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Command-and-control: Alternative futures of geoengineering in an age of global weirding

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ABSTRACT

In July 2012, Russ George, the founder of Planktos Inc., organized efforts to dump 100 tons of iron sulfate off the coast of Canada to engineer a plankton bloom that would, ostensibly, absorb carbon dioxide and store it in the depths of the Pacific Ocean. As George's geoengineering experiment is one of the largest and first of its kind, many were quick to denounce his rogue action while others were delighted to see that he succeeded as a large algae bloom was reported to have emerged. Using the George event as a point of entry for exploring alternative futures of geoengineering in an age of global weirding, this project fuses the 2×2 scenario modeling technique with the "Mānoa School" four-futures method by situating command and control, along X (control) and Y (command) axes as two critical uncertainties and key drivers of change that will impact the design, development, and diffusion of climate mitigation engineering initiatives, which some see as holding the only solution to avert global catastrophe and others condemn as a postnormal remedy.

> In this century, the greatest environmental progress will come about not through endless lawsuits or command-and-control regulations but through technology and innovation. —George W. Bush (2003) [15]

1. Introduction

In July 2012, Russ George, the founder of Planktos Inc., organized an effort to dump 100 tons of iron sulfate off the coast of Canada to engineer a plankton bloom that would absorb carbon dioxide (hereafter CO_2) and store it in the depths of the Pacific Ocean. While "the operators claim the iron generated a plankton bloom of about 10,000 square kilometers" [64], a 2011 report from the Intergovernmental Panel on Climate Change (hereafter IPCC) notes the low CO_2 storage potential and global side-effects of ocean fertilization, which is further problematized by the rising trend of ocean acidification—an impediment to algae growth [43,72]. As George's "rogue" endeavor was one of, if not, the first of its kind, which explains why it drew criticism and reflection on the limits and implications of initiatives to mitigate climate change, many remain concerned about the overall dearth of action toward reducing global CO_2 emissions [54]. As the Mauna Loa Observatory recently reported, atmospheric CO_2 recently reached 400 parts-per-million for the first time in "more than 2.5 million years," and the last time it was this high "the globe's temperature averaged about 3 degrees C warmer, and sea level lapped coasts 5 meters or more higher" [10]. In light of such reports, the Planktos incident has done much to re-enliven discussions

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concerning the legal, ethical, and political implications of geoengineering, which, in spite of the unanswered questions and sizable risks, some see as the only possible solution to the challenges ahead [38,50,65,66,85].

At present, there are two major types of geoengineering initiatives: CO_2 sequestration, which involves capturing, storing, and/or removing greenhouse gases, such as ocean fertilization, and solar radiation management (hereafter SRM), which centers on limiting the amount of sunlight that penetrates the atmosphere [30,41,51,71,88]. According to the IPCC's Fourth Assessment Report (hereafter AR4), geoengineering "options tend to be speculative and many of their environmental side-effects have yet to be assessed; detailed cost estimates have not been published; and they are without a clear institutional framework for implementation" [8, p. 621]. Complicating things further, and as noted by former President Bush, there is a perceived and actual shift away from *command-and-control* regulation on environmental issues, which pioneered a regime of "detailed regulations followed up by an ongoing inspection program" [81]. While this strategy defined the rise of the Environmental Protection Agency (EPA) in the U.S., the limitations of this approach, particularly for large-scale climate engineering projects, are readily apparent, especially given the postnormal challenges of global warming. Explicating the postnormal contours of our historical moment, Sardar argues, "Ours is a transitional age, a time without the confidence that we can return to any past we have known and with no confidence in any path to a desirable, attainable or sustainable future" [74, p. 435]. Given the immense ethico-political issues raised by geoengineering, charting alternative futures can offer critical insights for exploring possible, probable, plausible, and preferable aspects of climate engineering initiatives, especially since, "if we cannot learn the lessons of history we need another source for the imagination to conceive of more sustainable and attainable futures" [74, p. 444].

Drawing on the "value of mash-ups" [22, p. 58], this paper fuses the 2×2 scenario modeling technique with the "Mānoa School" four-futures method [26] by situating command and control along *X* (*control*) and *Y* (*command*) axes as two critical uncertainties for modeling alternative futures of geoengineering. The pairing of the Mānoa School modeling method with the 2×2 approach provides additional complexity and context for the scenarios, which take a global perspective and focus on the events surrounding geoengineering initiatives as much as their potential design, development, and diffusion. Whereas the pole of each axis on a 2×2 matrix commonly denotes degree (high versus low), *control* (*X*-axis) and *command* (*Y*-axis) are not framed herein according to intensity but rather according to kind with each pole denoting unique views of both perceived and actual complexity of global warming and potential remediation strategies and tactics [68]. In order to contextualize and operationalize the alternative futures presented herein, *command* and *control* are critically explored and reterritorialized from a postnormal purview in subsequent sections. As the basis for the *Y*-axis, *command* is couched within the ongoing debate concerning the origin and meaning of the *Anthropocene*, which suggests that humans are now among the "great forces of Nature" [80, p. 843]. *Control*, on the other hand, is situated within the discourse on environmental security, which mediates the "dramatic ground swell of interest in environmental change as a potentially key variable in understanding security and conflict," specifically the weaponization of Mother Nature's fragility and fury [31, p. 2]. As the foundation for reconceptualizing command and control, the concept of *global weirding* is explicated to address ongoing and expected shifts in perspective, policy, and practice.

2. From global warming to global weirding

Given some of the concerns raised in AR4 and expectations that the Fifth Assessment Report (hereafter AR5), which will be officially released in 2014, will give greater weight and attention [46] to geoengineering, global warming is actually a sort of *global weirding*—a neologism coined by Hunter Lovins, co-founder of the Rocky Mountain Institute, and popularized by Thomas Friedman [35,36]. In light of George's experiment and the increasing possibility that the world may need to take significant steps to abate a constellation of ecological crises, an exploration of alternative futures of geoengineering in an age of global weirding provides an opportunity to consider the impacts and ramifications of potential remedies while imagining what might lie ahead should any or all of the proposed *solutions* be enacted, which many find worrisome since "the cure could be worse than the disease" [79, p. 620]. Contending with the postnormal precarity of geoengineering lies at the heart of life in an age of global weirding, and while this contention may seem trite to those with a penchant for forecasting alternative futures, life in a postnormal world is profoundly weird (and getting weirder) for many.[1] While the future(s) impacts and implications of climate engineering remain speculative, the two sides of the geoengineering debate are already apparent.

Articulating the two sides succinctly, George, who unsuccessfully attempted an ocean fertilization project five years earlier, argued that his efforts were "'organic gardening, not rocket science'" [69]. While the outspoken entrepreneur's candor was certainly intended to raise eyebrows, if not funds from investors, the purported success of his 2012 experiment mixes more than metaphors as ocean fertilization enhances natural processes of CO_2 sequestration (i.e. organic gardening) and yet presumes a level of systemic command-and-control that remains, at present, elusive (i.e. rocket science). Complicating the matter further, the U.N.'s 2010 convention on biological diversity applies only to the rather amorphous category of geoengineering initiatives that can and/or might effect biodiversity, which puts the Planktos incident into a bit of a legal gray area [92]. Considering the lack of a regulatory framework, the dearth of international law, and the absence of a

[1] This weirding has much to do with the existential challenges to traditional worldviews brought to the fore by global warming. In a study examining this exact dynamic, Barker and Bearce found that "belief in Christian end-times theology significantly predicts resistance to government action aimed at curbing global warming," which clearly remains an issue in the U.S. and elsewhere [7, p. 272].