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Chairman Mike Rogers
Ranking Member Jim Cooper
Strategic Forces Subcommittee
House Armed Services Committee
Rayburn 2216
House of Representatives
Washington, DC 20515

Dear Mike Rogers and Jim Cooper,

The NAS report on "Peer Review and Design Competition ..." provides useful commentary on peer review and background on the nuclear weapons design and maintenance process.

However, I believe that the great emphasis on "design competition" in the nature of competitive designs of new warheads for missiles or bombs seriously misses the point and does not assess the very substantial costs-- both opportunity costs and the spur that such a program gives to international competitors and potential enemies, who have much more to gain from innovations and weapon development than does the United States. The appearance of continuous active nuclear weapon design competition can have negative as well as positive benefit.

I particularly take exception to the argument that the U.S. nuclear deterrent is impaired by the lack of a visible series of competitive designs and prototyping of new nuclear warheads and bombs. I can understand that whatever the merit of an argument, it can apparently be strengthened by indicating that without the proposed program, U.S. deterrence of nuclear war or war in general will suffer,

> *"p. 5: they did not exercise the complete set of skills required in the NNSA complex to design nuclear weapons that would be an effective deterrent, nor was the credibility of any design assessed by fabricating a device or by non-nuclear testing."*

but we have had experience with this argument before:

> In support of the National Ignition Facility, in the years following the 1992 moratorium on nuclear testing initiated by the Administration of President George H.W. Bush, it was argued that without continued nuclear explosion testing, evident the world over by seismic records of the underground nuclear explosions at the U.S. national test site, nuclear deterrence could be maintained only by the achievement of "ignition" at NIF. I took the other side in this discussion, arguing that such a proposal was self-serving and

that the argument itself contributed to the *weakening* of deterrence, because the United States clearly had many nuclear weapons which had been tested and could be maintained indefinitely in the future by what is known now as a LEP (Life Extension Program); More particularly, the suggestion that such a force-in-being of tested nuclear weapons suffered in deterrent value because ignition could not be achieved in a charge of fusion fuel a million times smaller than that in a weapon was both logically deficient and both politically and technically wrong headed. Unforeseen difficulties, either in principle or in practice might prevent the achievement of ignition at NIF, without in any way impairing the continued ability of the United States to produce two-stage thermonuclear weapons.

And that is how it turned out—failure to achieve ignition, but few had believed the hype.

Thus I think it is highly undesirable to argue that routine design competitions, through the prototype stage of the nuclear explosive package-- NEP-- are essential to the maintenance of robust U.S. nuclear deterrence.

In fact, I have no animosity to the idea of design competition and proposed such in a paper of 2008 and in my testimony to the congressionally mandated Commission on the Strategic Posture of the United States.[1] As for motivation of the technical teams in the two NNSA design labs, I judge that effectively contributing to the continuing effectiveness of the stockpile through life extension programs (LEP) is judged a worthier goal than winning a football-game-like competition.

There are very substantial costs associated with such design competition, and goals of infrastructure advancement should be to reduce greatly the cost of activities in the U.S. nuclear weapon design laboratories, and also the time required for planning, programming, and carrying out such programs.

Furthermore, the Report states, *"Moreover, as other nations pursue new designs or strategies that could constitute serious threat evolutions, the United States could find itself in a precarious security situation were it not to maintain nuclear weapon design, development, and production skills to address such evolving demands."* implying that new U.S. nuclear weapons would be necessary to respond to new nuclear weapon designs by others. This is rarely the case.

The Report makes a stab at stating the magnitude of the effort required in such a design competition,

> *"Roughly speaking, the committee imagines a design competition as involving a few dozen laboratory staff members, with a larger number in the first year of each competition, plus some prototype development and experiments up to and including hydrodynamic tests. These parameters suggest a scale for the endeavor that the committee deems appropriate.*"

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[1] http://fas.org/rlg/9007TEST1.pdf
https://www.armscontrol.org/act/2008_12/Garwin "A Different Kind of Complex: The Future of U.S. Nuclear Weapons and the Nuclear Weapons Enterprise," by R.L. Garwin includes
"Yet, the work done so far on the RRW program has re-energized the nuclear laboratories and their involvement in the nuclear weapons complex. Such a major effort should be undertaken every five years or so. I know firsthand from my involvement with this program that new insights have arisen from the new focus on simulation and computation."

but the authors neither provide any rationale for this statement, nor work out its program cost or opportunity cost. And in my opinion it does not go far enough, because the NEP is not a weapon in itself, until it is integrated with the bomb or warhead, on which it puts demands, and which, in turn, influence the design of the NEP.

The load and vibration characteristics of Navy and Air Force-strategic reentry vehicles and their corresponding NEPs are quite different-- posing now well-recognized impediments to the "3 + 2" approach.

The Labs do important work in areas of nonproliferation and counter-terrorism, in a much larger volume of design space than would be involved in analyzing and developing alternative warheads for the U.S. stockpile. As with learning a foreign language, this provides insights into elements of U.S. weapons.

Since the Administration of President George H.W. Bush, the U.S. nuclear weapon program has been based on the judgment that the U.S. does not need new nuclear weapon capabilities-- a judgment that I share. The continued viability of the nuclear deterrent has been focused on ensuring that the U.S. nuclear weapons will continue to function decade after decade, by LEPs that include, if necessary, production of new plutonium pits, refreshment of the high explosive and other elements subject to deterioration, and the substitution of thoroughly tested components either in the NEP or external to it.

It should be repeated that many of the aspects of a nuclear explosion important in wartime have never been tested in underground nuclear explosion tests, where the NEP is at rest, surrounded by rock rather than by air, not subject to rotation or deceleration in the range of tens of times that of gravity, and the like. It is strange, therefore, that the essential role of realistic "flight testing" now achieved with the "HFJTA"—High-Fidelity Joint Test Assembly-- is eliminated from the requirement for prototypes.

Finally, if the United States argues that the continued development and readiness for manufacture of nuclear weapons with new characteristics is essential to its deterrence, how can other states resist such arguments from their nuclear weapon establishments? Is it really in the United States interest to have vigorous competitions not only between two U.S. nuclear weapon design laboratories but also among all the weapon labs of the world? And what impact will ongoing vigorous design competitions have on the resolve of non-nuclear-weapon state members of the NPT to support the NPT and the CTBT?

Far better is continued emphasis on improving the robustness of command and control, surety of nuclear weapons storage and transport, and increased capability for preventing nuclear weapon theft.

/ Richard L. Garwin /

Richard L. Garwin
Relevant biography at https://www.armscontrol.org/act/2008_12/Garwin and also appended.

Richard L. Garwin was born in Cleveland, Ohio, in 1928. He received the B.S. in Physics from Case Institute of Technology, Cleveland, in 1947, and the Ph.D. in Physics from the University of Chicago in 1949.

He is IBM Fellow Emeritus at the Thomas J. Watson Research Center, Yorktown Heights, New York. After three years on the faculty of the University of Chicago, he joined IBM Corporation in 1952, and was until June 1993 IBM Fellow at the Thomas J. Watson Research Center, Yorktown Heights, New York. In addition, he is a consultant to the U.S. government on matters of military technology, arms control, etc. He has been Director of the IBM Watson Laboratory, Director of Applied Research at the IBM Thomas J. Watson Research Center, a member of the IBM Corporate Technical Committee, Adjunct Research Fellow in the Kennedy School of Government, Harvard University; and Adjunct Professor of Physics at Columbia University. He has also been Professor of Public Policy in the Kennedy School of Government, Harvard University. From 1997 to 2004 he was Philip D. Reed Senior Fellow for Science and Technology at the Council on Foreign Relations, New York.

He has made contributions in the design of nuclear weapons, in instruments and electronics for research in nuclear and low-temperature physics, in the establishment of the nonconservation of parity and the demonstration of some of its striking consequences, in computer elements and systems, including superconducting devices, in communication systems, in the behavior of solid helium, in the detection of gravitational radiation, and in military technology. He has published more than 500 papers and been granted 47 U.S. patents. He has testified to many Congressional committees on matters involving national security, transportation, energy policy and technology, and the like. He is coauthor of many books, among them Nuclear Weapons and World Politics (1977), Nuclear Power Issues and Choices (1977), Energy: The Next Twenty Years (1979), Science Advice to the President (1980), Managing the Plutonium Surplus: Applications and Technical Options (1994), Feux Follets et Champignons Nucleaires (1997) (in French with Georges Charpak), Megawatts and Megatons: A Turning Point in the Nuclear Age? (2001) (with Georges Charpak), and "De Tchernobyl en tchernobyls," (with Georges Charpak and Venance Journe) (2005).

He was a member of the President's Science Advisory Committee 1962-65 and 1969-72, and of the Defense Science Board 1966-69. He is a Fellow of the American Physical Society, of the IEEE, and of the American Academy of Arts and Sciences; and a member of the National Academy of Sciences, the Institute of Medicine, the National Academy of Engineering, the Council on Foreign Relations, and the American Philosophical Society. He served on the Council of the National Academy of Sciences 1983-1986 and 2002-2005.

The citation accompanying his 1978 election to the U.S. National Academy of Engineering reads "Contributions applying the latest scientific discoveries to innovative practical engineering applications contributing to national security and economic growth." He received the 1983 Wright Prize for interdisciplinary scientific achievement, the 1988 AAAS Scientific Freedom and Responsibility Award, the 1991 Erice "Science for Peace" Prize, from the U.S. Government the 1996 R.V. Jones Foreign Intelligence Award and the 1996 Enrico Fermi Award, the Federation of American Scientists: Public Service Award 1971 and 1997, University of Chicago Enrico Fermi Institute and Departments of Physics and Astronomy: Public Service Medal (2002), Case Alumni Association: Gold Medal (2002), Academie des Sciences (France): La Grande Medaille de l'Academie des Sciences-2002, and Fellow of the IEEE (November 2003) "for contributions to the application of engineering to national defense." In 2003 he received from the President the National Medal of Science.

From 1977 to 1985 he was on the Council of the Institute for Strategic Studies (London), and during 1978 he chaired the Panel on Public Affairs of the American Physical Society. He is a long-time member of Pugwash and has served on the Pugwash Council.

His work for the government has included studies on antisubmarine warfare, new technologies in health care, sensor systems, military and civil aircraft, and satellite and strategic systems, from the point of view of improving such systems as well as assessing existing capabilities. For example, he contributed to the first U.S. photographic reconnaissance satellite program, CORONA, that returned 3 million feet of film from more than 100 successful flights 1960-1972. He contributed also to the current electro-optical imaging systems and various electronic intelligence satellite systems deployed by the U.S. government.

He has been a member of the Scientific Advisory Group to the Joint Strategic Target Planning Staff and was in 1998 a Commissioner on the 9-person "Rumsfeld" Commission to Assess the Ballistic Missile Threat to the United States. From 1993 to August 2001, he chaired the Arms Control and Nonproliferation Advisory Board of the Department of State. On the 40th anniversary of the founding of the National Reconnaissance Office (NRO) he was recognized as one of the ten Founders of National Reconnaissance.

Since 2009 he has been a consultant to the Office of Science and Technology Policy in the Executive Offices of the President. In 2010 he was a consultant to Secretary of Energy Steve Chu on the Deep Water Horizon (BP) oil spill, and in 2011 he supported Secretary Chu again on the U.S. response to the damaged reactors at Fukushima Dai-ichi.

(Biography current as of 08/13/12)