



**Oceans 2025 is a new research programme funded by the Natural Environment Research Council (NERC) to deliver key strategic scientific goals.**

The programme is designed by and implemented through seven leading UK marine centres addressing at a national scale, the challenges of a changing marine environment. Oceans 2025 will increase our understanding of the size, nature and impacts of these changes and address some of the most fundamental issues in marine science.

# Oceans 2025 covers ten major themes

- 1) Climate, ocean circulation and sea level
- 2) Marine biogeochemical cycles
- 3) Shelf and coastal processes
- 4) Biodiversity and ecosystem functioning
- 5) Continental margins and the deep ocean
- 6) Sustainable marine resources
- 7) Health and human impacts
- 8) Technology development**
- 9) Next generation ocean prediction
- 10) Integration of sustained marine observations

# Marine Technology and the Natural Environment Research Council



## Theme 8 Technology at NOCS

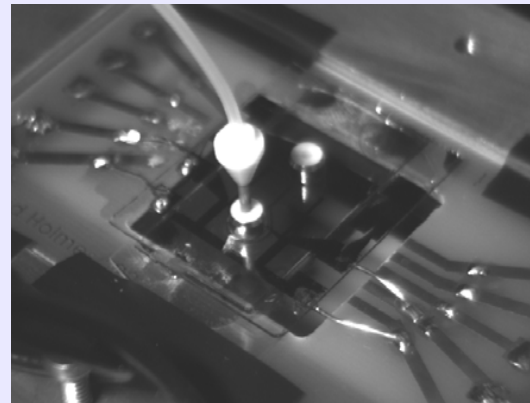
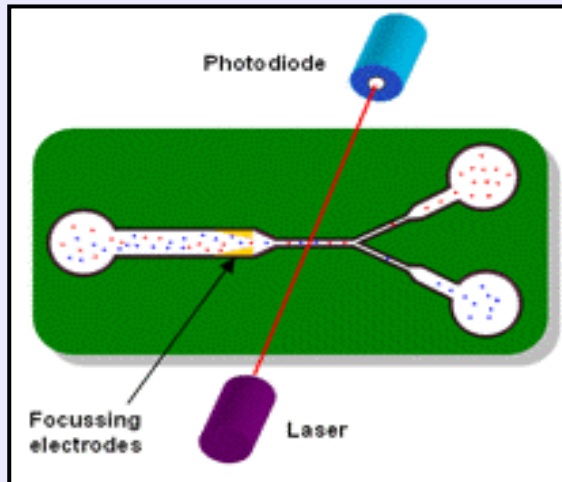
- Sensors:** Harness recent developments in microfabrication of fluidic devices.
- Platforms:** Fill some highest priority gaps: cost reduction, operating depth, intelligent measurement strategies and long range, long duration operations.
- Communications and information:** Keep up with paradigm shifts in communications and information technology to enable radical change in the *impact* of measurements.
- Reliability:** Work towards targeted reliability of observing systems to ensure fitness for purpose.

## Developing new biological sensors

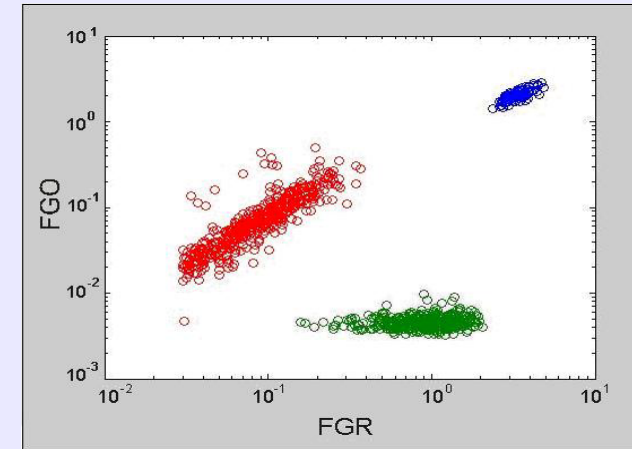
Giuseppe Benazzi,  
Matt Mowlem's PhD  
student joint with  
Prof. Hywel Morgan, ECS



### Towards a micro flow cytometer on a chip



'Chip-in-lab'  $\mu$ FACS.  
Interconnects for focusing and  
detection electrodes visible to  
left and right of fluidic chip with  
sample delivery tube connected.



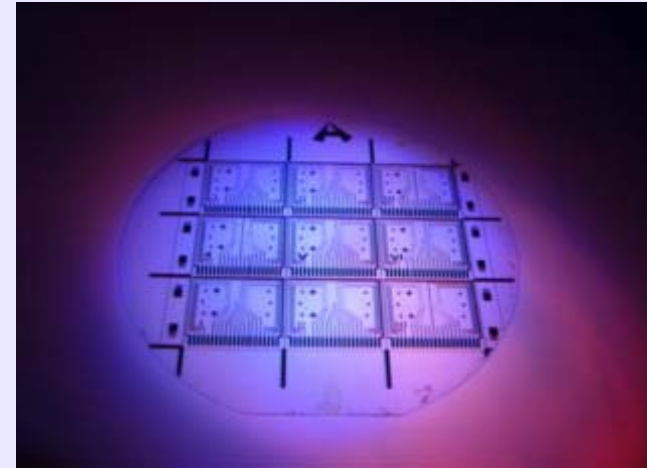
$\mu$ FACS autofluorescence  
analysis of:

*Isochrysis galbana* (green),  
*Synechococcus sp.* (red) and  
*Rhodospirillum rubrum* (blue).  
FGR = red fluorescence  
(532nm excite, 675nm detect)  
FGO = orange fluorescence  
(532nm excite, 585nm detect).

Flow cytometer concept

# Sensor Development at NOC in Oceans 2025

- ❑ Experimental *in situ* lab-on-chip, microFACS for phytoplankton and evanescent wave devices for methane demonstrated in the marine environment.
- ❑ Miniature sensor systems ready for commercialisation to include Mn/Fe liquid core waveguide system, ammonia wet chemical analyzer.
- ❑ Devices produced for direct support of marine science to include: miniature pH (Wet Chemical Analyzer), open ocean nutrients (miniature Liquid Core Waveguide), fast oxygen microelectrode.



## Information & Communication

- ❑ Use Semantic Web ideas and a systems approach considering data and metadata from sensor to user, complementing initiatives such as MarineXML. Using recent concepts and tools e.g. SensorML we envisage embedding within marine sensors and instruments the ability to create metadata for communication to data servers and archive centres.
- ❑ First aim is to provide interoperable interfaces, metadata encodings and automated processing of underway data from RRS *James Cook*, and with the British Antarctic Survey, from RRS *James Clark Ross* (building on existing BAS projects connecting instruments in the Antarctic to the web).