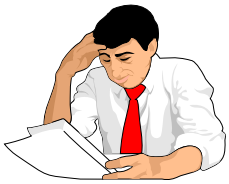

Methodology of Research and Development

From Research of Satellite Communications to General Research

❹ (Series final) Shock of the East Japan Great Earthquake and National Research

Takashi Iida, JFSC Special Advisor, AIAA Fellow

In this opinion column, it is intended to argue how to conduct research and development (R&D) on satellite communication, especially for national security. This is why we step forward in the 21st century of the chaos which was determined by the terrorist attacks to the U.S. on September 11, 2001, and in order to deal in a century of chaos, R&D of national security, especially satellite communications becomes particularly more and more important. On that occasion, an R&D methodology in general R&D as well as one of satellite communications is argued based on experience of the management of Communications Research Laboratory of the author's former job. Therefore, the content may be based on the author's own dogmatism and prejudice, but please forgive me because of an opinion column.

At this series No. 1, under a subtitle: "Competition Predominance and Researchers' Attitude", the topics of competition dominance and innovation, researchers' attitude, and what study should be done are considered. Therefore, at this series No. 2, it is considered how the research management should be done. Then at the series No. 3, how to proceed studies related to national security was discussed. At the series No. 4, as the series final, I would like to discuss how the shock of the East Japan Great Earthquake has influenced to the R&D in Japan, how to manage it, and what the national research institutes should conduct. In particular, the author suggests next two points for the science and technology policy: to let shift the national R&D to the national security and to let breed deep craft to wake up technology innovation to turn on the offensive.

◆◇Shock of the East Japan Great Earthquake◇◆

In this series of column, I have discussed how to proceed the national security related research while taking satellite communications for an example so far [1][2][3]. At this column, as a series final, based on the shock of the East Japan Great Earthquake, I would like to discuss what change should be conducted on the research management, especially on the management of national research. Although the manuscript of this article is written after one year of the East Japan Great Earthquake, the terrible experience of the disaster has not been faded because a very big earthquake continued for a few seconds even at my residing place. At first, three shocks by this great earthquake disaster that the author have been impressed are described, and an argument about the cause is developed focusing on these shocks in the followings.

First, watching the situation attacked by Tsunami on that day of the disaster on TV was a great shock, but in particular, characters of 'SOS' on the roof of a public institution such as a hospital particularly gave me shock. Although I am afraid of a problem of a copyright, **Figure 1** is anyway shown [4]. That is a great shock because the situation of 'SOS' characters on the roof could not considered at the present when a communication system is developed very well. Is this a problem of communication technology, or a matter of policy? A communication concerned people should feel concern in anyway.

The second shock is that there was not a robot which can be used in our country on the occasion of a serious accident of a nuclear power plant. Our country wasn't a major robot country?
I am amazed that the weakness was exposed. Whether conventional research and development (R&D) is a problem [5].

The third shock is that our country does not have a database of how much a botanical plant absorbs radioactive material, in relation to an accident of a nuclear power plant [6]. I was appalled to underdevelopment of the database.

Fig. 1 An isolated disaster sanatorium (photo by Yomiuri airplane on Mar. 13, 2011 [4]

On the basis of these shocks, it is discussed in the following what cause of such matters is and what we should do. On this occasion although I may digress from the main theme, I would like to try to write what I usually think.

◆◇Cause of the Shock and Search of the Solution◇◆

■Amendment of Science and Technology Policy

Shocked the nonadaptive of science and technology for 3.11 East Japan Great Earthquake, a revision of the conventional science and technology policy of our country is required. At first it needs to be examined how the fourth Basic Plan of Science and Technology, that is an indicator of a science and technology policy for five years, is revised at the time of its start from 2011 fiscal year. The fourth Basic Plan of Science and Technology aimed to solve social problem in two major themes of environment and medical care at first, but under the influence of the East Japan Great Earthquake, the minister in charge of science and technology policy and the knowledgeable members of the Council for Science and Technology Policy decided to reexamine it on March 31, 2011 [7]. They judged that it lacks good sense to promote the basic plan with two big pillars of "green" and "life" assuming normal growth while Japan faces revival from the disaster. They examine the contents to assume contribution to the society turning to revival, reviewing Japan's policy related to a national growth strategy, reconsidering the policy of atomic energy, and examining a method of an energy study.

The sub-committee of Industrial Technology, Keidanren, proposed at the same time an idea for the review of the fourth Basic Plan of Science and Technology that it is indispensable to declare strongly importance of innovation for contributing "the construction of safe and secure country". In addition, the followings are proposed: emphasis of "safe / secure innovation", review of energy associated measure policy in green innovation, spread promotion to society of results of R&D, information dispatch to the inside and outside of country by an expert and improvement of technology literacy of the nation, cooperation reinforcement between researchers of different field, and to reserve an enough science and technology related budget [8].

The Council for Science and Technology Policy amended the fourth Basic Plan of Science and Technology that starts from the 2011 fiscal year in the middle of August, 2011 [9]. According to that, the government emphasizes the R&D to be connected to solve the problem that the nation or industry confronts, such as revival from the disaster of the East Japan Great Earthquake and reinforcement of an industry competitive power, and switches to the problem-solution-type research as the most important one, although it has given so far the research budget concentrated on the fields such as information and communication or life sciences. It also states that the problem is the ability to do practice, that practical technology and organization need to be organized promptly by combining freely knowledge and talented people of various fields such as engineering or sociology, that leadership is needed to gather superior researchers over a fence of government ministries and agencies and research institutes, and that technology innovation to raise an industry competitive power could not be created, if cooperation of R&D of a country with a company is not established. At

the same time it requests the effect that balanced with the amount of budget. In this way, the fourth Basic Plan of Science and Technology is changed its content to "problem solution type" to overcome the problem that Japan faces. However it is worried that Japanese technology withers away, pursues only an immediate result, and shrinks a scale of its study if only the actual profit is considered important [10]. In addition, there is an opinion that looking-forward or -up way of thinking is necessary against negative feeling for science and technology due to helplessness of experts, including that scientists who could not give appropriate advices to politicians at crisis, or the technical officers who could not improve necessary measures while being in a position to know its deficiency of an electric power company [11].

As the worse matter, the Council for Science and Technology Policy is suspended due to that the personnel affairs proposal of its members has not been discussed in the Diet in the end of 2011 [12]. In addition, the Strategic Headquarters for Space Policy should carry an adjustment function of a policy of the whole government about space development plan, but only the plan focused on the Quasi Zenith Satellite is in progress to be made without fundamental argument on the long term policy [13]. While an argument on reorganization of the Council for Science and Technology Policy is in progress to strengthen the reinforcement of pivotal headquarters function of a science and technology policy, its concrete image is not yet seen. However, to me, the author does not deny the impression that both these measures and pointed out problems look like somehow cut and paste. Because we experienced great disaster of unprecedentedness of the East Japan Great Earthquake, I think that its reform and amendment should be more drastic, more understandable and clearer. I would like to describe my personal opinion next.

■Measures for the Shock and Necessity of Drastic Revision of R&D Method

A revision of the science and technology policy mentioned in a previous paragraph seems to be only a symptomatic treatment persistently for the East Japan Great Earthquake. Rather at this chance, the revision based on a viewpoint of more forward and broader perspective is necessary. Therefore I would like to point out next two as a revision of a science and technology policy. First, to shift the target of national R&D to national security. Second, to foster deep craft to wake up technology innovation for more offensives. These are explained below.

◇ To Shift Target of National R&D to National Security

When we consider the word of social safe / security, it is easy to fall into an argument whether safe is different from security or not, or which is appropriate to write safe first and security later or vise versa, but it would simply mean as national security, saying without worry about misunderstanding. If measures to this earthquake disaster is performed from a security point view, it becomes clear very much.

As for security of a means of communication for the first shock, although importance of satellite communications as national security has been discussed so far [3], a case of such a great disaster gives a chance to demonstrate a special feature of satellite communications, and the difficult situation of communication after a disaster could be evaded. After all, the terrestrial telecommunication link is weak at the time of a great earthquake disaster. Telecommunication link falls in particular easy victim because most ground structures are damaged for the Tsunami disaster. After all such a time is a turn of satellite communications, but it cannot be used at the time of an emergency unless it is usually used. It is vital to always introduce satellite communications facilities into public accommodation such as an example of the SOS as shown in **Fig. 1**. In addition, of course, both WINDS and ETS-8 satellites were utilized effectively for restoration of communication of a stricken area [14][15]. The WINDS satellite was used effectively, in particular, for the large capacity communication to exchange information for restoration of stricken Matsushima base of the Self-Defense Force [16]. In addition, each communication company makes an effort, and the terrestrial telecommunication link seems to have considerably restored one week later, but meanwhile, satellite communications was turned on, and was used effectively [17-20].

I hear that satellite communications link seems to have been installed between the Fukushima Daiichi Nuclear Power Plant and the main office, and to be operated effectively. There are facilities for disaster communication in a local-government, and the Local Authorities Satellite Communications Organization (LASCOM) operates it [21]. Satellite communications system for

disaster mitigation resembles military satellite communications system, and as for its development, R&D described in this series No. 3 would work effectively [3]. Therefore, communication security at the time of earthquake disaster could be covered from a security of communication in national security point of view.

The problem of a robot of the second shock would be due to the main reason that there was not demand of a robot to move, although our country establishes a robot for industry well [22]. In the case of the U.S., demand of a robot is increased rapidly by the battle front war in Iraq and Afghanistan [23][24]. If a way of thinking of a radio communication link to control robot is degree of so-called model wireless remote controller in our country, such a way is ashamed. The reliability of telecommunication link should be improved by more cooperation with experts of communications technology. As for such a technology, the United States Armed Forces seems to have much experience. If practice experience, besides battlefield experience if possible, will be required for future development. These are to be able to deal from a national security point of view.

As for the database maintenance deficiency of the third shock, the national organization of R&D should prepare such a database. I have heard that the national research institute was originally established to prepare such a database. In fact, a model of research institute is said to be Lykeion which was established by Aristotle in the fourth century B.C. The institute was different from academia, and performed to organize research and to gather every information [25]. However, advocating science and technology dependent country, a study of a national institute got involved in cutting-edge study since 1980's. This was not a bad thing, but maintenance of a database or maintenance of standards, which, if anything, was quiet has been cut off. Furthermore, by influence of neoliberalism from 1990's including marketization, deregulation, privatization and public employee reduction, increased mobility of employment than seniority, wage system based on operations evaluation, and easy change jobs system from lifetime employment are lionized [26]. Such a trend influenced into a research organization, achievements evaluation and the definite term employment for a researcher were introduced. And then, because maintain work of database and standards is regarded as a work of the shade by a trend of hero-worship to take Nobel prize and to publish in the science journal Nature, particularly a national research organization reduced or abolished these related projects. When it becomes in this way, it may be natural that a database is not possessed. The revival of lifetime employment so that there is work slowly and carefully and a work domain without achievements evaluation would be necessary even if there is some criticism. For such a study quiet at a glance, worth of work would be enhanced by imposing a responsibility on the national security and its consciousness. But I do not say that all the employment forms should be pulled back, needless to say, a study performed in environment of competition to demand result and its evaluation is necessary naturally.

In addition, as administrative reform, becoming an Incorporated Administrative Agency is pushed forward, and clamping for its management becomes severer. The maintenance of a database is not accumulated in such situation. I heard that the necessary software could be prepared for Internet at its beginning time, If the U.S. government office opens its own software. On the other hand, there is not at all such accumulation in the case of our country, that is, it is not a system of accumulation. A panel session "Space and Society" in the International Astronautical Congress (IAC) held in Bremen, Germany, in 2003 was begun by a chairperson's question to panelists: "Why do you develop the space?" or "How does it connect with society?". I was impressed that one of panelists from NASA answered proudly, "We develops space by an order of the government." [27] I think that this thought is the same line as national security.

Budget Screening and Disaster Management

I would like to say in conjunction with earthquake disaster correspondence one more. It is related to how the budget screening influenced earthquake disaster correspondence. I had doubt toward the budget screening from its beginning. I hear that it began originally in order to sort whether a certain bus route is necessary in a local authority. It will have the propriety in its own way. However, I have still doubts about the budget screening that performs up to the national policy in opening to the public and mainly by the economic index. I hear that LASCOM was also regarded as questionable because this budget screening treats parachuting of a public employee as one of main

enemies. Parachuting does not formally seem to be regarded as a problem when I read a result of the budget screening, but it cannot be denied that the LASCOM people in charge were discouraged very much. But the LASCOM operates a nucleus of telecommunication link of J-ALERT (a nationwide warning system) that was used as a warning system of the case of North Korean rocket launching recently, not to speak of having still struggled for security of communication in this earthquake disaster [28]. In addition, there seems to be some examples that a conclusion of budget screening caused obstacles at the time of this disaster. For examples, the security of the food warehouse that is near to an earthquake disaster sites became difficult by the criticism [6], oil storage might be the same, although the super dike is criticized, this must be considered even a disaster of once in 100 years, and the super computer criticism is famous. When such examples are considered, the budget screening that performs financial reduction and the criticism of parachute as a main problem may be inappropriate for disaster correspondence.

◇ To Foster Deep Craft to Wake Up Technology Innovation

In an argument of the Basic Plan for Science and Technology, a story that technical innovation is important always comes out [12]. It is a difficult problem how to occur the technical innovation that is the basis of science and technology development. I have never heard the method how to raise it. I introduced a view that factors to cause technical innovation decreased in this No,2 series [2]. It is caused by the loss of "Low-Hanging Fruit" (free land, smart and uneducated kids and technological breakthroughs) [29-31].

About another factor that innovation happens, as I introduced in Book review [32], there is a phenomenon that the front where new technology develops is centralized to only one country or area [33]. For example, the industrial revolution was happened in the U.K., chemical industry in Germany, and IT in the U.S. Why is this phenomenon happened? Why does the main body of technology concentrate on a specific area without simultaneous multiple places? If technology appears from technical information and/or scientific information, any country having an engineer and a scientist with the knowledge should be able to be innovative likewise. However, genuine high technology is born from the element which is not always knowledge. It is called as "deep craft". According to Reference [33] about deep craft, it seems to be the following. The deep craft is aggregate of plural intellect not simple knowledge. It is to know whether or not it can work. It is to know what kind of method is used, what kind of principle seems to succeed, and what kind of parameters should be used for a given technology. It is to know what carry well if you talk with anyone at the corridor, what method should be taken not to go in the wrong direction, what things should be neglected, and what theory should be watched. This kind of deep craft is based on science, but it is not simple knowledge. In addition, it is provided from the gathering of faith culture for common recognition, and the tacit culture for universal experience.

For example of IT, based on accumulation of the IT technology that was inherited from Dr. Norbert Wiener's cybernetics in the latter half of 1940's in a university of the eastern part in the U.S. [34], furthermore based on systematic accumulation such as Stewart Brand and Gregory Bateson, network related ventures were brought up from a generous atmosphere of Silicon Valley. This Silicon Valley was created and supported by the U.S. space development movement [35][36]. There are a reason many areas aiming at Silicon Valley in the world including China, Taiwan, Brazil, and Scotland, but why Silicon Valley in the U.S. is one and only one is that it is neither "a collection of high technology", nor an industrial area, nor a research institute, nor a venture incubator institution. In there, there is an opportunity to challenge, and there is the structure which can recover even if failed, and there is community praising a scholar of success [37]. That is just deep craft there.

As I wrote in Reference [36], dynamic knowledge and skill of the Hellenism period themselves were not lack of the technology that caused the Industrial Revolution [25]. In fact, there was an astronomical computer which used precise gears and differential gears in Greek culture [38]. In spite of that, the Industrial Revolution did not occur [25]. Therefore, there may not exist deep craft which developed to the Industrial Revolution in Greece.

I do not know well how such deep craft is brought, but, if deep craft is extended to the whole culture from mere technology, for example, the Renaissance came into existence in Italy. The achievement of Medicis is particularly big in influence of the Platonic Academy which Lorenzo the

Magnificent sponsored in Florence. The prosperity of the Renaissance there continued near 300 years [39]. The Renaissance could be surely built on the deep craft. Then how about in Japan? I think that probably there may be Buddhism culture in the Nara era in the past, but in late years in Genroku era the culture in the Edo era may apply to it. Even if there were the red light district culture in the base, about ukiyoe prints as a symbol of Genroku era culture, Juzaburo Tsutaya's achievement was big as a producer [40]. In this way an example of deep craft appears in Japan, but amazing more, a Japanese put abrasion processing and made a stone implement of a long sword first before more than 15,000 years than in Europe. Furthermore, a Japanese race of hunters invented an earthenware vessel first in the world before 5000 years than when it was observed in Europe [41]. Then how about in the future? We must think deeply.

As for the science and technology policy, innovation comes rather through R&D, that is, we should focus on preparing the environment of facilitating deep craft than enumerating items of R&D. Method of national security will be the way, too. Thinking in this way, I wonder where a genius who performs one's ability unmanageable since one's young age, particularly genius of science, goes in Japan. The RAND corporation in the U.S. had the character of the socket of such a genius [42][43]. That reminds me, in Tokyo, Japan, criticism for elites was repeated and, for example, a school district combination selection system of a municipal senior high school was abolished and introduced school grouping system. As a result, an elite high school such as Hibiya senior high school was abolished. The person who should say a genius seems to come out in sports or art recently, but where such a talented person in natural science goes now? Will it be left as it is?

In conjunction with this, I don't feel fine, the University of Tokyo examines autumn entrance to school so that a foreign student is easy to come to Japan, due to upset of decline of a level of technology of our country, in particular a level of university [44]. I agree with a opinion that the professors of the university excavates a novel theme, thinks out original study technique and must continue sending superior papers quoted by persons of world than think about entrance to school in autumn [45]. Rather, impression occurred in this East Japan Great Earthquake. All of 184 pupils of Kamaishi elementary school at Kamaishi-city coastal place survived without a sacrifice [46]. Besides, they were not merely guided and escaped. Pupils left school on March 11 earlier than usual because shortened school hours of the end of fiscal year. They spent free time from adult management. Parents and teachers, who witnessed a town swallowed up by big Tsunami, decided to prepare for "The children cannot already be rescued", but the children took far exceeded action of adult expectations. The children had escaped by themselves to safe place utilizing the knowledge of disaster prevention. Furthermore, the children lead small brothers by the hand and carried a physically handicapped friend on their back, appealed to adults for refuge and saved much life. This should right say a grand achievement. Talk of fall enrollment to university appears to be a tiny story. It may be said that there was grand deep craft in a wide meaning.

◆◇Considering Research of National Institute◇◆

I have insisted that the national research organization should exist for national security, and that the research theme of a public research organization should be concentrated on national security related one [3]. A kind of abstract general idea of national security seems to become concrete by the East Japan Great Earthquake disaster. Because it becomes important for a public research organization to perform the study that is not outstanding such as a maintenance or security of a database-related study, the policy that has been pushed forward for around 10 years such as not lifetime employment but positively fluidity, introduction of numerical target, and enforcement of study evaluation would be necessary to be reviewed. In addition, the research which is aimed at the Nobel Prize should not be performed and the research for writing papers is out of the question. It will be necessary to perceive that paper or Nobel Prize comes with the result later.

Then I would like to think about how this matter be treated in the research organization such as National Institute of Information and Communications Research (NICT), as an example. Because a word of "national security" can be searched in the Web site of NICT, national security may be recognized than before, and it is good itself, but I feel only that a term of national security is used as

same level as social safe / security. It will be better that national security is brought forward. As for the method of R&D, I wrote about a study theme about satellite communications previously [46]. I think that an idea of conventional R&D, namely development of a new frequency band, development of utilization technology of frequency resources, would be proper in the future too. But it is necessary to study invulnerability of system as well as increase of communication capacity and flexibility of use as national security related technologies. The invulnerability technology may include technology of anti-jamming and anti-nuclear explosion. Signal processing and antenna beam forming technology are important for the former, and satellite communications technology in the higher frequency than millimeter wave band is important for the latter. About a nuclear explosion, it is required that there exists any researcher understanding electronic wave propagation under plasma environment of nuclear explosion. Considering as above, it is clear that most of the studies of NICT, which have been cultivated from Radio Research Laboratory (ex-former NICT), Communications Research Laboratory (former NICT), are important for the national security related research. Therefore, from such a point of view, it is important to make position of study theme clear and to recognize them again while preventing the scatter of a researcher. Researches that advocate the national security at NICT might be sense of incongruity. But because the roots of NICT, namely, the Radio Physics Laboratory of Ministry of Education and the Fifth Army Technology Laboratory of Army Weapon Administration Headquarters conducted the research of national security of our country [48], it is appropriate that NICT conducts the research based on its roots.

There seems recently to be the impression why an incorporated administrative agency becomes a perfect target from the budget screening. If this is true, in particular, it not only discourages researchers who work at the incorporated administration agency and carry R&D, but also the institute itself becomes impoverish. I am afraid of being to have a problem in national security of our country.

Epilogue

I have described to let a national research shift to national security, but it seems to be necessary to let the whole study of a country shift to national security if based on the shock of the East Japan Great Earthquake. Although many people may feel resistance for this sentence, we must think back to the Constitution of Japan to think about this. A discussion on the Constitution is described at the discussion considering national security held at General Assembly of AIAA-JFSC in 2010 [49]. BS-Fuji Prime News is also useful for this subject [50].

Even if there is the feeling that chaos world began since the beginning of the 21st century, the times of chaos may not be necessarily bad to let technology progress. Because there is the next description in Nanami Shiono's writing [51]: "Orson Welles who played the third man in the old masterpiece movie 'the Third Man' said in a near last scene; 'You accuse me the villain. But, after peace of several hundred years, only the cuckoo clock has been made in Switzerland. On the other hand, the great culture opened by Leonardo da Vinci and Michael Angelo in the Renaissance times when Cesare Borgia and other guys were doing their evil.' I, such as me, am not supposed to try to find why such a phenomenon was caused, because even an intellectual person such as Bertrand Russell can not understand it."

Therefore, we may not need to become pessimistic for R&D activity even if it is the times of chaos. I described a lot of personal opinions here. According to the Oxford dictionary, "opinion" means originally a statement of advice by an expert on a professional matter, but the first meaning is a view or judgment formed about something, not necessarily based on fact or knowledge. So I expect a future discussion from many readers [52].

Acknowlegment

I would like to thank heartily the members of the Space Japan Review Editorial Committee for their argument and valuable comment.

References

[1] T.Iida: “Space Japan Opinion: Methodology of Research and Development—From Research of Satellite Communications to General Research ❶ Competition Predominance and Researchers Attitude”, Space Japan Review, No.75, Aug./Sep., 2011, http://satcom.jp/75/spacejapanopinione.pdf.
[2] T.Iida, “Space Japan Opinion: Methodology of Research and Development—From Research of Satellite Communications to General Research ❷ Research Management”, Space Japan Review, No.76, Oct./Nov., 2011, http://satcom.jp/English/e-76/spacejapanopinione.pdf.
[3] T.Iida, “Space Japan Opinion: Methodology of Research and Development—From Research of Satellite Communications to General Research ❸ Method for National Security Related Research”, Space Japan Review, No.77, Dec./Jan., 2011/2012, http://satcom.jp/English/e-77/spacejapanopinione.pdf.
[4] " M9 Earthquake ... unable to confirm the safety of tens of thousands of people" (in Japanese), http://www.yomiuri.co.jp/feature/ejeq2011/20110313j.htm
[5] "Truth and Falsehood: Foreign Made Robot is Active for Nuclear Power Plant and Cleaning—Robot Market Delays by Risk Avoidance", Nikkei Shimbun, Nov.8, 2011 (in Japanese).
[6] "Asking Mr. Shinohara, Deputy Minister of Agriculture, Forestry and Fisheries, about secure stability and safety of food", Prime News, BS-Fuji, Apr.6, 2011 (in Japanese).
[7] "Basic Plan of Science and technology Reconsidered due to the great disaster", Asahi Shimbun newspaper, Apr.1, 2011 (in Japanese).
[8] Sub-committee of Industrial Technology, Keidanren: "Idea for the Review of the Fourth Basic Plan of Science and Technology", Keidanren, Apr.27, 2011 (in Japanese).
[9] "Editorial: New Plan of Science and Technology—Perform ability is asked ", Nikkei Shimbun, Aug.13, 2011 (in Japanese).
[10] "Post-3.11—Changing science and technology dependent country (1) Under slogan 'contributing to society'", Nikkei Shimbun, Jan.30, 2012 (in Japanese).
[11] "Editorial: To explore 'new modern' facing front, up and outer", Nikkei Shimbun, Mar.10, 2012 (in Japanese).
[12] H.Satoh: " Control tower of science and technology policy, confusion", Asahi Shimbun, Mar.1, 2012 (in Japanese).
[13] "Editorial: Successful in Rocket, Draw a picture that connects to the future", Asahi Shimbun, May 19, 2012 (in Japanese).
[14] S.Takayama, T.Kaname, M.Akioka and T.Takahashi: “Disaster Area Support on the Great East Japan Earthquake by Communication Satellite WINDS and ETS-VIII”, Journal of IEICE, Vol.95, No.3, pp.201-206, Mar. 2012 (in Japanese).
[15] M.Nakao, N.Tomii, S.Takayama, T.Hashimoto, T.Horiuchi, H.Kohata, M.Ikeda, T.Kaname and K.Sunagawa: "Flash Report: JAXA's Activities Using Satellites 'Kizuna' and 'Kiku-8' for the East Japan Great Earthquake", Space Japan Review, No.77, Dec./Jan. 2011/2012, http://satcom.jp/77/flashreportj.pdf (in Japanese).
[16] H.Kimata: "Disaster Relief Activities Using Ultra High Speed Satellite 'Kizuna' ", Tsubasa, pp.131-134, Sep., 2011 (in Japanese).
[17] T.Hirose, Y.Imaizumi and H.Yoshida: "NTT's Disaster Relief Satellite Communication System Used for the East Japan Great Earthquake", Space Japan Review, No.76, Oct./Nov., 2011, http://satcom.jp/76/specialreportj.pdf (in Japanese).
[18] Y.Shimazaki: "Flash Report: Satellite Communications Demonstrated Real Value in Mobile Communication Infrastructure for Early Recovery of Disaster", Space Japan Review, No.74, June/July, 2011, http://satcom.jp/74/flashreportsoftbankj.pdf (in Japanese).
[19] Y.Tanaka: "Flash Report: IPSTAR's Activities for the East Japan Great Earthquake", Space Japan Review, No.75, Jun./Jul., 2011, http://satcom.jp/74/flashreportipstarj.pdf (in Japanese).
[20] Communications Engineering Div., Engineering & Operations Group, SKY Perfect JSAT Corporation: "Flash Report: SKY Perfect JSAT's Activities for the East Japan Great Earthquake", Space Japan Review, No.75, Aug./Sep., 2011, http://satcom.jp/75/flashreportjsatj.pdf (in Japanese).

[21] C.Ohuchi and Y.Izumi: "Feature: Regional Satellite Communication Network System Using Satellite for Disaster Management and Administrative", Space Japan Review, No.54, Feb./Mar., 2008, http://satcom.jp/54/reportj.pdf (in Japanese).
[22] T.Sugimoto: " Why Robot for Nuclear Power Plant Made in Primarily Japan is Only One, While Others are Foreign-Made Product, Lack of Commercialization Experience", Asahi Shimbun newspaper, Jun.25, 2011 (in Japanese).
[23] W.Singer: “Wired For War—The Robotics Revolution and Conflict in the 21st Century”, Penguin Press, 2009.
[24] T.Iida: "Space Japan Book Review -From a satcom researcher point of view 'Peter Warren Singer: “Wired For War—The Robotics Revolution and Conflict in the 21st Century", Penguin Press, 2009”, Space Japan Review, No.72, Feb./Mar. 2011, http://satcom.jp/English/e-72/spacejapanbookreviewe.pdf .
[25] J.D.Bernal: “Science in History”, C.A.Watts & Co., Ltd., 1965.
[26] M.Noguchi: " Logical and Psychological Criticism of Bureaucracy—Friend and Enemy of Democracy", Chuko-shinsho, No.2128, 2011 (in Japanese).
[27] T.Iida: "Topics From Within: Attending IAC2003", Space Japan Review, No.31, Oct./Nov., 2003, http://satcom.jp/English/english0310-11/conferencereport1e.pdf .
[28] C.Ohuchi and Y.Izumi: "Selected Paper: On the J-ALERT（National Immediate Alert System)", Space Japan Review, No.63, Aug./Sep. 2009, http://satcom.jp/63/selectedpaperj.pdf (in Japanese).
[29] Tyler Cowen: "The Great Stagnation", Penguin, 2010.
[30] M.Wakatabe: "Economic Commentary; [Economic Trend] Was the source of growth lost? Discussion on decline of innovation, Enhance 'Anticipates' by mobilizing the policy", Nikkei Shimbun Newspaper, Mar. 7, 2011 (in Japanese).
[31] T.Iida, “Space Japan Book Review -From a satcom researcher point of view ‘Tyler Cowen: "The Great Stagnation", Penguin, 2010’", Space Japan Review, No.75, Aug./Sep. 2011, http://satcom.jp/English/e-75/spacejapanbookreviewe.pdf .
[32] T.Iida, “Space Japan Book Review -From a satcom researcher point of view ‘W. Brian Arthur: “The Nature of Technology—What Is and How It Evolves”, Free Press, 2009’", Space Japan Review, No.76, Feb./Mar. 2012.
[33] B.Arthur: “The Nature of Technology What Is and How It Evolves”, Free Press, 2009.
[34] N.Wiener: “I Am A Mathematician”, Doubleday & Company, Inc., 1956.
[35] J.Ikeda: "Web X Social X America—Imagination of <Global age>", Kodansha modern new book, 2011 (in Japanese).
[36] T.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 .
[37] N.Okada: "U.S. Frontline: Silicon Valley Grew Mr. Jobs, One and Only Reason", Nikkei Shimbun, Apr.4, 2012 (in Japanese).
[38] J.Marchant: “Decoding The Heavens -Solving the mystery of the world’s first computer”, Da Capo Press, 2009.
[39] K.Satoh: "City of Botticelli Florence", Kawade Shobo Shinsha, 1998 (in Japanese).
[40] "Juzaburo Tsutaya's Work", Extra issue "Taiyo", Heibonsha, 1995 (in Japanese).
[41] Jared Diamond: “Guns, Germs, and Steel The fates of Human Societies”, W.W.Norton & Co., 1997.
[42] Alex Abella: “Soldiers of Reason: The RAND Corporation and the Rise of the American Empire”, Houghton Mifflin Harcourt, 2008.
[43] T.Iida: “Space Japan Book Review—From a satcom researcher point of view: Alex Abella: ‘Soldiers of Reason: The RAND Corporation and the Rise of the American Empire’, Houghton Mifflin Harcourt, 2008’”, Space Japan Review, No.71, Dec./Jan. 2011/2012, http://satcom.jp/English/e-71/sjrbookreviewe.pdf .
[44] "Tokyo University Considers Migrating to Fall Admission, Accelerate Internationalization, No

Change of Admission Test, Inevitably Influence to Adoption of Company", Nikkei Shimbun, Jul.1, 2011 (in Japanese).
[45] J.Shibata: "My Opinion: Fall Admission—Tokyo University must Raise Research Performance at First", Asahi Shimbun, Apr.2, 2012 (in Japanese).
[46] "Close-up the Present: Children and the Great Disaster 2 Great Tsunami: We Survived This Way", NHK-TV, Jan.17, 2012 (in Japanese).
[47] T.Iida: “[Special Talk] Satellite Communication for National Security: Increase of Role and a Method of Future Research”, IEICS Tech Report, SAT2008-64, Feb.26, 2009 (in Japanese).
[48] T.Iida: "Summary Report of Panel Discussion 'Radio Experience Immediately after World War II from around 1940", Space Japan Review, No.73, Apr./May, 2011 (in Japanese).
[49] "Discussion on Consideration of National Security of our Country @AIAA-JFSC General Assembly", Space Japan Review, No.72, Feb./Mar., 2011 (in Japanese).
[50] "Consider the Constitution Now 1: Ask the former Prime Minister Shinzo Abe—Problem with Process of Constitutional Formation", BS Fuji Prime News, Apr.30, 2012 (in Japanese), http://www.bsfuji.tv/primenews/movie/index.html?d120430_0
[51] Nanami Shiono's Collected Works of Renaissance 2 –“Women in the Renaissance”, Shinchosha, 2001 (in Japanese).
[52] http://oxforddictionaries.com/definition/opinion