Speech

Foundation of the Dr. Masao Horiba's Award

Masao Horiba

Honorable chairperson of the Screening Committee
for the Dr. Masao Horiba's Award

HORIBA, Ltd.
Chairman[*1]
Doctor of Medical Science

*1: Dr. Masao Horiba proceeded from Chairman to Supreme Counsel at June 18, 2005.

It all started in an empty laboratory

I appreciate all of you coming to celebrate the First Masao Horiba's Award. Yesterday, October 17 was the Horiba Radio Laboratory's birthday, the predecessor of HORIBA, Ltd. It was founded in 1945, 59 years ago. In the same year on August 15th Japan, defeated in World War II, surrendered at her discretion. The laboratory was then to come 2 months and 2 days later.

I was a student of the Science Faculty in Kyoto University, studying Physics under Professor Bunsaku Arakatsu. Soon after the war ended, the U.S. forces, the Allied Occupation I mean, came along, and all the experimental work in atomic nuclear physics came to be totally prohibited. The forces broke the cyclotron[*2] into fragments, gathered it all up in a truck, and threw all the pieces away into Osaka bay. They went away with every piece of the remaining peripheral parts, and what was left was a vast space without a machine.

We were stunned by what had happened, now knowing we had nothing left to do. After a while, I started feeling troubled… "I should do something. I can't idly sit here wasting time, I must start something," I said to myself. As you know, counting: measuring Alpha, Beta, and Gamma rays, is a very important process in Nuclear Physics. Nobody knows how many rays are there and when they are generated unless they are correctly measured. A ray may be 'born' once a minute, or several hundred million rays may appear in a second. It is absolutely necessary to understand this precisely.

In those days the measurement was generally obtained by means of a tube-type device (which is a type of measurement system that uses a vacuum-tube) giving its results as binary codes. The result needed to be expressed in the decadal (base 10) system, which is really a fiddly task. So I thought

I would invent a converter that can process the binary codes into decadal at a very high speed. We believed that the converter should be surely required in times of peace. I now recall we, at that time, tried to produce a computer.

However, soon we had to change our minds. Then, “Made in Japan” had a totally different meaning from now. Condensers were rarely leakage-free, and they often blew. To realize the supposed computer, we had to start from condenser development.

Once we started condenser development, it turned out we had made wonderful condensers. It is embarrassing to say this on my own, but it really was. Why wonderful? Because we thoroughly controlled the quality by rigorously analyzing every chemical and material used production. There was no secret other than this. So at the time these were groundbreaking condensers.

We showed our condenser to Matsushita, Hitachi, and Mitsubishi Electric. They rated the condensers very highly, promising many orders. Yet you know, condensers are mass production items. You need a facility for mass production in response to such large orders. So we asked them to furnish us with the funds for such a facility, but this time they didn’t agree with us. They had the all-important money to buy the product but not a single Yen to lend.

We had to travel from customer to customer, in our search for funds. Finally, we visited Imazato in Osaka city. Now here was a small company producing almost all of the phonograph motors in Japan at that time. The old man, the Director I mean, listened to my story and said, “I see. How much you want?” I instantly figured out as much as I could - 3-million yen. The old man was quiet with my answer for a while, but then he surprised me by saying “It’s a good deal. I will lend you the money!” So, funded by him, we resolved to build a condenser factory. Soon we found a site for our factory. Then, just as we were waiting for construction to start, dreadful news broke - The Korean War.

*2: Cyclotron (Figure 1) applies a high-frequency voltage to two “D-shaped” electrodes whose plain surfaces are vertical to a magnetic field. This accelerates electrically charged particles such as alpha particles, protons, and deuterons along a circular path. In 1945, there were 4 cyclotrons in Japan: two at RIKEN (the Institute of Physical and Chemical Research), one at Kikuchi Laboratory in Osaka University and the other at Arakatsu Laboratory in Kyoto University, which were all destroyed just after the end of the war.

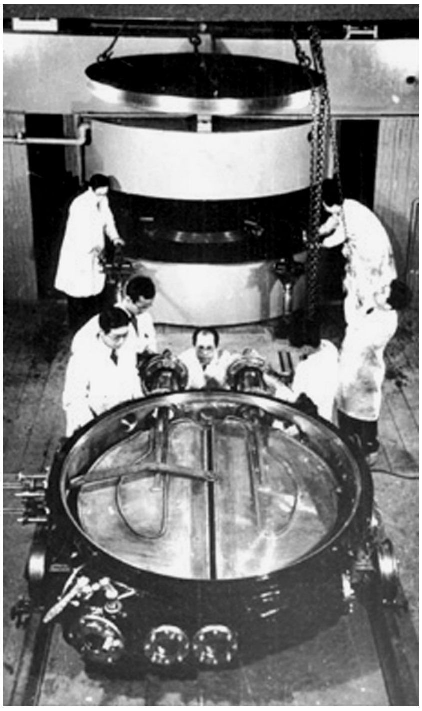

Figure 1 Cyclotron of the Institute of Physical and Chemical Research, Disposed of into Tokyo Bay (Version 2) (Photograph presented by RIKEN; Independent Administrative Institution)

Producing a pH meter to produce…

Inflation caused by the Korean War was awful. In a couple of months, the price of nonferrous metal had suddenly tripled. My 3-million yen suddenly meant less. At least 8, or 9-million was necessary. In those days the average monthly cost of living was almost 3-thousand yen, so to me, 3-million and 9-million were no different. I went out to see the old man. He got furious. "Go away, idiot! You should realize how much 9-million is!" He was of course very experienced and knew the true value of 9 million yen. The whole plan was swallowed-up by inflation.

I was totally at a loss. Should I change my mind and go off be an office worker? I thought. However I myself had debts of a million yen. A million yen was of course big money for me. It would take more than 100 years to pay off if I had a good salary of 5-thousand yen per month. What should I do? The answer was the pH meter that I had developed for our condenser.

I have to confess; developing pH meters was the last thing on my mind. My dream was to make a condenser, a counter, and a computer. I would have been talking then as a person now from IBM or Microsoft. Yet all my beautiful plans had gone up in smoke. Unlucky? Yes, but this was the starting point for me to gradually change my attention and focus on pH meters, selling them as a tool to produce condensers.

Selling pH meters was, however, not such a desperate choice. I started the business in 1953, when (ironically) the Korean War finally ended. The Japanese government policy at that time was nothing but Rice - because everybody was hungry. Then what do you suppose they required for that? The answer is fertilizer. A fertilizer using ammonium sulfate[*3]. Ammonium sulfate appears only in crystalline form, (looking just like a white granulated sugar) when the ammonium and sulfur are completely neutralized. This neutralization requires quite stringent controls, because even slight acidity would result in acid soil, whereas alkalinity would ruin rice. Every chemical factory in Japan started making ammonium sulfate accordingly, and pH control had become a critical issue everywhere. The pH meter business went unexpectedly well, in this way helping us to get off the ground. My million-yen debt was finally paid back, and the years that followed brought us the HORIBA we now know.

*3: Ammonium sulfate: As a fertilizer with immediate result, played an important role in expanding food production in Japan.

A balance always needs a weight

It is amazing that 59 years have passed since I grappled with the first HORIBA pH meter. Most of the people who were supporting me at that time have since passed away, and so cannot be here with us. I wish such people more than anyone could join us now, but that's how it goes. I myself am suffering from many "malfunctions," even though I pretend to be functioning perfectly.

It is thanks to the newer medical devices that I can live with my many ailments, such as I do. What is the most significant contributions are coming from analytical, diagnostic technology. My two big cancers were both detected by medical devices, not by myself, and removed without problem. I stand here talking to you now and for sure I owe all this to the power of medical science.

Sorry about the private news again, but this year I will be 80 years old. In this opportunity I wish to be a help to society through our business, in the analytical and measurement field.
As you all know, analytical measurement is the most fundamental foundation. Amid a variety of industries and academic fields, in time one can always find some hot new subjects. Yet all of these seemingly new subjects are rooted in the same one technology: analyzing, and measuring. Without this there can be no scientific advance.

It is my repeated complaint that this fundamental technology is left out in the cold, whether in industry or academics. Even Kyoto University is not an exception; Analytical Chemistry has disappeared from their principal courses[*4]. I talked to the Ministry of Education and the Ministry of International Trade and Industry, but both their responses were quiet. They said the budget is low, and also human resources are scarce. Analytical measurement it seems, is an old-fashioned, low-key subject, and students perhaps imagine they wouldn't be able to make their way in the world with it. I dare to say, that eventually the analytical measurement research laboratory will be occupied by only a small number of researchers who are unusual unique people.

*4: The University currently has a diminishing number of courses or lessons whose principal subject is Analytical Chemistry.

Those unique people are, however, the foundation of science. Analysis means standardization and a "Standard" is inevitably necessary. Suppose you have a balance without a weight. A balance itself can't tell you how much something weighs. It is the weight that makes a balance useful and significant. Analysis is the same thing. When you measure pH, you need the Standard pH value in order to compare. When you measure gas, ppm or ppb can tell you much but only with the Standard. This is why I emphasize the importance of a Standard.

I'd like to tell you the story about when I visited the U.S. in 1958. It was my first visit to the U.S, but through the visit I profoundly realized the significance of "Standard." I visited NBS[*5], National Bureau of Standards, which was really a great surprise. They were producing a Cadmium Standard Cell[*6]. Cadmium sulfate solution, when changing the concentration at several places below the decimal point, increases acidity to allow the deviation of 4 μV to be zero. They adhered strictly to this point through the thorough research, for it was the ideal point from which to base the standard cell. Taking temperature fluctuation into account, they were developing a standard cell using a constant temperature bath maintained to within ±0.0005 °C.

Some scientific papers may describe we can easily make a temperature bath controlled to within a millidegree. Yet if you actually try it, you will notice it is not such an easy task. You should prepare three stages of solutions with different heat capacities, and put the stages of less and less heat capacity on the inside for the temperature control. When the temperature bath is finally ready, the temperature has to be controlled in increments of 0.1 °C to check the thermal behavior for each temperature change.

I saw a team of six U.S. researchers knuckling-down to this task. Their concern was whether the voltage tolerance of ten to the minus seventh power was accurate enough or not! I was shocked by the enormous gap between the two countries - how far we had to go. The U.S. government in those days was seriously thinking of such a strict level of standardization. The NBS had enormous equipment, three times as large as this room, for making the Standard gas. In various fields, standardization meant so much, which impressed me greatly - enough to speak out about the need for standardization in Japan.

*5: NBS (National Bureau of Standards) is an organization of the Federal Government that assists the standardization of industrial technology. In 1998, the organization was revised to become the NIST (National Institute of Standards and Technology).

*6: The Cadmium Standard Cell (Figure 2) was also used in Japan until 1976 as the governing standard.

Figure 2 Cadmium Standard Cell (Presented by AIST (National Institute of Advanced Industrial Science and Technology))

Dialogues with government earned today

This is why I proposed to the Government that they should implement standards, although most of my proposals were in vain. Yet in the meantime environmental pollution came to be an issue in Japan. It was in the 1960s. Many regulations were enshrined into law such as SO_2 and NOx emissions began to be limited.

Accordingly our gas analyzers graduated. The method was called “flow mixture*7,” in which we diluted a cylinder concentration of 100% into 100 ppm, 50 ppm, and further, and made a scale for each concentration.

*7: Flow mixture: A method of generating standard gas by 1) controlling the component gas and dilution gas correctly to each flow rate, 2) mixing them uniformly.
The method uses capillary tubes for high accuracy flow control, and controls the gas flow by adjusting the differential pressure between the inlet and outlet of each capillary tube. When the characteristics of capillary tubes are the same, the flows change with the same ratio at component and dilution sides regardless of the fluctuation of atmospheric pressure and/or peripheral temperature. This allows extremely low interference to the flow ratio, which turns into a mix concentration that is very precisely known.

In those days we had several competitors for gas analyzers, including SHIMADZU in Kyoto and TOSHIBA BECKMANN in Tokyo, a joint venture company of TOSHIBA. They all worked making gas analyzers. Although our products targeted the same measurement areas, an awkward problem came up; the Standard again. Customers started to sound selfish, like “We’ve chosen the SHIMADZU, for the result would go lower,” or “HORIBA showed higher values, so forget it.” I was totally dissatisfied with this situation, and talked to the Government again. All of this happened because of a peculiar Government rule. While the customers used analyzers of different scales, different values, once they reported results over a certain ppm, the factory chief would soon find himself fired. Give me a break!… We can do better than that. It should be the Government who implements and maintains the standards.

However, the Government was again weak-kneed. “We know you’re right, but you know, it’s tough,” the official gave a shrug. That was enough. I resolved that we would do it on our own. What would happen if we get together, all of us, with SHIMADZU and TOSHIBA BECKMANN, and cooperate for establishing a company for making a Standard Gas? The official, batting his eyes, shook his head. “Impossible. Competitors are just competitors. You guys are bloody battling, aren’t you?” I didn’t give up. For a month I worked on persuading members of these companies, and finally established a company “Standard Technology Co., Ltd. (S-TEC)” (1974). There we made the Standard Gas, and then supplied it back to each of our original companies. So from then, the measured result became consistent between us, based on the standard. Since the weight is the same, the result should be the same even though the balance is different. This is the power of standardization.

It was soon after that the government took action. This time they insisted it was their job, and determined to establish a huge association called JMI (Japan Machinery Metals and Inspection Institute)[*8] for verification. They knew they needed the Standard for verification. They came to us, "Mr. Horiba, we need the standard gas generator made by S-TEC." I laughed and said, "I have never heard of the Government buying (a Standard) from a private individual!" They had no choice. They finally bought our standard gas analyzer - at the highest price of course!

However, their revenge was also great. They certified *our* machinery using *our* standard gas generator, but signed *their* names. Without their signatures no machine could be shipped. Something was wrong, wasn't it? We first delivered our product, visited the same customer with our test machine and asked them to certify it with a nice high price. Well, in this way our relationship has continued until today through battles of dialogue, to find out a way to enhance standardization.

*8: JQA at present (Japan Quality Assurance Organization).

Japan owes much to some "Unique" people

Standardization, analysis, and measurement. I believe these areas are indispensable in every field of science and technology. These days people tend to talk about biotechnology challenges, or feel like listening to news about the latest IC chips. Yet all of these are inextricably connected to analytical measurement. Why on earth does this essential subject have to be diminished so?

Now at last the Japanese government, the Ministry of Economy, Trade and Industry, and the Ministry of Education, Culture, Sports, Science and Technology have started thinking about supporting this field. But the universities are still in 'passive mode.' In such a harsh environment, however, there are some unique people quietly maintaining their steady progress. I would like to assist these people who are invariably taking a most vital if seemingly invisible part.

Today I listened to the presentations of Award winners, and felt this strongly again. They are all similarly humble, diligent, and hardworking. What drives them is nothing but their enthusiasm and belief in the subject. I want as many people as possible to notice such sincere researchers, so that the researchers can go ahead with pride and meet their challenges.

Such researchers, and their supporting environment would give, I dare to say, much vigor to science and technology in Japan. The Masao Horiba's Award is filled with this spirit. Now I'm just a humble old guy, but I would really appreciate your further understanding and assistance toward this small challenge of mine.

Again thank you from bottom of my heart to those many for their assistance supporting the Award. The assistance is heart-warming at times, surprisingly splendid at others, but at all times greatly moving. Thank you.

<From the speech at the Award ceremony, held at Shiran Kaikan hall in the Kyoto University in October 18, 2004>