TRUE STORY OF TRMM
-THE WORLD FIRST MISSION TO MEASURE RAIN BY SATELLITE BORNE RADAR-

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ABSTRACT:

TRMM (Tropical Rainfall Measuring Mission) was successfully launched from Tanegashima Japan by H-1 rocket in November 1997 and is still alive in good health. TRMM is continuing to accumulate global precipitation data even today. TRMM is one of the longest life and most successful satellite projects.
TRMM is an US-Japan joint satellite project. Japan contributed the world first satellite borne radar and launching vehicle, and USA provided other 3 instruments, satellite and telemetry command, tracking and control. And both sides equally participate and cooperate in data analysis and utilization.

In the middle of 1970's, the Radio Research Laboratories (RRL) decided to adopt remote sensing as a new major research area following to satellite communications and broadcasting which was almost completing the initial phase, and selected rain to measure by satellite borne radar. It was well known that rain was one of the most important parameters for our life but the accurate global data had not been obtained yet. In one of the efforts to use higher frequencies, such as millimeter waves, for satellite communications, RRL had made considerable efforts to know the radio wave attenuation by rain in high frequencies and to measure the rain intensity. We had established revolutionary method of rain measurement by changing from classical time consuming statistic method using data of rain gauges deployed below the radio wave path, to new rain radar method which enable us to obtain 3-dimentional information almost instantly.

We began our effort to measure rain from space, exactly speaking, to obtain money for the purpose in 1977. It was 20 years before the TRMM launch. The budget request was approved and we started to develop an air borne two frequencies scatterometer/radiometer in the next year, as the first step. In the beginning of 1980, the air borne flight experiments were successfully taken place. In the end of the year, collaboration was proposed by GSFC/NASA. In 1983 after we had enough experiences, we started to discuss joint experiment. We sent our air borne radar/radiometer with a scientist to GSFC/NASA and installed on NASA air plane (P3-C). The joint flight experiment started around Wallops Island in 1985. NOAA also joined to this flight experiment with their radar installed P3-C. In September of the year, NASA proposed TRMM as a joint satellite project. I responded that we planned to install 2 frequencies rain radar/radiometer on the space station. An official of NASA mentioned, "We prefer small satellite project since the space station must be of the one in next century". It was astonishing comment for us. Everybody of Japan believed at the time that the space station will be in operation in 1992, because Mr. Reagan had just come to Japan for requesting participation of Japan to the space station project and assured its 1992 operation to Mr. Nakasone. Today, we know the NASA official was honest. I agreed with NASA to make TRMM as an US-Japan joint satellite project. And in the November 1985, TRMM workshop was held in Maryland where the outline of TRMM mission, specification and sharing role of the US and Japan were discussed and agreed.
TRMM was proposed SSLG (Standing Senior Liaison Group, the highest organization for space program cooperation between the US and Japan) meeting in June 1986 from both side and approved. Immediately after the meeting, however, we realized nothing was ready to move in the both side, especially in Japan side. In the August, I visited the office of Dr. Edelson, an Associate Administrator with the US side colleagues of TRMM. The International Affairs division of HQ/NASA was reluctant especially to launch TRMM by H-I rocket of Japan, but Dr. Edelson agreed to carry out TRMM project as proposed and to send his letter to Prof. Saito, his counterpart of Japan side of SSLG. When the letter arrived, Japan side was in utterly confusion. After long discussion and negotiation, the replying letter was sent from Japan (STA, Science and Technology Agency) to the US (NASA/HQ) proposing one year feasibility study by Expert Panel.
The Expert Panel meetings were held 4 times in 1987 in Tokyo and Hawaii. Based on studies of the Expert Panel, "International Symposium on Tropical Precipitation Measurement" was organized in Tokyo in October 1987. It was actually the announcement of TRMM inauguration by scientists. The final report of TRMM Expert Panel study was sent to NASA and STA and signed by both agencies in the spring of 1988. It was about 10 years before TRMM launch. The outline of history in the 10 years will be shown at the presentation. It was tiresome and sometime even frustrated long way to the launch in November 1997. However, when I look back to the 10 years now, I realize it gave us the key for great success of TRMM. We continued various air borne experiments around Wallops, Caribbean and western Pacific, and study on development of algorithm for extracting rainfall information from measured data. Now we are convinced that the 10 years efforts made us to be able to have better results and make excellent contribution for meteorology by TRMM. Some of the flight experiments will be shown in the presentation.

International cooperation sounds nice but it is difficult and even troublesome in most case. TRMM was not the exception. There are so many differences in systems, procedures, way of doing and thinking, habit and cultures between both sides which may cause misunderstandings, mistakes, disappointments, frictions and disputes. As an example, the fiscal year starts from opposite side of year,

from October in USA and from April in Japan. The phases of space program of USA and Japan are looked similar but essentially different.
It is common that while the situation is adverse and difficult in the initial phase, everybody is willing to cooperate, but once things become moving well and the number of participants increase, discords arise in somewhere and it develops to frictions and even catastrophe in some cases. Fortunately, we were able to avoid catastrophes with better understanding, good friendship and solid reliability among original members.

TRMM will see the 13th birthday in the coming November and we are sure it will work well until passing the baton to GPM, succeeding Global Precipitation Measurement program.
When we initiated the efforts to measure rain from space by radar more than 30 years ago, we did not expect or even imagine such excellent and splendid results would be coming out of this mission TRMM. It is the achievement and fruits by the dedicated efforts of thousands of people who have participated to this long time mission from academic communities, government agencies, various types of companies and many others, even mass media.
It has become clear that water resource is one of the most serious problems of our future environment of this “Planet of Aqua”.
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