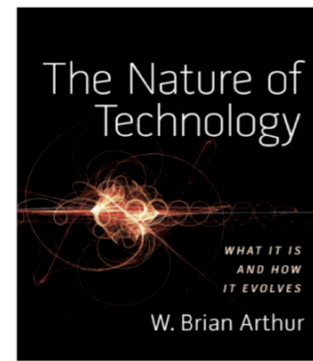


## SPACE JAPAN BOOK REVIEW

From a satcom researcher point of view  
Reviewer: Takashi Iida, Editorial Advisor, AIAA Fellow



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### W. Brian Arthur: “The Nature of Technology What Is and How It Evolves”, Free Press, 2009.

I have paid attention to the author, W.B.Arthur, of this book, since I cited his outlook on appearance of Internet that resembles the dawn of the Industrial Revolution, in the Reference [1]. I think that this book is suitable as a book review of Space Japan Review, because this book includes a discussion about technical development and innovation and thus space development related examples are quoted. Dr. Arthur advanced to economics after he learned electrical engineering and he is known as one of pioneers on chaos theory. He is an invited professor of Santa Fe Research Institute and also a visiting researcher of Palo Alto Research Institute. Since he likes an airplane very much and obsolete radio equipment, I imagine that we feel close to him.

The principal claim of this book is to reverse the traditional view that technology contribute to the economy, while the economy is not only a result because technology develops evolution autonomously like an organism, as mentioned in the book review of newspapers [2] [3]. New technology is created by a combination of existing technologies, and the constitution element of the technology is also a technology. In this way the technology becomes one of the chaos systems. I would like to stop thinking because I am a layman about economics. Rather, I would like to introduce the followings written in this book interesting engineers and/or researchers of communications technology.

At first what kind of relationship there is between science and technology. There exists a thought that technology is an applied science, but Dr. Arthur has a different thought. This is because science and technology ties firmly each other and technology is woven into the science, and technology supplies science technical skill and equipment to obtain insight through observation and inference. If technology is a scientific application, I have felt sense of incongruity due to a nuance that technology is in the down stream while science is in the up stream, like that designing work is in the up stream and manufacturing one is in the down stream. But Dr. Arthur's way of thinking sweeps away my sense of incongruity.

In addition, a radar technology is described as an example that technology is developed by a combination of technology in this book many times. I am interested in a radar, because it was my study object at the age of a graduate student. In 1930's before development of a radar, a plane which crossed over the Strait to the Great Britain was detected by a concrete large sound mirror of a little less than 5 m diameter and a sharp human being of hearing to detect its sound from around 32 km away. This technology became the radar which is far much effective in the World War II by electric signal technology. A large power transmit tube which is fundamental for a radar is developed as follows. In 1940, John Randall and Harry Boot hit on a principle of cavity magnetron. A principle is derived from a tip of something. Randall got an idea of cylinder type resonance cavity from Heinrich Hertz's book that he watched at a bookstore.

By the way, the space related technology is described in this book as an example whose project is extremely complicated, namely the example of technology formed by the constitution element advanced several steps from the direct use of a technology. For example, the Mars rover is a combination of drive motor, digital circuit, communication system, steering servo, camera and wheel. The space plan to the moon is also assembled by the technologies which are learned from various precedent technology.

Furthermore, the innovation, a process that creates a new thing includes four mechanisms.

They are a new solution in the technology that is innumerable small advancement and adjustment piled up, completely new technology, technology that is developed in addition to new technology, and the main body of the whole technology. All of these various sides of innovation are important and are different merely from originality. The innovation can emerge when people faces plural problems and many problems recognized particularly enough. In other words, the innovation is born when people devoted to hit on a solution finally. The innovation is regarded as technical development and/or evolution. The invention of a triode tube in the beginning of 1900's is given as an example: Lee De Forest experimented with the method to raise receiving sensitivity for radio signal. He got a triode tube by inserting the third electrode to a diode tube. This was a long-awaited invention for a radio technology of those days.

In addition, it is assumed in this book that technology itself self-produces in the same way as the theory of evolution. Then a question raises whether the technology continues developing without stopping. Dr. Arthur denies the end of technology development. There are two reasons. First, if needs is developed consistently, and discovery of a new phenomenon is possible, it is enough to let technology development permanently drive. Second, technology has always a kind of problem. Besides, many are a certain plural cases. Adoption of fuel technology using coal raw materials causes global warming. Adoption of the nuclear energy which is eco-friendly energy causes a problem of radioactive waste. If there is a problem, a solution is born, and the phenomenon that a problem is given to another problem again does not seem to change all the time in future either. Technology cannot but change without stopping as far as there is this phenomenon. In this book, Dr. Arthur says that to give up technology is to cease being a human being. Technology plays a major role in shaping human being.

Finally, a very interesting thing is described in this book. There is a phenomenon that the forefront of new technology development concentrates on a single country or area. For example, the Industrial Revolution concentrated to the U.K., chemical industry to Germany and IT to the U.S. Why is this phenomenon occurred? If the technology is born from technical information or scientific one, the innovative technology should be born in any country by engineers and scientists having the knowledge. On this point, the genuine high technology is born from the element which is not knowledge and it is called with "the deep craft" in this book. Although the deep craft is based on science, it is based not on a simple knowledge, but on aggregate of plural intellect. See this book for more detail. It is obtained by bringing together the culture of faith, that is recognized commonly, and the tacit culture of universal experience. I remember the followings in conjunction of the description above. Mechanical knowledge and skills of the Hellenistic period, in itself, had no shortage of technology for the Industrial Revolution. But the Industrial Revolution did not occur in spite of that [4]. The Renaissance came into existence in Italy if I said more. What is it in Japan? Probably Buddhism culture of the Nara era, Genroku era culture of the Edo era may correspond to it in the past. Then, what is it in the future? It will be necessary for us to think well.

## References

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