Dr. Teller, I Presume…

by Michael Lennick

At 95 years of age Edward Teller, the father of the Hydrogen Bomb, had only one regret…

INTRODUCTION

October 31st, 1952. Halloween was just getting rolling in California when, half a world away on the South Pacific island of Elugelab, the firing circuits closed on Ivy-Mike, the first practical test of the prototype hydrogen bomb. Ghosts and goblins roamed the Berkeley streets as Dr. Edward Teller, the driving force behind the new weapon, sat quietly in a darkened basement, patiently scanning for subtle, indirect evidence that he had irrevocably altered the world yet again. He had to squint to read the slowly-moving pen of the seismograph - a device normally used to record earthquakes. If the test shot was successful Teller would see it here perhaps fifteen minutes after the event, once the unprecedented shock wave had traversed the interior of the planet to impact the seismograph's detector.

It was already November 1st - All Saints' Day - at the test site. The early morning skies were breathtakingly clear over Einewitok Atoll. A thousand nautical miles north lay the Mariannas, from which Curtis LeMay's bombers had launched the firebombings of Japanese cities, as well as the only two nuclear attack missions ever flown to completion. The huge task force waited at sea, anchored in a rough semi-circle thirty miles south of the doomed test island. At T-Zero a radio signal from the control room aboard the cruiser Estees triggered 92 detonators to fire simultaneously, compressing a tangerine-sized plutonium core to super-criticality. The resulting fission explosion, about the size of the Nagasaki blast, was only the first step. In a few millionths of a second it would create the conditions, the necessary heat, pressure and radiation, to enable nature's lightest, most plentiful elements to undergo fusion - to momentarily burn as a man-made star upon the surface of the earth.

Down in Teller's borrowed basement lab the signal arrived exactly as anticipated, a tiny blip on a slowly-rotating paper cylinder. He quickly sent word to his former colleagues at the Los Alamos Nuclear Weapons lab in New Mexico. Ironically, the radio silence invoked by security concerns meant the lab that had built the first atomic bombs as well as the new hydrogen test device would receive their initial hint of a successful detonation from its estranged and isolated co-inventor. The telegram read: "It's a boy."

Dr. Edward Teller - Manhattan Project physicist, father of the Hydrogen Bomb, reputed role model for Stanley Kubrick's "Dr. Strangelove", and to many minds perhaps as close as real life has ever come to creating a James Bond-style supervillian - was born in Hungary in 1908. As a child he witnessed the horrors of Bela Kun's Red Terror and Miklos Horthy's far more brutal facist regime, events which go a long way towards explaining his lifelong distrust of the Soviet Union. Fleeing the burgeoning Nazi menace, Teller and other Hungarian emegres like Leo Szilard, John von Neumann and Theodore von Karman began to think of themselves as "The Martians" - an origin legend with wide appeal among the rapidly expanding group of physicists then fleeing Hitler's Europe to land professorships in American universities.

Teller was a singular presence among his peers. Loud, aggressive, cocksure, he could dominate any conversation with whatever agenda he was pushing that day. It was not entirely his choice to monitor the 1952 Ivy-Mike test from that Berkeley basement, but he had long ago antagonized and alienated the Los Alamos physicists who would built the device before ultimately walking off the project - hardly a unique situation in the long career of Edward Teller. His shadow looms over much of the 20th century and reaches well into the 21st. An early member of Robert Oppenheimer's team at Los Alamos, Teller made key contributions throughout the Manhattan Project, though almost as an afterthought. As early as 1942 he had grown bored with the physics of atomic bombs. He quite literally had bigger fish to fry.

Teller demonstrated much concern over his perceived rank among his colleagues. He never won the Nobel Prize (for that matter neither did Oppenheimer.) His great

strength lay in his ability to seize upon an interesting idea and promote it doggedly, for years if necessary - long after its originators had lost interest and moved on. His primary claim to fame, the development of the hydrogen bomb in the early 1950s, is a perfect example. It was Teller's close friend Hans Bethe's work on the carbon cycle, explaining for the first time how stars achieve fusion and thus create heavier elements, that laid the groundwork. Bethe would win the Nobel Prize for those discoveries. At an early conference assembled to determine the feasibility of the uranium bomb, Nobel laureate Enrico Fermi, the man who built the world's first nuclear reactor, observed that conditions at the epicenter of a fission explosion would mimic the temperatures and pressures found at the cores of stars. Fermi then suggested the possibility of utilizing an atomic bomb to trigger a fusion reaction in hydrogen. It was a thought exercise, but Teller grasped the concept instantly and was unable to let it go. For the remainder of the conference he dominated the discussion with exotic schemes to design fusion bombs as part of their wartime mandate. It was only after Oppenheimer pointed out the need to achieve a working fission bomb before fusion could be contemplated that Teller agreed to focus on the task at hand, but the idea never quite reached his back-burner. Throughout the war years Teller continued to view the atomic bomb as little more than a mundane engineering exercise. This infuriated his friend and immediate supervisor Hans Bethe, now head of the Theoretical Division at Los Alamos - a posting Teller felt more rightfully belonged to him. After much cajoling, Oppenheimer finally gave him permission to pursue his fusion chimera, so long as he would agree to pitch in on fission problems as required.

Ironically enough, Teller was an early adherent of the pacifist movement among Manhattan Project scientists. It was widely believed that Germany, where the potential of nuclear fission was first explored, had its own well-advanced bomb project, likely under the leadership of Teller's great former teacher Werner Heisenberg. Most Los Alamos physicists, many with families still in Europe, signed on specifically to beat Hitler to the bomb. After Germany's surrender, the idea of dropping such a weapon on a battered nation with no atomic program of its own was abhorrent to many. Teller approached Oppenheimer for advice when asked to sign a petition protesting the bomb's

anticipated deployment against Japanese civilians. Oppenheimer told Teller a scientist's job was to do science - it was up to elected politicians to draft policy, a position Teller adopted as his own.

Teller found little support for his Super bomb in the post-war calm, a period which didn't last very long. The 1949 test of a Soviet fission device, built using plans stolen from Los Alamos by wartime spy Klaus Fuchs, surprised American politicians, though not American physicists. Teller and others had long argued that, despite extraordinary security, the only real secret of the atomic bomb was whether or not it was possible. Hiroshima had answered that question in a manner no one could ignore. Successful nuclear programs in other countries were now inevitable.

Teller immediately lobbied for a crash program to develop his Super bomb as a response. Former Los Alamos director Robert Oppenheimer, now a respected government advisor, led the AEC committee asked to consider the proposal. After much discussion the committee determined Teller's initial design to be undeliverable (which it was), and recommended steering clear of expensive and unnecessary research, focusing instead on the creation of a moderate arsenal of "off the shelf" fission weapons. The committee believed this would provide a far more credible deterrent to Soviet ambition. Beyond that, the Hydrogen bomb's potential lack of an upper yield limit made it, in the opinion of Oppenheimer, Fermi, and others, "an obscene weapon", as well as one without a useful target in the Soviet Union - that is to say, a target that couldn't be adequately devastated by one or more Nagasaki-sized fission bombs. As committee member I. I. Rabi pointed out, only the United States had any cities large enough to provide tempting fusion targets. Finally, the suggestion was made that by turning away from H-bomb research the United States might actually inspire the Soviet Union to do likewise, a reasonable hope given the physical and economic ruin that nation had suffered in their fight against Nazi Germany.

Oppenheimer's recommendations appalled Teller, who felt his old friend had utterly misunderstood Stalin's dangerous ambitions. Among many in Congress and the Air Force the report was seen as openly treasonous - a mind-set Teller was able to exploit very effectively in his quest for backing.

Teller got his go-ahead for a crash program on the Super - which, thanks to an insight by the mathematician Stanislaw Ulam, had now been completely re-designed. The new configuration was so logical and elegant that even Oppenheimer called it "sweet". Shortly after the Ivy-Mike shot Robert Oppenheimer found himself removed from government service. In subsequent months, as Cold War hawks assumed higher positions of power, Oppenheimer's Top Secret "Q" clearance was revoked amidst charges of disloyalty, stemming largely from his pre-war leftist associates, as well as his more recent attitudes towards the hydrogen bomb. To salvage his reputation Oppenheimer chose to fight back, requesting a hearing before the Atomic Energy Commission. At the 1954 closed-door sessions a stream of scientists and colleagues, including Manhattan Project Army General Leslie R. Groves and one of the security officers who'd cleared him during the war, testified on his behalf. To the astonishment of Oppenheimer and the rest of the scientific community, Edward Teller was recruited by the prosecution. Asked if Oppenheimer's clearance should be reinstated, Teller testified, "In a great number of cases I have seen Dr. Oppenheimer act…in a way which for me was exceedingly hard to understand. I thoroughly disagreed with him in numerous issues and his actions frankly appeared to me confused and complicated. To this extent I feel that I would like to see the vital interests of this country in hands which I understand better, and therefore trust more."

Teller paid mightily for those words. Most of his friends in the scientific community turned their backs on him. For the remainder of his life Teller insisted that his testimony had not harmed Oppenheimer significantly. More recently, and very specifically in the interview that follows, Teller claimed his words were a one-time overreaction - the impetuous result of his learning only that morning of Oppenheimer's own palavering years earlier in failing to fully and promptly disclose the approach that

had been made to him by his old Berkeley friend Haakon Chevalier on behalf of the Soviet Union. Nevertheless, and despite Teller's assurances to the contrary, Oppenheimer was devastated by the outcome of the AEC hearing. His security clearance never restored, he spent the remainder of his career at the Institute of Advanced Study in Princeton, before dying of cancer at 62.

Edward Teller took great pride in viewing himself as one of the principal heroes of the Cold War. He believed with all his heart that the hardline positions he urged against Soviet expansion, his insistence on an overwhelming nuclear deterrent and his advocacy of strategic missile defence were all instrumental in the prevention of nuclear war, not to mention the eventual fall of the Soviet Union. In this he may well have been correct, although it would ultimately take a fresh-thinking Soviet leader like Mikhail Gorbachev to recognize the global risk and financial folly of endlessly trying to match the west warhead for warhead.

Teller's great blindspot lay not in his comprehension of science nor his soaring imagination and curiosity, but in his understanding of the people he shared this fragile planet with (as he freely admitted in his appraisal of Oppenheimer's motives during the AEC hearings.) His perpetual disputes with colleagues were a minor issue compared with the dangerous trust he placed in government officials until quite late in life. Buoyed by Oppenheimer's wartime counsel to leave politics to the politicians, Teller failed to see the hidden depths of the Faustian bargain he'd so eagerly made with the ambitious generals then running the Air Force and SAC. The true miracle may be not that we survived the years of nuclear testing and saber rattling, but that wiser minds prevailed over the opinions of men like World War II hero General James Doolittle, whose 1953 advisory committee recommended that the Soviet Union be given two years to "come to terms", and then attacked with nuclear weapons if they failed to do so.***** Far more dangerous was Strategic Air Command founder and later Air Force Chief of Staff General Curtis LeMay (the model for Kubrick's Jack D. Ripper if ever there was one), who constantly baited the Soviets with illegal spy plane overflights (including the notorious U2 missions), and maintained a SAC policy (with details hidden even from government officials) that would

launch his "Sunday Punch", a simultaneous attack on Soviet dams, military installations, cities, towns and rural population centers using everything in the arsenal, in response to any Soviet incursion no matter how slight - basically an Armageddon in an afternoon. To the end of his life LeMay was furious that such an attack was never carried out. He died believing Presidents Truman, Eisenhower and Kennedy to be rank cowards for not crushing the Soviets while their country held the exclusive means to do so.

Today the Soviet nuclear threat is as non-existent as the Soviet Union itself, although there are still thousands of warheads and core components scattered around the globe. The danger has moved to the periphery, and so is far harder to calculate or control. What are the ultimate intentions of those nations purchasing nuclear technology from the likes of Pakistan's Abdul Quadeer Khan? Should an organization like Al Qaeda succeed in building or acquiring even a crude nuclear weapon, would deterrence have much value? Well before the attacks of 9/11, Richard Rhodes concluded his excellent history "Dark Sun - The Making of the Hydrogen Bomb" with the thought that nuclear weapons as instruments of war have actually been obsolete since their initial use six decades ago. One can only hope this remains so, despite the reality that, in many ways, our world is now more dangerous than ever.

A NOTE ABOUT THE FOLLOWING INTERVIEW: Towards the end of his life, Dr. Teller was not an easy man to see. This television interview, printed here in its entirety, came about only after months of very difficult "auditioning" on my part. Teller wanted to be sure the discussion would be serious in tone, and that his interviewer knew what he was talking about. Towards that end I was required to submit a series of essay-style answers meant to establish my position and knowledge on a number of topics, not all of them nuclear-based. This process continued even as I was setting the lights in Dr. Teller's Berkeley study. He would regularly call me over to ask my opinion of, say, recent political developments in Hungary, or to quiz me on something he had included in his just-published autobiography. Apparently I passed his many tests, although it wasn't until we'd been talking freely for half an hour or so that I lost the apprehension that he might yank his mic off at any moment and wheel himself from the room. Although we had

conversed by letter, phone and fax I had no idea what to expect from the man in person, and freely admit to many pre-conceived ideas based on his long public image. I hope the reader comes away from the following transcript with the same sense that I got in person, that of a brilliant scientist and thinker still vibrant at the end of his days. Teller's thoughts on free will as evidenced by the unpredictable actions of sub-atomic particles reflect work only now being reported, nearly two years after his death. Early influences, opportunism and Cold War politics aside, Teller remained ever childlike, in both the best and worst senses of that word. The long-term consequences of his work are still playing themselves out, and will determine whether future historians regard Edward Teller as a genuine titan, or the ultimate terminator.

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Michael Lennick has written and directed films and television series on space travel and technology for the past twenty years. His latest project, "Dr. Teller's Very Large Bomb", will air in late 2005.

Interview with EDWARD TELLER
Conducted by Michael Lennick
(to be edited accordingly by AH Magazine)

LENNICK: Dr. Teller, I wonder if we could begin with your good friend Leo Szilard, specifically your involvement with the Einstein letter addressed to President Roosevelt.

TELLER: SZILARD IS A VERY INGENIOUS AND INTERESTING PERSON. ALMOST 10 YEARS MY SENIOR. WHO I HAVE MET EVEN AS A HIGH SCHOOL STUDENT IN HUNGARY. WE KEPT UP OUR FRIENDSHIP, AND ONE DAY HE CAME TO ME AND TOLD ME ABOUT WERNER HEISENBERG AND THE LETTER HE WAS CARRYING. I WAS SUPERIOR TO SZILARD IN ONE RESPECT, I DROVE A CAR. HE DID NOT HAVE A DRIVING LICENCE. HE NEEDED A CHAUFFEUR. HE TOLD ME WHAT IT WAS ABOUT. I WOULD HAVE BEEN GLAD TO HELP HIM IN ANY CASE. I TENDED TO AGREE WITH HIM AND AGREED TO DRIVE HIM WHEREVER HE NEEDED TO GO, WHICH ACTUALLY WAS THE END OF LONG ISLAND WHERE EINSTEIN HAD HIS SUMMER VACATION. THAT WAS THE BEGINNING.

LENNICK: The beginning of the Manhattan Project.

TELLER: THE BEGINNING OF EVERYTHING.

LENNICK: Your work in nuclear physics will certainly form a large part of your legacy, but your writings suggest that you were heading in a different direction as a young man.

TELLER: AN ENTIRELY DIFFERENT ONE. THE MOST IMPORTANT PART OF MY EDUCATION WAS MY STUDY WITH A GREAT MAN WHOM I ADMIRED, WHOM I CONTINUED TO CONSIDER A WONDERFUL PERSON, AND NOT ONLY A WONDERFUL SCIENTIST, WERNER HEISENBERG. I LEARNED FROM HIM THE AMAZING NEW STORY OF QUANTUM MECHANICS. SOMETHING THAT SAYS THAT A FUTURE IS TRULY UNPREDICTABLE AND THAT WE MAY WELL HAVE SOMETHING LIKE A FREE PERSONAL WILL. I WORKED ON MOLECULAR SPECTRA, A BIG AREA IN THIS NEW SCIENCE. I WAS HAPPY DOING IT, I WAS HAPPY TEACHING IT, AND HAD FISSION NOT COME ALONG I WOULD HAVE CONTINUED TO DO IT HAPPILY EVER AFTER.

LENNICK: What are your thoughts about Dr. Heisenberg's involvement in the German nuclear effort, in particular Germany's failure to produce a viable weapon?

TELLER: IT WAS A PECULIAR, WERNER HEISENBERG, MY TEACHER, WORKED ON IT AS A GERMAN CITIZEN, WHICH HE WAS, BUT HE WAS NOT A NAZI. HE WAS ALMOST SENT TO A CONCENTRATION CAMP, BUT HE HAD TO WORK ON IT, BECAUSE HE COULD NOT LEAVE HIS COUNTRY. HEISENBERG FOUND THAT THE JOB WAS EXTREMELY DIFFICULT. HIS ATTITUDE NORMALLY WOULD HAVE BEEN "THIS THING, LET'S GET IT DONE." IN THIS CASE HIS ATTITUDE WAS DIFFERENT, THANK GOD. HE WANTED TO DO IT, YES, BUT NOT IN HIS HEART. HE HAD OBLIGATIONS TO DO IT, BUT I BELIEVE HE DID NOT SUCCEED BECAUSE HE WAS NOT REALLY CONVINCED THAT HE MUST SUCCEED. DURING THE WAR OF COURSE I DID NOT KNOW THAT. I WAS NOT VERY INFORMED ABOUT HEISENBERG AT THAT TIME, THOUGH I KNEW ALWAYS THAT HEISENBERG WAS A VERY DECENT PERSON.

LENNICK: You clearly accept the theory that Dr. Heisenberg could have done the job but worked slowly and buried important discoveries in order to deny Hitler the bomb.

TELLER: IT'S NOT A THEORY, IT'S SOMETHING BASED ON A LOT OF DETAIL.. THERE HAS BEEN A TENDENCY, I ALMOST WOULD LIKE TO CALL IT A CONSPIRACY, TO BLAME HEISENBERG. I WANT VERY SHARPLY AND DEFINITELY TO CONTRADICT THAT.

LENNICK: And yet there were no guarantees of success, for the Germans, the British or the Americans. The engineering problems in 1939 must have seemed overwhelming.

TELLER: WE DID NOT KNOW HOW DIFFICULT IT WOULD BE. THAT THERE WAS A POSSIBILITY OF SUCCESS, AND THAT THERE WOULD BE PEOPLE IN GERMANY WHO WOULD WANT TO USE IT TO HELP HITLER TO RULE THE WORLD, I HAVE NO DOUBT. ALL HEISENBERG WANTED WAS FOR THE WAR TO BE OVER AND HIS COUNTRY, GERMANY, NOT TO SUFFER VERY BADLY

LENNICK: Did you know intuitively that you could make the gadget work, that if a way could be found to purify enough U-235 a crude but deliverable weapon was a certainty?

TELLER: I AM TEMPTED TO SAY YES. WE KNEW THAT IF WE COULD HAVE SUCCEEDED WE COULD AT ONE BLOW DESTROY A CITY.

LENNICK: Germany surrendered shortly before your final push towards the Trinity Test. What effect if any did the loss of the original threat have on the pace of work at the lab?

TELLER: THE MATTER WAS HARDLY DISCUSSED, THERE WAS A GENERAL IMPETUOUS TO GET IT DONE. WE WERE CLOSE TO THE END. WE HAD TO DO IT. THERE WAS NO DOUBT IN PEOPLE'S MINDS ABOUT DEMONSTRATING THE EXPLOSION, WHICH HAPPENED IN THE MIDDLE OF JULY. I REMEMBER DRIVING AWAY FROM THAT KNOWING THAT NEXT TIME IT WOULD BE NOT A DEMONSTRATION, AND I FELT VERY WORRIED ABOUT IT. SO DID MANY OTHER PEOPLE IN LOS ALAMOS. AFTER THE JAPANESE MISSIONS WE RECEIVED THE NEWS THAT THE WAR WAS OVER, AND MOST DOUBTS ENDED. THERE WAS A FEELING OF JOY AND CELEBRATION AT THE LAB, AFTER ALL WE MADE A BIG CONTRIBUTION TO ENDING THE WAR. SOME CELEBRATION WAS JUSTIFIED. I DID NOT WHOLE HEARTEDLY PARTICIPATE

LENNICK: Could I ask you to recall the morning of July 16th?

TELLER: THAT IS A VERY SHARP MEMORY. I HOPE IT WILL ONLY GET HARDER AND NOT DISTORTED BY MY THINKING ABOUT IT SO OFTEN. IT SHOULD HAVE COME IN THE EVENING OF THE 15TH, BUT IN THE MIDDLE OF THE DESERT IT WAS RAINING IN THE SUMMER WHEN IT SHOULDN'T HAVE. THE SHOT WAS POSTPONED. THEN WE HEARD IT WILL BE FIRED THE MORNING OF THE 16TH AFTER A FEW HOURS DELAY. I WAS WITH A

GROUP OF PEOPLE, I DON'T KNOW HOW FAR, MAYBE 20 MILES FROM THE POINT OF EXPLOSION. WE WERE TOLD TO LIE DOWN WITH OUR BACKS TO THE EXPLOSION. I OBEYED, AND DID LIE DOWN, BUT I DID NOT TURN MY BACK TO THE EXPLOSION. I LOOKED STRAIGHT AT IT. WE WERE GIVEN WELDING GLASSES TO PUT BEFORE OUR EYES TO SHIELD THEM FROM POSSIBLE RADIATION. I HAD THAT GLASS AND PUT ON SOME EXTRA GLASSES, NOT LOOKING AT THE TARGET. AT OUR DISTANT OBSERVING STATION WE WERE INFORMED ABOUT THE TIME THE EXPLOSION WOULD COME. WE HAD THESE REPORTS FROM TIME TO TIME. THEN QUITE A WHILE, MAYBE AS MUCH AS HALF AN HOUR. BEFORE THE SHOT THE REPORTS STOPPED AND WE DID NOT KNOW WHAT HAD HAPPENED. ACTUALLY WE HAD SOME CONNECTION EXCEPT FOR THE LAST FEW MINUTES. THESE WERE EXTREMELY LONG. WE DID NOT HEAR ANYMORE REPORTS. MAYBE THE SHOT WAS CALLED OFF. THEN CAME THE TIME, THE ACTUAL TIME. I WAS, AS I TOLD YOU, LOOKING STRAIGHT AT THE OBJECT. IT WAS EARLY IN THE MORNING, THE SUN WASN'T UP YET. THE FAINT LIGHT OF THE COMING SUN WAS NOT FAINT COMPARED TO THE EFFECT OF THE SHOT. AT LEAST THAT IS HOW IT SEEMED TO ME THROUGH THE DOUBLE GLASSES THAT I HAD. THERE WAS THE SHOT, A LITTLE LIGHT, AND THE FIRST SECONDS A DISAPPOINTMENT. IS THAT ALL? SO I TIPPED THE WELDING GLASSES AND LOOKED DOWN AT THE SAND NEXT TO ME. AND THAT GAVE THE EFFECT AS WHEN IT'S MIDDAY - A HEAVY CURTAIN ON YOUR WINDOW AND THE FIRST SUNLIGHT IS STREAMING IN. AND IT WAS ONLY REFLECTED LIGHT. THEN I WAS IMPRESSED. I TOOK OFF THE GLASSES AND LOOKED AT IT, AND THERE WAS A FIREBALL RISING, ILLUMINATING THE WHOLE WORLD. THEN AFTER MAYBE TEN MINUTES, 15 MINUTES, WE GOT UP AND STARTED TO WALK AWAY. THINGS WERE DIFFERENT. AS I TOLD YOU, THERE WAS A STRONG FEELING THAT WHATEVER COMES NEXT, IT WILL BE MUCH MORE THAN A FIREBALL.

LENNICK: Most accounts of Los Alamos speak of the very different styles of leadership provided by Dr. Oppenheimer and the Army General Leslie Groves. I wonder if you could give us your impressions of the general and his impact on the scientific team.

TELLER: HE WAS A MAN IN CLOSE CONTACT WITH OPPENHEIMER. NOT IN CONTACT WITH MOST OF THE OTHERS. I SAT ONCE WHEN I WENT FOR A CERTAIN MISSION TO WASHINGTON NEXT TO HIM AND I GOT THE IMPRESSION OF A SIBILANT MAN WHO SPOKE UP OCCASIONALLY TO DOUBT WHAT I WAS SAYING. THEN IT WAS CLEAR THAT I THOUGHT THAT THINGS COULD REALLY SUCCEED. I SPOKE UP DEFINITELY AND SAID SO AND GENERAL GROVES EXPRESSED HIS DOUBTS IN WHAT I WAS SAYING, AND I HAVE TO SAY HE WAS MOST IMPOLITE, AT LEAST TO

ME. AND THAT TIME ONE OF HIS ADVISORS, A GERMAN SCIENTIST, SPOKE UP AND SAID "DOCTOR TELLER WAS TRYING TO TELL YOU THAT IT MIGHT VERY WELL WORK." JUST THAT WAY. THE EFFECT WAS MARVELLOUS. FOR THE FOLLOWING IMPORTANT PART OF THE SESSION GENERAL GROVES DID NOT CRITICISE ME, NOT AT ALL. THAT WAS ALL OF MY CONNECTION WITH HIM

LENNICK: You've written that your primary working relationship at Los Alamos was with Robert Oppenheimer, who recruited most of the scientists for the lab. What are your memories of him?

TELLER: PLENTY AND NOT EASY TO TELL. SEE I WANT PEOPLE TO HEAR THE STORY. THERE WERE SOME OF US WHO BELIEVED ENOUGH IN THE WORK REALLY TO MOTIVATE IT, REALLY TO NOT HAVE TO BE BROUGHT TOGETHER.. OPPENHEIMER IN A WAY WAS A LATE COMER. TO THE MASS OF THE PEOPLE, TO MANY OF THE PEOPLE HE WAS A MOTIVATOR, AND WHEN HE WANTED TO BE HE WAS A VERY GOOD MOTIVATOR. HE UNDERSTOOD WHAT PEOPLE SAID, HE UNDERSTOOD WHAT MADE THEM TICK AND HE ENCOURAGED THEM. HE WAS, ONCE HE UNDERTOOK THE JOB, HE WAS VERY ANXIOUS THAT HE SHOULD SUCCEED. HE WAS VERY ANXIOUS THAT THE BOMB ACTUALLY SHOULD BE DROPPED. AND HE DID DO THIS. HE WOULD SAY OF JAPAN THAT IT'S A TERRIBLE THING, THEY HAVE NO WEAPONS, THE WAR IS OVER, BUT LET'S DO IT. OPPENHEIMER WAS NOT A PERSON WITHOUT CONTRADICTIONS.

LENNICK: Many of which would be highlighted in later years. I've often been struck by the historical irony that the FBI and the Army put such effort into preventing knowledge of the work from leaking out during the war, either to the enemy or to our wartime allies. And yet, with all of the dossiers compiled on Oppenheimer and his family and friends, they actually managed to miss the two Soviet spies who really were working at the lab. Were you surprised by the Soviet detonation in 1949, or the revelations of how close their agents actually got to your work? I'm thinking, of course, of Klaus Fuchs.

TELLER: WE DID NOT KNOW TOO MUCH ABOUT IT. WE DID KNOW THAT THEY WERE WORKING ON IT. WE DID KNOW ENOUGH TO REALISE THAT THEY HAD THE MAIN IDEA. THEY HAD A VERY EFFECTIVE SPY IN KLAUS FUCHS. HE WAS GERMAN JEW AND A VERY NICE PERSON, A HIGHLY INTELLIGENT PERSON. I DON'T KNOW WHAT NAZIS DID TO HIS FAMILY BUT THEY DID TERRIBLE THINGS. HE WAS ACTUALLY INFORMING THE SOVIETS OF THE ESSENTIAL THINGS WE DID. AND I FOUND OUT THAT LATER HE GOT MONEY FOR IT. I'M ABSOLUTELY CERTAIN THAT HE DID NOT DO IT FOR MONEY. I COULD NOT DISAGREE WITH HIS ACTIONS

MORE THAN I DO, YET HE BEHAVED AS A FRIEND, AND SOMEHOW I CANNOT THINK ABOUT IT IN VERY DIFFERENT TERMS.

LENNICK: Fuchs was present for some of the earliest discussions of the thermonuclear super bomb that you were working on while implosion was still under development. What level of technical detail might he have been able to present to Beria after the war?

TELLER: IN MY AUTOBIOGRAPHY I DESCRIBE IT IN AS MUCH DETAIL AS I WAS PERMITTED TO, WHICH IS NOT TOO MUCH. THE SUBJECT IS AND REMAINS A SECRET. IF YOU ARE REALLY INTERESTED I HAVE TO TELL YOU ONE THING, READ MY AUTOBIOGRAPHY, I HAVE WRITTEN AS MUCH AS IS STRICTLY PERMISSIBLE, AND NOTHING MORE.

LENNICK: I imagine during the war, work on the super must have seemed impossibly more complex than implosion, if only because of the vast number of events that had to take place within milliseconds of the triggering blast to ignite the fusion fuel and keep it burning. How were you able to address some of these problems in the age of desktop adding machines?

TELLER: AMONG MY HUNGARIAN FRIENDS THERE WAS ONE PARTICULARLY INGENIOUS, JOHN VON NEUMANN, ONLY A FEW YEARS, MAYBE A FEW YEARS OLDER THAN I. HE CHANGED THE THINKING ABOUT COMPUTING MACHINES. INSTEAD OF A HARD WIRED MACHINE THAT WAS GOOD FOR ONE JOB, HE INVENTED SOMETHING FLEXIBLE THAT COULD BE INSTRUCTED, AND COULD WORK NOT ONLY OTHER THINGS THAT YOU TOLD THE MACHINE TO WORK, BUT ON THE ALTERNATIVES THAT THE MACHINE ITSELF HAS FORMED. A TREMENDOUS PIECE OF PROGRESS THAT HAS IN THE MEANTIME DEVELOPED SO THAT YOU KNOW, IN DAY TO DAY LIFE, IN COMMERCIAL LIFE, IT PLAYS A CONSIDERABLE ROLE. MY FRIEND DIED AT ABOUT 50 YEARS OF AGE. HE DID NOT SEE THE TREMENDOUS SUCCESS OF HIS WORK. AS IT WAS, ONE OF THE FIRST BENEFICIARIES WERE THE PEOPLE AT LOS ALAMOS. THE EARLY CALCULATIONS ON THE SUPER HAD BEEN DONE BY HIS METHOD AND OUR SUCCESS RELIED TO A GREAT EXTENT ON HIS COMPUTING MACHINES.

LENNICK: If I could digress for a moment, this seems a good time to bring up the diss-proportionate Hungarian connection to physics in the 20th century. I remember reading an interesting theory once that postulated that the citizens of Hungary, a country with no linguistic connection to its neighbours, were clearly aliens settled in this mountainous region, and that you've been using your superior intellect to help the rest of us along for decades now. I'm sure you've

heard this speculation, but I can't help wondering whether you've thought about a more logical explanation.

TELLER: A LOT, AND I HAVE NO CONCLUSIONS. I HAD FOUR HUNGARIAN FRIENDS, ONE A REAL SUPERFICIAL BECAUSE HE WAS SO MUCH OLDER, THEODORE VON KARMAN. HE WAS RESPONSIBLE FOR THE PLANNING OF THE FIRST FLEET OF BOMBERS THAT DEFEATED GERMANY. THE SECOND ONE WAS LEO SZILARD. HE WAS RESPONSIBLE FOR EARLY WORK ON ATOMIC ENERGY. THE THIRD ONE WAS ZIGNER. A VERY MODEST, INCREDIBLY INGENIOUS MAN WHO IN THE NEW THEORY MADE GAVE CONTRIBUTIONS BY INTRODUCING SIMPLIFICATIONS DUE TO THE SIMILAR PROBLEMS. HE HAD A HUGE ROLL TO PLAY IN DESIGNING NUCLEAR REACTORS, THE PEACEFUL APPLICATION OF NUCLEAR ENERGY PRODUCTION. THE FOURTH ONE WAS JOHN VON NEUMANN, WHO I HAVE ALREADY MENTIONED. TO MY MIND HE WAS MOST INGENIOUS OF THE WHOLE GROUP. EXCEPT POSSIBLY FOR ME, WHO IS SOMETIMES GIVEN THE HONOUR TO BE MENTIONED WITH THE OTHERS. AND ALL OF US TOGETHER HAD BEEN MENTIONED BY THE OLDER THEODORE VON KARMAN, WHO DENIED THAT WE ARE HUNGARIANS, WE ARE MARTIANS. AND SINCE HE COULD NOT TALK ENGLISH WITHOUT AN ACCENT WE HAD TO PRETEND TO COME FROM SOME PLACE ELSE BECAUSE NO ONE WOULD BELIEVE A MARTIAN. SO WE SETTLED ON HUNGARY AND THAT IS FROM WHERE WE CAME.

LENNICK: I've always been amazed by the widespread acceptance of the Martian origin theory.

TELLER: IT'S AS NICE A THEORY AS I'VE EVER HEARD AND THEODORE VON KARMAN WAS FAMOUS FOR HIS STATEMENTS OF TRUE IMPORTANT EVENTS. HE ALWAYS INSISTED ON NEVER BEING TOO CONFINED BY THE HAPPENINGS OF THE ACTUAL EVENTS. HE ALSO NEVER TOLD A GOOD STORY TWICE WITHOUT IMPROVING ON IT

LENNICK: You're not widely known for actively propagating the Martian theory.

TELLER: NOT NECESSARY, IT'S A SIMPLE FACT.

LENNICK: But I'm sure you'll agree that in the aftermath of World War Two you were far more famous for your leading roll in developing hydrogen weapons as a counterforce against what you saw as Soviet aggression in Europe and beyond. Looking back, how do you view your role in America's deployment of a thermo-nuclear defence strategy?

TELLER: I ABSOLUTELY ACCOMPLISHED IT. I SAW, AND I SAW CORRECTLY, THAT BOTH ATOMIC WEAPONS AND HYDROGEN BOMBS, SUPER BOMBS, WOULD BECOME IMPORTANT. I SAW CORRECTLY THAT THE SOVIETS WOULD HAVE BOTH IN A SHORT TIME. I DID TWO THINGS WITH TWO CONVICTIONS, TO DEVELOP OUR BOMB FIRST AND TO ACT IN A WAY THAT WE SHOULD NEVER USE IT EXCEPT TO DETER THE USE BY OTHERS. IN THAT WE SUCCEEDED. THE SOVIET LEADERS AFTER STALIN WHO WERE NOT COMPLETE FANATICS REALISED THAT THEY CANNOT POSSIBLY WIN WITHOUT TERRIFIC LOSSES. AND IN THE END THEY RESIGNED. THAT THEY RESIGNED WAS WAS THE TRIUMPH AND SUCCESS OF THE RUSSIAN PEOPLE. BUT HAD THEY HAD THE POWER OF THE HYDROGEN BOMB BEFORE WE HAD, I DON'T KNOW WHAT WOULD HAVE HAPPENED. ALL OF US, ALL OF US WHO ARE STILL ALIVE, WOULD SPEAK RUSSIAN.

LENNICK: There was such a large divide at the time among western advisors on when, or if, the Soviets would develop nuclear weapons. Why do you suppose that was if, as you yourself have said, the greatest secret of the atomic bomb is that it can be done at all?

TELLER: HOW CAN I POSSIBLY TELL? A LOT OF IT WAS DUE TO THE EXCELLENT WORK OF THE PEOPLE WHO CAME TO LOS ALAMOS. THESE WERE AMERICANS, BUT TO NOT A SMALL EXTENT THEY WERE REFUGEES OF HITLER'S REGIME. THERE WERE ALSO INSPIRATIONAL AMERICAN LEADERS, AND AMONG THOSE OPPENHEIMER WAS MOST OUTSTANDING. HIS EFFORTS INSPIRED US TO SUCCESS BEFORE THE ENTIRE WORLD. EVEN SO WE WERE AHEAD OF THE SOVIETS BY ONLY A FEW YEARS AND NOT MORE.

LENNICK: Still we can't escape the historical irony that Oppenheimer was ultimately destroyed over his post-war leadership of the Special Advisory Committee, especially in its recommendations against the development of the Hydrogen Bomb and what he saw as a costly and ultimately futile arms race with the Soviet Union.

TELLER: WHAT YOU SAID IS BELIEVED BY MANY AND IS COMPLETELY WRONG. OPPENHEIMER WAS NOT DESTROYED. OPPENHEIMER WAS DEPRIVED OF HIS SECURITY CLEARANCE. HE WAS AFTER THAT NO LONGER ASKED TO ASSIST IN POLICY MATTERS. HE WAS MADE THE SCIENTIFIC LEADER OF A GROUP IN PRINCETON, THE INSTITUTE OF ADVANCED STUDY, THE MOST OUTSTANDING THEORETICAL GROUP IN THE WORLD. TO BE THE HEAD OF THAT AND BE DESTROYED IS QUITE A COMBINATION. BUT HE WAS EXTREMELY AMBITIOUS. AND HE WAS DEEPLY HURT BY NOT AGAIN BEING ASKED. AND THEN HE DIED. TO WHAT EXTENT DUE TO THESE EVENTS I DON'T KNOW. I KNOW THAT A

YEAR AFTER HE LOST HIS CLEARANCE HE GOT A HIGH DISTINCTION THAT I GOT A YEAR AHEAD OF HIM, AND FOR WHICH I RECOMMENDED HIM. TO BE DESTROYED AND TO LEAD PRINCETON AND TO GET THAT HIGH DISTINCTION, SOMEHOW THESE DO NOT A HUNDRED PERCENT GO TOGETHER.

LENNICK: I take your point. Yet history views your testimony at the 1954 AEC Hearings as a factor, perhaps the primary factor, in the decision to deny the renewal of Dr. Oppenheimer's clearance. Your life in the aftermath of that hearing was impacted to almost the same degree as his. In hindsight, would you testify any differently today?

TELLER: (LONG PAUSE) I CAN NOW SAY YES. I HAVE THOUGHT ABOUT THIS A GREAT DEAL IN RECENT YEARS. IN MY TESTIMONY IN THE OPPENHEIMER MATTER I WAS PREPARED TO SAY OPPENHEIMER WAS A LOYAL CITIZEN. I DID SAY THAT. BUT ONLY IMMEDIATELY BEFORE MY TESTIMONY I RECEIVED INFORMATION THAT OPPENHEIMER ALSO ACCUSED ONE OF HIS FRIENDS OF ESPIONAGE FOR WHICH THERE HAS BEEN NO EVIDENCE. I RECEIVED THAT INFORMATION AND IT INDUCED ME TO BE A LITTLE MORE OPEN ABOUT THE POINT THAT I DID NOT AGREE WITH OPPENHEIMER IN MANY DETAILS OF WHAT HE WAS DOING. I SHOULD HAVE TOLD THE MEETING AT THAT TIME THAT I HAD BEEN INFLUENCED BY THAT INFORMATION I GOT CONCERNING THE STATEMENTS OF OPPENHEIMER ON HIS FRIEND CHEVALIER. I WISH I HAD.

LENNICK: Are you saying it was only momentary anger over the way Oppenheimer treated his friend Haakon Chevalier that let you to speak against your friend as you did?
TELLER: NOT ANGER, MORE OF A FEELING OF RESPONSIBILITY. I COULD NOT IGNORE SUCH RESPONSIBILITIES. I SEE NOW I SHOULD HAVE GIVEN MY SOURCE OF INFORMATION. I HAD BEEN TOLD NOT TO REPEAT THE SOURCE, BUT I SHOULD HAVE IGNORED THAT AND TOLD IT. THE RESULT WAS PAIN FOR OPPENHEIMER AND FOR ME, BUT IT WAS NOT ANGER. IT WAS WORRY AND MORE WORRY.

LENNICK: Worry that the world was then far too dangerous for the attitudes of men like Oppenheimer, Rabi and the rest of the advisory committee towards the Soviet Union?

TELLER: I WAS NOT ALONE IN THIS. IT WAS A SIMPLE FACT. OPPENHEIMER WAS A GOOD FRIEND, A GREAT AND WISE MAN WHO THEN SAW THE WORLD IN A FOOLISH WAY. SADLY, HISTORY HAS PROVEN THIS TO BE SO.

LENNICK: You stood practically alone in the scientific community after the hearings, especially among your fellow physicists from Los Alamos. How were you able to re-establish relationships with your colleagues?.

TELLER: NOT EASILY, AND WITH SOME NOT EVER, BUT WITH THE HELP OF SOME OF MY FRIENDS, MOST PARTICULARLY MY HUNGARIAN FRIENDS. FOR INSTANCE SZILARD WAS NOT IN AGREEMENT WITH ME. WE WERE IN SHARP DISAGREEMENT, YET HE DID NOT LEAVE ME IN THE SLIGHTEST. IN THE SLIGHTEST. AMONG THE OTHERS WHOM I HAVE NOT KNOWN AS I KNEW THE HUNGARIANS, CLOSE FRIENDS, MORE RECENT FRIENDS… I LOST FAR TOO MANY.

LENNICK: Well before the AEC hearings you had already broken off from the Los Alamos group, going so far as to lobby the government for a new lab here at Berkeley to work on the Super following the breakthrough you shared with Stan Ulam.

TELLER: ULAM HAD THE REFINEMENT. IT WAS A GOOD IDEA AND WE NEEDED TO EXPLORE IT. MY WORK AT LOS ALAMOS WAS OVER. I HAD RECOMMENDED WE BUILD A NEW LABORATORY, WHICH MOST FORTUNATELY BECAME A REALITY IN LIVERMORE. THIS BECAME MY NEW HOME. I'M STILL CONSULTING THERE TWO DAYS PRACTICALLY EVERY WEEK.

LENNICK: And yet the first full fusion test, the Mike shot, was a Los Alamos device. You've described sitting in a darkened room in the basement at Berkeley and watching the shot on a seismograph printout, which led to your telegram message of "It's a boy." After leading the push for the super, why were you not present for the birth of this child?

TELLER: IT WAS NOT YET THE SUPER. IT WAS A TEST OF CERTAIN THEORIES, MINE AND ULAM'S. WE WERE AT THE VERY BEGINNING. OF THE PROJECT. AND THEN CAME THE FIRST RELEVANT TEST SHOT IN THE PACIFIC. THE HEAD OF LOS ALAMOS, BRADBURY, KINDLY INVITED ME TO ATTEND. I COULD NOT GO. I HAD TO STAY IN LIVERMORE. BUT ON THE ADVICE OF A VERY EXCELLENT SEISMOLOGIST FRIEND I HAD THE SEISMOGRAPH SET UP AND ALL SEISMOLOGISTS IN BERKLEY WATCHING. I WAS INDEED WATCHING IN THE BASEMENT AT BERKLEY. THE TIME CAME AND WENT AND NOTHING WAS SEEN. IT COULDN'T HAVE BEEN, BECAUSE THE ONLY WAY TO FIND IT WAS TO SENSE IT, WAS TO OBSERVE THE SHOCK THAT CAME THROUGH THE EARTH. AND THAT WAVE MOVING AT SOUND VELOCITY TOOK ABOUT A QUARTER OF AN HOUR OR MORE TO ARRIVE. SO WHEN NOTHING CAME I KNEW

THAT'S ALRIGHT, WAIT AND SEE. THE SHOCKWAVE ARRIVED PRECISELY AT THE TIME WHEN IT SHOULD HAVE ARRIVED, AND HAD ROUGHLY THE RIGHT SHAPE. THEN I WENT OUTSIDE THE MODULE. THE SEISMOLOGISTS NEXT DOOR WERE ALSO WATCHING. WE FOUND THAT WHAT WAS SEEN WAS PRECISELY WHAT SHOULD HAVE BEEN SEEN. AT THAT TIME I KNEW IT WAS A SUCCESS. REMARKABLY ENOUGH THE PEOPLE IN LOS ALAMOS DID NOT KNOW THAT BECAUSE THEIR REPRESENTATIVES IN THE PACIFIC, WHERE THE SHOT ACTUALLY TOOK PLACE, THEY WERE NOT ALLOWED TO TELL HOME UNTIL WASHINGTON MADE UP IT'S MIND THAT IT WAS CLEAR. THEY DID NOT KNOW I SENT THE WIRE. I WAS NOT ALLOWED TO WIRE ANYTHING CLASSIFIED SO I MADE UP MY OWN CODE. I DID NOT MENTION ANY EXPLOSION, ONLY THAT IT WAS A BOY. I'M GLAD TO SAY THE MESSAGE WAS RECEIVED, UNDERSTOOD AND IT WAS THEIR FIRST NEWS THAT THE SHOT WAS A SUCCESS. THOUGH I HAVE TO APOLOGISE FOR THE SEXIST CHARACTER.

LENNICK: What began as an elite branch of physics is now a well-established part of the dialogue in world politics. Have you been surprised by the growth of public interest in science since the end of the Second World War?

TELLER: THAT IS A VERY COMPLICATED QUESTION. MY BRANCH OF SCIENCE BECAME PUBLIC POLICY THE MOMENT THE WORLD KNEW OF HIROSHIMA. UNFORTUNATELY A PROPER DISCUSSION REQUIRES A BACKGROUND AND EDUCATION THAT MANY PARTS OF, KNOWLEDGE AND UNDERSTANDING FOR A NON-SCIENTIST IN PARTICULAR, IS NOT AN EASY MATTER.

LENNICK: Are you saying a lack of grounding in physics or mathematics disqualifies citizens from participating in discussions of scientific matters which might affect them?

TELLER: NO. FROM THE BEGINNING OF THE 20TH CENTURY THERE HAS BEEN GREAT INTEREST IN SCIENCE. VERY PARTICULARLY THERE WERE TWO PIECES OF ENORMOUS PROGRESS. EINSTEIN'S RELATIVITY AND QUANTUM MECHANICS OF THE DAY, IN WHICH MY TEACHER HEISENBERG PLAYED A GREAT PART. THESE TWO IDEAS RESULTED IN GREAT UNDERSTANDINGS WHICH WERE PECULIAR IN THAT IN MANY RESPECTS THEY CONTRADICTED COMMON SENSE. EINSTEIN'S CONCLUSION WAS THAT NOTHING COULD GO FASTER THAN LIGHT. WE LIVE IN THE MILKY WAY SYSTEM, A COLLECTION OF STARS, SO EXTENSIVE THAT IT TAKES MORE THAN A HUNDRED THOUSAND YEARS FOR LIGHT TO GET FROM ONE END TO THE OTHER. AT THE OTHER END

OF THE MILKY WAY SYSTEM THE DEVELOPMENT OF MAN SHOULD HAVE TAKEN PLACE. WE STILL DO NOT KNOW ABOUT IT BECAUSE ON OUR OWN PLANET THE MAIN PART OCCURRED IN LESS THAN THE LAST THOUSAND YEARS. IN FACT, THE MILKY WAY SYSTEM IS BIG ENOUGH SO THAT THE TWO ENDS CAN HARDLY BE IN TOUCH WITH EACH OTHER. THIS IDEA OF LIMITED LIGHT VELOCITY, THE IDEA THAT THE QUESTION OR THE TWO EVENTS ARE SIMULTANEOUS OR NOT, YOU CANNOT PROPERLY JUDGE WITHOUT SAYING HOW FAST YOU ARE MOVING. THEY ARE COMPLETELY FOREIGN TO COMMON UNDERSTANDING. QUANTUM MECHANICS EVEN MORE.

LENNICK: Alright, but we live in an era in which science impacts every aspect of our lives, and those without your frame of reference may still insist on weighing in using their own. Lately it would seem that international commerce or even religion have had more impact on scientific policy, at least in this country. Does this concern you?

TELLER: YES, THOUGH IN THE 19TH CENTURY IF A PHYSICIST BELIEVED IN GOD HE HAD TO ADMIT THAT GOD IS UNEMPLOYED, UNEMPLOYED I SAY BECAUSE OF EARTH IS BILLIONS OF YEARS OLD, THOUSANDS OF MILLIONS OF YEARS OLD, IF THE WORLD HAS BEEN CREATED BILLION YEARS AGO, IT HAS BEEN CREATED WITH A LAW IN WHICH AT THAT TIME PHYSICISTS BELIEVED IN CAUSE AND EFFECT, ACCORDING TO WHICH THE WHOLE FUTURE IS ABSOLUTELY DETERMINED BY WHAT WE CAN SEE TODAY. QUANTUM MECHANICS SAYS THAT THE FUTURE IS NOT DETERMINED - WE CAN'T FIND OUT ABOUT THE FUTURE. PROBABILITIES PERHAPS BUT NOT CERTAINTIES. IF QUANTUM MECHANICS IS RIGHT, AND IF YOU HAPPEN TO BELIEVE IN GOD, THERE IS PLENTY FOR GOD TO DO. HE IS ANYTHING BUT UNEMPLOYED. THAT SHOULD GIVE YOU A BIT OF A FEELING HOW IMPORTANT FOR THE GENERAL WAY OF THINKING SCIENCE HAS BEEN. ON TOP OF THAT THERE CAME THE PRACTICAL APPLICATIONS OF WHICH THE NUCLEAR EXPLOSIONS ARE A SYMBOL. THE RESULT WAS A GROWING INTEREST IN SCIENCE IN THE LAST HALF OF THE 20TH CENTURY. BUT THERE IS A LIMIT. THE MORE WE KNOW THE MORE SEEMS UNKNOWABLE, CERTAINLY TO LAYMEN OR THOSE OF RELIGIOUS INTENT. NEARLY ONE HUNDRED YEARS AFTER THE BIG BANG THEORY THOSE OF THE PUBLIC WHO ARE INTERESTED ARE ONLY BEGINNING TO UNDERSTAND HOW ENORMOUS THE UNIVERSE REALLY IS. I SAY ENORMOUS AND SECRETLY I BELIEVE PERHAPS INFINITE.

LENNICK: Infinity was not a concept that Einstein was very comfortable with, though his colleague Neils Bohr seemed to be leaning in that direction.

TELLER: YES EINSTEIN WAS WRONG. THOUGH TO MY MIND BOTH EINSTEIN AND BOHR ARE VERY DATED. I MUST AGREE WITH YOU THOUGH THAT BOHR UNDERSTOOD EINSTEIN. EINSTEIN NEVER UNDERSTOOD BOHR.

LENNICK: If scientific progress is a process of testing and rejecting existent theories in search of deeper truths, is there anything that disturbs you in the current thinking?

TELLER: WHAT SCARES ME MOST IS WHAT I CALL THE GREEN MOVEMENT. IT STARTED IN GERMANY AND IT SAYS IF YOU FALL DOWN TOO MUCH LET'S STOP LEARNING. THE FACTS OF THE UNIVERSE ARE TOO DANGEROUS TO KNOW. WHAT TO DO WITH THESE THINGS IS A PROBLEM. WRONGLY APPLIED IT CAN BE VERY DANGEROUS, BUT ANYTHING WRONGLY APPLIED CAN BE DANGEROUS, AND I THINK THE ONE THING THAT WE MUST DO, THAT PUTS US ABOVE ANYONE ELSE IS UNDERSTAND. WE MUST EXPLORE, WE MUST LEARN, WE MUST FIND OUT. WE MUST NEVER CONSIDER KNOWLEDGE DANGEROUS. BUT THE APPLICATION OF THE KNOWLEDGE… THERE, LOOK OUT.

LENNICK: Well this brings us back to the very discussions you began with Compton in Chicago, when it was clear that the knowledge held by an elite few was about to change the world for all time. Oppenheimer made it clear then that the job of the scientists was to do science, with public policy to be decided by their elected representatives. You clearly agreed with that position for most of your career. Have you changed your mind?

TELLER: PERHAPS TO A DEGREE. I THINK WHAT WE NEED TO DO IS TO OPEN UP CAREFULLY AND GRADUALLY THE SECRETS, ESTABLISH INTERNATIONAL CORPORATION AND IN PARTICULAR ESTABLISH IT FOR INTERNATIONAL BENEFIT. I WILL GIVE YOU ONE EXAMPLE. ONE FIELD IN WHICH WE MADE PROGRESS IN THE LAST HALF CENTURY, BUT NOT ENOUGH, IS WEATHER PREDICTION. FIFTY YEARS AGO NO ONE COULD PREDICT WEATHER FOR TWO OR THREE DAYS, NOW WE CAN PREDICT WEATHER FOR FIVE DAYS. CONSIDERING THE ENORMOUS PROGRESS IN COMPUTING POWER WE SHOULD BE FARTHER. I BELIEVE WITH PROPER CO-OPERATION WE COULD PREDICT WEATHER TWO WEEKS IN ADVANCE AND THAT WOULD BE EXTREMELY IMPORTANT - TO KNOW WHEN TO START THE CROPS AND WHEN TO BRING THEM IN, TWO WEEKS IN ADVANCE, TO KNOW WHEN A HURRICANE MAY COME, WHEN A FLOOD MAY COME, THE DIFFERENCE IN MONEY WILL AMOUNT TO BILLIONS OF DOLLARS. THIS HAS NOTHING TO DO WITH RELIGION AND MUST NOT TAKE THAT INTO CONSIDERATION. WORKING WITH SCIENCE, BELIEVING IN SCIENCE, THIS COULD ONLY FURTHER THE MUTUAL CONFIDENCE OF ALL NATIONS.

LENNICK: Especially in an increasingly anti-science age. Did you ever think you would see such a backlash?

TELLER: NOT LIKE THIS. BUT IT WAS NOT UNEXPECTED. I THOUGHT IT WOULD OCCUR MANY YEARS AGO, AFTER NEWS OF HIROSHIMA. BUT SCIENCE EDUCATION AND INTEREST WENT UP. PERHAPS THE SPACE PROGRAM WAS THE CAUSE. MANY STUDENTS IN THE WEST WERE INSPIRED BY THE SOVIET EXAMPLE, WHICH WAS QUITE UNEXPECTED AND EXTRAORDINARY. THE RUSSIANS WERE MAKING A POINT ABOUT THEIR MISSILE CAPABILITIES AND IT WORKED. WE COULD USE SUCH INSPIRATION AGAIN.

LENNICK: This wouldn't be the first time in history that a technologically advanced civilisation turned their backs on progress. Do you see us reaching the point of burning our ships in the harbour and closing our borders as China did in the middle ages?

TELLER: I WOULD LIKE TO GIVE AN OPINION ON YOUR EXAMPLE IF I HAD ONE. MY KNOWLEDGE OF CHINESE HISTORY IS TOO FRAGMENTED TO BE COMPLETELY CONVINCING, BUT I DO KNOW THAT CHINA HAD CLEARED A PATH IN THE DISCOVERY OF DISTANT CONTINENTS. MY FRAGMENTARY INFORMATION IS THAT THE CHINESE GOT SCARED AND THEY FEARED TO DEVELOP THAT FLEET ANY FURTHER. THEY WERE OFF TO EUROPE ABOUT 500 YEARS AGO, THEY THEN FELL BEHIND. IF I REPRESENT THAT CORRECTLY IT WOULD BE A FRIGHTENING EXAMPLE OF WHAT COULD HAPPEN.

LENNICK: Especially in an age in which extremists on all sides are pushing us away from discovery, insisting that we accept absolute truths as given without question.

TELLER: I HAVE ONE REMARK HERE THAT YOU MIGHT NOT EXPECT. IT IS ABOUT THE TERRORISTS. FOR THE LAST FEW YEARS WE HAVE BEEN NOMINALLY AT WAR WITH THE TERRORISTS. THE TERRORISTS AS YOU KNOW THEM TODAY ARE MUSLIMS. AS YOU UNDERSTAND IT TODAY IT IS A VERY SMALL PORTION OF THE MUSLIMS. OUR PRESIDENT AND OUR LEADERS HAVE GONE OUT OF THEIR WAY TO FIGHT THE TERRORISTS, WITHOUT IDENTIFYING THEM FROM THE MASS OF THE MUSLIMS, WITHOUT GENERATING ADDED CONTROVERSIES. THIS COULD NOT BE MORE IMPORTANT. WE HAVE WAR, BUT IN THAT WAR WE SHOULD BE VERY CLEAR NOT TO ANTAGONISE THE BILLION MUSLIMS IN THE WORLD. AND I THINK OUR BEHAVIOUR IN THAT RESPECT CONTINUES TO BE EXCELLENT. CERTAINLY IT HAS BEEN FAIR.

LENNICK: Do you think the people who attacked us care about such distinctions?

TELLER: I KNOW LITTLE ABOUT THEM. BUT I KNOW MANY LEADERS ON THIS SIDE. SOME OF THEM ARE MY CLOSE ASSOCIATES ARE ENGAGED ACTIVELY IN THIS WORK. AND I CLAIM FROM WHAT I HEAR ABOUT THE DETAILS THAT WE HAVE BEEN VERY CAREFUL, THAT WE ARE IN FACT NOT OVER REACTING.

LENNICK: You have a unique perspective on this, having helped provide the world with access to nearly unlimited power, both to destroy and preserve. How do you respond to the new reality of small, unaligned nations and even individual groups attempting to get nuclear weapons and other means of mass destruction?

TELLER: WITH EXTREME DISMAY, BUT NOT WITHOUT HOPE AND OPTIMISM. THE DANGER IS THERE, BUT THESE THINGS YOU MENTION ARE NOT EASY TO DO. WE FOUND THIS OUT. FOR A SMALL GROUP NUCLEAR WEAPONS ARE VERY PROBABLY MORE TROUBLE THEN THEY ARE WORTH. YOU CAN DO MORE DAMAGE FOR MUCH LESS COST. EVEN BIOLOGICAL WEAPONS, TO MY MIND THE DANGER IS THERE FOR SUCH WEAPONS TO START SOMETHING LIKE THE GREAT DISEASES THAT KILLED MILLIONS OF PEOPLE, YET THIS HAS NOT HAPPENED. WHY NOT? THESE COMPOUNDS ARE CHEAP, AND THERE HAVE BEEN ATTEMPTS, BUT THE NUMBER OF PEOPLE KILLED WERE ABOUT A DOZEN OR TWO. WHY? I WILL GIVE YOU TWO ANSWERS, ONE HONEST, ONE HOPEFUL. THE HONEST IS, I REALLY DON'T KNOW. THE HOPEFUL IS, OUR RESEARCH IN CONTRACTING CONTAGION HAS GONE SO FAR THAT FOR THE TERRORISTS TO OVERCOME IT IS NOT EASY. YOU WILL SEE THIS IS THE CASE WITH NUCLEAR WEAPONS AS WELL. ALWAYS THERE IS A BALANCE.

LENNICK: I would love to talk to you for hours but I don't wish to fatigue you. I'd like to end with a note that you touch on in your autobiography about your hopes for the future, including the work you'd like to see revived utilising nuclear power for space exploration.

TELLER: IT'S ANOTHER SOURCE THAT COULD BE VERY USEFUL TO GET EVEN TO THE NEAREST STAR WHERE WE CAN REALLY EXPECT LIFE TO EXIST. OF COURSE IT MIGHT EXIST IN OUR OWN SOLAR SYSTEM, PERHAPS ON MARS OR TITAN, IN WHICH CASE THERE IS A CHANCE, A BARE CHANCE, FOR IT TO BE DISCOVERED IN THE VERY NEAR FUTURE.

LENNICK: You write with even greater ambition than that, of plans for fusion vehicles to carry us beyond the solar system.

TELLER: ONE CANNOT GO FASTER THAN LIGHT. IF ONE WANTS TO GO TO THE NEXT STAR AND COME BACK IT WILL TAKE AT LEAST A NUMBER OF YEARS. BUT PROBABLY WE WILL NOT BE ABLE TO GO THAT FAST, SO IT WILL TAKE MUCH LONGER. THE UNIVERSE IS INCREDIBLY BIG AND THERE MIGHT BE THOUSANDS, MILLIONS, BILLIONS OF PLACES WHERE THERE IS LIFE AND WHERE THERE IS SOMETHING EVEN HARDER TO IMAGINE. UNFORTUNATELY THESE PLACES ARE INCREDIBLY WELL ISOLATED FROM EACH OTHER THROUGH SUCH IMMENSE DISTANCES. BUT WE HAVE BEGUN AND WILL CONTINUE. THAT IS VERY EXCITING TO ME.

LENNICK: As you look back on an extraordinary career, if you could write your own legacy, what would you emphasise?

TELLER: THE LOVE OF SCIENCE. I USED TO BE A SIMPLE ADVOCATE OF OUR GOVERNMENT. I HAVE CHANGED. BY BEING A LITTLE MORE CURIOUS ABOUT THE WORLD I HAVE LEARNED THAT THE DIFFERENCE BETWEEN CULTURES IS A VARYING THING, WHICH CAN AND SHOULD BE REDUCED BY EMPHASISING POSITIVE CORPORATION. WEATHER IS ONLY AN INITIAL EXAMPLE.

LENNICK: Dr. Teller, for my final question may I ask you if there is anything you regret?

TELLER: YES, CONCERNING OPPENHEIMER. I SHOULD HAVE BEEN MORE CAREFUL. I WISH I WAS. BUT AS FAR AS PEOPLE GETTING ANGRY WITH ME, I WISH THE OUTCOME HAD BEEN A LITTLE MORE GENTLE
LENNICK: Thank you Dr. Teller. It's been a great honor speaking with you today.

TELLER: THANK YOU. YOU ARE A GOOD INTERVIEWER. FOR HOW LONG DID WE SPEAK?

LENNICK: A little more than an hour.

TELLER: REALLY? THANK YOU. YOU MAY USE IT ALL.

LENNICK: Thank you sir.

TAPE ENDS.