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# The Return of Dr Strangelove

## The politics of climate engineering as a response to global warming

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In August 1883 the painter Edvard Munch witnessed an unusual blood-red sunset over Oslo. He was shaken by it, writing that he ‘felt a great, unending scream piercing through nature’. The incident inspired him to create his most famous work, *The Scream*.<sup>2</sup> The sunset he saw that evening followed the eruption of Krakatoa off the coast of Java.

The explosion, one of the most violent in recorded history, sent a massive plume of ash into the stratosphere turning sunsets red around the globe. The gases emitted also caused the Earth to cool by more than one degree and disrupted weather patterns for several years.

The cooling effect of large volcanic eruptions has been known for some time. Sulphuric acid haze forms from the sulphur dioxide spewed into the upper atmosphere reducing the amount of solar radiation reaching the Earth. It’s estimated that the eruption of Mount Pinatubo in the Philippines in 1991—the largest since Krakatoa—cooled the Earth by around 0.5°C for a year or more.<sup>3</sup>

Today, a coalition of forces is quietly constellating around the idea of transforming the Earth’s atmosphere by simulating volcanic eruptions to counter the warming effects of carbon pollution. Engineering the planet’s climate system is now attracting the attention of scientists, scientific societies, venture capitalists and conservative

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<sup>2</sup> Donald Olson, Russell Doescher and Marilyn Olson, ‘When the Sky Ran Red: The Story Behind “The Scream”’, *Sky & Telescope*, February 2004, pp. 29-35

<sup>3</sup> Scott Barrett, ‘The Incredible Economics of Geoengineering’, *Environmental and Resource Economics*, vol. 39, pp. 45-54, 2008, p. 47

think tanks. Despite the enormity of what is being proposed—nothing less than taking control of Earth’s climate system—the public has been almost entirely excluded from the planning.

### **Carbon-sucking methods**

Geoengineering is defined as “the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change”.<sup>4</sup> Methods fall into two types: carbon dioxide removal from the atmosphere and solar radiation management aimed at reducing heat coming in or reflecting more of it out.<sup>5</sup>

A number of methods have been put forward to extract carbon from the atmosphere. Fertilising the oceans with iron filings is thought to promote the growth of tiny marine plants called phytoplankton that absorb carbon dioxide as they grow and, on death, take carbon to the ocean depths. Trials have been unpromising, and it is feared such schemes would create “dead zones” in the ocean.

Another carbon-removal scheme would install in the ocean a vast number of floating funnels designed to draw nutrient-rich cold water from the deep to encourage algal blooms that suck carbon dioxide from the air and then take it down to the depths. This idea has met with little enthusiasm.<sup>6</sup>

A third idea is to build thousands of devices, called sodium trees, that would extract carbon dioxide directly from the air and turn it into sodium bicarbonate from which carbon dioxide could be separated before being safely stored—somewhere.<sup>7</sup> This too remains speculative and it’s hard to see how it would be cheaper to extract carbon dioxide from the air, where its concentration is 0.04 per cent, than from the exhaust of a coal-fired power plant.

### **Sun-blocking methods**

Rather than removing surplus carbon dioxide from the atmosphere, most geoengineering schemes are aimed at cooling the planet by increasing the Earth’s

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<sup>4</sup> Royal Society, *Geoengineering the Climate: Science, governance and uncertainty*, The Royal Society, London, 2009, p. 1

<sup>5</sup> Royal Society, *Geoengineering the Climate*, p. 1

<sup>6</sup> James Lovelock, *The Vanishing Face of Gaia*, Penguin, Camberwell, 2009, p. 98

<sup>7</sup> Robert Kunzig and Wallace Broecker, *Fixing Climate*, Green Profile, London, 2008, pp. 234-45

albedo, that is, the extent to which it reflects incoming solar radiation. Some of the ideas would be far-fetched even in a science fiction novel. One proposal is to send ten trillion 60-centimetre reflective discs, in lots of one million every minute for thirty years, to a point in space known as L1 which is 1.5 million kilometres from Earth towards the Sun.<sup>8</sup>

Another idea is to launch specially designed, unmanned ships to plough the oceans sending up plumes of water vapour that increase cloud cover. Up to 1500 dedicated vessels would be needed. Others have suggested converting dark-coloured forests into light-coloured grasslands. Or we could mandate the whitening of city rooftops and roads, a requirement already for some houses in California, although the creation of shining cities could offset warming only a little.<sup>9</sup>

The option that is taken most seriously is altogether grander in its conception and scale. The scheme proposes nothing less than the transformation the chemical composition of the Earth's atmosphere so that humans can regulate the temperature of the planet as desired. It involves injecting sulphur dioxide gas into the stratosphere, 10-50 kilometres above the Earth's surface, to create sulphate aerosols, particles that reflect solar radiation. Currently the atmosphere reflects about 23 per cent of solar radiation back into space, and it's estimated that the injection of enough sulphate aerosols to reflect an additional two per cent would offset the warming effect of a doubling of atmospheric carbon dioxide.<sup>10</sup> In the stratosphere sulphate particles remain in place for one or two years, unlike aerosol pollution in the lower atmosphere that may last only a week.<sup>11</sup>

Various schemes have been proposed, with the most promising being adaptation of high-flying aircraft fitted with extra tanks and nozzles to spray the chemicals. A fleet of 747s could do the job. To have the desired effect we would need the equivalent of one Mount Pinatubo eruption every three of four years. The emissions from the eruption in April of Iceland's "Mount Unpronounceable" were less than a hundredth

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<sup>8</sup> Royal Society, *Geoengineering the Climate*, pp. 32

<sup>9</sup> Royal Society, *Geoengineering the Climate*, pp. 25; David Adam, 'Paint it white', *Guardian*, 16 January 2009

<sup>10</sup> Royal Society, *Geoengineering the Climate*, pp. 2, 24

<sup>11</sup> Paul Crutzen, 'Albedo enhancement by stratospheric sulfur injections: A contribution to resolve a policy dilemma?', *Climatic Change*, vol. 77, nos 3-4, pp. 211-20

of those from Pinatubo,<sup>12</sup> so we'd need the equivalent of one of those every week, indefinitely.

Another analogy is the vast brown haze, due largely to the burning of fossil fuels, which envelops the lower stratosphere and is concentrated over South Asia and China. By cutting the amount of incoming solar radiation, the haze keeps the Earth cooler than it would otherwise be, a process of 'global dimming' that masks the effect of global warming.<sup>13</sup> In affluent countries, air pollution laws have reduced smog allowing more solar radiation to reach the Earth's surface, hastening warming.<sup>14</sup> The expansion of global aviation is working the other way; it's estimated that when all aircraft were grounded for three days after the 9/11 attack on the United States daytime temperatures in that country rose as the skies cleared.<sup>15</sup>

### **Dangers of enhanced dimming**

Attempting to regulate the Earth's climate by enhanced dimming is fraught with dangers and would probably backfire. For example, the oceans absorb around a third of the extra carbon dioxide pumped into the atmosphere by humans. The acidity of the oceans is slowly rising, dissolving corals and inhibiting shell-formation by marine organisms.<sup>16</sup> Injecting sulphur dioxide into the stratosphere may reduce incoming solar radiation but it would do nothing to slow the acidification of the oceans. In other words, responding to warming by reducing the amount of solar radiation reaching the Earth's surface disregards the complexity of climate change; it is not just about the atmosphere but the entire carbon cycle that governs life on Earth.

One proposal is to inject a haze of sulphur dioxide above the Arctic only, shading the ice-cap. This idea, referred to as the "yarmulke" method<sup>17</sup> after the Jewish skullcap, responds to the deepest concern of climate scientists, Arctic melting, but no one

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<sup>12</sup> <http://www.bloomberg.com/apps/news?pid=20601087&sid=amGJGA3ODkU>

<sup>13</sup> Although soot particles can also amplify warming.

<sup>14</sup> Crutzen, 'Albedo enhancement by stratospheric sulfur injections'

<sup>15</sup> David J. Travis, Andrew M. Carleton and Ryan G. Lauritsen, 'Contrails reduce daily temperature range', *Nature*, vol. 418, 8 August 2002, p. 601

<sup>16</sup> H. D. Matthews, L. Cao, and K. Caldeira, 'Sensitivity of ocean acidification to geoengineered climate stabilization', *Geophysical Research Letters*, vol. 36, 2009

<sup>17</sup> <http://www.realclimate.org/index.php/archives/2009/08/a-biased-economic-analysis-of-geoengineering/>

knows what the flow-on effects could be. When you tinker with the climate system everything is implicated.

In 1954 the eminent geoscientist Harrison Brown published a book in which he proposed solving world hunger by increasing the carbon dioxide content of the atmosphere to stimulate plant growth.<sup>18</sup> Brown suggested the construction of “huge carbon-dioxide generators pouring gas into the atmosphere” and calculated that doubling the amount in the atmosphere would require the burning of at least 500 billion tons of coal. Brown’s book was endorsed by Albert Einstein. His wish has come true: we have huge carbon-dioxide generators pouring gas into the atmosphere. They are called coal-fired power stations. Curiously, it was one of Brown’s students, Charles David Keeling, who a decade later, from his measuring station on Mauna Loa in Hawaii, first alerted the world to the rising concentration of carbon dioxide in the atmosphere and its implications for the warming of the world.

Harrison Brown wanted to pump carbon dioxide into the atmosphere to improve the lot of humankind. Today there is incipient pressure to pump sulphur dioxide into the atmosphere to control the effects of pumping too much carbon dioxide into it. Although our understanding of the effects of climate engineering is rudimentary, to say the least, one effect of it may indeed be to increase hunger. A study published in 2008 in the *Journal of Geophysical Research* concluded that injection of sulphur dioxide into the stratosphere may disrupt the Asian and African summer monsoons, reducing the food supply for billions of people.<sup>19</sup>

### **Moral hazards**

Although ideas for climate engineering have been around for at least twenty years, until recently public discussion has been discouraged by the scientific community. Environmentalists and governments have been reluctant to talk about it too. The reason is simple: apart from its unknown side-effects, geoengineering would weaken resolve to reduce carbon emissions. Economically it is an extremely attractive substitute because its costs are estimated to be “trivial” compared to those of cutting

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<sup>18</sup> The story is told by Robert Kunzig and Wallace Broecker in *Fixing Climate*, p. 262

<sup>19</sup> Alan Robock, Luke Oman and Georgiy Stenchikov, ‘Regional climate responses to geoengineering with tropical and Arctic SO<sub>2</sub> injections’, *Journal of Geophysical Research*, vol. 13, 2008

carbon pollution—cheap enough for a single country easily to offset the emissions of the whole world.<sup>20</sup>

To date, governments have feared being accused of wanting to escape their responsibilities by pursuing science fiction solutions. The topic is not mentioned in the Stern report and receives only one page in the Garnaut report. As a sign of continuing political sensitivity, when in April 2009 it was reported that President Obama's new science adviser John Holdren had said that geoengineering is being vigorously discussed as an emergency option in the White House, he immediately felt the need to issue a "clarification" claiming that he was expressing only his personal views.<sup>21</sup> Holdren is one of the sharpest minds in the business and would not be entertaining "Plan B"—engineering the planet to head off catastrophic warming—unless he was fairly sure Plan A would fail.

Nevertheless, so anxious are scientists at the escalation of emissions and the tardiness of the response that some now feel emergency measures must be considered. The dam broke with a 2006 editorial by the eminent German atmospheric chemist Paul Crutzen. Crutzen, who won the 1995 Nobel Prize for Chemistry for his work on the hole in the ozone layer, wrote that cutting emissions is "by far the preferred way" to respond to warming, but in the absence of resolute action it is now time to explore "the usefulness of artificially enhancing earth's albedo and thereby cooling climate by adding sunlight-reflecting aerosol in the stratosphere".<sup>22</sup> He stressed that plans to alter the chemical composition of the atmosphere should be seen as an escape route if global warming gets out of control. Crutzen is one of the growing numbers of scientists arguing that we need to consider Plan B. The foremost scientific institutions now agree, with the US National Academy of Sciences organising a conference and the Royal Society issuing a report in September 2009.<sup>23</sup>

On the surface, fiddling with the dimmer switch is an almost irresistible political fix for governments. It gets powerful lobbies off their backs, gives the green light to burn

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<sup>20</sup> Barrett, 'The Incredible Economics of Geoengineering'

<sup>21</sup> 'Obama's science chief eyes drastic climate steps', Associated Press, 8 April 2009, [http://www.thebreakthrough.org/blog/2009/04/john\\_holdrens\\_minor\\_geoenginee.shtml](http://www.thebreakthrough.org/blog/2009/04/john_holdrens_minor_geoenginee.shtml)

<sup>22</sup> Crutzen, 'Albedo enhancement by stratospheric sulfur injections'

<sup>23</sup> Royal Society, *Geoengineering the Climate*. As we saw in Chapter 5, in the late seventeenth century the Royal Society was instrumental in unleashing the powers of Prometheus, so there is an irony in the fact that in the twenty-first century it is leading the campaign to counter the consequences.

more coal, avoids the need to raise petrol taxes, allows unrestrained growth and is no threat to consumer lifestyles.<sup>24</sup> In short, compared to cutting greenhouse gas emissions geoengineering gets everyone off the hook. No government is yet willing to lend official support to geoengineering, but the pressure is building and the day when the government of a major nation like the United States, Russia or China publicly backs serious consideration of Plan B cannot be far off. Then the floodgates will open.

Even now, beneath the radar, Russia has already begun testing.<sup>25</sup> Yuri Izrael, a Russian scientist who has advised Prime Minister Putin, has tested the effects of aerosol spraying from a helicopter on solar radiation reaching the ground. He now plans a full-scale trial.<sup>26</sup>

### **Hubris**

Not all influential advocates of climate engineering adopt a cautious approach; some are gung-ho. When the potentially severe side-effects of geoengineering are pointed out, the more cavalier climate engineers say they can be managed with other techniques, such as spreading lime in the oceans to counter acidification. Some concede that liming the seas would not be feasible as a generalised response, but maintain it could still be deployed to protect highly valued zones.<sup>27</sup> One idea is to offset acidification by installing a network of under-sea pipes that inject alkalis around sites such as the Great Barrier Reef.<sup>28</sup> For some, turning the planet into a museum of natural artefacts while the rest goes to ruin seems easier than phasing out coal.

In classical Athens hubris was a crime. In a memorable instance, after Achilles had killed Hector he tied the body to a chariot and dragged it around. In modern times, parallels can be seen in the willingness of US soldiers at Iraq's Abu Ghraib prison to

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<sup>24</sup> John Virgoe, International governance of a possible geoengineering intervention to combat climate change, *Climatic Change*, (2009) 95:103–119

<http://www.springerlink.com/content/81101h3tj5386400/fulltext.pdf>

<sup>25</sup> <http://www.springerlink.com/content/14n1047050013048/>

See also <http://sandberghans.blogspot.com/2008/03/why-did-ipccs-yuri-izrael-speak-at-anti.html>

<sup>26</sup> <http://motherjones.com/environment/2009/12/copenhagen-geoengineerings-big-break>

<sup>27</sup> David Victor, 'On the regulation of geoengineering', *Oxford Review of Economic Policy*, vol. 24, no. 2, 2008, p. 327

<sup>28</sup> Kurt House, Christopher House, Daniel Schrag and Michael Aziz, 'Electrochemical acceleration of chemical weathering as an energetically feasible approach to mitigating anthropogenic climate change', *Environmental Science and Technology*, vol. 41, no. 24, 2007, p. 8467

take photographs of their captives in humiliating poses.<sup>29</sup> In Ancient Greece, Hubris was paired with Nemesis, the goddess of divine retribution whose “blade of vengeance”, wrote Aeschylus, “yields a ripe harvest of repentant wo”<sup>30</sup> on those who imagine themselves to be beyond the reach of the gods or put themselves above the laws of men. The climate engineers believe they can control the forces of nature and bend Gaia’s will to their own.

For millions of years the temperature of the Earth and the amount of carbon dioxide in the atmosphere have more or less moved together, creating ice ages and warm epochs. The relationship is governed by certain primary factors—notably peaks of solar radiation, volcanic events, methane release and, now, human release of fossil carbon—as well as secondary feedbacks—especially ice melt changing the Earth’s albedo, and carbon dioxide release from the land and oceans.

Recourse to climate engineering to counter human-induced warming is an unconscious attempt by one species to decouple the great process that links the composition of the atmosphere to the temperature of the Earth and the biotic systems of the land and oceans. Instead of decoupling growth of the economy from growth of carbon emissions, a link two centuries old, the climate engineers want to decouple global warming from growth of carbon emissions, a link as old as life itself.

### **Nemesis**

More vivid sunsets like the one Edvard Munch saw would be one of the consequences of using sulphate aerosols to engineer the climate; but a more disturbing effect of enhanced dimming would be the permanent whitening of day-time skies.<sup>31</sup> A washed-out sky would become the norm. If the nations of the world resort to climate engineering, and in doing so relieve pressure to cut carbon emissions, then the concentration of carbon dioxide in the atmosphere would continued to rise and so would the latent warming that would need suppressing. It would then become impossible to stop sulphur injections into the stratosphere, even for a year or two, without an immediate jump in temperature. It’s estimated that, if we did stop, the back-up of greenhouse gases could see warming rebound at a rate 10-20 times faster

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<sup>29</sup> Philip Gourevitch and Errol Morris, *Standard Operating Procedure*, Penguin, Harmondsworth, 2008

<sup>30</sup> Aeschylus, *The Persians*

<sup>31</sup> Crutzen, ‘Albedo enhancement by stratospheric sulfur injections’

than in the recent past,<sup>32</sup> a phenomenon referred to, apparently without irony, as the “termination problem”.<sup>33</sup> Once we start manipulating the atmosphere we could be trapped, forever dependent on a program of sulphur injections into the stratosphere. In that case, human beings would never see a blue sky again.

The international community has found it difficult to agree on strong collective measures to reduce emissions. Country circumstances are diverse and impacts uncertain. Against this, climate engineering is cheap, immediately effective and, most importantly, available to a single nation. Among the feasible contenders for unilateral intervention, one expert names China, the United States, the European Union, Russia, India, Japan and Australia.<sup>34</sup>

The situation might be compared to one in which seven people live together in a centrally heated house, each with their own thermostat and each with a different ideal temperature. China will be severely affected by warming, but Russia might prefer the globe to be a couple of degrees warmer. If there is no international agreement an impatient nation suffering the effects of climate disruption may decide to act alone. It is not out of the question that in three decades the climate of the Earth could be determined by a handful of Communist Party officials in Beijing. Or the government of an Australia crippled by permanent drought, collapsing agriculture and ferocious bushfires could risk the wrath of the world by embarking on a climate control project. If this seems far-fetched, perhaps the most sobering question to ask of the future of geoengineering is: What would Sarah Palin do?

### **Dr Strangelove and right-wing think tanks**

Two of the earliest and most aggressive advocates of planetary engineering were Edward Teller and Lowell Wood. Teller was the co-founder and director of the Lawrence Livermore National Laboratory in San Francisco, said to have a “near-mythological status as the dark heart of weapons research”.<sup>35</sup> He is often described as the ‘father of the hydrogen bomb’ and was the inspiration for Dr Strangelove, the wheelchair-bound mad scientist prone to Nazi salutes in Stanley Kubrick’s 1964 film

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<sup>32</sup> H. Damon Matthews and Ken Caldeira, ‘Transient climate-carbon simulations of planetary geoengineering’, *Proceedings of the National Academy of Science*, vol. 104, no. 24, 12 June 2007

<sup>33</sup> Royal Society, *Geoengineering the Climate*, p. 24

<sup>34</sup> Victor, ‘On the regulation of geoengineering’, p. 331, n. 14

<sup>35</sup> Jeff Goodell, ‘Can Dr. Evil Save The World?’, *Rolling Stone*, 3 November 2006

of that name.<sup>36</sup> In 1979 Teller blamed Jane Fonda for a heart attack, taking out a full page advertisement in the *New York Times* claiming the attack was brought on by his frenetic efforts to counter anti-nuclear propaganda after the Three Mile Island accident.

Lowell Wood was recruited by Teller to the Lawrence Livermore National Laboratory and became his protégé. For decades Wood was one of the Pentagon's foremost "weaponers", leading him to be christened "Dr Evil" by critics. He led the group tasked with developing the technology for Ronald Reagan's ill-fated Star Wars missile shield, which included plans for an array of orbiting X-ray lasers powered by nuclear reactors. Since 1998 Wood and Teller have been promoting aerosol spraying into the stratosphere as a simple and cheap counter to global warming.

Like fellow members of the scientific elite that provided the brain-power for the military-industrial complex in the post-war decades, Teller and Wood believe it is man's duty to exert supremacy over nature. It is perhaps for this reason that they have long associations with conservative think tanks that deny the existence of human-induced global warming. Wood is listed as an expert with the George C. Marshall Institute, a Washington think tank that became one of the main centres of climate denial in the 1990s. Wood is also a visiting fellow at the right-wing Hoover Institution, a centre of climate scepticism partly funded by ExxonMobil and host to Thomas Gale Moore, the author of *Climate of Fear: Why We Shouldn't Worry About Global Warming*.<sup>37</sup> Edward Teller, who died in 2003, was also affiliated with the Hoover Institution. In 2003 the Marshall Institute and Hoover Institution jointly released a book titled *Politicizing Science: The Alchemy of Policymaking* that contained laments on the suppression of "sound science" from well-known climate sceptics Patrick Michaels and Fred Singer.<sup>38</sup>

It is strange that geoengineering is being promoted enthusiastically by a number of right-wing think tanks that are active in climate denialism. In addition to those I have mentioned, the Competitive Enterprise Institute, the American Enterprise Institute and

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<sup>36</sup> Although Teller was Jewish and left Europe in 1935. Teller had a prosthetic foot while Dr Strangelove had a prosthetic hand. See the Wikipedia entries on Teller and Dr Strangelove.

<sup>37</sup> Alex Steffen, 'Geoengineering and the New Climate Denialism', *Worldchanging*, 29 April 2009 <http://www.worldchanging.com/archives/009784.html>

<sup>38</sup> [http://media.hoover.org/documents/0817939326\\_283.pdf](http://media.hoover.org/documents/0817939326_283.pdf)

the Heartland Institute support geoengineering. The American Enterprise Institute, an influential conservative think tank that offered \$10,000 to academics for papers debunking the IPCC report,<sup>39</sup> has launched a high-profile project to promote geoengineering.<sup>40</sup>

Why would activists who deny warming is occurring and oppose measures to reduce emissions support the development of a technology aimed at countering global warming? Of course, geoengineering protects their supporters and financiers in the fossil industries because it can be a substitute for abatement and a justification for delay<sup>41</sup> (for example, ExxonMobil has provided funding to the American Enterprise Institute<sup>42</sup>), but I think a deeper explanation lies in their beliefs about the relationship of humans to the natural world. Pursuing abatement is an admission that industrial society has harmed nature, while engineering the Earth's climate would be confirmation of our mastery over it, final proof that, whatever minor errors made on the way, human ingenuity and faith in our own abilities will always triumph. Geoengineering promises to turn failure into triumph.

While some agonise over whether geoengineering would be a substitute for greenhouse gas reductions instead of a complement to them,<sup>43</sup> Wood and Teller, and the right-wing think tanks that promote climate manipulation, have few doubts. Not only should it be pursued instead of reducing emissions, but geoengineering plus rising carbon dioxide concentrations would in fact be a *superior* outcome compared to a situation in which there was no global warming to worry about because "air fertilization" would stimulate food production.<sup>44</sup>

Lowell Wood believes that climate engineering is inevitable; it's a matter of time before the 'political elites' wake up to its cheapness and effectiveness. In a statement that could serve as Earth's epitaph, he declared: "We've engineered every other

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<sup>39</sup> [http://www.sourcewatch.org/index.php?title=American\\_Enterprise\\_Institute](http://www.sourcewatch.org/index.php?title=American_Enterprise_Institute)

<sup>40</sup> <http://www.aei.org/yra/100009?parent=1>. The AEI was close to the Bush Administration and its trustees include Dick Cheney.

<sup>41</sup> Steffen, 'Geoengineering and the New Climate Denialism'

<sup>42</sup> [http://www.sourcewatch.org/index.php?title=American\\_Enterprise\\_Institute](http://www.sourcewatch.org/index.php?title=American_Enterprise_Institute)

<sup>43</sup> Royal Society, *Geoengineering the Climate*, p. 45

<sup>44</sup> Edward Teller, Roderick Hyde and Lowell Wood, 'Active Climate Stabilization: Practical Physics-Based Approaches to Prevention of Climate Change', paper submitted to the National Academy of Engineering Symposium, Lawrence Livermore National Laboratory, April 2002

environment we live in—why not the planet?”<sup>45</sup> Wood wrote a paper with Teller arguing that the costs of sulphur injections to offset warming would amount to only one per cent of the cost of reducing emissions.<sup>46</sup>

Wood is contemptuous of the ability of world leaders to reduce emissions—which he dubs “the bureaucratic suppression of CO<sub>2</sub>”<sup>47</sup>—and of their ability to reach a consensus on trialling geoengineering. In Jeff Goodell’s words, he predicts popular resistance to the idea of “toying with the integrity of the Earth’s climate just so Americans don’t have to give up their SUVs”.<sup>48</sup> So Wood speculates about getting private funding from a billionaire for an experiment. “As far as I can determine, there is no law that prohibits doing something like this”.<sup>49</sup> Wood is right: there is no law against a private individual attempting to tinker with the Earth’s climate.

### **Regulating climate regulation**

This goes to the heart of the push to develop the tools for climatic manipulation. The debate over engineering the world’s climate is at present largely confined to a tight-knit group of scientists some of whom want to keep the public in the dark and fend off regulation of their activities. In his intriguing new book, *How To Cool the Planet*, Jeff Goodell reveals a series of three private dinners held on the fringes of the 2009 conference of the American Geophysical Union that brought together the main players.<sup>50</sup> The dinners were convened by two leaders in the field, Ken Caldeira of Stanford University and David Keith of the University of Calgary. Lowell Wood was a prominent presence.

Goodell describes the three dinners as “a turning point in the evolution of geoengineering as a policy tool” and quotes Wood’s summing up of the dinners: “This is like nothing that human beings have thought about before”.<sup>51</sup> Wood subsequently emailed Goodell saying that when he talks to people opposed to geoengineering he says to them: “You don’t have to argue with me, and I don’t have to argue with you,

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<sup>45</sup> Goodell, ‘Can Dr. Evil Save The World?’

<sup>46</sup> Teller et al., ‘Global Warming and Ice Ages’

<sup>47</sup> Quoted in James R. Fleming, ‘The Climate Engineers: Playing god to save the planet’, *Wilson Quarterly*, vol. 31, no. 2, 2007, p. 48

<sup>48</sup> Goodell, ‘Can Dr. Evil Save The World?’. The quote is slightly modified.

<sup>49</sup> Goodell, ‘Can Dr. Evil Save The World?’

<sup>50</sup> Jeff Goodell, *How To Cool the Planet*, Houghton Mifflin Harcourt, New York, 2010, pp. 109 ff

<sup>51</sup> Goodell, p. 115

let's find something more pleasant to talk about, because I'm going to win." Why bother informing the public when engineering the climate is inevitable? We just need to wait until the fools realise there is no alternative.

In March 2010 a private meeting of leading climate engineers, held in Asilomar, California, aimed to develop guidelines to govern research and testing.<sup>52</sup> Those invited wanted a voluntary code of conduct that would forestall regulation by governments and the international community so that the experts could work unhindered at their task of understanding how to control of the Earth's climate system.

David Keith has argued that an international treaty may be unnecessary because the use of solar radiation management could be regulated by unwritten "norms".<sup>53</sup> This is despite his acknowledgement that the threat of unilateral action is very real; any one of a dozen countries could begin it within a few years. The technology for solar radiation management is simple and cheap. All you need are planes that can fly high enough equipped with tanks and nozzles to spray sulphuric acid or sulphur dioxide. Keith says one person could decide to do it.

"The fact is that with the right technology it may be cheap enough, through engineering the stratosphere, that literally individual human beings may have the wealth necessary to introduce an ice age."<sup>54</sup>

Perhaps the wealthy individual he has in mind is Bill Gates, who has covertly been funding geoengineering research for three years with the advice of Keith and Caldeira.<sup>55</sup> They now oversee Gates' research fund, which has spent some \$4.5 million to date, including funding the three private dinners at Asilomar. Keith will not reveal what the money is being spent on, downplaying it as "a little private funding agency".<sup>56</sup> Right—the world's richest man has a little private funding agency devoted to researching ways to manipulate the Earth's climate system. Conspiracy theory anyone?

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<sup>52</sup> <http://www.etcgroup.org/en/node/5080>

<sup>53</sup> <http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/221/10011304.htm>

<sup>54</sup> <http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/221/10011304.htm>

<sup>55</sup> <http://news.sciencemag.org/scienceinsider/2010/01/bill-gates-fund.html>

<sup>56</sup> <http://news.sciencemag.org/scienceinsider/2010/01/bill-gates-fund.html> Keith emphasised the need for transparency in his evidence to the House of Commons Inquiry.

Gates is also an investor in a firm named Intellectual Ventures that is promoting a scheme called “StratoShield”, which would pump sulphur dioxide into the upper atmosphere through a 30-kilometre hose held aloft by V-shaped blimps.<sup>57</sup> Intellectual Ventures is run by Nathan Myhrvold, former chief technology officer at Microsoft, and includes Lowell Wood among its associates.<sup>58</sup>

Gates is not the only billionaire lone ranger who wants to save the planet. Richard Branson has set up his own “war room” to do battle with global warming.<sup>59</sup> The battalions he wants to mobilise on “the path to victory” are successful entrepreneurs—like himself—and their weapons are “market driven solutions to climate change”. It’s a shiny new business model to save the planet. The Carbon War Room—where inspirational quotes from Richard Branson are mixed in with those of other titans like Churchill, Roosevelt and Einstein—represents the type of rich man’s folly common amongst modern entrepreneurs with a Messiah complex.

Branson’s War Room site links to a paper co-authored by Lee Lane of the American Enterprise Institute, published by the centre run by “skeptical environmentalist” Bjorn Lomborg. The paper concludes that the benefits of geoengineering vastly outweigh the costs and shows how to set an optimal temperature for the Earth for the next two hundred years. The authors write that ethical objections from environmental advocacy groups may present an obstacle to the deployment of solar radiation management, before noting with relief: “In reality, important economies remain largely beyond the influence of environmental advocacy groups.”<sup>60</sup> They expect that deployment of solar radiation management will be led by nations with weak environmental lobbies—which of course means dictatorships.

While one or two experts are warning of the “urgent need to restrain what we might call irresponsible entrepreneurial activity in this field”,<sup>61</sup> most climate engineers fear government regulation and oppose “premature” moves towards an international treaty

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<sup>57</sup> <http://intellectualventureslab.com/wp-content/uploads/2009/10/Stratoshield-white-paper-300dpi.pdf>

<sup>58</sup> Goodell, *How To Cool the Planet*, pp. 112-3

<sup>59</sup> <http://www.carbonwarroom.com/>

<sup>60</sup> J Eric Bickel & Lee Lane, *An Analysis of Climate Engineering as a Response to Climate Change*, Copenhagen Consensus Center, Copenhagen Business School, Denmark, undated, p. 26. The authors thank Lowell Wood for advice.

<sup>61</sup> John Virgoe,

<http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/221/10011304.htm>

that could outlaw geoengineering. Most advocate what they call a “bottom-up” process among scientists and interested parties, reflecting a profoundly anti-democratic worldview. In the words of the ETC group, an NGO campaigning against climate engineering: “Suggesting a ‘bottom-up’, governance process for such top-down planet-altering technologies is absurd”.<sup>62</sup>

### **Hubris again**

The climate engineers want to respond to climate peril with a grand intervention, “a technological conquest of technology”<sup>63</sup> designed to seize control of the planet’s climate system. It is an approach breath-taking in its audacity and astonishing in its arrogance. The attitude of the planetary engineers is so out of sync with contemporary climate science and so at odds with modern attitudes to the natural world that they appear as throwbacks from another era, perhaps the one captured by Arthur Conan Doyle in his fictional character Professor George Edward Challenger—a crazed and pugnacious scientist blessed with a supreme faith in his own intellectual capabilities.

In a short story first published in 1928, Professor Challenger is struck by a Lovelockian insight—that “the world upon which we live is itself a living organism, endowed ... with a circulation, a respiration, and a nervous system of its own”.<sup>64</sup> Deducing that this sentient Earth must be oblivious to the presence of Lilliputian creatures crawling over its outer rind, the professor resolves to “let the earth know that there is at least one person, George Edward Challenger, who calls for attention—who, indeed, insists upon attention”. So in the Sussex countryside he orders a shaft dug through the crust eight miles deep. When the pit reaches the soft, heaving body of the giant organism he orders a sharp, hundred-foot drill to be suspended just above it.

When all is ready, including the assembly up above of a bevy of dignitaries and a throng of curious members of the public, the iron dart is “shot into the nerve ganglion of old Mother Earth”. The effect? “It was a howl in which pain, anger, menace, and the outraged majesty of Nature all blended into one hideous shriek.” The earth trembled and the great pit closed over like a wound being healed. As the tumult

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<sup>62</sup> <http://www.etcgroup.org/en/node/5073>

<sup>63</sup> Karl Jaspers, *The Future of Mankind*, University of Chicago Press, Chicago, 1961, p. viii

<sup>64</sup> Arthur Conan Doyle, ‘When the World Screamed’, in *The Lost World & Other Stories*, Wordsworth Editions Ltd, Hertfordshire, 1995

settled and the multitude gathered their wits, all eyes turned to Challenger as “the mighty achievement, the huge sweep of the conception, the genius and wonder of the execution, broke upon their minds”. The triumphant professor bowed to their acclaim. “Challenger the super scientist, Challenger the arch pioneer, Challenger the first man whom Mother Earth had been compelled to recognize.”