INTERVIEW: DR. DON GUBSER

We Have to Get Youth Excited About Science

Dr. Don Gubser is the Head of the Material Science Division at the Naval Research Laboratory in Washington, D.C. He also teaches at George Washington University. He was interviewed on Sept. 12, 2006 by Wesley Irwin.

Question: What do you do at the Naval Research Lab?

The Naval Research Laboratory is the corporate laboratory for the Navy. We have multi-spectrum areas of research, but one of those areas is in material science. I'm in charge of the material science division at NRL which deals with a whole range of materials, from structural materials, to worrying about ship's steel, trying to make new steels which would be more resilient to blast, to some very sensitive electronic devices which can be used for sensitive communications.

My particular area is in superconductive materials, which can be used for new power sources and energy-saving devices on ships. Looking at the fundamental aspects, we are a more basic research laboratory, trying to stay in touch with the science, and understanding how that science can be applied to Naval applications. We are not an engineering laboratory, building motors, or electronic circuits, etc. We're more focussed on the materials that may lead to advances in those applications.

Question: How much of the NRL funding comes from the government, and how much comes from the private sector?

Very little from the private sector. I would say our laboratory is about 95 percent government-funded. About 90 percent is funded from military sources and 5 percent from government sources.

Question: You mentioned the work in changing the internal composition of some of these Naval engines. Are there any other projects you see on the horizon for materials research development?

Some of the more exciting areas are in nano-crystals. Nano-science is one area where we're trying to exploit the unique properties of the nano-scale to develop new sensors, new photovoltaic devices.

We're also looking at using material systems, to do some functions which a normal material won't do, for instance, putting embedded electronics into a composite structure—using composites not just for structure, but as structure and property together.

I would say the materials integration into a materials system is a very exciting area we're moving into, as well as nano-science, exploiting the uses of small-scale materials.

Question: Have the current Congressional budget cuts affected your research?

My only concern is a longer-range, general one. I have not seen the science budget in my particular laboratory increasing at the rate of inflation of doing science. So it's not a budget cut; it's just a constant little annoyance that each year we seem to be going down by a percent or two in buying power, and over the long term, that can have a significant effect. In general, the funding has not kept up with the inflation of doing science.

Question: What do you see as the potential for economic cooperation in the world for some of the superconductivity and other technologies that you are specializing in?

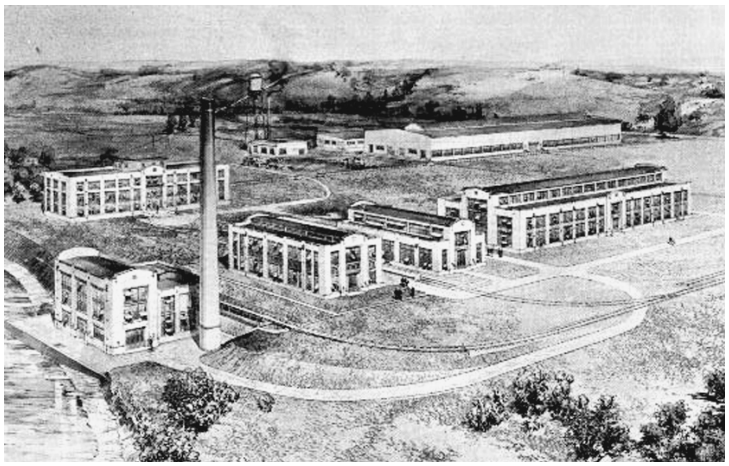
George Carruthers/NRL

Students at a Naval Research Laboratory space science workshop learn to operate a sounding rocket ultraviolet spectrograph.

I can answer that with two different hats. Firstly, with large scale applications of superconductivity, you're talking about such things as fusion energy, and that's the ITER [International Thermonuclear Experimental Reactor] project. That can't go on without international cooperation, and that certainly is what's happening.

I think the superconductor supercollider, which did not have international funding, is an example that you can't have these large international projects without sufficient funding and collaboration.

On the military side, collaboration is somewhat more restrictive because of the classified nature of certain military projects. . . .



The original site of the Naval Research Laboratory in Washington. Congress, acting upon the recommendation of the Naval Consulting Board of the United States, under the chairmanship of Thomas Alva Edison, appropriated funds for the establishment of a naval research laboratory in 1916. Construction began immediately, but was not completed until 1923.

Question: What about the development of naval propulsion systems? In particular, the development of magnetic propulsion to launch objects into space and so forth, as a launching system.

If you're talking about ship propulsion with magnetohydrodynamics—which is passing currents through seawater in the presence of a magnetic field—although it's technically feasible, it's a very inefficient way of doing it and it probably would not happen, even though there are some small demonstrations.

If you're talking about launching projectiles across in a rail-gun type manner, the Navy is working on rail-gun technology. In this division, what we're focussing on most is the wear and tear of the rail, since we're the materials division.

In fact, probably one of the biggest problems with the rail gun, is that you're passing very high current through a very high speed, moving contact, and it's tremendous wear on the sliding rails. I think the science is definitely there and is very feasible. The Navy believes it is very feasible.

It's a matter of whether we can solve some of the materials-related problems in this new regime of high-speed sliding contacts. It's something we're working on. It's a very exciting future, and I'm bullish on it.

Question: It's sounds great! Other scientist I've spoken with at the conference commented on how the U.S. has slipped in various science fields, including in recruitment of youth. Do you see that same sort of phenomenon in your field, and if so, do you have any proposals for reversing the process?

At NRL, we populate our science staff by hiring people from a post-doctorate pool. We get post-docs from universities, and we get a fairly good number of post-docs, although we're finding a larger and larger percentage of those are not U.S. citizens. This does create a problem, specifically in the Navy, or the military in general, where you need a higher level of clearance.

I also teach at George Washington University, and in my classes the predominate number of people are foreign born. I've noticed in the past 20 years that more and more students in training are foreign-born and now, recently, a lot of those are going back. Although at this moment, we're still able to hire the people that we need, I do worry about that in the long term.

How do we excite the U.S.-born to get into some extremely exciting areas in science across the board, from superconductivity, to electronics, to propulsion? It's a very exciting area, and it's difficult to reach some of the younger people. You probably have to reach them in high school or even in junior high school to get them excited. . . .

One of my best lectures was when I described to my class what I did as a scientist at the Naval Research Laboratory. I described the excitement of the field I was in, what was going on, and in fact I got an applause at the end of the lecture. It really reached out to the class. . . .

As far as reaching youth, let me just tell you a story: I used to go to my children's grade school class—they'd want some scientist to go in and talk to them—and I used to bring in liquid nitrogen and throw liquid nitrogen on the floor and do all sorts of cryogenics demonstrations. The class loved it!

One day I was exercising at the NRL gym, and a person came up and introduced himself to me and said: "I was in your science class. The reason I went into the science field was your scientific demonstration. It got me so excited I just went on into science."

That really made me feel good, so I said above, "junior high or high school," but maybe even younger, because this is a guy I talked to when he was in the first or second grade!

Question: It certainly seems that when youth are involved in doing the actual hands-on experiments and reliving the discoveries for themselves, it creates a much better dynamic in the classroom to actually develop knowledge than merely memorizing something out of a textbook.

I've been in the scientific field now for 40 years, superconductivity for most of that time, and I've been at the Naval Research Laboratory for 38 of those years. I have felt fulfilled in science. It has been truly exciting. I have had some truly exciting moments when I have discovered things. I enjoy telling people about it, and it has been a very rewarding career.

I certainly would like to stimulate a lot of other youth to go into this area because they can have great satisfaction if they dedicate their life to it.