# Edinburgh engineer working to fix the polar ice caps

## Cambridge University announced that they are creating The Centre for Climate Repair, a centre for research which will find ways to repair climate change, global warming, call it what you will. The aim is to ensure that any future damage to Earth is arrested. One of the ideas which it has chosen to examine is being worked on here in Edinburgh.

The deceptively simple idea is to make the clouds whiter and so more reflective, sending all the sun's rays back to space. This will have the effect of cooling the earth beneath, and may lead to complete reversal of the melting polar ice caps and other aspects of global warming.

The initial idea is attributed to John Latham, but the way that it will actually work in practice is the result of almost 20 years' work by Professor Stephen Salter.

Professor Salter is Emeritus Professor of Engineering Design at University of Edinburgh. He has invented many things (some of which you can see in the National Museum of Scotland such as the Salter Duck used as a model in the wave energy industry).

This is not the work of a moment, but rather the work of many years with complex computer modelling and mathematical calculations.

Listen to our talk with Professor Salter here on Anchor.fm

Professor Salter explained to us what he has worked on over the last two decades: “Cambridge University are setting up a group to repair the climate and they have been saying quite nice things about the work I have been doing.

“I am hoping that this might at last get us a bit of money.

“They said that they thought this is one of the better ways of repairing the climate and I hope that when they look into it a bit more closely they will agree.

“I want to reflect more solar energy back out to space and I want to do this using John Latham’s idea. The solar energy would not reach ground level. Instead it would be reflected back out to space where it does not do us any harm.

“We need to reflect about 0.5% of what is coming in. It’s a tiny amount and you would not be able to see this by looking at the cloud from above. This will change the reflectivity of clouds by changing the size distribution of the drops in the clouds by increasing the number of ‘condensation nuclei’ that you need to form a drop.”

Professor Salter confirmed that this can be done anywhere in the world where there is fairly clean air and some sunshine and some wind. The energy comes from the wind and it is used to move the ships through the water to make energy to filter the water and pump it out. It is distributed by turbulence – by the wind blowing over the sea.

He explained that the spray vessels could be used fairly near the Arctic because there is more energy (or sunlight) going in there during the couple of months around mid summer than there is in the Equator. He said:”We need to choose where and when to do this and by making the correct choice we might be able to get the best combination of cooling and changes to rainfall.”

## What is the idea?

John Latham's idea is to brighten the clouds above the earth by spraying sea water at them. (The sea water would be 'cleaned up' before being distributed into the air, but it is the sodium chloride which is key.) Using the correct size of water droplets would mean that more of them attach to aerosol particles – and they would be smaller and whiter. We all know that dark clouds mean a storm is coming – and usually with large raindrops. This is the opposite – whiter clouds with smaller droplets.

## How will it work?

Unmanned hydrofoil ships or spray vessels will be deployed around the world anywhere there is fairly clean air and some wind – the energy comes from the wind. They will be powered by renewable energy and by Flettner rotors instead of sails. The nozzles will spray water at the grey clouds, turning them white.

**The resultant cold air will fall to the sea surface. Estimates used in Professor Salter's research show that 300 such vessels could save Arctic ice, coral and moderate hurricanes all over the world.**

## What will the outcome be?

The clouds become more reflective. It is acknowledged that although it may be highly effective this is an emergency treatment of the problem and could be reduced if carbon emissions are reduced across the world, otherwise it would continue to be used as a 'sticking plaster'.

Professor Stephen Salter with his emergency procedure to halt climate change is being considered by The Centre for Climate Repair at Cambridge University PHOTO Martin P McAdam

Professor Salter told The Edinburgh Reporter : “The end result would be that we would be going back to the climate that we had in pre-industrial times. We could moderate hurricanes making them less aggressive, save the coral in the Barrier Reef, stop sea levels rising and stop losing the Arctic ice. That is probably the most important thing to do in the short term because if we lose the ice we warm up the seabed and we warm up the permafrost around the Arctic. That releases methane which is a very much nastier greenhouse gas than carbon dioxide. We could get a very unpleasant positive feedback where warmer seas make more methane and more methane makes warmer seas. That could be very dangerous indeed.”

At the beginning of the month climate scientists Dr Emily Shuckburgh was appointed as the first director of the Cambridge Carbon Neutral Futures Initiative, and The Centre for Climate Repair is part of that. At the time of her appointment Dr Shuckburgh said : “Climate change is one of the

most pressing problems facing humanity. The University of Cambridge has an opportunity to use its position as one of the world's foremost academic institutions to take a leading role in finding ambitious solutions to this complex issue.

"Cambridge already has many groups working on climate-related research. This Initiative aims to bring together these groups to tackle this urgent global challenge holistically. This is about addressing every aspect of a sustainable future – the impact it will have on our lives, our work, our society and our economy – and ensuring decisions are based on the best available knowledge."

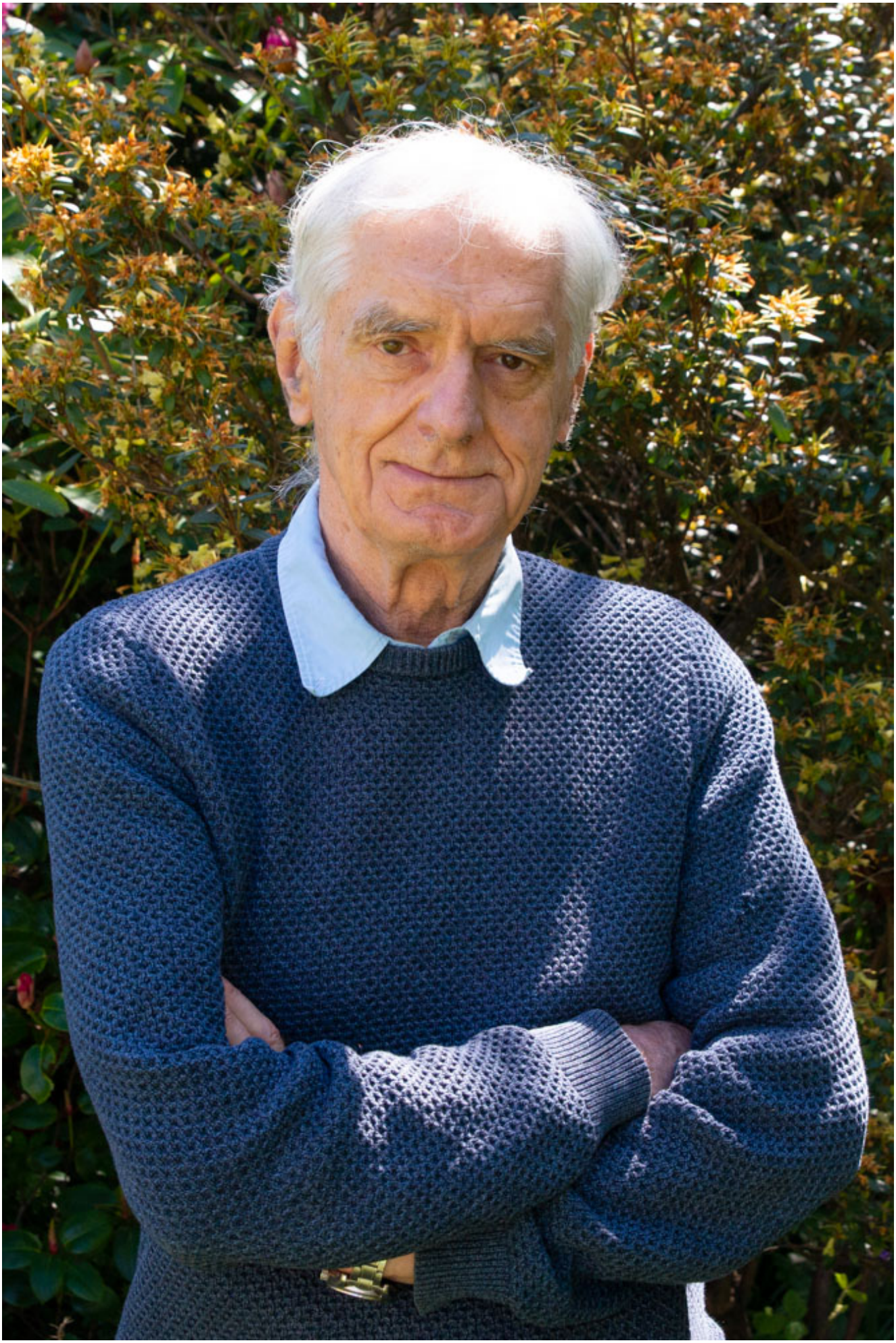
So it comes down (at least partly) to the work of one scientist in Edinburgh who may be able to contribute to that knowledge. He says that to make this idea commercial and build the flotillas needed it would need an investment of around £100 million a year to finance the total cost of around £1billion.

There are some other 'showstoppers' according to Professor Salter. He concluded : "We need to remove a few of the possible showstoppers. One of them is whether we can filter the water well enough so that it does not clog the nozzles.

"We want to understand all the side effects whether we would make climate change that we don't want. There is some very exciting and encouraging work coming from Norway which shows that we make dry places a bit wetter and wet places a bit drier. The effect is biggest in the Arctic but we need to be quite sure about that and quite sure about the size of drops being sprayed – and that they are all the same size. That is very important."

An artist's impression of hydrofoil spray vessels in action for Latham's proposal to reverse global warming with marine cloud brightening. Propulsion comes from Flettner rotors. Energy generation comes from alternating pitch-variation of hydrofoils driving parallelogram linkages to hydraulic rams. Filtered water is pumped through sub-micron spray nozzles. Latent heat for evaporation comes from the air with rapid cooling by several degrees. Cold air falls to the sea surface where it spreads out and gains heat from the water until turbulence spreads it through the marine boundary layer to cloud level. About 300 vessels in the right place and at the right season could cancel warming to date. The method can save Arctic ice and coral and moderate hurricanes. © John MacNeill.

Even the design of the ships which may be used as spray vessels has something to do with Edinburgh. Professor Salter explained to us that they will not have textile sails like a normal sailboat but something called Flettner rotors to power them. The cylinders spinning about their axes with air blowing across them will act exactly like an aeroplane wing. Anton Flettner first came up with that design in the early 20th century and sailed a ship which he had converted from the Baltic to Leith. He won the race against a normal ship with sails and took it to New York. Sadly his order book was left unfulfilled as a result of the 1929 Depression.



Professor Stephen Salter whose work on climate change may at last be recognised PHOTO Martin P McAdam