Old Legends

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SCIENCE FICTION IS ABOUT DIALOG. SCIENCE ITSELF IS A CONTINUOUS, SOMETIMES RANCOROUS DIALOG ABOUT OBSERVATIONS AND EXPERIMENTS, WITH A NUMBER OF ESSENTIAL AND OH-SO-USEFUL RULES: FALSIFIABILITY, REPEATABILITY, UNIVERSAL IMPLICATIONS, AND REMOVAL OF SELF FROM THE FINAL EQUATION. SOMEHOW, THIS HAS LED TO THE MISTAKEN IMPRESSION THAT SCIENTISTS—OR AT LEAST SOME SCIENTISTS—ARE MORE OR LESS THAN HUMAN: COLD, PRECISE, UNCARING. THOSE WHO HAVE MET A LOT OF SCIENTISTS KNOW HOW WRONG THIS IS. GREGORY BENFORD, A HIGHLY REGARDED PHYSICIST HIMSELF, HAS MET A LOT OF SCIENTISTS; SOME OF THEM, THE MOST INFLUENTIAL OF OUR TIME.

THIS ARTICLE—ESSAY BY WAY OF MEMOIR—SERVES TO ILLUMINATE THE QUESTIONS ASKED BY CARTER SCHOLZ, AND TO CONNECT SCIENCE FICTION INTIMATELY WITH MODERN SCIENCE. IS IT POSSIBLE THAT SCIENCE FICTION KNOWS SIN, AS WELL?

LONG BEFORE I became interested in science itself, I was a science fiction reader. The Space Age changed that in 1957. At the time it seemed that the central metaphor of science fiction had become real, foggy legend condensing into fact.

I read about Sputnik on the deck of the *S.S. America,* sailing back from Germany, where I had lived for three years while my father served in the occupying forces. The one-page mimeographed ship's newsletter of October 4 gave that astonishing leap an infuriatingly terse two sentences.

By the time I re-entered high school in the U.S., just emerging from years when the Cold War seemed to fill every crevice of the world, the previously skimpy curriculum was already veering toward science, a golden, high-minded province. Suddenly I found that I could take a full year of calculus and physics in my senior year. This was quite a change. I put aside my devoted reading of the sf magazines and launched myself into science, the real thing.

I began to think seriously that a career of simply studying the physical world, which I had often read about in fiction, could be open to such as me. I had done reasonably in high school up until Sputnik, getting Bs and As, but not thinking of myself as one of the really bright members of the class. I imagined that I would probably end up as an engineer, but I really wanted to be a writer. When I scored high in the national scholastic exams of 1958 nobody was more surprised than I. But those scores opened the advanced classes to me in my senior year, and a whole new landscape.

This fresh path led directly to an early afternoon in 1967, when two physicists and a clerk from the personnel office at the Lawrence Radiation Laboratory ushered me into a large office without preamble, and there sat a distracted Edward Teller behind a messy desk piled high with physics journals.

To my surprise, the other physicists quickly excused themselves and left. Teller was scientific director of the Laboratory then, fabled for his work developing the A-bomb and H-bomb, and his epic split with Robert Oppenheimer.

They sprang Teller on me without warning. I had gone up to Livermore to discuss working there as a research physicist, following my doctoral thesis at the University of California at San Diego. Nobody told me that Teller insisted on taking the measure of every candidate in the program. "We didn't want you to be nervous," one said later. It worked; I was merely terrified.

He was the most daunting job interviewer imaginable. Not merely a great physicist, he loomed large in one of the central mythologies of modern science fiction, the A-bomb. In the next hour no one disturbed us as Teller quizzed me about my thesis in detail.

Attentively he turned every facet over and over, finding undiscovered nuances, some overlooked difficulty, a calculation perhaps a bit askew.

He was brilliant, leaping ahead of my nervous explanations to see implications I had only vaguely sensed. His mind darted as swiftly as any I had ever encountered, including some Nobel Laureates. To my vast surprise, I apparently passed inspection. At the end, he paused a long moment and then announced that he had "the most important kvestion of all." Leaning closer, he said, "Vill you be villing to vork on veapons?"

Unbidden, images from Stanley Kubrick's film *Dr. Strangelove* leaped to mind. But Teller had impressed me as a deep, reflective man. I said I would—occasionally, at least. I had grown up deep in the shadow of the Cold War. My father was a career army officer, and I had spent six years living with my family in occupied post-war Japan and Germany. It seemed to me that the sheer impossibility of using nuclear weapons was the best, indeed the only, way to avoid strategic conventional war, whose aftermath I

had seen in shattered Tokyo and Berlin. Paralleling this direct experience was my reading in science fiction, which had always looked ahead at such issues, working out the future implied by current science.

That afternoon began my long, winding involvement with modern science and fiction, the inevitable clash of the noble and imaginary elements in both science and fiction with the gritty and practical. I have never settled emotionally the tensions between these modes of thinking. Growing up amid the shattered ruins of Germany and Japan, with a father who had fought through World War II and then spent long years occupying the fallen enemy lands, impressed me with the instability of even advanced nations. The greatest could blunder the most.

I quit Livermore in 1971 to become a professor at the University of California at Irvine. In novels such as *In the Ocean of Night,* written after my "Rad Lab" days, I see in retrospect that I was thrashing out my mixed feelings. I often turned to other scientists to fathom how my own experience fit with the history of both science and fiction in our time. I did not see then how intertwined they were and are, and how much we face the future using the legends of the past.

SIXA VS. SEILLA

"Veapons" called immediately to mind the central fable of sf in those days—the event which seemed to put the stamp on John Campbell's *Astounding* magazine. In the spring of 1944 Cleve Cartmill published a clear description of how an atomic bomb worked in *Astounding,* titled "Deadline." Actually, Cartmill's bomb would not have worked, but he did stress that the key problem was separating non-fissionable isotopes from the crucial Uranium 235.

This story became legend, proudly touted by fans after the war as proof of sf's predictive powers. It was a tale of an evil alliance called the Axis—oops, no, the Sixa—who are prevented from dropping the A-bomb, while their opponents, the Allies—no, oops, that's the Seilla—refrain from using the weapon, fearing its implications.

In March 1944 a captain in the Intelligence and Security Division and the Manhattan Project called for an investigation of Cartmill. He suspected a breach in security, and wanted to trace it backward. U.S. security descended on Campbell's office, but Campbell truthfully told them that Cartmill had researched his story using only materials in public libraries.

A Special Agent nosed around Cartmill himself, going so far as to enlist his postman to casually quiz him about how the story came to be written. The postman remembered that John Campbell had sent Cartmill a letter

several days before the Special Agent clamped a mail cover on Cartmill's correspondence. This fit the day when agents had already visited Campbell's office. Campbell was alerting his writer, post-haste. Soon enough, Security came calling.

Sf writers are often asked where they get their ideas. This was one time when the answer mattered. Cartmill had worked for a radium products company in the 1920s, he told the agent, which had in turn interested him in uranium research. He also fished forth two letters from Campbell, one written ten days short of two years before the Hiroshima bombing, in which Campbell urged him to explore these ideas: "U 235 has—I'm stating fact, not theory—been separated in quantity easily sufficient for preliminary atomic power research, and the like. They got it out of regular uranium ores by new atomic isotope separation methods; they have quantities measured in pounds . . ." Since a minimum critical mass is less than a hundred pounds, this was sniffing close to Top Secret data.

"Now it might be that you found the story worked better in allegory," Campbell advised, neatly leading Cartmill to distance the yet unwritten tale from current events. Plainly Campbell was trying to skirt close to secrets he must have guessed. Literary historian Albert Berger obtained the formerly secret files on the Cartmill case, and as he points out in *Analog* (September, 1984), Campbell never told Cartmill that wartime censorship directives forbade *any* mention of atomic energy. Campbell was urging his writer out into risky territory.

Cartmill was edgy, responding that he didn't want to be so close to home as to be "ridiculous. And there is the possible danger of actually suggesting a means of action which might be employed." Still, he had used the leaden device of simply inverting the Axis and Allies names, thin cover indeed. Campbell did not ask him to change this, suggesting that both men were tantalized by the lure of reality behind their dreams.

The Office of Censorship came into play. Some suggested withholding *Astounding*'s mailing privileges, which would have ended the magazine. In the end, not attracting attention to the Cartmill story and the magazine seemed a smarter strategy. Security feared that ". . . such articles coming to the attention of personnel connected with the Project are apt to lead to an undue amount of speculation." Only those sitting atop the Manhattan Project knew what was going on. "Deadline" might make workers in the far-flung separation plants and machining shops figure out what all this uranium was for, and talk about it. The Project was afraid of imagination, particularly disciplined dreaming with numbers and facts well marshaled. They feared science fiction itself.

All this lore I already accepted, but I was curious about those at the top

of the Project, such as Teller. Self-cautious, a mere, fresh postdoctoral physicist, I did not at first ask him about any of these legendary events. I was busy, too, learning how science works in such lofty realms.

I discussed both physics and politics with Teller while at the Lab, finding him delightfully eccentric and original. One hammering-hot summer day in Livermore, we continued well into the lunch hour. Teller wanted to go swimming, but refused to break off discussions. "Ve must not be all in our minds, all the time." I went with him. He cut an odd figure as he threaded among the muscular sunbathers, mind fixed on arcane points of theoretical physics, his skin pale as the underbelly of a fish. He sat at the pool edge and shed his suit, tie, shirt, the works right down to—instead of underwear—a swim suit. This man plans ahead, I thought.

As a boy in Budapest he had come in second in a contest with a streetcar, losing a foot. Beside the pool he unfastened his artificial foot, unembarrassed. (In *Dr. Strangelove,* I couldn't help recalling, it was an artificial hand.) He kept talking physics even as he wriggled over to the edge. He earnestly concluded his point, nodded earnestly, satisfied, and then seemed to realize where he was. I could almost hear him think, *Ah, yes, next problem. Svimming. Vere iss . . . ?* "Edward," I began—and Teller instantly flung himself like an awkward frog into the water, obliviously comic.

Moments like these led me to finally see through the cultural aura that obscures figures like Teller. They are more vast and various than we think, funnier and odder and warmer. Dr. Strangelove doesn't exist. Teller had made a name for himself at Los Alamos by thinking ahead. He proposed the hydrogen fusion bomb, the Super, while the A-bomb was under development—and lobbied to skip the A-bomb altogether, leapfrogging to the grander weapon.

With his penchant for problem-solving, Teller was a symbol of the "techno-fix" school of warfare, and by the 1960s the times were running against him. At one Livermore lunch, an arms control negotiator furiously said to me, "He's the Satan of weapons! We've got to stop him." Many scientists felt just as strongly.

H. Bruce Franklin's *War Stars: The Superweapon and the American Imagination* made the case that sf, particularly in the pulp magazines, strongly influenced U.S. foreign policy. In the 1930s Harry Truman had read lurid pulp magazine sf yarns of super weapons settling the hash of evil powers. Often they were held in readiness after, insuring the country against an uncertain future.

Truman wasn't alone. Popular culture's roots run deep. Time and again at Livermore I heard physicists quote sf works as arguments for or against the utility of hypothetical weapons. As I came to know the physics community more widely, this complex weave deepened.

BEEPS

At Livermore I got involved with the theory of tachyons, the theoretically possible particles which can travel faster than light. Not the sort of thing one imagines a "weapons lab" allowing, but Teller allowed the theorists a wide range. When the tachyon idea popped up in the physics journals, I discussed it with Teller. He thought they were highly unlikely, and I agreed, but worked on them anyway out of sheer speculative interest. With Bill Newcomb and David Book, I published in *Physical Review* a paper titled "The Tachyonic Antitelephone." We destroyed the existing arguments, which had avoided time-travel paradoxes by re-interpreted tachyonic trajectories moving backward in time as their anti-particles moving forward in time. It was simple to show that imposing a signal on the tachyons (sending a message) defeated the re-interpretation, so the causality problem remained. If sending a tip-off about a horse race to your grandfather made him so rich he jilted your grandmother and ran off to Paris, that was just as bad a violation of cause and effect.

Teller invoked a different argument against tachyons, which recalled the casual lunchtime discussions at Los Alamos, which were legendarily fruitful. At one, Enrico Fermi asked his famous question, "Where are they?"—and raised the still fiercely contentious issue of why aliens, if they are plentiful in the galaxy, haven't visited us by now. (That question undoubtedly inspired the proposal that radio listening might turn up alien broadcasts, made by Giuseppe Cocconi and Philip Morrison in 1959—the same Morrison who had worked in the Manhattan Project.) Using similar logic, Teller noted that tachyons could be used to send messages backward in time. "Vhy haven't they been sent? Vere are our messages from the future?"

Our answer was that nobody had built a tachyon receiver yet. Neat, perhaps, but a bit too neat. Surely somehow nature would not disguise such a profound trick. There had to be a way of seeing from theory why such disturbing things could not occur.

I was so intrigued by these hypothetical particles that I wrote papers investigating their consequences. That drew me into a distant friendship with Gerald Feinberg of Columbia University, who had introduced some of the ideas of tachyonic field theory. He was an amiable, concentrated man, always thinking through the broad implications of the present. He was also a first-class physicist who had edited a science fiction fanzine in high school with two other upstart Bronx Science High School students, Sheldon Glashow and Steven Weinberg—who later won the Nobel prize for their theory which united the weak and electromagnetic forces. Titled ETAOIN SHRDLU for the frequency of letter use in English, the only fanzine ever

edited by Nobel Prize winners stressed science with earnest teenage energy. (A generation later Stephen Hawking spent most of his free time reading sf paperbacks. Enthusiastically discussing them decades later with me, he was like most readers, able to recall plots and ideas easily, but not titles or authors.)

Tachyons were the sort of audacious idea that comes to young minds used to roving over the horizon of conventional thought. Because of Feinberg I later set part of my tachyon novel at Columbia. By the late 1970s I thought tachyons quite unlikely, since several experiments had failed to find them (after an exciting but erroneous detection in 1972). Still, the issue of how physics could *prove* that time communication is impossible remained—the primary issue for all of us, including Teller. Tachyons seemed a better way to address this than the more exotic beasts of the theorists' imaginations, such as space-time wormholes.

So I framed the issue using tachyons, exploring how people in the future might get around the problem of having no receiver: by using energetic tachyons to disturb a finely tuned experiment in a physics lab in the past. Gerry chuckled when he heard this notion, pleased that his theoretical physics had spawned a novel about how scientists actually worked. He was rather bemused by the continuing cottage industry of tachyon papers, now numbering in the several hundreds. When an Australian experiment seemed to find cosmic rays moving over twice the speed of light, the field had a quick flurry of interest. Gerry was intrigued, then crestfallen when the results weren't confirmed.

He told me years later that he had begun thinking about tachyons because he was inspired by James Blish's short story, "Beep." In it, a faster-than-light communicator plays a crucial role in a future society, but has an annoying final *beep* at the end of every message. The communicator necessarily allows sending of signals backward in time, even when that's not your intention. Eventually the characters discover that all future messages are compressed into that *beep,* so the future is known, more or less by accident. Feinberg had set out to see if such a gadget was theoretically possible.

This pattern, speculation leading to detailed theory, I encountered more and more in my career. The litany of science is quite prissy, speaking of how anomalies in data lead theorists to explore new models, which are then checked by dutiful experimenters, and so on. Reality is wilder than that.

No one impressed me more with the power of speculation in science than Freeman Dyson. Without knowing who he was, I found him a like-minded soul at the daily physics department coffee breaks, when I was still a graduate student at the University of California at San Diego. I was very impressed that he had the audacity to give actual department colloquia on

his odd ideas. These included notions about space exploration by using nuclear weapons as explosive pushers, and speculations on odd variants of life in the universe. He had just published a short note on what came to be called Dyson spheres—vast civilizations which swarm around their star, soaking up all available sunlight and emitting infrared, which we might study to detect them. (This was a direct answer to both Fermi's question and the Cocconi-Morrison proposal—more links in a long chain.) Dyson had read Jules Verne while a child, and at age eight and nine wrote an sf novel, *Sir Phillip Roberts's Erolunar Collision,* about scientists directing the orbits of asteroids. He was unafraid to publish conjectural, even rather outrageous ideas in the solemn pages of physics journals. When I remarked on this, he answered with a smile, "You'll find I'm not the first." Indeed, he descended from a line of futurist British thinkers, from J. D. Bernal of *The World, the Flesh and the Devil,* to Olaf Stapledon to Arthur C. Clarke. In *Infinite in All Directions,* Dyson remarked that "Science fiction is, after all, nothing more than the exploration of the future using the tools of science."

This was a fairly common view in those burgeoning times. In my first year of graduate school in La Jolla I noticed Leo Szilard at department colloquia, avidly holding forth on his myriad ideas. Szilard had persuaded Einstein to write the famous letter to Roosevelt explaining that an A-bomb was possible, and advocating the Manhattan Project. He had a genius for seizing the moment. Szilard had seen the potential in nuclear physics early, even urging his fellow physicists in the mid-1930s to keep their research secret. I had read Szilard's satirical sf novel *The Voice of the Dolphins* in 1961, and his sf short stories, and decided to wait until I had time from a weathering round of classes to speak to him. I was just taking some difficult examinations in late May 1964 when Dyson told me that Szilard had died of a heart attack that morning. It was a shock, though I had scarcely exchanged a dozen words with him. (Of his rather cerebral fiction he had said, "I am emotionally moved by extraordinary reasoning.") I had not seized the moment.

Szilard was obsessed with nuclear dangers, and Dyson carried some of Szilard's thinking forward. A student of Dyson's made headlines in 1976 by designing a workable nuclear weapon using only published sources. I recalled the Cartmill episode. When I remarked on this, Dyson said, "The link goes back that far, yes." At the time I didn't know what he meant.

Throughout all this, politics was not an issue. I was a registered Democrat, others were Republican, but our positions did evolve from our politics.

Scientists often read sf at an early age and then drift away, but many maintain a soft spot in their hearts for it. Some, like me, bridge the two communities.

So it was no surprise to me when Teller enlisted sf allies in his policy battles. Especially effective in the 1980s was Jerry Pournelle, a rangy, technophilic, talented figure. With a .38 automatic he could hit a beer can at fifty yards in a cross wind. As needed, he could also run a political campaign, debug a computer program or write a best-selling science fiction novel—simultaneously. When he asked me to serve on the Citizens' Advisory Council on National Space Policy in 1982, at first I didn't realize that Jerry wasn't proposing just another pressure group. This was a body which had direct lines to the White House, through the National Security Advisor. Teller, too, was "in the loop."

Pournelle dominated the Council meetings with his Tennessee charm, techno-conservative ideas and sheer momentum. An oddly varied crew assembled: writers, industrial researchers, military and civilian experts on subjects ranging from artificial intelligence to rocketry. The Council, a raucous bunch with feisty opinions, met at the spacious home of science fiction author Larry Niven. The men mostly talked hard-edge tech, the women policy. Pournelle stirred the pot and turned up the heat. Amid the buffet meals, saunas and hot tubs, well-stocked open bar, and myriad word processors, fancies simmered and ideas cooked, some emerging better than half-baked.

Blocking nuclear weapons had always appealed to me. My misgivings about military involvement in the space program and other areas, which had surfaced in my novels repeatedly, vanished in matters which clearly were the military's province. Never, in all the policy and technical consulting I did while a professor at UCI, did I doubt that solving the immense problem of nuclear war lay somehow outside the province of the physicists who had started it all. But physicists could contribute—indeed, they had to try.

I favored as a first goal defending missiles and military command centers, using ground-based systems of swift, non-nuclear-tipped rockets. Technically this was small potatoes, really, not much beyond the capacity already available under existing treaties, which after all had allowed the Soviets to ring Moscow with a hundred fast defensive rockets, nuclear-tipped and still in place today.

The more ambitious specialists talked of war stars—great bunkers in the sky, able to knock down fleets of missiles. I doubted they could deal with the tens of thousands of warheads that could be launched in a full

exchange. Still, to me that fact was a better argument against the existence of those thousands of warheads, rather than an argument against defense.

Finally, we settled on recommending a position claiming at least the moral high ground, if not high orbits. Defense was inevitably more stabilizing than relying on hair-trigger offense, we argued. It was also more principled. And eventually, the Soviet Union might not even be the enemy, we said—though we had no idea it would fade so fast. When that happened, defenses would still be useful against any attacker, especially rogue nations bent on a few terrorist attacks. There were plenty of science fiction stories, some many decades old, dealing with that possibility.

The Advisory Council met in August of 1984 in a mood of high celebration. Their pioneering work had yielded fruits unimaginable in 1982—Reagan himself had proposed the Strategic Defense Initiative, suggesting that nuclear weapons be made "impotent and obsolete." The Soviets were clearly staggered by the prospect. (Years later I heard straight from a senior Soviet advisor that the U.S. SDI had been the straw that broke the back of the military's hold on foreign policy. That seems to be the consensus now among the diplomatic community, though politically SDI is a common whipping boy, its funding cut.)

None of this was really unusual in the history of politics, policy and science fiction. H. G. Wells had visited with both presidents Roosevelt, Stalin, Churchill and other major figures. In 1906 Theodore Roosevelt was so dismayed by the Wellsian portrait of a dark future that he asked him to the White House for a long talk about how to avoid drifting that way. Wells's attention to war as the principal problem of the modern era found a ready audience among world leaders. Jules Verne had not commanded such respect in the corridors of power, and no writer since Wells has, but in the late twentieth century it seemed that science fiction's grasp of possibilities was once more called forth, this time by the same government which had fretted over Cleve Cartmill.

In the summer of 1984 all things seemed possible. I was not surprised that Robert Heinlein attended the Advisory Council meetings, dapper and sharp-witted. And out of the summer heat came a surprise visitor—Arthur C. Clarke, in town to promote the opening of the film made from his novel, *2010.* Clarke had testified before Congress against the Strategic Defense Initiative, and regarded the pollution of space by weapons, even defensive ones, as a violation of his life's vision.

Heinlein attacked as soon as Clarke settled into Larry Niven's living room. The conversation swirled around technical issues. Could SDI satellites be destroyed by putting into orbit a waiting flock of "smart rocks" (conventional explosives with small rockets attached)? Would SDI lead to further offensive weapons in space?

Behind all this lay a clear clash of personalities. Clarke was taken aback. His old friend Heinlein regarded Clarke's statements as both wrong-headed and rude. Foreigners on our soil should step softly in discussions of our self-defense policies, he said.

It was, at best, bad manners. Perhaps Clarke was guilty of "British arrogance."

Clarke had not expected this level of feeling from an old comrade. They had all believed in the High Church of Space, as one writer present put it. Surely getting away from the planet would diminish our rivalries? Now each side regarded the other as betraying that vision, of imposing unwarranted assumptions on the future of mankind. It was a sad moment for many when Clarke said a quiet good-bye, slipped out and disappeared into his limousine, stunned.

In that moment I saw the dangers of mingling the visionary elements of sf with the hard-nosed. The field welcomed both, of course, but the world chewed up those of such ample spirit.

Behind much of this was Teller, close advisor to Reagan. He got involved with exotica such as X-ray lasers, which I thought beside the point. The answer lay not in vastly different, new technology, but using tried-and-true methods with a different strategic vision.

I was naive about what would follow. While the Soviets got the message quite clearly—because they watched what we did, and didn't merely listen to the public debate—and began thinking about throwing in the towel altogether. Meanwhile, over the Strategic Defense Initiative issue Nobel laureates ground their axes, techno-patter rained down, politicians played to the gallery—ships passing in the night, their fog horns bellowing.

Our present had become, for that sf fan reading a newspaper report of Sputnik, completely science fictional. Even in the 1980s, though, I did not know how deep the science and science fiction connection went.

OLD LEGENDS

I had always wondered about Teller's effectiveness at influencing policy. In the 1940s, as James Gleick remarks in *Genius,* a biography of Richard Feynman, Teller was as imaginative and respected as Feynman. He was the great idea man of the Manhattan Project. So it was natural for me to ask him finally about science fiction's connection with both scientific discovery (tachyons) and science policy (the Manhattan Project).

"For long range thinking I trust in the real visionaries—the ones I prefer to read, at least. The science fiction writers. I haf always liked Mr. Heinlein, Mr. Asimov, of course Mr. Clarke—they are much more important in the long run than any Secretary of Defense."

So we talked on about how he had read magazines in the 1940s in Los Alamos, bought similar hardbacks as they began to appear in the 1950s, and eventually from the press of events kept up with only a few favorites—the hard sf types, mostly but not exclusively.

He pointed out to me an interesting paragraph in an old paperback.

> We were searching . . . for a way to use U 235 in a controlled explosion. We had a vision of a one-ton bomb that would be a whole air raid in itself, a single explosion that would flatten out an entire industrial center . . . If we could devise a really practical rocket fuel at the same time, one capable of driving a war rocket at a thousand miles an hour, or more, then we would be in a position to make almost anybody say "uncle" to Uncle Sam.
>
> We fiddled around with it all the rest of 1943 and well into 1944. The war in Europe and the troubles in Asia dragged on. After Italy folded up . . .

That was Robert A. Heinlein as "Anson MacDonald" in "Solution Unsatisfactory," in the May 1941 *Astounding.* It even gets the principal events in the war in the right order.

"I found that remarkable," Teller said, describing how Manhattan Project physicists would sometimes talk at lunch about sf stories they had read. Someone had thought that Heinlein's ideas were uncannily accurate. Not in its details, of course, because he described not a bomb, but rather using radioactive dust as an ultimate weapon. Spread over a country, it could be decisive.

I recalled thinking in the 1950s that in a way Heinlein had been proved right. The fallout from nuclear bursts can kill many more than the blast. Luckily, Hiroshima and Nagasaki were air bursts, which scooped up little topsoil and so yielded very low fallout. For hydrogen bombs, fallout is usually much more deadly.

In Heinlein's description of the strategic situation, Teller said, the physicists found a sobering warning. Ultimate weapons lead to a strategic standoff with no way back—a solution unsatisfactory. How to avoid this, and the whole general problem of nuclear weapons in the hands of brutal states, preoccupied the physicists laboring to make them. Nowhere in literature had anyone else confronted such a Faustian dilemma as directly, concretely.

Coming three years later in the same magazine, Cleve Cartmill's

"Deadline" provoked astonishment in the lunch table discussions at Los Alamos. It really did describe isotope separation and the bomb itself in detail, and raised as its principal plot pivot the issue the physicists were then debating among themselves: should the Allies use it? To the physicists from many countries clustered in the high mountain strangeness of New Mexico, cut off from their familiar sources of humanist learning, it must have seemed particularly striking that Cartmill described an allied effort, a joint responsibility laid upon many nations.

Discussion of Cartmill's "Deadline" was significant. The story's detail was remarkable, its sentiments even more so. Did this rather obscure story hint at what the American public really thought about such a superweapon, or would think if they only knew?

Talk attracts attention. Teller recalled a security officer who took a decided interest, making notes, saying little. In retrospect, it was easy to see what a wartime intelligence monitor would make of the physicists' conversations. Who was this guy Cartmill, anyway? Where did he get these details? Who tipped him to the isotope separation problem? "And that is vhy Mr. Campbell received his visitors."

So the great, resonant legend of early hard sf was, in fact, triggered by the quiet, distant "fan" community among the scientists themselves. For me, closing the connection in this fundamental fable of the field completed my own quizzical thinking about the link between the science I practice, and the fiction I deploy in order to think about the larger implications of my work, and of others'. Events tinged with fable have an odd quality, looping back on themselves to bring us messages more tangled and subtle than we sometimes guess.

I am sure that the writers of that era, and perhaps of this one as well, would be pleased to hear this footnote to history. Somebody really was listening out there. I suspect today is no different. Perhaps the sf writers are indeed the unacknowledged legislators of tomorrow.