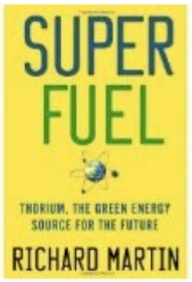
SPACE JAPAN BOOK REVIEW

From a satcom researcher point of view

Reviewer: Takashi Iida, Editorial Advisor



http://www.amazon.com

Richard Martin: "Superfuel, the Green Energy Source for the Future", Macmillan Science, 2012.

In the first part of this book, it was written that a researcher who studied a method to use nuclear energy as power of the rocket which carried freight to space in NASA institute paid attention to a thorium nuclear reactor, and it seemed that this book deserved to be this column. This book review is based on Japanese translation version.

Mr. Richard Martin of an author of this book is a science writer and a scientific journalist graduated from Yale University and the University of Hong Kong. He has written many articles relating to an energy problem in magazines including "Wired", "Time" and "Fortune". In addition, he charges a writing of an energy investigation report by clean technology in Pike Research company. Because Stewart Brandt [1] related to Whole Earth Catalog which affected network science has been concerned in early 1990's about "Wired" magazine [2], this seems to be to some extent influential magazine. I remember the sense of intimacy to the author who is a residence in Boulder, Colorado because I had stayed there for one year.

This book states that a thorium nuclear reactor, comparing it with a uranium nuclear reactor, has the next advantages to solve in substance the various problems that can trouble us now.

- Thorium has deposits nearly 4 times in comparison with uranium, and it can supply energy which is a source of electricity to human society for the next several thousand years.
- It cannot produce nuclear weapons with a thorium nuclear reactor.
- The thorium fluoride molten salt reactor which is one of an influential candidate of a thorium nuclear reactor is usable as a garbage dumping place of waste nuclear fuel. In other words, a nuclear fission material of disposal reentry vehicle and waste nuclear fuel of an uranium nuclear reactor can be used as fuel, and left waste nuclear fuel can be in a stable condition within 300 years and it needs not not be stored by digging a hole up in the ground for several thousand years.

Because the situation over a thorium nuclear reactor, structure of a nuclear reactor and a characteristic of each atom are described with an episode in detail, it deserves reading, although there are many places that I can not follow due to an amateur to the reactor. I have interest in rather how research and development and practical use of a huge project like a nuclear reactor were pushed forward than knowledge of nuclear reactor itself.

As it became clear that an atom bomb could be realized from a study including uranium and radioactivity, the U.S. inclined all powers in order to have an atom bomb earlier under World War II than the Nazis. By fortunately also that Hitler did not show interest in an atom bomb, the U.S. was able to develop an atom bomb earlier. But it was unhappy that two atom bombs were dropped on our country and the pitiful damage was brought. When the World War II was finished, the atom bomb development organizations and persons concerned finished their duty. It was with a problem how to use the developed technology. By the World War II, the large-scale sea battle became the past scene and only aircraft is not a panacea as a military force by the progress of the radar. In such a situation, a submarine attracted attention, and a concept of the dreamlike nuclear submarine was come up, that the fuel supplying was not necessary and could go into hiding and work secretly for many days.

A successful development of the nuclear submarine was accomplished by U.S. Navy Admiral H. Rickover. A submarine was designed on the basis of a German submarine to move with high-speed calmly underwater, and the width was decided with 8.5m. Therefore, a pressurized water reactor (a light water reactor) using uranium as a small nuclear reactor was designed and really succeeded. A light water reactor was built to accept a special demand of the submarine which was small space, but this development invited an ironical situation. In other words, bringing electricity in a city afterwards, it has become a main technology for nuclear power industry to supply around 20% among world electricity.

On the other hand, a nuclear reactor using thorium was studied from those days, and the first on the list was A. Weinberg, Director of Oak Ridge National Laboratory. This book describes these two people who completely differ in character in spite of similar growth in detail. I know the development of nuclear submarine as a superior example of the research management method by H. Rickover [3]. But it was a new knowledge for me that he was described in this book as a person who was endowed with talent of his defeating an enemy at the same time to be excellent. On the other hand, A. Weinberg seemed to be a person who was excellent

and gathered up everything while hearing an opinion of a person of circumference without making an enemy.

By the way, a plan of an atomic energy plane happened by the air force when the naval nuclear submarine went into service. But a plane is different from a ship. There are limitation of both weight and capacity and a big risk when it crashed. Therefore, this concept did not seem to come true, but this concept was pushed forward strongly, and A. Weinberg, Director of Oak Ridge National Laboratory, was made the person in charge of its research and development. He was not so positive and its development had not been advanced, since originally it seemed not to be a realization-related plan. President Kennedy decided its cancellation after all. As a result, the responsibility of making a blunder of the development was attributed to A. Weinberg. Originally he promoted a thorium nuclear reactor. In fact, he succeeded in development of a small experimental thorium fluoride molten salt reactor of 7,500 kW in 1965, and it had run for four years. However, a study budget of a thorium nuclear reactor was largely reduced with the downfall of A. Weinberg, too.

In spite of many merits of the thorium nuclear reactor, the reason why its development has not been advanced is that the system of an uranium nuclear reactor is completed now in the atomic energy industry. In addition, because uranium is cheap, it is lack of incentive to establish new system of the thorium nuclear reactor whose effectiveness is not completely proved.

Nevertheless, the author of this book insists that the world energy circumstances would be improved for the better, if the thorium nuclear reactor is utilized. He recognizes that a renewable energy, a carbon capture and storage technology and a space-based solar power can not be put to practical use due to economical reason. On the contrary, global warming advances by discharge of CO_2 due to burning oil and the human undergoes a crisis of the life and death, if the nuclear reactor is not utilized by anti-nuclear power movement. This book describes nothing about shale gas, but I imagine the same to drain CO_2 if burn it. What we should pay attention is that thorium is provided by a process gathering a rare earth. I am interested whether rare earth export regulation by China leads to preservation of thorium resources.

I knew a thorium nuclear reactor by reading articles [4][5] that Mr. Takashi Kamei wrote in “My viewpoint” of the Asahi Shimbun over twice. This book introduces Mr. Kamei’s activity about a thorium nuclear reactor in Japan. It is not described a lot, but a design active scantily is told.

The author of this book has a viewpoint of promoting thorium nuclear reactor after having considered about an accident of Fukushima nuclear power generation. However, the anti-nuclear power movement group seems to consider that even a little radioactivity released from a thorium nuclear reactor is dangerous. However, according to the book review by Tatsujiro Suzuki [6], the document [7] points out that there is clear classification of "safe" or "danger" about radioactivity released from nuclear power generation in almost all of books in a bookstore. Readers should consider the important fact of “Risk does not become zero” and “Risk management has trade-off by all means” through the document. We will have to think about this point.

Finally, I describe two matters that I am attracted interest in what is written in this book. Firstly, the number of atomic energy-related graduate school students decreased sharply in U.S. for a period of the latter half of 1990's, but this state changes slowly recently, and it is now said that the field of atomic energy is considered to be promising. Secondly, about a problem of tritium generated by uranium nuclear fission, it is described in this book that salt used as intermediate coolant of thorium fluoride molten salt reactor already captures tritium, and the captured tritium can be removed in a re-processing system. These facts seem to be what we could have hope in the future.

In addition, a short book review [7] of the Nikkei Shimbun is useful. Furthermore, references [9] and [10] are also useful.

References

[1] Takashi Iida: “[Discussion] Post-Web 2.0 and Looking for Reason Why IT Venture Doesn't Grow Up in Japan", Space Japan Review, No.74, June/July, 2011, http://satcom.jp/English/e-74/discussione.pdf

[2] http://en.wikipedia.org/wiki/Wired_(magazine)

[3] M.Hans and A.Levine: “The Management of Research Institutions”, NASA SP-481, 1984.

[4] Takashi Kamei: "My Viewpoint: Low Carbon Society—For industrial reform by thorium ", Asahi Shimbun, Jul.27, 2010 (in Japanese).

[5] Takashi Kamei: "My Viewpoint: Nuclear Power Generation—Study thorium power plant not born nuclear weapons", Asahi Shimbun, Nov.28, 2008 (in Japanese).

[6] Tatsujiro Suzuki: "Junko Nakanishi’s ’Risk Studies of Nuclear Accident and Radiation’ The realistic recommendations to the decontamination and discussion for return", Nikkei Shimbun, Jun.8, 2014 (in Japanese).

[7] Junko Nakanishi: "Risk Studies of Nuclear Accident and Radiation", Nippon Hyoron Sha, 2014 (in Japanese).

[8] "Richard Martin’s ‘Superfuel’ Disappeared from history ‘rival’", Nikkei Shimbun, Nov.17, 2013 (in Japanese).

[9] Kazuo Furukawa: “Safety Revolution of Nuclear Power Plant”, Bungeishunju, Ltd., 2011 (in Japanee).

[10] R.Yoshioka and M.Kinoshita: “Present Status of Thorium Nuclear Reactor Development”, Document at 17th Atomic Energy Commission, No,2-2, May 9, 2013 (in Japanese).