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The Melting of 'Nuclear Winter'

By Russell Seitz

> "Apocalyptic predictions require, to be taken seriously, higher standards of evidence than do assertions on other matters where the stakes are not as great."
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> ---Carl Sagan, Foreign Affairs, Winter 1983 -84

The end of the world isn't what it used to be. "Nuclear Winter," the theory launched three years ago this week that predicted a nuclear exchange as small as 100 megatons ("a pure tactical war, in Europe, say" in Carl Sagan's phrase), in addition to its lethal primary effects, would fill the sky with smoke and dust, ushering in life-extinguishing sub-zero darkness, has been laid to rest in the semantic potter's field alongside the "Energy Crisis" and the "Population Bomb." Cause of death: notorious lack of scientific integrity.

The Nuclear Winter conjecture has unraveled under scrutiny. Yet not so long ago, policy analysts took it so seriously that there is reason to examine how the powerful synergy of environmental concern and the politics of disarmament drove some scientists to forge an unholy alliance with Madison Avenue. Mere software has been advertised as hard scientific fact.

How did this polarization arise?

In 1982, a question arose within the inner circle of disarmament activists: Could the moral force of Jonathan Schell's eloquent call to lay down arms, "The Fate of the Earth," be transformed into a scientific imperative? Peace-movement strategists wanted something new to dramatize nuclear war's horrors. As Ralph K. White put it in his book "The Fearful Warriors": "Horror is needed. The peace movement cannot do without it." What they got was surreal -- a secular apocalypse.

A 1982 special issue of the Swedish environmental science journal Ambio considered the environmental consequences of a nuclear war. This special issue did little to evoke a mass response of the sort needed to change the course of strategic doctrine. But one article contained the seed of what would become Nuclear Winter.

Mr. Sagan seized upon an article by Messrs. Paul Crutzen and Steven Birks that raised the question of a "Twilight at Noon" if the fires ignited by nuclear holocaust were to convert much of the fuel in both woodlands and cities into enough soot to enshroud the globe. In the hands of others their concerns would be transformed into an exhortation.

The chilling climatic impact of this soot can be modeled with existing software. The paper that resulted came to be known as TTAPS, after the initials of its authors beginning with Richard Turco and ending with Carl Sagan.

Audubon Society president Russell Peterson, whose wife was editor of

Ambio, sent the issue to Robert Scrivner of the Rockefeller Family Fund. Mr. Scrivner convened an ad hoc consortium of foundations and scientific groups with a bent for disarmament. Cornell astrophysicist and media personality Carl Sagan assembled a scientific advisory board that drew heavily from such organizations as the Union of Concerned Scientists, Physicians for Social Responsibility, the Federation of American Scientists and the Natural Resources Defense Council. Two-dozen foundations and more than 100 scientists were recruited.

A BONE-DRY BILLIARD BALL

Nuclear Winter never existed outside of a computer, except as a painting commissioned by a PR firm. Instead of an earth with continents and oceans, the TTAPS model postulated a featureless, bone-dry billiard ball. Instead of nights and days, it postulated 24-hour sunlight at one-third strength. Instead of realistic smoke emissions, a 10-mile-thick soot cloud magically materialized, creating an alien sky as black as the ink you are reading. The model dealt with such complications as geography, winds, sunrise, sunset and patchy clouds in a stunningly elegant manner -- they were ignored. When later computer models incorporated these elements, the flat black sky of TTAPS fell apart into a pale and broken shadow that traveled less far and dissipated more quickly.

The TTAPS model entailed a long series of conjectures: if this much smoke goes up, if it is this dense, if it moves like this, and so on. The improbability of a string of 40 such coin tosses coming up heads approaches that of a pat royal flush. Yet it was represented as a "sophisticated one-dimensional model" -- a usage that is oxymoronic, unless applied to Twiggy.

To the limitations of the software were added those of the data. It was an unknown and very complex topic, hard data was scant, so guesstimates prevailed. Not only were these educated guesses rampant throughout the process, but it was deemed prudent, given the gravity of the subject, to lean toward the worst-case end of the spectrum for dozens of the numbers involved. Political considerations subliminally skewed the model away from natural history, while seeming to make the expression "nuclear freeze" a part of it.

"The question of peer review is essential. That is why we have delayed so long in the publication of these dire results," said Carl Sagan in late 1983. But instead of going through the ordinary peer-review process, the TTAPS study had been conveyed by Mr. Sagan and his colleagues to a chosen few at a closed meeting in April 1983. Despite Mr. Sagan's claim of responsible delay, before this peculiar review process had even begun, an $80,000 retainer was paid to Porter-Novelli Associates, a Washington, D.C., public-relations firm. More money was spent in the 1984 fiscal year on video and advertising than on doing the science.

The meeting did not go smoothly; most participants I interviewed did

not describe the reception accorded the Nuclear Winter theory as cordial or consensual. The proceedings were tape recorded, but Mr. Sagan has repeatedly refused to release the meeting's transcript. (The organizers have said it was closed to the press to avoid sensationalism and premature disclosure.) According to Dr. Kosta Tsipis of MIT, even a Soviet scientist at the meeting said, "You guys are fools. You can't use mathematical models like these to model perturbed states of the atmosphere. You're playing with toys."

Having premiered on Oct. 30, 1983, as an article by Mr. Sagan in the Sunday supplement Parade, the TTAPS results finally appeared in Science magazine (Dec. 23, 1983). This is the very apex of scholarly publication, customarily reserved for a review article expounding a mature addition to an existing scientific disipline -- one that has withstood the testing of its data and hypotheses by reproducible experiments recorded in the peer-reviewed literature. Yet what became of the many complex and uncertain variables necessary to operate the Nuclear Winter model? They were not set forth in the text -- 136 pages of data were instead reduced to a reference that said, simply, "In preparation." The critical details were missing. They have languished in unpublished obscurity ever since.

The readers of Science were still bewildered when, just one week later, another article by Mr. Sagan -- "Nuclear War and Climatic Catastrophe" -- appeared in Foreign Affairs. Mr. Sagan argued that, because of the TTAPS results, "What is urgently required is a coherent, mutually agreed upon, long-term policy for dramatic reductions in nuclear armaments..."

In hastening to maximize the impact, Mr. Sagan made mistakes. While he cited the following passage as coming from a companion piece in Science that he had co-authored, it did not actually appear in the published version of that article: "IN ALMOST ANY REALISTIC CASE involving nuclear exchanges between the superpowers, global environmental changes sufficient to cause an extinction event equal to or more severe than that of the close of the Cretaceous when the dinosaurs and many other species died out are likely. (Emphasis added)." The ominous rhetoric italicized in this passage puts even the 100 megaton scenario of TTAPS on a par with the 100 million megaton blast of an asteroid striking the Earth. This astronomical mega-hype failed to pass peer review and never appeared in Science. Yet, having appeared in Foreign Affairs, it has been repeatedly cited in the literature of strategic doctrine as evidence.

Rather than "higher standards of evidence," Mr. Sagan merely provided testimonials. He had sent return-mail questionnaires to the nearly 100 participants at the April meeting, and edited the replies down to his favorite two-dozen quotations. What became of the hard copy of the less enthusiastic reports remains a mystery, but it is evident from subsequent comments by their authors that TTAPS received less than the unanimous endorsement of "a large number of scientists." Prof. Victor Weisskopf of MIT, sized up the matter in early 1984: "Ah! Nuclear Winter! The science is terrible, but, perhaps the psychology is good."

Many scientists were reluctant to speak out, perhaps for fear of being denounced as reactionaries or closet Strangeloves. For example, physicist Freeman Dyson of the Institute for Advanced Studies at Princeton was privately critical in early 1984. As he put it, "It's (TTAPS) an absolutely atrocious piece of science, but I quite despair of setting the public record straight....Who wants to be accused of being in favor of nuclear war?"

Most of the intellectual tools necessary to demolish TTAPS's bleak vision were already around then, but not the will to use them. From respected scientists one heard this: "You know, I really don't think these guys know what they're talking about" (Nobel laureate physicist Richard Feynman); "They stacked the deck" (Prof. Michael McElroy, Harvard); and, after a journalist's caution against four-letter words, "'Humbug' is six [letters]" (Prof. Jonathan Katz, Washington University).

In 1985, a series of unheralded and completely unpublicized studies started to appear in learned journals -- studies that, piece by piece, started to fill in the blanks in the climate-modeling process that had previously ben patched over with "educated" guesses.

The result was straightforward: As the science progressed and more authentic sophistication was achieved in newer and more elegant models, the postulated effects headed downhill. By 1986, these worst-case effects had melted down from a year of arctic darkness to warmer temperatures than the cool months in Palm Beach! A new paradigm of broken clouds and cool spots had emerged. The once global hard frost had retreated back to the northern tundra. Mr. Sagan's elaborate conjecture had fallen prey to Murphy's lesser known Second Law: If everything MUST go wrong, don't bet on it.

By June 1986 it was over: In the Summer 1986 Foreign Affairs, National Center for Atmospheric Research (NCAR) scientists Starley Thompson and Stephen Schneider declared, "...on scientific grounds the global apocalyptic conclusions of the initial nuclear winter hypothesis can now be relegated to a vanishingly low level of probability."

Yet the activist wing of the international scientific estabishment had already announced the results of the first generations of interdisciplinary ecological and climatological studies based on Nuclear Winter. Journalists paid more attention to the press releases than the substance of these already obsolescent efforts at ecological modeling, and proceeded to inform the public that things were looking worse than ever. Bold headlines carried casualty estimates that ran into the proverbial "billions and billions."

This process culminated in the reception given the 1985 report of the National Academy of Sciences (NAS). Stressing the uncertainties that plagued the calculations then and now, it scrupulously excluded the expression "Nuclear Winter" from its 193 pages of sober text, but the

report's press release was prefaced "Nuclear Winter...'Clear Possibility.'"
Mr. Sagan construed the reports to constitute an endorsement of the theory.

But in February 1986, NCAR's Dr. Schneider quietly informed a gathering at the NASA-Ames Laboratory that Nuclear Winter had succumbed to scientific progress and that, "in a severe" 6,500-megaton strategic exchange, "The Day After" might witness July temperatures upwards of 50-plus degrees Fahrenheit in mid-America. The depths of Nuclear Winter could no longer easily be distinguished from the coolest days of summer.

As the truth slowly emerged, private skepticism turned often to public outrage, and not just among the "hawks." Prof. George Rathjens of MIT, chairman of the Council for a Livable World, offered this judgement: Nuclear Winter is the worst example of the misrepresentation of science to the public in my memory."

THE POLITICS OF THE MATTER

On Jan. 23, 1986, the leading British scientific journal Nature pronounced on the political erosion ofthe objectivitiy vital to the scientific endeavor: "Nowhere is this more evident than in the recent literature on 'Nuclear Winter,' research which has become notorious for its lack of scientific integrity."

But it is by no means solely within the halls of science that responsibility lies or where redress and the prevention of a recurrence must be sought. Policy analysts have shown themselves to be the lawful prety of software salesmen. They seem to be chronically incapable of distinguishing where science leaves off and the polemical abuse of global-systems modeling begins. The results of this confusion can be serious indeed. Doesn't anybody remember the last example of the "Garbage In, Garbage Out" phenomenon -- the "Energy Crisis"? That crisis also began as a curve plotted by a computer. But it ended as "The Oil Glut." Factoids, scientific or economic, have a strange life of their own; woe to the polity that ignores the interaction of science, myth and the popular imagination in the age of the electronic media.

To historians of science, the Nuclear Winter episode may seem a bizarre comedy of manners; having known sin at Hiroshima, physics was bound to run into advertising sooner or later. But what about the politics of this issue? Does all this matter? Mr. Sagan evidently thinks it does. His homiletic overkill has been relentless. An animated version of his obsolete apocalypse has been added to his updated documentary "Cosmos -- A Special Edition." This fall, prime-time audiences will watch in horror as the airbrushed edge of nuclear darknes overspreads planet Earth. Marshall McLuhan was right on the mark -- with television's advent, advertising has become more important than products.

What is being advertised is not science but a pernicious fantasy that strikes at the very foundation of crisis management, one that attempts to the transform the Alliance doctrine of flexible response into a dangerous vision. For despite its scientific demise, the specter of Nuclear Winter is haunting Europe, Soviet propagandists have seized upon Nuclear Winter in their efforts to debilitate the political will of the Alliance. What more destabilizing fantasy than the equation of theater deterrence with a global Gotterdammerung could they dream of? What could be more dangerous than to invite the Soviets that the Alliance is self-deterred -- and thus at the mercy of those who possess so ominous an advantage in conventional forces?

The Roman historian Livy observed that "where there is less fear, there is generally less danger." Until those who have put activism before objectivity come to apprehend this, nuclear illusions, some spontaneous and some carefully fostered, will continue to haunt the myth-loving animal that is man.

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