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# Secretary of the Navy Presentation
## *24 & 25 January 1997*

*Remarks and slides as parts of a multimedia presentation prepared for delivery by D.R. Russ George, to The Honorable John H. Dalton Secretary of the Navy, his staff, and top admirals Off Site at Quantico Marine Base.*

# Sonofusion A New Source of Nuclear Energy

(Energy Too Cheap To Meter! An old story or a new paradigm?)

Secretary Dalton, Under Secretary Danzig, Admiral Johnson, Admiral Gehman, General Krulak, General Neal I thank you and your colleagues for inviting me to come to speak and work with you today and tomorrow.

It's a great honor and a privilege to be here to share with the top leadership of the Navy and Marines my view of the future of energy technology. I am very much encouraged by the keen interest and effort put forth to gather this forum together. As you listen to my presentation I am sure you will find I am optimistic about the future and welcome the opportunity to share and consider with you and the rest of the assembled experts here, views which may help you lead the Navy and Marine Corp. into the 21st Century.

Today I head a small high technology start up company in the Silicon Valley in California where we produce devices to control a new form of nuclear energy we call Sonofusion. We have recently completed successful demonstrations of the technology for the Electric Utility Industry through the Electric Power Research Institute. We are now engineering scaled up versions of the experimental devices for a variety of utility, consumer, and aerospace applications.

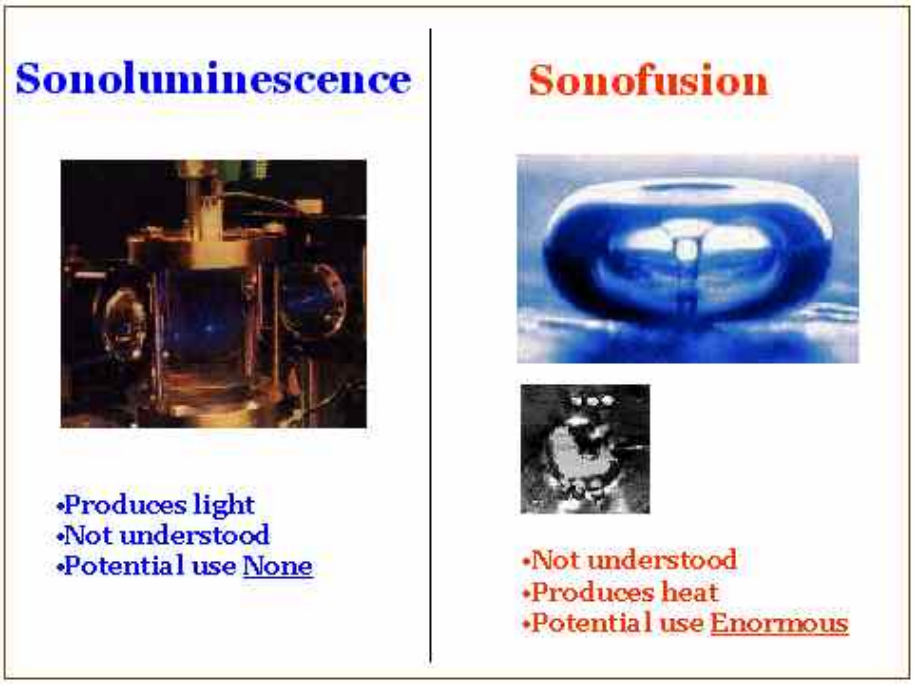
To give you just a quick overview of the background of this new technology I'll focus on two closely related phenomenon sonoluminescence and sonofusion. Perhaps the better known of these exotic topic areas is Sonoluminescence which is a brief flash of brilliant light produced by cavitation, collapsing bubbles. The origin of the flash is still unknown though many leading scientists speculate that it may have a nuclear origin. It was first reported in science 1920's.

The second lesser known topic (at least to the public) is Sonofusion or Microfusion. This is an entirely new class of nuclear reaction initiated by collapsing bubbles in association with a solid state lattice. It was first observed by scientists at my company in 1989.

There is a big difference between these two phenomenon. Sonoluminescence produces an impossibly short flash of light that has great scientific curiosity value but little

potential application. Sonofusion produces abundant heat energy and it's potential for use in energy applications is enormous.

Slide ***Sonoluminescence Sonofusion Potential***




Here is a quick run through of a historical time line in cavitation and acoustic science.

Slide - ***Sonofusion Sonoluminescence***

- Cavitation physics was developed by Lord Rayleigh for the British Admiralty 1895 to solve the problem of erosion of ship propellers.

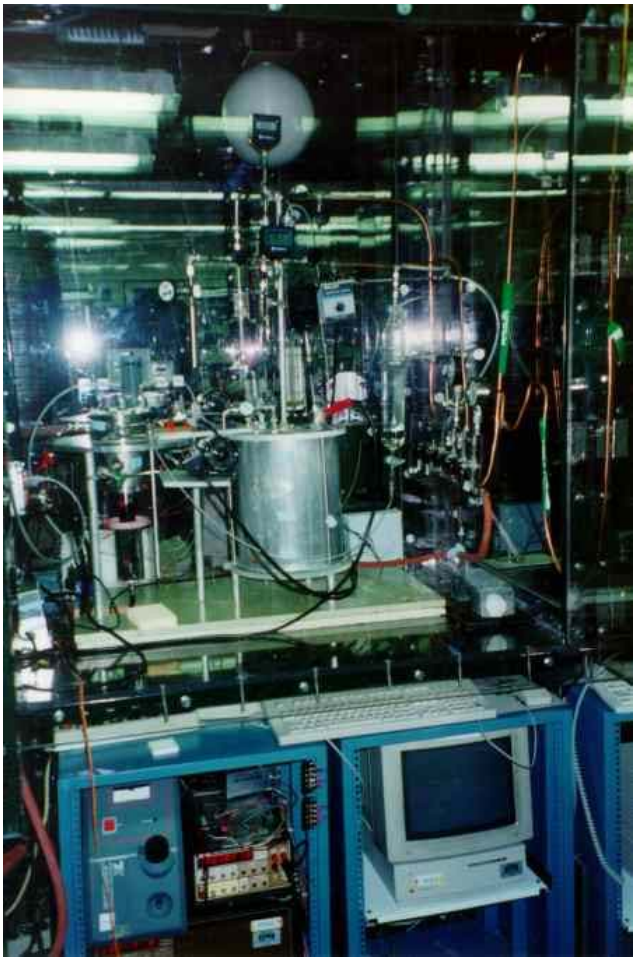
- Ultrasonics was developed for practical applications in Germany in the 1930's

- Sonochemistry re-invented in the U.S. and Germany 1980's
- A UCLA professor proposed Sonofusion in Scientific American 1994 (E-Quest had it in 1989 but was working in secret 'til 1993)
- Lawrence Livermore started a program in 1995 to seek sonofusion. Their press releases trigger NY Times reports 1996. They still haven't seen it.
- Today the field enjoys the attention of researchers in major physics labs around the world.

While we first observed sonofusion in 1989 we worked in secret for several years not certain what kind of tiger we had by the tail. By 1993 we felt we had a good handle on the technique and process. At the invitation of scientists at Los Alamos National Laboratory we took some of our experimental apparatus to the labs in the fall of 1993. For a week with LANL and NRL scientists assisting we ran experiments searching for radiation and other signature effects. No radiation was observed but we did observe some of the signature reactions we had come to know as sonofusion.

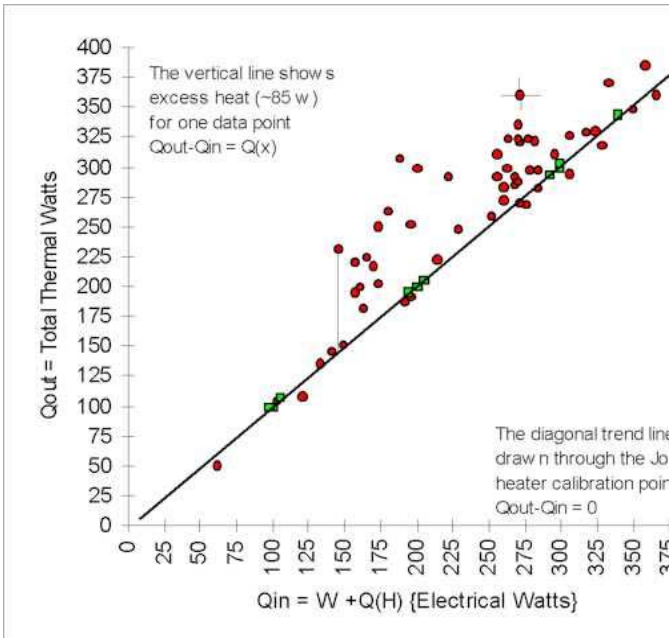
In the spring of 1994 we returned to Los Alamos for a month long series of additional experimental work this time with the cooperation of the Electric Power Research Institute (EPRI) and Rockwell/ Rocketdyne Laboratories. The experiments were successful but we were still uncertain of what we had a hold of. The reactions simply did not fit any known theoretical nuclear model (and they still don't.) This work was followed by an offer from EPRI to fund further demonstrations at SRI laboratories in Menlo Park California in 1995-96.

Slide ***MKII at SRI 1995-96***



Since heat is the most useful and easily observed product of the reactions we produce the following chart of data from the EPRI demonstration project gives a picture of heat production in our MK2 series apparatus.

Slide ***Data showing Sonofusion heat during EPRI/SRI demonstration project***

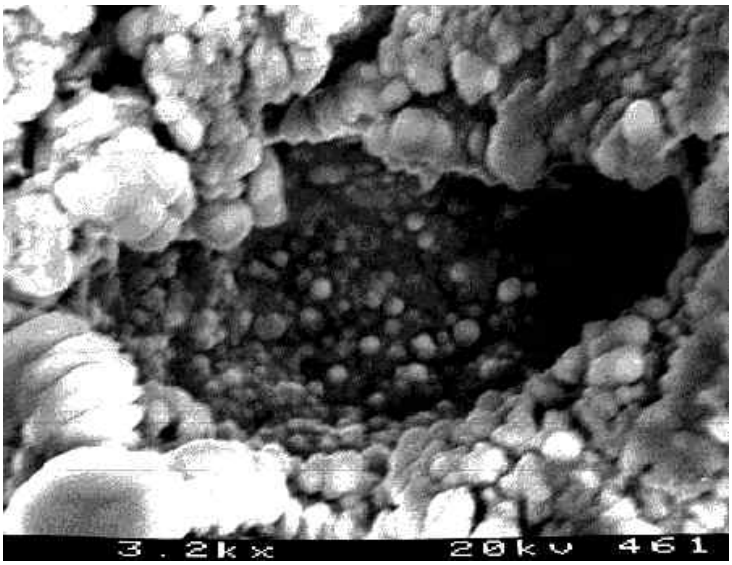



Today we work in our own labs with MK 4 & 5 series apparatus which are performing far better than the MK2 and routinely yield 5 times as much heat energy as electrical energy used.

Heat in the form of data points on a chart is sometimes hard to grasp so I've put in the next slide to show you some of the physical manifestations of that heat. The following scanning electron microscope image shows the site where a micro-nuclear explosion took place beneath the surface of the metal which was large enough to break through the surface. I like to refer to these events a being volcano like eruptions. An extensive search of the literature found only one other reference to features in metals with this same appearance. That is in classified research on the artificial and highly unstable nuclear element Californium which undergoes spontaneous nuclear fission and produces features very similar to our volcanoes.

Slide

***Eruption site where a deep microfusion explosion breached the surface***




Just to review what I've covered so far.

Slide - ***Sonofusion An New Fusion Energy Source!***

- We recently demonstrated to the Electric Utility Industry an entirely new nuclear fusion technology we call Sonofusion or Microfusion
- The technology today is producing 2:1 - 5:1 the energy output as input
- Power levels are nearing the several kilowatt range and should readily scale to tens of kw.

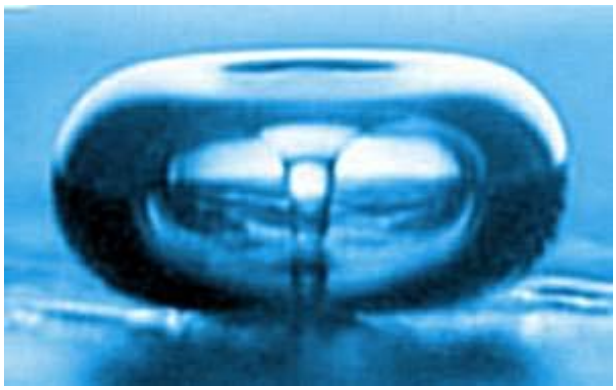
Slide - ***Basics of the technology***

- We use cavitation produced by intense ultrasound to initiate and control nuclear reactions in solid state environments

- The reactions produce heat at expected nuclear energy densities
- No penetrating radiation or dangerous waste is produced
- Just clean heat energy and helium

Our basic tool in this work is a tiny collapsing or cavitating bubble.

Slide ***Cavitation Bubble***



***A Cavitation bubble at point of collapse driven by intense ultrasound***

Slide - ***Demonstration projects***

- 1993 and 1994 at Los Alamos National Laboratory (NRL scientists present)
- 1994, 1995, 1996 for Electric Power Research Institute (EPRI) at Stanford Research International (SRI) (NRL scientists present)
- EPRI technical report in final publishing stages now, will go to member utilities within a few weeks.

One of the key methods we employ to get this work done since we have only limited resources is active collaboration with outside researchers. I like to call this my virtual lab.

Slide - ***Teamwork Via our Virtual Lab***

- Work is active and collaborative
- Formal projects EPRI, SRI, LANL, NRL (CRADA in draft stage now)
- Informal collaborations LLNL, PNL, LBL, Rockwell, Lockheed, AEC (France), MITI (Japan), Bhaba (India)
- Universities in the US, France, and Japan

In addition to our work at and with various outside groups I have described our work in oral and written presentations for DOE, NASA, NRL, EPRI, SRI, LBL, LLNL, Lockheed, Rockwell, MITI, Canon, Hitachi, Mitsubishi, Motorola, China Development Corp., French AEC, French Economic Development Agencies, Indian AEC, Canadian Energy Institute, universities, and the American Chemical Society and the American and Japanese Acoustical Society's

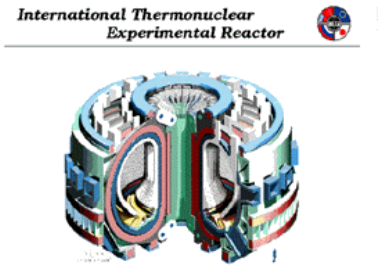
Slide - ***Where are we headed***

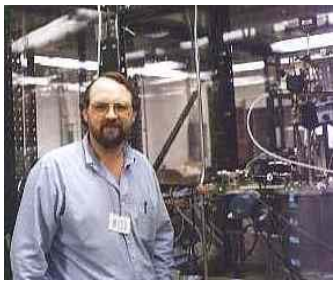
- Compact devices for industrial and consumer use, distributed local energy production
- First products will be marketed for the research lab this year

- Specialized applications space, high tech, and other needs

My presentation wouldn't be complete without a word about our competition.

Slide - ***Our Competition***



On the left is an artists rendering of a gigantic Tokamak demonstration reactor. It is not planned for completion until at least the year 2030 at a cost of more than $25 billion dollars. Compare this with the MKII reactor to my left in this picture at SRI International making substantially greater energy output than input in demonstration experiments for the electric utility industry at a cost of less than $250 thousand dollars.

I'll try to anticipate and answer one question before I finish.

Slide - ***Why isn't this in the headlines?***

This is a question I am always asked about this breakthrough. Historically it's always been difficult get a technology launched.

***"What sir you would make a ship sail against the wind and currents by lighting a bonfire beneath her decks. I pray you excuse me I have no time for such nonsense."*** *Napoleon Bonaparte to Robert Fulton, upon hearing of the latter's plans for a steamship.*

We're just now stoking up the boiler Mr. Secretary we ought to be under way real soon!

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