



# from ice to ... space

## Polar research protecting satellites



“Powering  
growth in the  
£17 billion  
space sector”

Satellites quietly keep modern life moving. They guide planes, run phone networks power GPS, support banking systems and help keep the internet stable.

But they face a natural threat most of us never think about: solar storms. These bursts of energy from the Sun can damage satellites, block signals and disrupt services we rely on every day

Scientists at the British Antarctic Survey (BAS) have spent decades studying how the Sun can increase particle radiation sweeping around Earth. The most revealing clues come from the polar regions, where the effects of space weather are strongest.

By understanding how radiation builds, spreads and intensifies across different parts of near-Earth space, BAS has transformed what we know about the risks satellites face. This research led to a major breakthrough: a new space-weather forecast that protects satellites across many orbits.

It is the first ever forecast for medium Earth orbit, where GPS satellites fly and a huge improvement on the older, simpler forecasts used for satellites further out in space. Crucially, it gives satellite operators up to 24 hours' warning when radiation levels are likely to rise. That advance notice now shapes how satellites are designed, built, flown and insured.

The forecast is used by the European Space Agency, the Met Office and companies across the global space industry, helping them protect equipment, avoid service outages and keep critical systems running. It also feeds into national planning, including the UK's security risk assessments and international standards for dealing with extreme solar storms.

Better forecasting is a key part of strengthening the UK's resilience and helps reduce the impact of storms that might otherwise cost billions.

**Award-winning and internationally adopted, this BAS work shows how polar science delivers real-world benefits. It is protecting vital services we depend on every day and helping power growth in the UK's £17 billion space sector.**



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# from ice to ... desert

## Antarctic radar discovers desert water

“Ice-born  
technology  
helping find  
water”

A tool built to investigate the hidden world beneath Antarctic ice is now being used to search for something equally precious beneath the desert floor: water.

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BAS originally developed a highly sensitive radar system with University College London to measure how quickly ice shelves melt - a vital window into how our polar regions are responding to climate change.

But, when BAS scientists realised the same technology might also detect water hidden deep underground, a new opportunity emerged. With support from the Government Office for Technology Transfer (GOTT), BAS is exploring how the radar could be adapted to help people in regions where accessing water is a daily struggle - including parts of Africa, the Middle East, India and South-East Asia.

In many of these areas, groundwater is the most reliable source of water. Yet finding it can be expensive, slow and uncertain. Drilling is often guesswork; many attempts fail, wasting time, money and precious resources. Our adapted radar offers a smarter alternative. By reading subtle signals below the Earth's surface, it can indicate where water is present, whether a site is worth drilling and how groundwater levels change over time. Starting with field trials in Morocco, South Africa and India, this project has inspired interest from NGOs, local water providers and municipal authorities. They see the potential not just to find new sources of water, but also to monitor long-term supply, identify leaks and better protect water quality.

**For BAS, this project shows how ideas born in Antarctica can open unexpected doors. A radar built for the polar ice is now revealing possibilities in some of the driest places on Earth - a reminder that the tools we develop for one extreme environment can sometimes help meet urgent needs in another.**



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# from ice to ... motorways

## Electric HGVs power a greener polar route

“Creating jobs through clean logistics”

Clean transport isn't just transforming Britain's roads - it's powering science at the ends of the Earth.

In a world first, the British Antarctic Survey (BAS) is using 42-tonne electric HGVs to transport vital supplies for polar research through a partnership with Cambridge-based Welch's Transport, everything from scientific instruments to toothpaste now travels to UK ports on zero-emission vehicles before being shipped to Antarctica and the Arctic.

Each electric truck saves around one tonne of CO<sub>2</sub> every 630 miles - roughly the CO<sub>2</sub> from an economy-class return flight from London to New York - and together the fleet has already cut 55 tonnes, equivalent to taking more than 30 petrol cars off the road for a year.

The project is backed by UKRI's Innovate UK through the Zero Emission HGV and Infrastructure Demonstrator - part of the UK's eFreight 2030 initiative - which is trialling 100 electric HGVs and 32 megawatt-scale charging hubs nationwide.

The insights from BAS and Welch are helping accelerate the shift to cleaner, cheaper, more reliable freight across the UK.

This partnership is also fuelling local growth. Welch's saw 15% business growth in 2025, driven by customers switching to sustainable logistics. More clean-transport contracts mean more jobs: the company expects a 10% increase in staff by late 2026 and is planning a 10% expansion of its overall HGV fleet - including more electric vehicles.

**This collaboration shows how UK science and industry are driving cleaner, smarter logistics - strengthening national resilience, cutting carbon and powering green growth from Cambridge to the polar regions.**



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# from ice to... navigation

The science steering ships through sea ice

“33 tonnes of  
CO<sub>2</sub> saved every  
day on every  
Antarctic voyage”

The polar regions are changing fast. Sea ice in the Arctic and Antarctic still covers millions of square kilometres - at its winter peak more than twice the size of Europe - yet it is thinning, shifting and breaking apart in new ways as the climate warms.

Less ice doesn't mean less danger. It means less predictability. Icebergs drift into open water, floes move more quickly and conditions can switch in minutes.

For two decades, ships have relied on the British Antarctic Survey's Polar View service to navigate these shifting seas. It turns satellite data into near real-time maps that show exactly where the ice is and how it's moving, giving crews the insight they need to avoid hazards.

Used both in the Arctic and Antarctic, it now supports more than 6,000 users every month - from the Royal Navy to research ships and polar cruise operators – helping ships plan safer routes, cut fuel use and reduce emissions.

For many operators, the benefits are significant: some users report up to £150,000 saved per season through safer, faster routing and reduced fuel consumption. On a typical Antarctic voyage, Polar View can cut around 33 tonnes of CO<sub>2</sub> a day while in sea ice – roughly the same as running BAS's Signy research station for ten months.

BAS also works hand-in-hand with other national ice services through the International Ice Charting Working Group ensuring that sea-ice information is consistent, trusted and shared worldwide.

Alongside this, BAS helps to implement and refine the International Maritime Organization's POLARIS risk tool, weaving it into Polar View and other trailblazing operation services, so crews can plan routes that meet Polar Code safety rules while protecting fragile polar ecosystems.

By reducing delays, fuel use and costly damage, BAS research directly lowers operating costs for shipping, tourism and logistics companies, strengthening the UK's maritime economy.

**This work showcases British innovation at its best: world-leading science and international collaboration turned into tools that protect people, trade and fragile ecosystems. And by exporting this expertise worldwide, Britain builds influence and value in a fast-growing global market for green maritime technology - clear proof that polar science powers growth, resilience and leadership on the world stage.**



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# from ice to... DNA

## Unlocking the secrets of Antarctic microbes for biotechnology

Held deep within the British Antarctic Survey's freezers are decades of carefully preserved samples from some of the most extreme places on Earth - microbes living on windswept ice, frozen soils and remote polar rock.

**“Fuelling the UK's biotech boom”**

Each sample was collected for a specific research purpose and any material left over is archived with care - precious, hard-won and ready to support future discoveries.

Now, a partnership between BAS and leading UK biotech company Basecamp Research aims to unlock the hidden stories inside these frozen fragments.

With the help of portable DNA sequencers and powerful AI, scientists can now read the genetic fingerprints of Antarctic microbes with incredible detail. These organisms are masters of survival - thriving in temperatures that would break almost any other form of life. Understanding how they do it can reveal natural tricks that help solve real-world problems back home.

By looking closely at BAS's extraordinary sample archive, the aim is to uncover biological abilities that could inspire greener technologies, from low-energy detergents to cleaner industrial processes and in time, new medical innovations.

This partnership builds directly on BAS's scientific strengths. Already, it has brought new genetic sequencing tools into BAS labs, trained researchers in cutting-edge methods and supported joint scientific publications. Basecamp Research has licensed the DNA data from BAS samples - allowing them to use it in AI analysis, design new protein and enzymes not found in nature and apply these insights across a range of biotech research and development - showing how frozen life can fuel real innovation.

It also taps into a global surge of interest - and investment - in protein discovery and biotechnology. As companies and investors around the world race to find new enzymes and biological solutions, BAS's unparalleled polar archive gives the UK an edge, offering a window into forms of life rarely seen anywhere else on the planet.

**At its heart, this is a story about turning polar samples into new possibilities - showing how the most remote life on Earth can help spark greener technologies, strengthen UK science and reveal more about the astonishing resilience of nature in a changing world.**



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# from snow to... insight

Lakes as snowfall sensors

Snowmelt is underestimated by 50-100% in the world's major mountain ranges: snowfall measurements are too small, too scarce, and too biased.

“A  
breakthrough  
for measuring  
mountain water  
resources”

A BAS inventor has solved the problem of making unbiased, low-cost and frequent snowfall measurements over very large areas. Each new measurement spans an area larger than all the world's existing rain gauges combined.

**Used to update the physics of the Met Office's weather model, it's making the future of mountain water resources, food and energy more predictable for over a billion people.**



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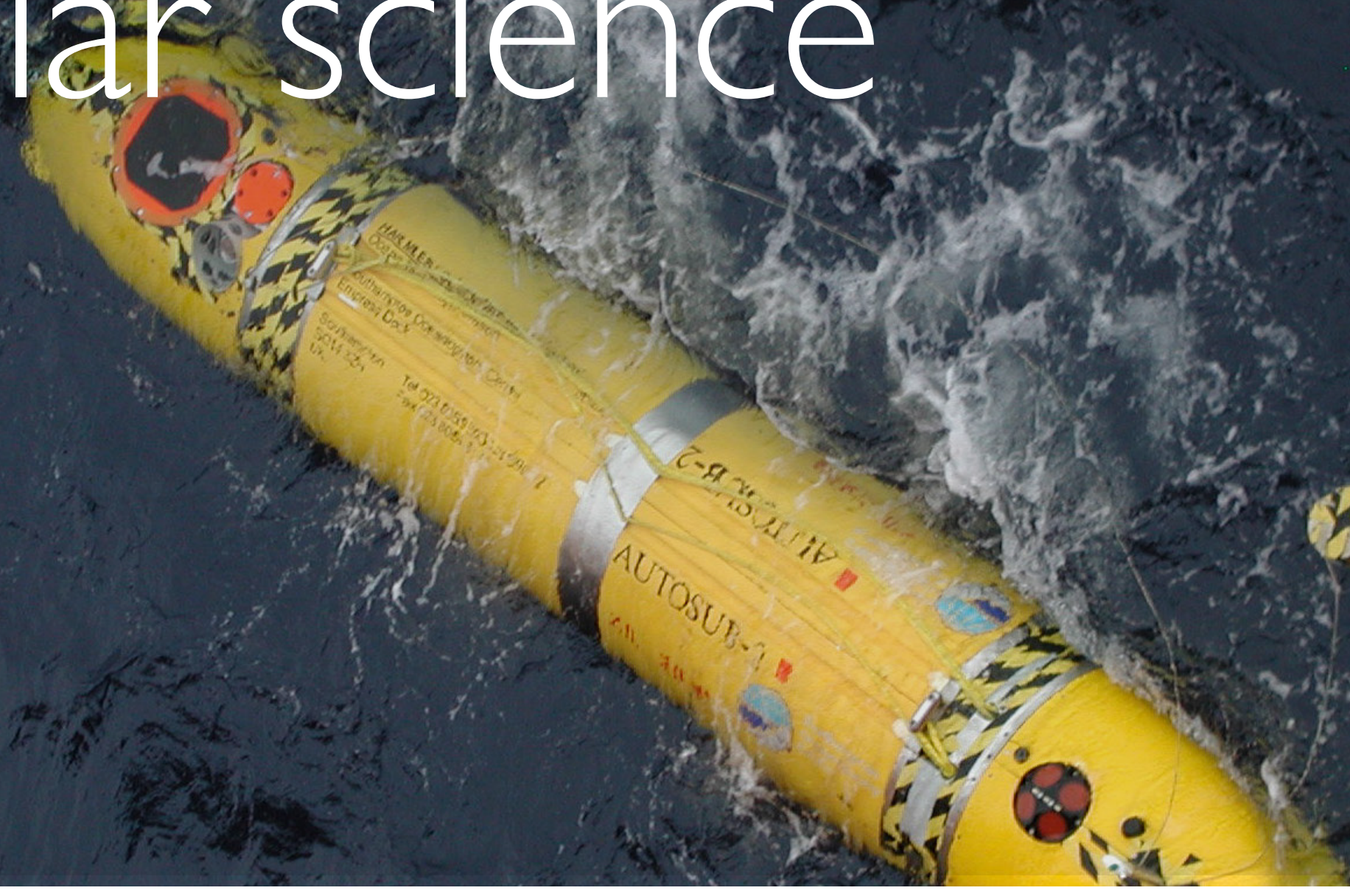


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# from ice to... intelligence

## AI-guided underwater robots transform polar science



“Smarter ocean science. Lower carbon”

Collecting ocean data usually means long, costly ship missions - but what if hundreds of underwater robots could take some of the hard work away?

This project develops AI to plan and coordinate fleets of vessels from huge research ships to autonomous gliders that all gather vital information about the oceans.

The system decides where each should go, how to share tasks and when to return for charging, all in a matter of seconds.

It squeezes the most data from every battery cycle, reduces the cost of fuel-hungry vessels and improves reliability.

**That means more data, less ship time and a smaller carbon footprint. It's a smarter, greener way to explore the seas - and other industries can use it too.**



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