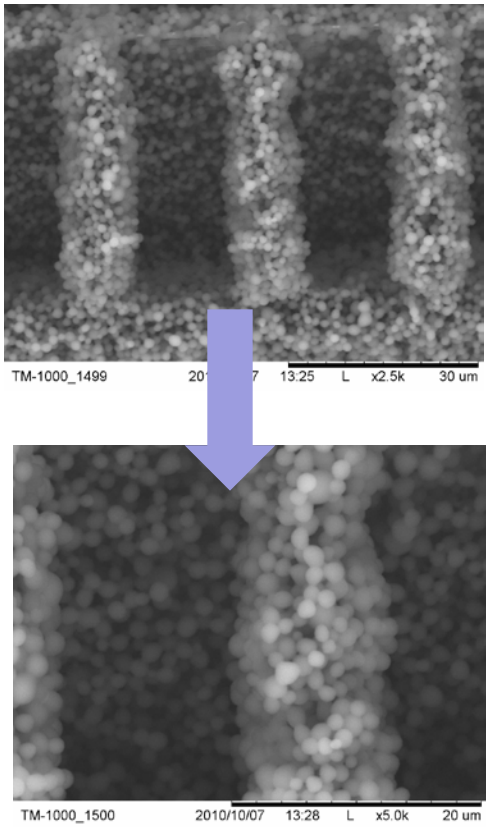
Silver doped fibre

PAN microcrystal holder



3D Tissue Scaffold

Silicon Microstructures coated by electrospraying



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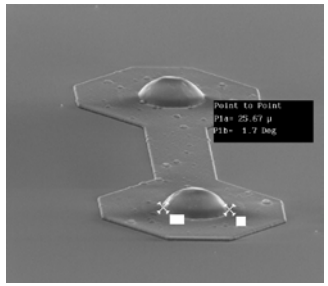
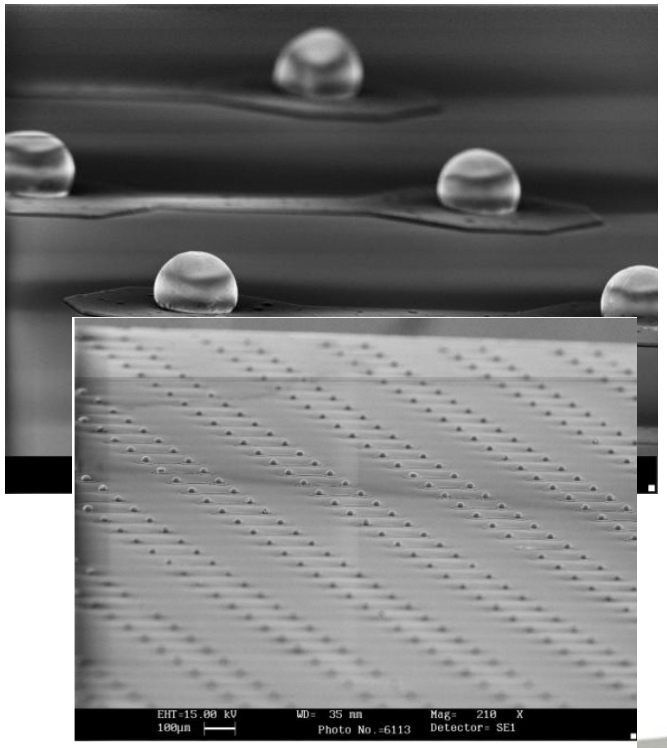
Indium bumping

- Recent success in developing and internal route to make In bumps.
- Pitch limited to about 50 microns.
- Also working on electroformed bumps – reached pitch of 25 micron (15 micron spheres)
- New development with a company should reach ~6 micron





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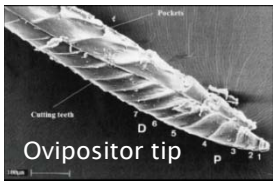
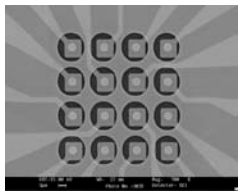
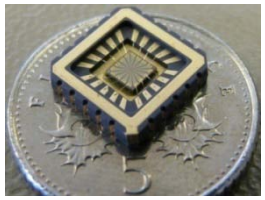
Other topics

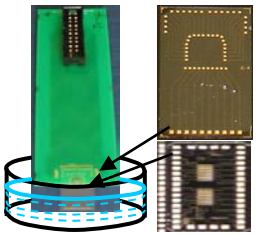


Biomemetic neural probe

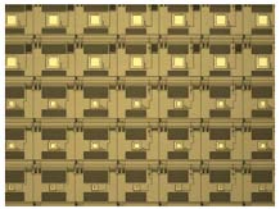


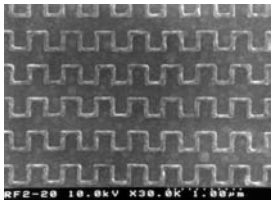


Protein sensing arrays

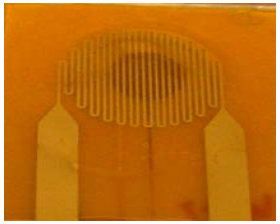


Protein sensing with FET, ASICs (right)

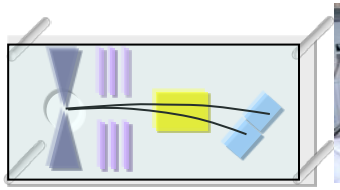




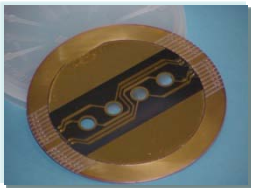
Photonic metamaterials



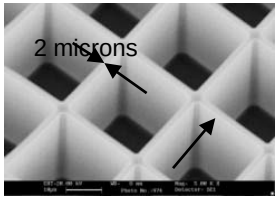
Oxygen sensor



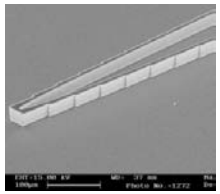
Breath analyser



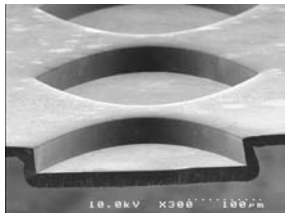
Aeroactuators



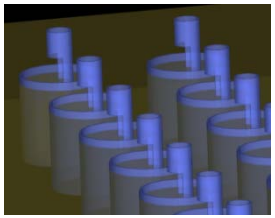
Scinitllators



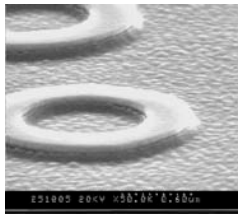
X-ray optics



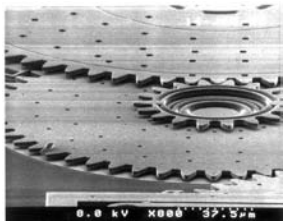
Diamond x-ray lenses



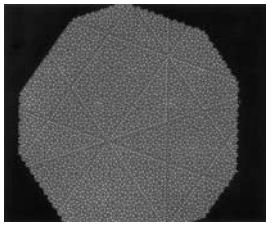
Protein stubs



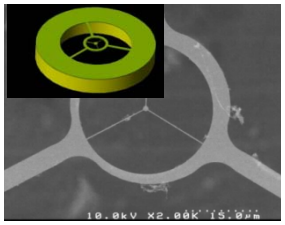
Magnetic micro-rings



MEMS for space

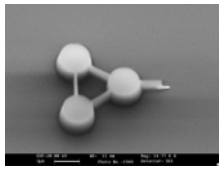


Quasi crystals



Laser targets

…and many more!



Business incubation

Oxsensis

Incorporated 2003
30 Staff at RAL

Incubating on site

microvisk technologies

Incorporated 2004
30 Staff

Off site but still accessing our facility

The ELECTROSPINNING Company

Incorporated 2008
3 Staff

Incubating on site

Cella Energy Ltd

cella energy

Spun out by Isis staff using some MNTC technology 14 staff

Incubating on site and internationally

What we can do for you

We solve your problems, by

- Consultancy leading to prototypes with routes to large-scale manufacture if required
- Grant collaborations, help identifying funding sources and applying
- Commercial partnerships (joint development of IP; or licensing existing IP to you)
- Training in MNT techniques from “quick look” to in-depth training in specific techniques
- Rental access to facility, lab space, office space, by the hour/week/month etc.
- Easy access to the wider capabilities of STFC technologies
- We are very well-connected to the wider UK MNT community and can channel requests/info/expertise.

Our current status

- Centres forum
- Outline Business case
  - BD required; we could become cost-neutral.
- Review

End