The Hansen Letter

Introduction by Howard Morland, November 2003:

This seven-thousand-word letter by Chuck Hansen, dated August 27, 1979, delivered a *coup de grace* to the government=s case for censorship of my *Progressive* magazine article on the H-bomb.

It is a bit odd that Senator Charles Percy of Illinois was the intended recipient of the letter. He was never involved in *The Progressive* case, nor was he Chuck Hansen=s senator. He did not, apparently, request such a communication, and after receiving it he did not subsequently play a role in The Progressive case. However, copies of the letter immediately began to circulate among all persons concerned with the case.

Hansen=s reason for writing the letter is not entirely clear, except as a vehicle for outlining his theory about the H-bomb secret. As he states in the letter, AThese... are some of the ideas I believe are presented in the Morland article (I have not seen the article).@ The defense attorneys in *The Progressive* case regarded him as an ally, of sorts, but wanted no part of his call for the punishment of Edward Teller, Theodore Taylor, and George Rathjens for security violations. Nonetheless, the defense was preparing to argue in court that the widespread distribution of this Hansen letter should moot *The Progressive* case. The letter clearly outlines the three H-bomb principles at issue in the case: separation of stages, compression, and radiation coupling.

However it introduces two obvious technical flaws. Hansen describes the use of two primaries, or fission triggers, one at either end of the fusion secondary, which would explode simultaneously to compress the fusion secondary between them. The problem with that plan is the unavoidable variability in the timing of the primary detonations. This variability is greater than the total time required for the much more rapid radiation implosion of the secondary. In other words, one primary would always be so much faster that it would make the slower primary irrelevant. The required simultaneous timing, within nanoseconds, is impossible, but also unnecessary. One primary will do.

He also places a delicate, high-voltage neutron generator inside each primary, where it would be destroyed before it could perform its function. The proper location is outside the primary, behind a protective blast shield; the neutrons can penetrate into the primary from that location.

These mistakes had the useful effect of demonstrating the truth of Hansen=s assertion that he had seen neither my manuscript nor any of the *in camera* court documents. His ideas were not contaminated by leaks. (Interestingly, he states in the letter that his idea for dual primaries came from reading between the lines of the redacted, public version of one of my classified affidavits.)

Two additional mistakes, common to both our descriptions, are: 1) the use of a solid, rather than a gaseous fusion booster charge in the primary, and 2) the failure to include any fissile material **B** the essential Aspark plug@ **B** in the secondary.

On the other hand, Hansen=s letter inadvertently corrects the most troublesome flaw in my *Progressive* article. It is no secret that the Kansas City plant makes an exotic, high density plastic foam for inclusion in H-bombs. In my diagram, I had incorrectly placed this plastic inside the secondary, as packaging material to suspend, or Alevitate,@ the fusion fuel. Hansen placed it, correctly, outside the secondary, filling the radiation channel that surrounds the secondary. He seems to have assigned it a role similar to the one I did, as mere packaging material which, in this case, holds the entire secondary suspended within the bomb casing. The big difference is that in Hansen=s scheme the radiation would pass through the plastic, heating it.

Defense experts were preparing to argue in court that Aany competent physicist@ (a character

often evoked in *Progressive* case arguments) would quickly dismiss Hansen=s nonsense about dual primaries and mis-located neutron generators and thus not be misled by those errors. However, Hansen=s plastic-filled radiation channel would immediately suggest the correct mechanism of radiation coupling, namely Amatter pressure,@ not Aradiation pressure@ as I had supposed, and thus Hansen=s description was actually closer to the truth than mine.

Before such arguments could be made to the court, however, the government on its own initiative declared the Hansen letter to be classified and began a futile effort to retrieve all known copies, two weeks after they had begun to circulate. In response, the Cal Berkeley student newspaper announced its intention to publish its copy and was promptly slapped with a prior restraint order on September 15. The *Chicago Tribune* had a copy and announced its intention to publish, unless it, too, was restrained by a court order. This would have made the *Chicago Tribune* a co-defendant in *The Progressive* case, but the *Madison Press Connection* newspaper published first, without warning, in a special edition on September 16. The government then declared the case moot, and gave permission for *The Progressive* to publish my article, citing the *Press Connection=s* publication of the Hansen-to-Percy letter as the reason.

Our speculative, flawed versions of the H-bomb secret were thereby officially declassified.

1783B Springer Road
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August 27, 1979

The Honorable Charles Percy
1200 Dirksen Senate Office Building
Washington, D. C. 20510

My Dear Sir:

I am sending you this letter in response to telephone conversations with one of your aides, Mr. William Mayer. The purpose of this communication is twofold: to summarize and detail my charges of security violations against three prominent Department of Energy consultants, and to give you a short education in thermonuclear weapons design, construction, and operation. Although everything in this letter has been derived from unclassified open sources, parts of it will deal with concepts and technical and political ideas currently defined as "secret restricted data" by the U.S. Department of Energy (even though this information is in the public domain). Should a copy of this letter reach either Col. Griffin or Mr. Sewell of the DOE in Germantown, they would probably classify it, as they did with Dr. Postol=s letter to Senator Glenn last May. Whether or not the DOE has such authority to arbitrarily classify and interfere with the thoughts and communications of private citizens is one of the many issues at stake in the PROGRESSIVE case.

I would like to make three major points. First, it is vital that you understand that the PROGRESSIVE case is a purely political issue, and that the technical information presented in the Morland article is not at all important, or even any longer relevant to the larger issues. The government has conceded that the technical information is already in the public domain, as stipulated in court affidavits in which the DOE admitted that the three concepts at issue in the Morland article lay in supposedly mistakenly declassified documents (UCRL-4725, UCRL-5280,

and others) which lay in plain view in an open DOE for several years, during which time no records were kept of who copied or otherwise had access to them. In addition, in letters to me dated April 10, 1979, and June 18, 1979, representatives of the DOE stated that my open research, and a national contest that I conducted, would lead to the generation and transmission of classified data -- this in spite of the fact that all of the information that I was seeking would come from unclassified published sources. It has also become obvious that at least one of the three concepts discussed in the disputed Morland article is currently unclassified in the Soviet Union, and that when it was discussed openly here in 1976 by a Soviet scientist, the U.S. government, acting through the Energy Research and Development Agency, classified his speeches (Morland might have stood a better chance of publishing his article in the USSR). The concepts discussed in the. Morland article deal with basic applied physics, and they are certainly no longer "secret" -- if they were, four other nations would not now have operating thermonuclear weapons. Even though the DOE now admits that this type of information is in the public domain, it is still trying to suppress the circulation of this data, in order to maintain a false illusion of secrecy, and to maintain a real monopoly over the dissemination of weapons-related information, and over the public discussion of American nuclear policies, policies which affect nuclear reactors as well as nuclear weapons.

The second point that I would like to make is that there exists some very strong circumstantial evidence -- both testimonial and documentary -- which suggests that at least three prominent American nuclear weapons physicists have knowingly and willfully disclosed sensitive, classified information in direct violation of their AQ@ security clearances. These men have never been punished or prosecuted for these wrongdoings, but when Howard Morland and I picked up their writings, we were both threatened with dire legal actions if we replicated this information in writings for public circulation. In the case of Mr. Morland, the government has made good on its threat by raising a civil suit against the editors and publishers of the PROGRESSIVE magazine (however, Morland has not been charged with any criminal violations of the Atomic Energy Act). I will detail my charges and evidence against these men later in this letter.

Finally, It is a necessary prerequisite to my discussion of these security violations that you understand, at a very basic level, how a thermonuclear weapon is constructed and detonated. I have enclosed a diagram which I shall refer to below. I am currently in a unique position to divulge this information to you, in that the staff of the PROGRESSIVE is muzzled by a court order, and the weapons scientists who know more than I do cannot talk about this subject without risking a violation of their security clearances.

As Dr. Postol states in his now-classified letter of April 25th to Senator Glenn, the successful detonation of a thermonuclear weapon requires that a variety of competing processes be delicately balanced under conditions of temperature and pressure that are extreme even compared to those found at the center of the sun. The two basic processes in competition are those which are trying to tear apart the nuclear assembly, and end the thermonuclear reactions, and those which seek to hold the assembly together to maintain its integrity long enough for the weapon to achieve an appreciable fraction of its design yield (explosive force). These competing forces give rise to a range of incredible physical phenomena in literally infinitesimal amounts of time (usually measured in fractions of microseconds); for example, the neutron flux (the volume or neutrons) in an exploding thermonuclear device creates an ionized plasma (a superheated gas) with the density of solid lead. The manner of obtaining these conditions, and of igniting and sustaining an arbitrarily large thermonuclear explosion, has been implemented in American weapons in a

fiendishly clever and ingeniously simple way, as described below.

I would like to give you a brief history at this point of some of the theoretical ideas which led to the discovery of the concepts now at issue in the PROGRESSIVE case. In the United States theoretical work dedicated to the achievement of a terrestrial thermonuclear fusion reaction was begun as early an 1942, during the first days of the Manhattan Project, which led to the development of the first atomic bombs. Preliminary ideas and research were pursued at a slow pace up to September 1946, when Dr. Edward Teller proposed a new thermonuclear system (later known as the TX-14 concept.) By the end of September 1947, the most favorable calculation at that time indicated the possibility of obtaining a 10-megaton yield (an explosive equivalent of 10 million tons of TNT) from a device weighing between 40 and 100 tons, which probably utilized liquid Isotopes of hydrogen for its thermonuclear fuel (these isotopes, deuterium and tritium, though difficult to store and handle, would conform exactly to known elements of thermonuclear reactions, and make the analysis and measurement of the thermonuclear Aburn@ efficiency and behavior easier). The use of lithium-6 deuteride (a compound similar to lithium hydride, but composed of the light isotope of the metal lithium and a heavy isotope of hydrogen gas) for a possible thermonuclear fuel was also proposed at this time. This would simplify the weaponization of a thermonuclear device, but it would also require the production of lithium and hydrogen isotopes, and would not solve any of the ignition problems.

At this time, the thermonuclear weaponeers were confronted with the problem of how to achieve an arbitrarily-sized, self-sustaining reaction (or "burn") by means of the explosion of a relatively small fission trigger. This problem consisted of four key elements: (1) the achievement of the proper conditions of temperature, pressure, and neutron flux to form an environment conducive to thermonuclear ignition and "burn"; (2) the ignition of the arbitrarily large thermonuclear fuel mass (or masses); (3) the perpetuation of this "burn" through many generations of thermonuclear reactions; and (4) the maintenance of the integrity of the fuel assembly (the thermonuclear fuel mass and the surrounding plasma cloud) for a period of time sufficient to achieve the desired explosive yield and efficiency (determined by the fraction of the fuel mass consumed before the assembly blew apart). These were very formidable problems thirty years ago, as the nuclear arrowsmiths raced with time to find their solution before the Soviets did.

A number of other possible approaches to the so-called ASuper@ (the H-bomb) were considered up to early 1951, but calculations indicated that all of them would die out after only a few generations of reaction, due to the cooling and physical disintegration of the fusion fuel mass. A lack of knowledge of the early stages of fission explosions, coupled with the slow-paced development of powerful atomic devices, also slowed the development of a successful thermonuclear weapon.

In the spring of 1951, a synergistic exchange of ideas between Dr. Teller and Dr. Stan Ulam, confirmed by extensive hydrodynamic calculations (studying the properties of materials at very high temperatures and pressures) performed on the embryonic electronic computers then available provided a promising solution to the ignition problem. The details of the so-called Teller-Ulam configuration are well known in 1979 to college students, but the idea is still classified in government circles (thus showing that the current DOE classification guidelines are probably at least 25 years behind the times in defining just what is and is not still truly secret). The Teller-Ulam idea definitely involved the use of a small amount of tritium (small in comparison to the total thermonuclear fuel mass) as an intermediate igniter to set off the larger deuterium fuel mass

(tritium, which fuses with deuterium at a temperature roughly an order of magnitude lower than that at which deuterium will fuse with other deuterium, is always found in the debris of American thermonuclear weapons that have been damaged or ruptured in airplane crashes and other BROKEN ARROW incidents; presumably, tritium must therefore be incorporated as a necessary weapon component). The idea was independent of the type of thermonuclear fuel to be used, which would be either Awet@ (liquid) deuterium and tritium, or Adry@ (solid) lithium-6 deuteride (as it turned out, the idea worked better with Adry@ fuels, which made practical, air-transportable weapons possible). The idea was <u>not</u> the substitution of Adry@ fuels for Awet@ isotopic fuel. It resulted in requiring only a relatively small (presumably, much less that 100 kilotons) fission explosion to Alight@ the thermonuclear reaction. The employment of a small fission detonator implied that the thermonuclear burn would be self-sustaining, once started. The crux of the idea turned out to be the relationship of the tritium Aigniter@ to the fission detonator, and to the larger fuel mass. In a high-yield weapon, the outer casing also played an essential role in the achievement of a successful ignition. This idea -- the so-called ATeller-Ulam configuration@ -- has been refined and developed over the last 28 years to be incorporated into numerous types of variously-sized aerial bombs and missile warheads.

Stan Ulam has described the principle as originally conceived as Aa different arrangement for allowing fusion to take place,@ Aa repetition of certain arrangements,@ later refined to Aan iterative scheme,@ from which Teller conceived Aa parallel version, more convenient and generalized.@ The idea was converted into an engineering design, and reportedly became the basis of the MIKE shot at Eniwetok atoll in November 1952, the first full-scale terrestrial fusion explosion in human history (MIKE utilized cryogenically**C**cooled liquid hydrogen Isotopes for fuel). Somewhat later, the Teller-Ulam idea was also used as the basis of six shots in the CASTLE test series in 1954, all of which used Adry@ fuels (a weaponized liquid-fueled design was in standby status at that time, to be tested if the Adry@ shots failed to fire).

What Teller and Ulam had accomplished was to come up with an arrangement of components which in one fell swoop provided the conditions of temperature and pressure necessary to support fusion, as well as maintaining the physical integrity of the fuel assembly for an appreciable length of time. A related development in 1951 also led to the development of a family of compact, high-powered fission Atriggers@ to supply the Amatch@ for the fusion fuel. In order to understand the cleverness of the Teller-Ulam idea, and to appreciate its necessity, a few words about fusion fuels are in order.

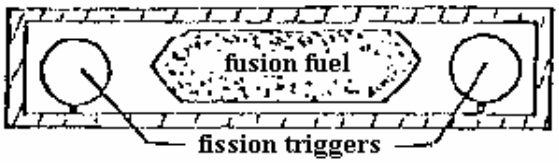
In order for a thermonuclear reaction to occur in a fuel mass comprised of lithium-6 tritide (lithium-6 compounded chemically with tritium gas), the fuel must be compressed to a density many thousands of times its original density (approximately 0.02 or 50 lbs/ft^3). This compression is necessary to force the nuclei of the atoms close enough together to fuse with one another. The density of the fuel mass is crucial to the maintenance of the thermonuclear reactions. The time required for a considerable fraction of the total number of lithium-6 deuteride and lithium-6 tritide nuclei to participate in the fusion process is, at a given temperature, inversely proportional to the concentration of nuclei, or the density of the thermonuclear fuel. It is thus essential that the fuel density be sufficiently high, implying that the fuel mixture must be in a condensed (highly compressed) state. Otherwise, thermonuclear fuel mass, after being Aignited@ by the fission detonator, would be scattered long before each atom in it would have an opportunity to participate in a thermonuclear reaction. Ideally, the fuel would not only be highly compressed, but it would

also be collapsing inwards upon itself, giving its atoms an inwardly-directed momentum which would help to resist the outwardly-directed explosive forces generated by the fusion reactions.

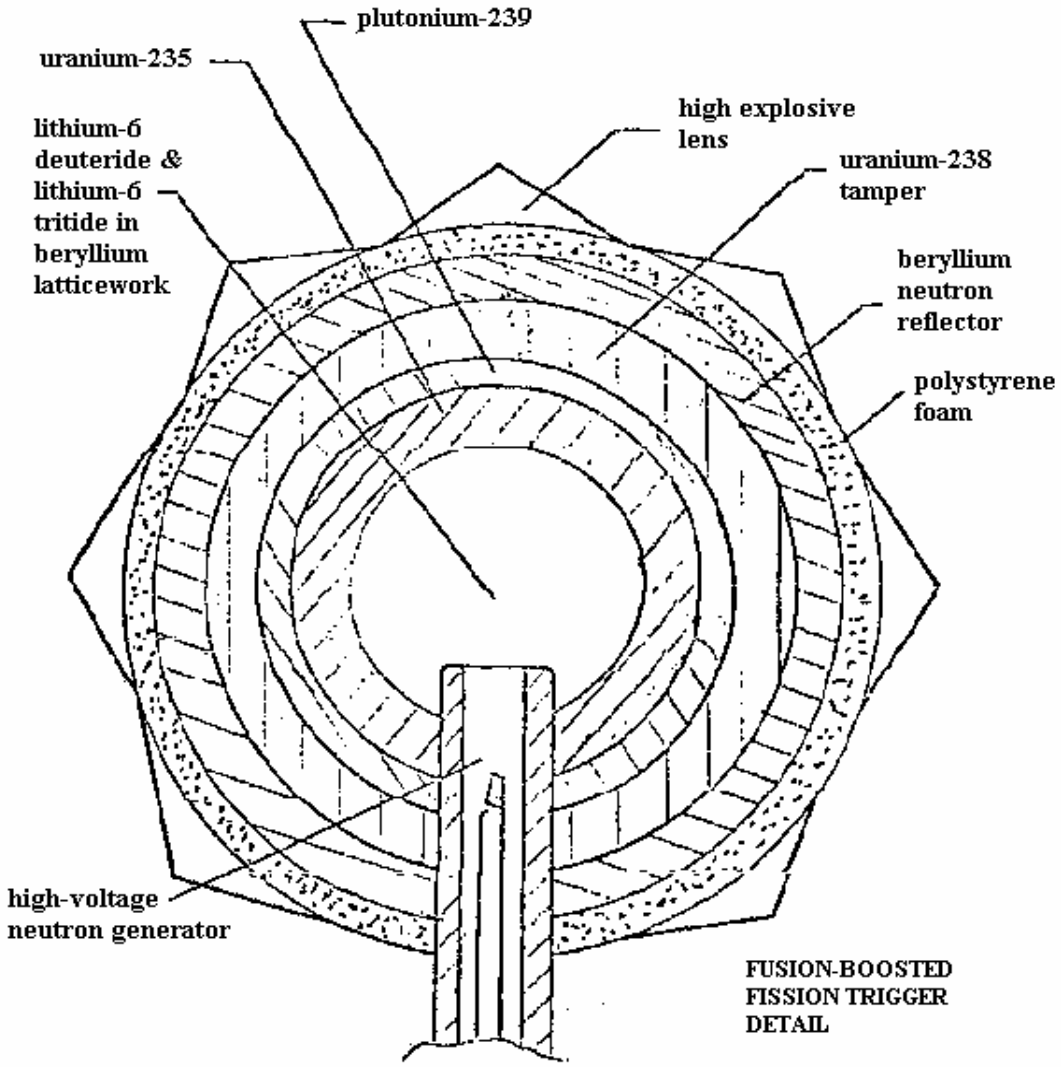
The Teller-Ulam configuration was a geometric design and arrangement of bomb components that allowed heat and pressure to be generated within the fuel mass by means of Asoft@ (low energy) X-rays. About 70 to 80% of the initial energy of an exploding atom bomb in manifested as these Asoft@ X-rays, and Teller and Ulam hit upon a scheme to use them to compress the fusion fuel. What they did was to direct these rays into the outer bomb casing of uranium-238 (an ordinarily non-fissionable isotope of uranium); the rays were absorbed by the casing and then re-emitted at a different energy level. These newly emitted rays were directed along the axis of an ellipsoid (a football shape) into the fuel mass or masses, first compressing it, then heating it. What happened next will be discussed in the description of the accompanying diagram, when the concept of isentropic compression is explained.

As a parallel development to the Teller-Ulam principle, the U.S. in the spring of 1951 (at the GREENHOUSE test series in the Pacific) also tested the concept of fusion boosting, wherein a relatively small atom bomb was filled with a center core of fusion fuels, in order to provide a more powerful bomb. This technique **B** using a large amount of fissionable materials to ignite a relatively small amount of fusion fuels **B** was the opposite of Teller and Ulam=s achievement, but it also led to the design of atomic triggers powerful enough to ignite larger masses of fusion fuels - in effect, a small H-bomb (the fusion-boosted atom bomb) was used to ignite a much larger H-bomb. This technique of fusion boosting was described in some detail in an illustrated article in TIME magazine on April 12, 1954; although some aspects of it apparently still remain classified, the details are by no means secret any longer -- another example of the DOE's remarkably outdated classification guidelines. I did not know until the PROGRESSIVE case broke that this was the means used in contemporary H-bomb triggers -- I knew that the U.S. had experimented with them in the early >50s, but I did not know that they were an essential ingredient in today=s weapons. (The use of boosted triggers in Morland's article can be derived from his Affidavit #I, and from the affidavit of Thomas R. Pickering of the National Security Ad-Hoc Working Group in Non-Proliferation. Affidavits by Morland and by Kosta Tsipis reveal that two of these triggers are used **B** more on this later.)

I shall now discuss the supposedly Asecret@ design and operation of contemporary U.S. thermonuclear weapons, as revealed in affidavits filed in the case, as well as many other public sources, and based on my knowledge of the physics and materials involved. I have not seen any classified documents (such as UCRL-4725 and UCRL-5280 -- I was in Los Alamos in 1973 and 1975, but I did not visit the library there), nor have 1 ever visited any of the facilities which produce weapons components.



H-BOMB CROSS SECTION



FUSION-BOOSTED FISSION TRIGGER DETAIL

As can be seen from the enclosed diagram, the basic bomb consists of two boosted fission Atriggers@ at opposite ends of a mass of lithium-6 deuteride fusion fuel, all contained in an outer casing of uranium-238. This particular geometric arrangement of separated elements (triggers and fusion fuel) is conceptually similar to that shown in diagrams shown in diagrams accompanying

articles by Drs. Edward Teller and Hans Bethe. in the ENCYCLOPEDIA AMERICANA and in the MERIT STUDENT=S ENCYCLOPEDIA, respectively. This arrangement requires that the outer weapon casing play an essential role (as medium to absorb x-rays and re-emit them into the fuel mass) in achieving thermonuclear ignition in a high-yield weapon (the outer casing plays a secondary role later in the explosion sequence, itself contributing to the total explosive force of a high-yield bomb). Whether or not the Teller and Bethe diagrams contain classified information, and who contributed to their creation many years ago, are matters now in hot dispute in the PROGRESSIVE case, and between me and the DOE. Other articles which suggest arrangements having the fusion fuel wrapped around the Atrigger@ are clearly inaccurate and unworkable -- such an arrangement would cause the fuel to be scattered, preventing its ignition.

These elements are separated from one another, and partia1ly supported by, a casing Afilling@ of polystyrene or polyurethane foam (revealed in uncensored portions of Morland affidavits I and 111; confirmed by UCRL-4725, Chicago Sun-Times, May 18, 1979). This foam also provides a latticework within which the fusion fuel masses are emplaced.

As mentioned earlier, there are two triggers in the bomb. The purpose of this is to allow a symmetrical compression of the fusion fuel between them, as well as allowing an x-ray source at each end of the bomb. These two fission triggers must fire simultaneously, or no fusion will occur. A sample trigger is shown in the diagram.

Within the center of the trigger is a device known as a neutron generator, a high-voltage neutron source which initiates the chain reaction in an atomic bomb (the trigger). Back in Athe old days@ of the dawn of nuclear weaponry, initial neutrons needed for the initiation of a fission reaction were provided by frangible hemispheres (Agolf balls@) of polonium and beryllium. When crushed, the mechanical action caused a nuclear reaction to take place, releasing some rather low-energy neutrons to begin the nuclear chain reaction in the uranium-235 or plutonium-239 fission fuel. The current generation of high-voltage neutron generation tubes create the neutron burst by accelerating small amounts of tritium or deuterium to high speeds. When the tritium and deuterium collide (fuse), neutrons -- on the order of several tens of millions -- are produced. These large numbers of initial neutrons help to create many fission reactions at the beginning of the fission explosion, thus increasing the efficiency of the triggers, and permitting more of the fissionable materials in them to be Aburned.@ These generators also act as a safety mechanism. If they don't fire at just the right moment, the fission reaction will not begin.

The rest of the trigger consists of a series of concentric elements, here shown as spheres (the actual arrangement may be more conical in shape, to allow for more efficient direction of the X-rays and neutrons produced by the trigger).

The outermost shell is an arrangement of specially-shaped high-explosive Alenses,@ carefully cast and positioned. A bridle of ignition wires and detonation leads from these Alenses@ to an intricate and precise electronic ignition control circuit box, which in turn is attached to a timer of some sort. The Alenses@ are separated from the surface of the next shell by a layer of polystyrene or polyurethane foam, in which the Alenses@ are positioned. The purpose of this foam will be described below.

The next inward layer (or shell) is a beryllium tamper, essentially a neutron reflector to Abounce@ neutrons back into the fissionable materials. Within this is a heavy uranium-238 tamper, which by the nature of its physical inertia causes the reacting assembly to stay together for a while longer than it otherwise would. Within this tamper are concentric shells of uranium-235 and plutonium-239. These materials are used in conjunction to either produce a higher yield-to-weight ratio, or to produce a more efficient fission reaction (by virtue of yielding more neutrons capable of causing fission reactions), or to serve as an additional, secondary tamper. Within the center of the fission Atrigger@ is a core of lithium-6 deuteride and tritium, suspended in a framework of beryllium. The neutron generator projects up into the center of this assembly.

The firing sequence of a high-yield nuclear weapon such as this design is a complex and precise affair. Every event must occur without fail at the right moment, or the bomb will either fizzle or produce a low yield. With a dual-trigger design like the one shown, a total of 8 separate explosions will occur within a matter of a few microseconds, from the instant of the high explosives detonation to the last gigantic fission explosion of the outer casing. This entire sequence is described as follows:

(1) The High Explosive Detonation: The Alenses@ around the trigger detonate simultaneously, creating an inwardly-directed wave which crushes the entire assembly down to 1/2 to 1/3 of its original diameter. The layer of foam around the fission core permits the shock wave to unite and build before slamming into the core. A duplicate explosion occurs in the Alenses@ around the other trigger.

(2) The First Fission: At some point in the implosion of the trigger, the neutron generator fires to provide an initial burst of neutrons to begin the fission in the uranium-235 and plutonium-239. The uranium-238 tamper holds the assembly together as the spheres crush together.

(3) The First Fusion: When the implosion shock waves from the high explosive lenses compress the fissionable materials, and as the fission begins, the resultant explosion provides an incredibly high pressure and temperature at the center of the core. These conditions are adequate to initiate fusion reactions in the lithium-6 deuteride and tritium fuel at the center of the trigger. The beryllium provides additional neutrons for the fusion reactions (beryllium yields neutrons when struck by high-energy neutrons; these beryllium-spawned neutrons breed more tritium from the lithium-6). The newly-spawned tritium in turn fuses with the deuterium in the lithium-6 deuteride **B** the maintenance of a fifty-fifty mixture of tritium and deuterium provides the optimum conditions for fusion reactions.

(4) Isentropic Compression: The exploding fission-fusion triggers release a wide variety of particles and rays; among the latter are do-called Asoft@ x-rays. The triggers are shaped and constructed so as to both enhance and direct these x-rays, as well as neutrons of several different energy levels (some are powerful enough to fission the outer weapon casing; others are used to breed tritium in the larger main fusion fuel mass). The Asoft@ x-rays are absorbed and re-emitted by the outer weapon casing, and directed into the main fusion fuel mass.

This mass **B** actually probably comprised of a number of small sub-masses **B** is similar in composition to that in the fission triggers; i.e., lithium-6 deuteride and a smaller amount of lithium-6 tritide. These individual masses are held in a latticework of foam, probably arranged in an overall ellipsoidal (football) shape. Each small mass is wrapped in a thin foil

of uranium-238. As the x-rays from the interior of the casing walls strike the foil, it absorbs them and re-emits other x-rays which ionize the outer layer of the fuel mass, causing an inwardly-directed shock wave to compress the lithium-6 deuteride. Because the ionization occurs at only the outer layer of the fuel, the mass is not appreciably heated at this time. A four-cubic foot mass of fuel **B** some 200 pounds **B** might be compressed into a volume adequate to fill a teaspoon, a space of only a cubic inch or so. The density of the fuel rises considerably when this happens, the fuel also develops an outer layer of plasma, a cloud of charged particles (nuclei stripped of their electrons).

(5) Addition of Heat: A tremendous amount of heat radiates into the fusion fuel mass from both triggers. The heat is expressed mainly as the kinetic energy of neutrons and other atomic particles. It creates a temperature inside the casing in the order of several tens of millions of degrees. This sudden elevation in temperature of the fusion fuel, following the isentropic compression, begins the larger main fusion reaction in the weapon.

(6) The Second Fusion Reaction: The highly compressed fusion fuel and surrounding plasma cloud are suddenly heated and subjected to intense neutron bombardment from the fission triggers. The temperature increase alone is. sufficient to raise the kinetic energy of the tritium in the fuel to cause it to begin fusing with the deuterium in the lithium-6 deuteride, while the neutrons from the fission explosions cause more tritium to be produced (via lithium transformation) within the fuel mass. The presence of beryllium around or near the fuel would also cause the neutron flux to be increased, and the quantity of tritium produced to increase appreciably.

As the tritium is spawned, and as it fuses with the deuterium, the temperature of the fuel mass would rise quickly to a point where deuterium-deuterium fusion could occur. This in turn would further raise the temperature and internal pressure of the remaining fuel mass and the surrounding plasma cloud, causing the fusion reactions to occur faster and more frequently, releasing ever more energy, until the energy loss to the atmosphere in the vicinity of the explosion (in the form of radiated ionizing energy and atomic and subatomic particles and rays) exceeds the rate of energy production, or until the reacting assembly (the remaining fuel mass and plasma) blows Itself apart. The layers of foil around the individual fuel sub-masses would tend to act as a fusion tamper, holding the individual masses together; the outer weapon casing of uranium-238, from an inch to three inches thick, would serve as an overall tamper holding the entire reacting assembly of fusion fuel and fission triggers together.

(7) The Second Fission: While the large fusion reaction is building up inside the casing, the casing is bombarded by high-energy neutrons from the fusion reactions. These neutrons are sufficiently powerful to cause fission to occur in the casing, creating a very large fission explosion which can yield up to 50 or 60% of the total bomb explosive yield.

All of these many explosions, implosions, and nuclear reactions take place within a matter of a few millionths of a second. They tend to interact with each other, each stage increasing the intensity of the others. As can be seen, timing is very critical **B** events must happen in the proper sequence, with the correct time interval between explosions or the bomb will fizzle or fall to fire. All of these components are located in a cylinder about four feet long and a foot and a half in diameter, a very small space indeed considering the magnitude of the forces involved in a nuclear or thermonuclear explosion.

These then are some of the ideas I believe are presented in the Morland article (I have not seen the article). My interpretation of some of the effects, and the placement of some components may not agree with Morland's; he is probably more correct and complete than I have been here. My main purpose in presenting this information was to give you an idea of some of the concepts at issue and to demonstrate that all of this purportedly secret information is in fact no secret at all.

With regard to the three DOE consultants and their security violations, one of the things which first caught my interest in the PROGRESSIVE case were the claims made by both sides. The government contended that Morland=s article contained classified information, concepts and data now defined as Asecret restricted data@ under current DOE classification guidelines. The magazine contended just as strongly that all of Morland's information came from public, unclassified sources. After I had a chance to review a number of affidavits filed by either side, I came to the conclusion that both sides were telling the truth. The next conclusion was inescapable: there must be secret, classified information in the public domain. Accordingly, in a letter dated April 23, 1979, 1 wrote to Congressman Paul McCloskey (my local congressional representative), and requested that he ask the Departments of Justice and Energy why B if this information was indeed classified B the men who had placed it in the public domain never teen prosecuted for violating the terms of their security clearances. The three gentleman I specifically named were Drs. Edward Teller of Stanford University; Theodore Taylor of the Institute for Advanced Studies at Princeton University; and George Rathjens, Massachusetts Institute of Technology.

My evidence against Teller was as follows:

-- I was informed by a knowledgeable source that Dr. Teller=s article on pages 654-656 of Vol. 14 of the current edition of the ENCYCLOPEDIA AMERICANA had never been cleared for publication, and that it contained restricted data. My source further stated that Col. John Griffin of the Office of Classification of the DOE had stated under oath in secret testimony in Milwaukee in March that the article had never been cleared. and given a choice between prosecuting Teller after the fact or letting the violation pass unpunished, the AEC chose to classify the fact that the article had never cleared, and forbade everyone to talk about it. Reportedly, there was widespread resentment among some more junior scientists at Livermore that this was allowed to occur.

B I did not have corroborating evidence for this charge; however, on May 3rd, a copy of my McCloskey letter of April 23rd was presented to the federal court in Milwaukee, attached to an affidavit from Col. Griffin which claimed that my letter contained secret information about Dr. Teller. At that point I no longer had doubts that my source was telling the truth.

B Dr. Theodore Postol of the Argonne National Laboratory filed two affidavits early in the PROGRESSIVE case. In his first, he stated that the diagram associated with the Teller article in the ENCYCLOPEDIA AMERICANA Asupplies an important insight into how the problem of stacking fusion materials in thermonuclear weapons might be solved. The diagram speaks for itself for any physicist.@ The Ainsight@ that he was referring to is the football (ellipsoidal) shaped fuel mass depicted in the Teller diagram. In a second affidavit, Dr. Postol demonstrated the accuracy of that statement by drawing up B in a matter of a few hours B a bomb design superior to the Morland design, based largely on Teller=s article (Dr. Postol is

not a weapons designer; he has never had a AQ@ clearance, but he does know a lot about thermonuclear physics). Col. Griffin of the DOE responded to Postol=s second affidavit by classifying it (although he left the footnotes to it unclassified!).

-- In an affidavit filed in the case by Dr. Hugh DeWitt, a plasma physicist at the Lawrence Livermore tab in California, his analysis of the Teller article has been deleted by Col. Griffin for Areasons of national security.@

-- An article by the same Dr. DeWitt published in the June 1979 issue of the BULLETIN OF THE ATOMIC SCIENTISTS was reviewed prior to publication by Col. Griffin. Griffin forced DeWitt to remove two key sections from it, one of which reportedly dealt with the Teller article in the encyclopedia. I do not know this for certain, but I have reason to believe that DeWitt stated that the Teller article was never cleared, and that it contains secret information (in the DeWitt article, the sentence after the deletion relating to Dr. Teller begins AAn even more disturbing case of government disclosure of <u>secret</u> information...@ B the underlining is mine).

B On April 25th, Dr. Postol and four of his colleagues at the Argonne lab wrote to Senator John Glenn of Ohio: part of their letter stated in effect that the Teller diagram reveals Athe nature of the particular design used in thermonuclear weapons in the U.S. stockpile,@ and further declares this configuration to be Athe basic design concept@ on which U.S. thermonuclear weapons are based. Col. Griffin responded to this by classifying the Postol letter on June 7th, only hours before I have a copy of it to Congressman McCloskey (I felt that McCloskey should see it because it backed up my charges of April 23rd against Teller).

It has become obvious since my original letter to McCloskey of April 23rd that there is developing a consistent policy of classification whenever Dr. Teller=s name is raised. The instances cited above would seem to suggest that the government is desperately trying to shield Dr. Teller from prosecution for his serious security violation. Dr. Teller and representatives of the DOE reacted to my charges as follows:

-- <u>On whether or not the article was ever cleared</u>: In a statement to a reporter for the Oakland Tribune on May 29, 1979, Mr. Jeff Garberson of the Livermore Lab stated that Teller did not submit his text to either the Livermore Laboratory or to the Atomic Energy Commission (AEC) before it was published. This was confirmed in a statement also made to the Tribune by Mr. Murray Nash of Col. Griffin=s office in Washington. Nash stated AHe (Teller) reviewed his own stuff and he determined that what he had in it was OK.@ This is contradicted by a letter also dated May 29th from Teller to McCloskey. Teller claimed that the article was reviewed a classification officer at the time (1969). This assertion was repeated in a letter dated June 27th from Duane Sewell of the DOE to Mr. McCloskey. It should be noted here that Howard Morland claims that the article first appeared in 1961 B not 1969, as the government asserts. This is entirely possible B most of the information in the Teller article was well known by the spring of 1954.

B <u>On the text of the article</u>: Teller asserts in his May 29th letter that there is nothing sensitive in the text. There seems a general consensus of opinion among all parties concerned that this is probably true.

- On the diagram that accompanies the Teller article: Ever since the PROGRESSIVE story broke, the nature and origin of this diagram has been shrouded in mystery and controversy. All representatives of the DOE and Dr. Teller himself disavow any knowledge of the origin of this drawing, and they will not comment on its meaning. Dr. Hans Bethe of Cornell University disavows any knowledge of a virtually identical drawing which accompanies his H-bomb article in the MERIT STUDENT=S ENCYCLOPEDIA. The publishers of the latter book claim that a staff artist drew the diagram; the AMERICANA editors claim that they no longer have any record of the source of their H-bomb diagram. The MERIT article appeared sometime around 1968 or 1969. If the Teller article also originated in 1969, as Teller claims, it is extremely odd that two copies of the same diagram appeared simultaneously in two unrelated encyclopedia articles, and that both drawings should depict the proper configuration of U.S. thermonuclear weapons, a configuration that the government claims is highly secret.

In spite of repeated attempts by myself and Mr. McCloskey in the past four months, the DOE has not provided any documentation showing when, where, and by whom the Teller article was cleared and reviewed, nor have they provided answers to questions we=ve raised about their activities with regard to the Postol and DeWitt affidavits, arid the DeWitt article and the Postal letter. We shall keep trying, however.

With regard to Dr. Taylor: John McPhee=s book, THE CURVE OF BINDING ENERGY, was based on extensive interviews that Taylor granted McPhee in 1974. In the book, Taylor discussed at some length fission weapon particulars; he furnished about 80% of the technical information a person would need to build a crude atomic bomb. Taylor discussed the use of beryllium as a lightweight neutron reflector, and the Ahammer and nail@ concept of enhancing the energy of the high explosives around the bomb core (translated by Morland into a layer of polystyrene foam between the explosives and the core). Dr. Taylor also discussed the idea of varying and directing the products and energies of an exploding fission device.

The Taylor book was a prime source of information for Princeton physics student John Phillips when he designed an atomic bomb for a class paper in 1977, and for Harvard economics student Dimitri Rotow in 1978. The Rotow paper was later classified as Asecret restricted data@ by the DOE (the Phillips paper was not classified because Phillips agreed to a government request that he censor himself, and not circulate or discuss the document -- Rotow, on the other hand, expressed a desire to publish his work, and the DOE came down very hard on him). A number of the concepts arid ideas expressed in the Taylor book were picked up by Howard Morland, expanded upon, and corroborated with other sources. The government is now attempting to prevent Morland from publishing these ideas, a few of which I have delineated earlier in this letter.

The response of the DOE to my charges against Dr. Taylor has been most intriguing. On May 29th, Dr. Taylor told Oakland Tribune reporter John Miller that he (Taylor) couldn=t say for certain whether he hadn=t inadvertently published or discussed classified information. I had been informed that Taylor had been verbally reprimanded by the AEC for failing to clear his interviews with McPhee in advance, and this seems to be confirmed by a letter from Duane Sewell of the DOE to Mr. McCloskey on June 27th, wherein Sewell states that the Taylor material was reviewed by the AEC after publication -- not in advance of publication, as Taylor was bound by

his clearance to have done. It also seems very odd to me that Dr. Taylor professes to be so concerned about nuclear weapons proliferation, after he furnished most of the information a person would need to build an atom bomb.

Concerning Dr. Rathjens: The evidence against him is as follows:

-- Morland Affidavit #I, paragraph 31: Dr. Rathjens identifies materials used in the fission triggers of H-bombs. AHow do you know?@ Morland asks. ABecause I=ve seen the designs,@ Rathjens replies. Morland asks Rathjens if the materials (uranium-235 and plutonium-239) are alloyed together. ALet a put it this way,@ Rathjens answers, Athey are not mixed at the molecular level.@

B Morland Affidavit #I, paragraph 69: Morland approaches Rathjens and says, AI am trying to understand the mechanics of the H-bomb. Could you take a look at this diagram of an H-bomb?@ Morland showed Rathjens a sketch of some classified design. Rathjens replies, A1 don=t think this will work.@

-- Morland Affidavit #I, paragraph 70: Morland describes a brainstorming session on weapons design in Rathjens= office. Rathjens is present, as is Dr. Philip Morrison, a former Manhattan Project weapons engineer. Dr. Rathjens does not stop the meeting, or inform Morland, Morrison, and the others that they ore violating the Atomic Energy Act by Agenerating and unlawfully transmitting secret restricted data.@ By letting them use his office, Rathjens seems to abet this activity.

-- Morland Affidavit #III, paragraph 8: A further discussion of the November 4, 1978 meeting in Rathjens= office.

-- Morland Affidavit #III, paragraph 10: Dr. Rathjens identifies a bomb component for Morland. A description of the component, and its name, have been deleted (by Col. Griffin) from the affidavit, for Areasons of national security.@

Although I have not seen the original uncensored copies of Morland Affidavits I, II, and III, I have very strong reason to believe that further reference to statements made by Dr. Rathjens are contained in them. All of these activities are in direct violation of Dr. Rathjens= security clearance.

Dr. Rathjens replied to my charges against him in a letter to me dated June 1, 1979, in which he threatened to sue me for libel. He claimed that he never gave any information about weapons design to Morland, conveniently overlooking all of the points cited above. In his letter to Mr. McCloskey of June 27th, Duane Sewell of the DOE stated that he knew of no publications by Dr. Rathjens dealing with the design of nuclear weapons B a statement which was incorrect, and which completely ducked the points I raised in reference to the three Morland affidavits.

None of these three gentlemen have yet been called to account by the DOE or by Congress for their illegal activities. In a letter dated June 26, 1979, from Ms. Barbara Allen Babcock. Assistant Attorney General for Civil Affairs, to Congressman McCloskey, stated that none of the particular instances I have cited were ever brought before the Justice Department for action, either before or after the disclosures took place. She goes on to state that this is probably because action by the

United States would highlight the sensitivity of the materials involved in these cases. I doubt very strongly her asserted reason for the lack of action in the cases of Drs. Teller, Taylor, and Rathjens -- if the government were truly worried about highlighting sensitive information, it would never have taken the PROGRESSIVE to court to begin with. (Ms. Babcock later told a reporter for the Palo Alto Peninsula Times-Tribune that the PROGRESSIVE case was a political matter handled by the Justice Department.@)

I believe that the three individuals named above have never teen prosecuted because the government, acting through the DOE, seems to use a double standard when it comes to the classification and release of sensitive technical and political information. On the one hand, prominent government scientists are apparently free to break the law with impunity, while more junior scientists and members of the general public are threatened with all sorts of legal ramifications for repeating or republishing information that is already in the public domain, especially information put there as a result of unauthorized disclosures by senior scientists. I hope the Congress will very soon take a long, hard look at the Atomic Energy Act as a result of the PROGRESSIVE case. It seems as though the classification policies and authority of the DOE need a major overhaul and redefinition.

Sincerely,

Chuck Hansen
American Aviation Historical Society