Oral History of Shoichiro Yoshida

Interviewed by:
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Craig Addison: Thank you for joining us, Yoshida-san. To begin with, please tell us about your education and family.

Shoichiro Yoshida: I graduated from the University of Tokyo and my major was in the faculty of engineering, the department of precision engineering. When I had education from elementary school to junior high school they created a special class for the selected students, those who were good at math and science. I was assigned as one of the students for that class. I started to learn math at that time. My family members include my wife, one daughter and one son.

Addison: Did you know what you wanted to pursue as a career during your studies?

Yoshida: My father was a watch manufacturer, so ever since my childhood I wanted to be an engineer for precision science and precision engineering.

Addison: You joined Nikon after graduation. Please talk about your first job at Nikon?

Yoshida: My first assignment was the design of an astronomic telescope. I spent approximately eight years in this field and was especially involved in the design of large scale telescopes. In 1960 I was assigned to a special project for the creation of optical grating machines. For optical grating we had a machine called a ruling engine. The ruling engine is a machine with a simple structure capable of ruling from several hundred to more than one thousand rectilinear grooves per millimeter on the surface of a glass blank several inches square [using] a diamond cutter. So it is a very precise machine. I was involved in the development of this machine for 10 years so it was very useful for us to develop steppers after that.

Addison: You have talked about your first 15 years at Nikon. What did you do after that period?

Yoshida: I became involved in measuring machines, such as co-ordinating measuring machines for mechanical parts. Several years later we became involved in the semiconductor industry. At the first stage [around 1970] we developed a mask aligner; an XY coordinating machine for measuring photomasks. We call it the optical interferometer model 2i. It was very popular in the United States to inspect photomasks. Fortunately I was awarded the BACUS Prize in 1998 for my work on the Nikon 2i.

[Editor's Note: The International Technical Group of the SPIE awards the BACUS prize to individuals who, through invention or other activity, have made a significant impact on the technology of mask making].

Addison: When you were developing the machines, what did you enjoy about the job?

Yoshida: The most impressive memory for me was my involvement in the ruling engine. I had my first hand experience for the use of the laser interferometer and I also had to do quite precise measurements in the order of nanometers and that work was quite challenging.

Addison: Was the Nikon 2i the company's first product for the semiconductor industry?

Yoshida: No. Before that we produced comparison microscopes for inspection of photomasks. At about the same time we developed the Nikon 2i also.

Addison: Who was the customer base?

Yoshida: The first [Nikon 2i] machine we sold was to Japanese IC manufacturers. After that we exported to the U.S. Many companies (were our customers), including Hitachi, NEC, Fujitsu, Toshiba. After that we sold to IBM and National Semiconductor.

Addison: Where did you get the ideas for the products?

Yoshida: I came up with the ideas myself. I then presented our concept to potential customers, and they secured the necessary funds and gave us an order to develop the product.

Addison: Do you recall you first customer visit? Was it a difficult sell?

Yoshida: As far as the 2i was concerned, Hitachi was our first customer. Yes, it was difficult because there was no such machine available at that time, namely, an XY coordinating machine with laser interferometer and photo electric microscope. These were quite new products so it was very difficult to persuade the customer how this machine would benefit them.

Addison: What about the competition at that time?

Yoshida: At that time there were no competitors. But the 2i was very expensive so we could [only] sell one or two machines per each customer.

Addison: Was the 2i a big success?

Yoshida: I think so. It was a good chance for us to enter into the semiconductor industry. Also the XY measuring machines technology base was transferred easily to steppers because both were very similar.

Addison: Please talk about the transition to steppers.

Yoshida: As you know, the stepper has several essential components. One is the optical lenses. We called it the Ultra Micro Nikkor. At that time we had been selling the UMN to the printing industry. The UMN technology was transferred to steppers, both were very similar. And as I mentioned earlier we had been developing XY measuring machines, so this mechanical part and the controlling system were transferred to steppers. At that time in the semiconductor industry, the resolution was becoming smaller and smaller. Customers requested from us less than 1 micron resolution. So I proposed to customers that the optical reduction system was the best method to manufacture such high resolution devices. Fortunately, the Japanese government-led VLSI consortium created in 1976, ordered the first machine from us via a government procurement contract. This was the first optical stepper for Nikon.

Addison: Who was the first commercial customer?

Yoshida: NEC, Toshiba…

Addison: Did the competition at the time have similar machines?

Yoshida: GCA in the U.S. had a similar stepper.

Addison: Was Nikon the first Japanese company to produce a stepper?

Yoshida: Yes, the first in Japan

Addison: Did you try and export to U.S?

Yoshida: As a first step, we sold mainly Japanese customers. After that we exported our machines to the United States. We established Nikon Precision Inc in the U.S. they tried to sell our machines in the U.S. If I recall the first U.S. customers were IBM and Texas Instruments.

Addison: What was your role in the development of the first Nikon stepper, the NSR-1010G?

Yoshida: I was involved in the total cycle of design because I myself came up with the ground design concept. And I led the design team for the first stage of design.

Addison: Being a camera maker, Nikon sold lenses to other stepper companies. Did you continue to do that after you developed your own stepper?

Yoshida: Before the stepper development, we were selling our special Ultra Micro Nikkor lens for photo repeaters (to GCA). But after entering into the stepper business we didn't sell our optical lenses to anybody.

Addison: What was the thinking behind Nikon's move into the stepper business?

Yoshida: Since we started out with inspection machines we always wanted to penetrate into the manufacturing machines as well, so I thought it would be a great chance and it would be a good opportunity.

Addison: What was your role in the company after the first stepper was developed?

Yoshida: I continued several years in the design department and after that I concurrently managed the sales department for steppers.

Addison: What was the competitive environment like? Where there are Japanese stepper makers?

Yoshida: No, but at that time alternating technologies were available, such as projection aligner from Perkin Elmer, and stepper itself from GCA. Also the projection aligner from Canon. So there were competitive businesses.

Addison: Was it a difficult business to compete in?

Yoshida: Yes, but our optical steppers had three major sales point. One was optical reduction ratio. We introduced 5 to 1. At the beginning every stepper had a 10 to 1 reduction ratio, so the exposure area is only 10 by 10 mm at that time, but we introduced 5 to 1, so we could expose 15 by 15 mm -- almost double the exposure area. This was a very strong sales point for us because the customer could increase throughput. Also, our machines had a laser interferometer, which provided 0.1 micron resolution. This was also a strong sales point. Another feature was the automatic alignment system of the Nikon stepper which allowed higher accuracy.

Addison: Please talk about your subsequent progression in the company, from design to sales.

Yoshida: In 1983, I was promoted to the stepper division manager, in charge of not only sales and design but also manufacturing. I was in that role for 5 or 6 years.

Frankly speaking, my personal interest is in design or developing the technology. So even now I visit frequently our design department and discuss [technology issues] with the young engineers.

Addison: What was your greatest challenge during your time as division manager?

Yoshida: It was when we had to develop a next generation model. At that time we were using only a mercury light source. After that we decided to go to a new light source, excimer laser. At the same time the stepper exposure system was transferred to a scanning system. So there was a big challenge in the design of this new stepper.

Addison: How did your career progress after division manager?

Yoshida: I was promoted to managing director of the entire Nikon Corporation. I managed not only the stepper business but also the microscope and measuring instrument division. After that I was promoted to executive vice president. Fortunately, in that role I was involved in the camera business also.

Addison: Were you familiar with camera business at that time?

Yoshida: I personally use Nikon cameras and I have a strong interest in photography.

Addison: But cameras and steppers are very different markets, consumer vs. industrial.

Yoshida: Basically, the technology background is very similar between the stepper business and the camera business. So I have a strong interest in the design and development of cameras (as well as steppers).

Addison: Did you ever personally design a camera?

Yoshida: No, only a stepper, and astronomical telescopes.

Addison: How did you become the CEO and chairman of Nikon?

Yoshida: It was because I pioneered a new business domain in Nikon. Nikon has a long standing tradition that the former president should assign the next president.

Addison: Nikon's semiconductor equipment business is very successful, so did that play a big role in your promotion?

Yoshida: Yes, I think so.

Addison: As chairman and CEO, do you have much involvement in the semiconductor equipment side of the business now?

Yoshida: I have transferred that responsibility to the president of the stepper business unit [Kariya-san, Nikon executive vice president]. He now manages everything. I rely upon him.

Addison: What is your view of the development of the Japanese semiconductor equipment industry, and specifically steppers? For example, were there many spin-offs from larger companies, or was most of the product development done in-house by the larger device makers or conglomerates?

Yoshida: As far as steppers are concerned, what we saw was the customer (device maker) coming directly to the independent stepper manufacturers. I did not see so many cases where device makers manufactured any exposure machines in house.

In the early stages, device makers such as Texas Instruments or IBM made their own exposure machines, such as contact printing machines. But after the stepper business developed they didn't manufacture in house. [In Japan], Hitachi was one exceptional case. They had lot of experience in manufacturing [equipment] so they tried to enter into the stepper business.

Addison: In your view, what was the main reason that the U.S. stepper makers, such as GCA, didn't succeed?

Yoshida: As far as stepper technology is concerned, optical technologies are the most essential part. But unfortunately in the United States they did not have specialized optical manufacturers. In Japan there are several, including Nikon, Canon, Olympus and others, and in Europe there is Ziess and Leica. They all have the skill of optical technologies. This is one reason. In the United States there are more high-grade technologies such as special optical equipment for satellites. So in these special areas they have excellent technologies, but for mass volume production they do not.

Addison: I read one article about GCA that said the company management didn't pay enough attention to the silicon cycles, and this was one reason for its troubles. Is this important to survive in the stepper business?

Yoshida: Yes, reading the cycles is a very important thing for the management of the stepper business. But it is the same story for us. We also have the problem of inventory, especially in the downturn phase. We are trying to shorten the manufacturing lead time.

Addison: What is your view of the trade friction between the U.S. and Japan semiconductor industries during the period that the SEMI Japan office was opened?

Yoshida: While device manufacturers were in the midst of U.S.-Japan trade friction, we [the equipment industry] had the trade partners' conference held in Hawaii, sponsored by SEMI. The atmosphere was tremendous. The people from the device manufacturers envied us.

Addison: Why do you think the ITPC was successful in bringing the Japanese and U.S. industries closer together?

Yoshida: The fact is that the U.S. market took the lead for equipment and materials in the semiconductor industry. They took the leadership for the establishment of the organization of SEMI as well. At that time, Japan was actually the follower of the U.S. market and U.S. industries, trying to catch up with U.S. industries. We also knew that there would be many things to learn from the U.S. at that time. So both the Japanese equipment manufacturers and materials makers started to realize we should be on good terms with the U.S. industries. That's how it got started.

[Even] before the trade partners conference held in Hawaii, when we had regular technical sessions at the Harumi exhibition fairground [where the current Tokyo Big Site venue is located]. We could listen to presentations from many famous U.S. IC makers. They were very high grade speakers. Many Japanese equipment manufacturers gathered to listen to these lectures.

Addison: What are your recollections about the beginnings of the SEMICON Japan show?

Yoshida: For Nikon, the first SEMICON Japan was 1978. We first exhibited at InterNepcon. After an independent trade show for the semiconductor industries was started [SEMICON], so some of the equipment manufacturers shifted from InterNepcon to the SEMICON show.

The SEMICON show [in Japan] met great turnout from the very beginning because the Japanese semiconductor industry was picking up very rapidly at that time. Many people attended. Many of our customers were coming to look at our equipment.

Addison: What about SEMICON West?

Yoshida: At Nikon I attended the first SEMICON West in 1976, even before SEMIC0N Japan had started. At our first SEMICON West we exhibited only measuring machines and comparison microscopes. We had not developed a stepper by that time. So our booth was very small.

Our booth was far away from the center of the expo. It was very difficult to make arrangements to demonstrate our machines [to the customer]. I installed the machines to demonstrate at the booth. It was very hard work for me!

Addison: Did you exhibit the SR1 stepper at any SEMICON show?

Yoshida: That was 2 or 3 years later, around 1980, when we first exhibited the stepper at the SEMICON show [both in Japan and at West].

Addison: What was the market reaction to the new machines?

Yoshida: At that time Nikon had already penetrated into the stepper market. We attracted much attention and our booth was quite close to the main entrance, so we had many visitors.

Addison: Was SEMICON West an important part of Nikon's strategy to reach into U.S. market?

Yoshida: Yes, that's right. It was an important strategic step to the U.S. market and we had so many customers visiting the booth that we were actually quite busy.

Addison: Please talk about how you became a member of the SEMI board of directors.

Yoshida: I spent a number of years as one of the members of the Japan committee for the SEMICON exhibitions and one of the committee members for the technical sessions. Since I had this long experience for SEMI events, I was evaluated to be on the board of directors of SEMI.

Addison: You served a term as chairman of SEMI in 1998-99. How did that come about?

Yoshida: I had been serving as one of the board members. Somebody recommended that I should take the position of vice chairman. At that time I knew that taking the position of vice chairman would automatically lead me to the chairman the following year. It was quite a difficult decision for me whether or not to assume that position. But I decided to take that step to be the vice chairman and then the chairman.

Addison: What were the highlights of your term as SEMI chairman?

Yoshida: At that time the semiconductor industry had become more global. Prior to that it was more or less a U.S.- Japan relationship. After that time more companies from Europe and Asia participated in these industries. We started to notice that there were some regionally unique issues, problems to be solved on the regional level. So we decided to set up the regional advisory boards in order to resolve issues and problems on a region level and then consolidate them on a global level.

Addison: Finally, not about history but about the future, what is your view on the future of lithography technology?

Yoshida: It is big concern for me. As you know, for the next generation lithography there are some candidates, F2 or EUVL, extreme ultra violet lithography. We are now concentrating on developing the immersion type for ArF [argon fluoride] and KrF [krypton fluoride], mainly ArF. After that we are developing EUV as the strongest candidate for the next generation. If we can develop EUVL tools we will obtain 32- nanometer [resolution]. This is actually the ultimate lithography tool. After that, and this is just

my personal opinion, some three dimensional devices should be developed because the minimal line width will be the limit of technology. So we have to go to multiple layers or something like that.

Addison: Thank you very much Yoshida-san.

Yoshida: It was my great pleasure.

END OF INTERVIEW

