@stephenserjeant

The Open University

STFC Food Network+ Precision Technology

Stephen Serjeant

June 2017, Manchester

Life-changing Learning

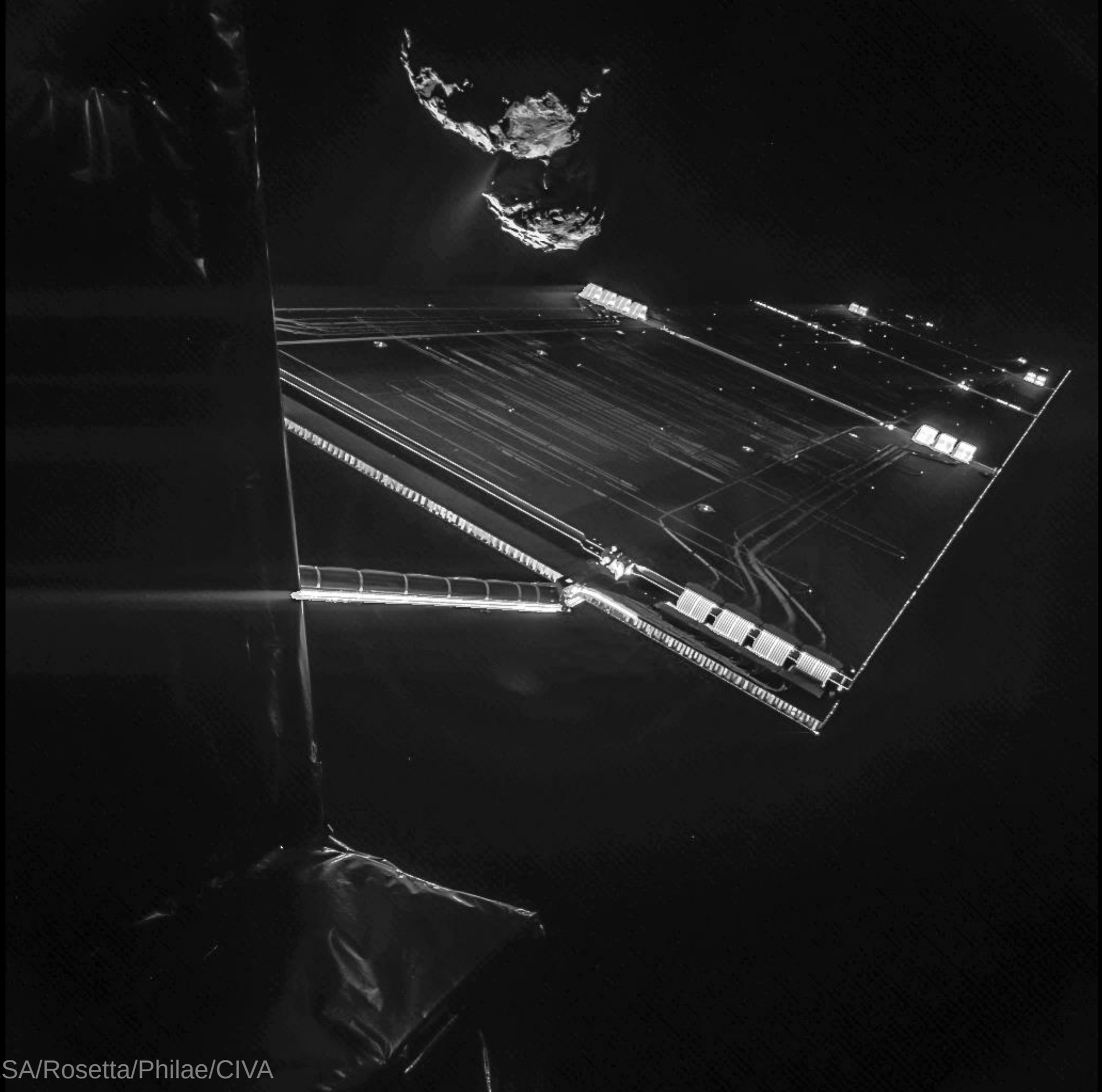

2 ZERO HUNGER
6 CLEAN WATER AND SANITATION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

un.org

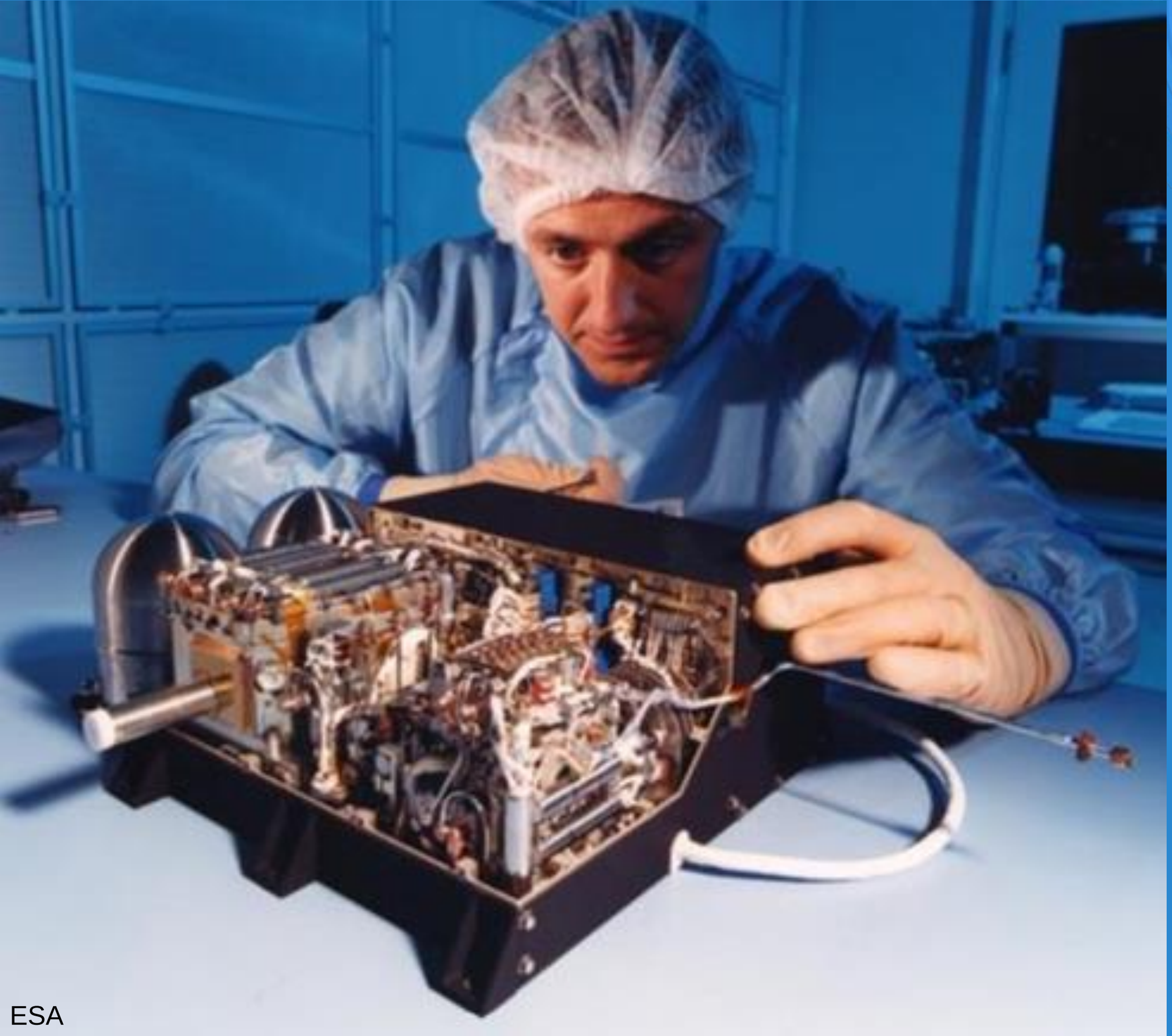
SRON

Case study one:

GC-MS



ESA/Rosetta/Philae/CIVA

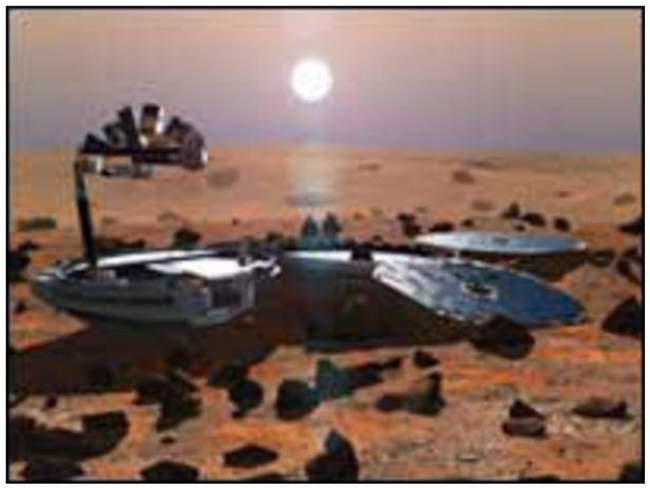


ESA

Last Updated: Thursday, 4 October 2007, 11:33 GMT 12:33 UK

Space technology to hunt down TB

A device developed for a mission to Mars could help spot signs of life closer to home - by identifying the bacterium that causes TB.



The technology was sent to Mars on the Beagle 2 lander

The Open University and London School of Hygiene and Tropical Medicine project will use a tiny detection kit made for the Beagle 2 project.

The gas chromatograph mass spectrometer (GC-MS) can pick out the unique chemical fingerprint of TB.

An expert hoped it would boost the poor diagnosis rate in developing countries.

SEE ALSO
- New image finds no Beagle traces
  16 Feb 07 | Science/Nature
- Drive to curb drug-resistant TB
  22 Jun 07 | Health
- Trials start on new TB vaccine
  28 Jul 07 | Health
- Tuberculosis
  08 Feb 03 | Medical notes

RELATED INTERNET LINKS
- London School of Hygiene and Tropical Medicine
- Wellcome Trust
- TB Alert
- Open University

www.bioneers.org; ounews.co/science-mct/space/comet-cancer-space

Contact: Geraint (Taff) Morgan, Open University

TABLE 5 Application of GC–MS for Food Safety and Quality—cont'd

Research Aim	Matrix	MS Technique	Additional Techniques/Main Results
Assessment of moisture damage	Cocoa beans	GC × GC-TOF-MS Full scan 40–250 *m/z* NIST library search	• Moisture damage to cocoa beans alters the volatile chemical signature of the beans in a way that can be tracked quantitatively over time. • 29 analytes that change in concentration levels via the time-dependent moisture damage process were measured using chemometric software.
Evaluation of the pervaporation process	Kiwifruits juices	GC-^{3}DIT-MS (target)	Volatile profile established by HS-SPME The most representative volatile compounds of the kiwifruit volatile fractionwere chosen for evaluating the pervaporation process.
Sugar compounds	Cereal and pseudocereal flour	GC-qMS Full scan *m/z* 50–400 WILEY 275 library for MS analysis	Compare sugar components of tested samples of flour of cereals bread wheat and spelt and pseudocereals (amaranth and buckwheat). Results were analyzed using descriptive statistics (dendrograms and PCA).

Pico, 2015, Mass spectrometry in food quality and safety: an overview of the current status

Case study two:

Terahertz (THz)

H-ATLAS

Digital Barriers PLC

PROS AND USES

On-line, non-destructive technique

Many more materials are transparent to THz radiation (as compared with IR)

Non-ionising.

CONS AND LIMITATIONS

Metal and polar liquids (such as water) completely opaque to THz radiation

THz radiation cannot penetrate metal

Expensive sources and detectors are major obstacles for commercial devices

CONTAMINANT CHARACTERISTICS

PHYSICAL	Sharp; hard; reflect, refract and transmit light
CHEMICAL	Composed of SiO_2
BIOLOGICAL	N/A

POTENTIAL FOR INNOVATION

THz

Proof of principle experiments exist which show how THz imaging can highlight buried glass in chocolate and meat, Ref [48,49]. With increasing levels of pattern recognition – this could be extended to particulate food.

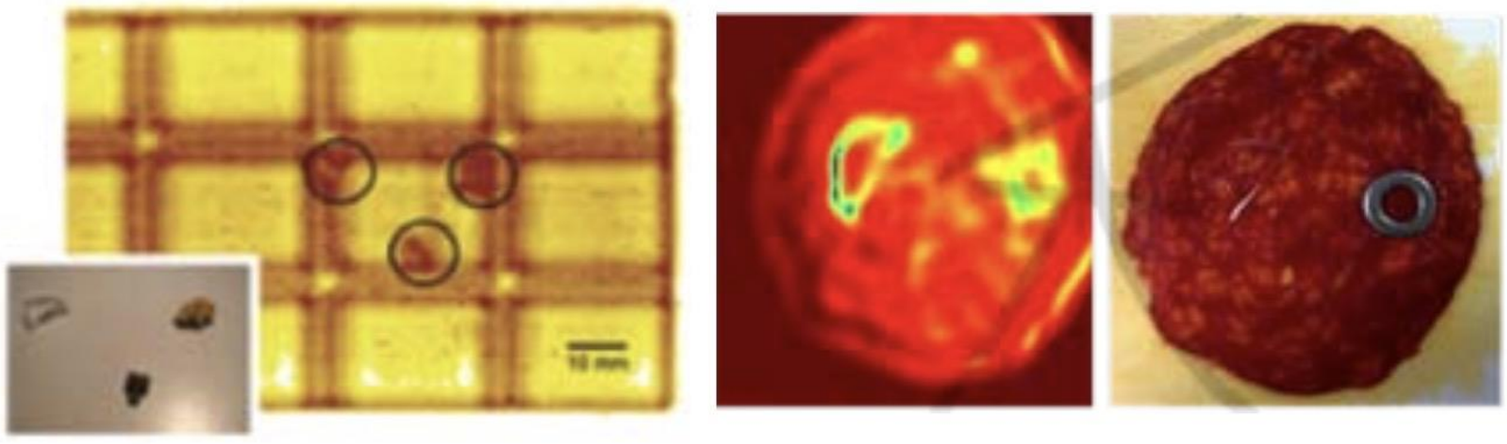


Figure 17. (left) THz image of glass in chocolate from Ref. 45 and (right) glass in meat from Ref. [46]

ULTRA

Ultrasound systems can detect impedance mismatches which can result from insect infestation.

NMR

Has been done for many years on fruit and Ref 37 lists many examples. Its slow measurement time and high resource cost still make the methods unsuitable for online detection. See Figure 24 for examples.

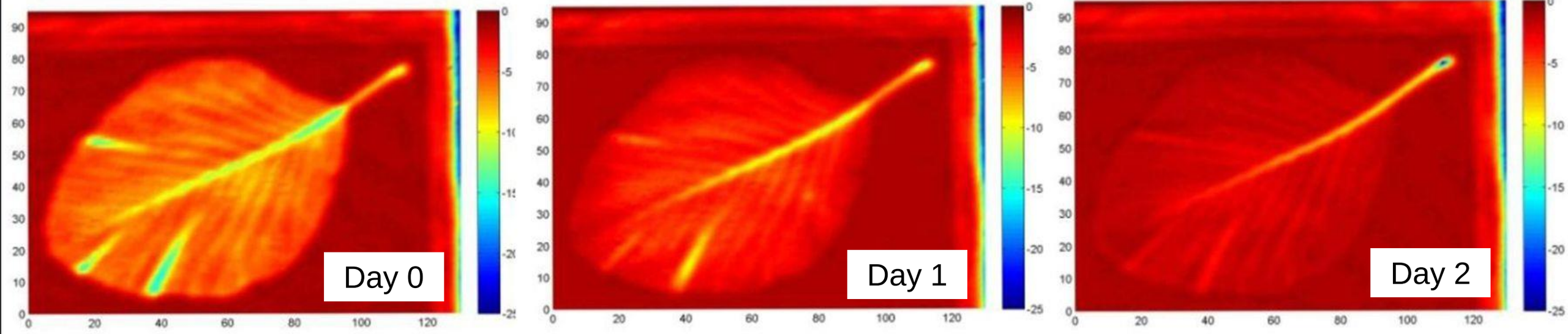
μ-wave

Microwave and THz methods can inspect food for high density and low density foreign bodies – including insects Refs [59 and 60]

THz

HYP

Just as hyperspectral imaging could determine damage to the surface of an apple, it could also locate the presence of insects.

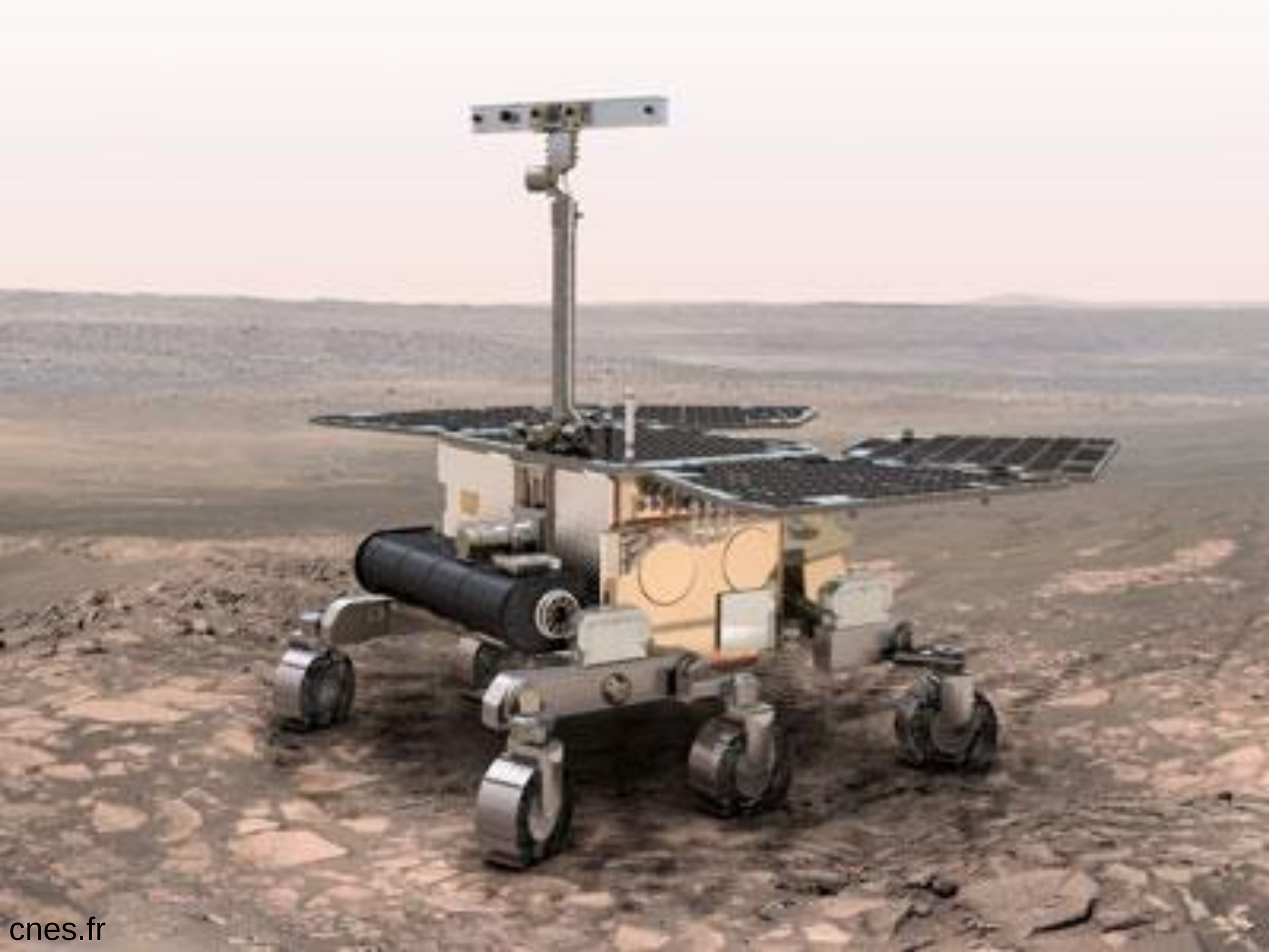


Terahertz images

Visible images

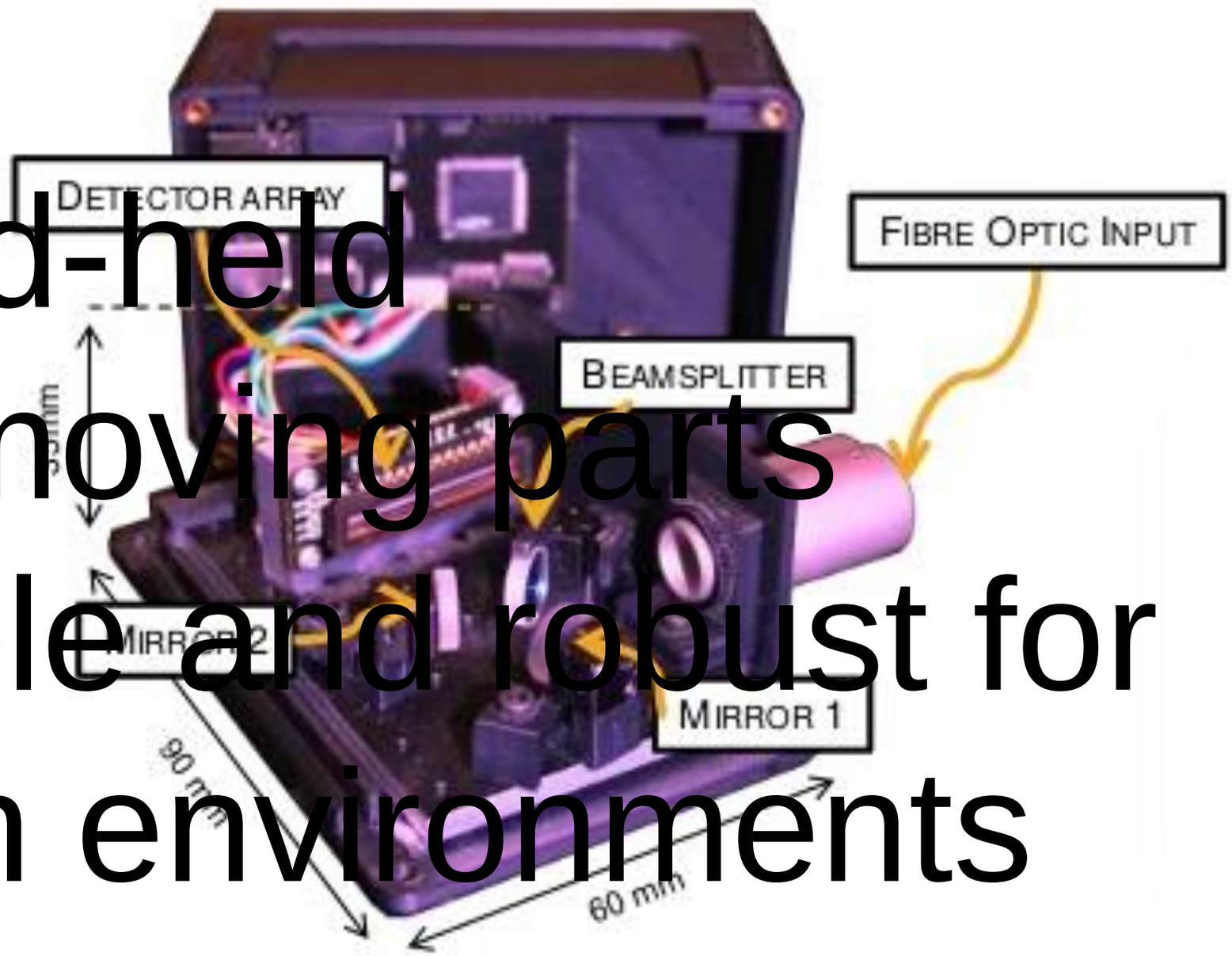
Case study three:

FT-IR & FT-UV



cnes.fr

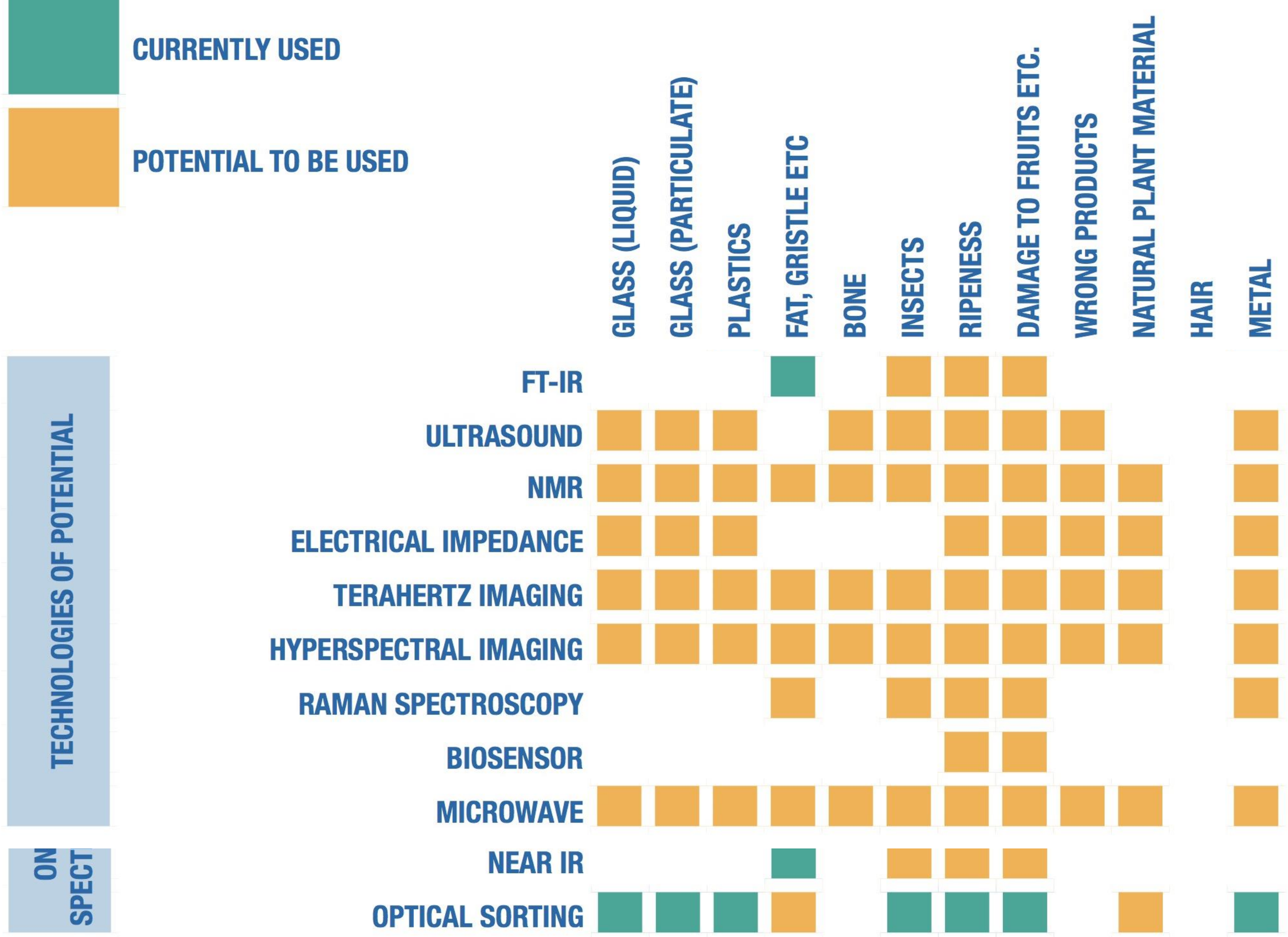
- Hand-held
- No moving parts
- Stable and robust for harsh environments



STFC; Kevin Smith

Contact: Paul Scholefield, Lancaster University

Other technologies



Knowledge Transfer Network: UK Sensing Technologies for Contamination in Food