STRONG CONFIDENCE IN OUR CORPORATE CULTURE AS A MANUFACTURING SITE

ST Mobile Display Corp.

Ohmi is a city that lies between eastern and western Japan, between Kyoto to the west and Kamakura and Edo to the east, and as such has been involved in all the major upheavals in Japanese history.
A rich world of mobile communications has been brought forth from this region.
ST Mobile Display Corp. (STMD) was created as a joint venture between Sony Corporation and Toyota Industries Corporation on March 31, 2005 to nurture the liquid crystal display (LCD) technologies developed by its predecessor company.
Along with ST Liquid Crystal Display Corp., which is also a joint venture between Sony and Toyota Industries, STMD will respond flexibly to the needs of this growing market as an important manufacturing site for Sony's low-temperature poly-crystalline silicon TFT LCD products for mobile equipment.

Tadaharu Tsuyuki
President
ST Mobile Display Corp.

(Present: Corporate Adviser)

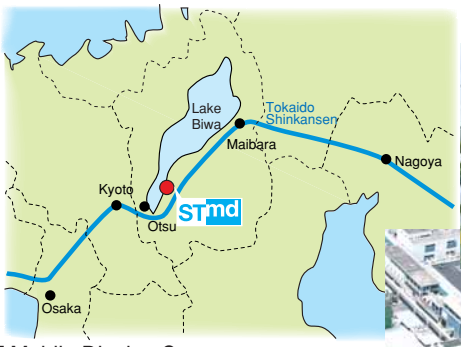
Hisao Hayashi
Executive Deputy President
ST Mobile Display Corp.

(Present: President)

Masuyuki Okuno
General Manager
Manufacturing Operations Dept.
ST Mobile Display Corp.

The view across Lake Biwa from Mt. Hieizan. Photograph by President Tsuyuki

*: This article is based on interviews on April 25, 2006.



ST Mobile Display Corp.
Established: March 31, 2005
Capital: 100 million Yen
(Sony Corporation: 80%
Toyota Industries Corporation: 20%)
Location: 800 Ichimiyake, Yasu-shi,
Shiga Prefecture
Employees: 384 (As of May 1, 2006)
Business: Development and manufacture of low-temperature polycrystalline silicon TFT liquid crystal displays
New infrastructure investment: 27 billion Yen
Production capacity: 25,000 units per month
(550 × 650 mm substrates)
(As of April 2007)
Mass production first started: April 2006

Episode

At the same time as starting up the production line, President Tsuyuki and the rest of the management team put special efforts not only into easing the concerns of the staff inherited from the company in its earlier form but also into increasing the motivation of the personnel. They quickly created a video introducing the new company, provided new work uniforms, and presented employees with children starting school the school backpacks required in Japanese elementary schools. Even though they knew that they were late relative to the recruitment cycle, they started recruitment of new graduates in April, and this was an effective advertising appeal for laying down roots in the community to develop the company even further.
According to President Tsuyuki "All of our employees who went to their alma maters to introduce the company were extremely enthusiastic. They called on the younger generation from their schools. We were extremely pleased to see this occur."
This spring, we had nine new graduates join previous graduates from their school in working for us as the first "class" since the new company was formed.

Continuity and Challenge in the Fully Automatic Production Line

"Look, it's eating its dinner just now."
President Tadaharu Tsuyuki pointed to an Automated Guided Vehicle (AGV) that had moved to a corner of the clean room.
"It recharges itself during the intervals between transport operations. When it has the time, it feeds itself."
It was Masuyuki Okuno, General Manager of the Manufacturing Operations Dept., who told us that "We put a lot of thought into where to locate the recharging points for efficiency. We had to put a lot of thought into whether the AGVs, of which there are several tens of units, should recharge themselves when their charge is almost completely exhausted or whether they should recharge themselves when only partially discharged. Don't you find this sort of problem fascinating?"
If we look back to the predecessors of STMD, one of its roots first appeared in 1996. In that year in the Yasu section of Shiga Prefecture, where the current STMD has its corporate headquarters, the industry's first fully automate production line for the TFT process (amorphous silicon) was completed. According to Okuno, who knew the situation at that time, the AGVs were the key to full automation.
"At that time, AGV motion was limited to just advancing and turning. We added sideways motion and diagonal motion modes, and that allowed an AGV whose motion was blocked to move around the obstacle. This greatly improved the line of flow and made full automation possible."
We have inherited and developed further an accumulation of production techniques of this sort, and applied this approach to the low-temperature polycrystalline silicon TFT LCD production line, which is an ever more complex process.
The "obviously visible" automation, such as AGVs, robot arms, and ceiling transport systems, is just a small part of this automation. Executive Deputy President Hisao Hayashi boasts that "We are overwhelmingly advanced in the software area as well."
"It is not merely the case that each process unit simply performs its processing according to the process recipe it is given. The system is designed so that each unit automatically acquires the data for the results of its processing, determines itself whether or not problems such as variations in quality have occurred, and provides feedback."
This system evaluates its own work while manufacturing the products. This is the extent to which automation has advanced.
Close coordination with Sony's process technology was indispensable to construct, and then further improve, such a production line. Okuno added that "Compared to amorphous technology, the low-temperature polycrystalline silicon TFT LCD technology has a great variety of items that must be managed closely, and thus is that much more difficult. Still, we all hope to create an even better automated line than we have now."
Implementing automation for a new field is meaningful exactly because it is a new field. President Tsuyuki emphasized that dust management is one of those issues.
"Since high resolution is a main sales point of the low-temperature polycrystalline silicon TFT technology, thoroughgoing dust management is required for manufacturing. The adverse effects of dust increase as the size of the devices shrink, and as the number of people watching digital terrestrial TV broadcasts on cellular phones increases, the requirements for picture quality will become more stringent. For that reason we have made a point of achieving nearly full automation even in the cell processes (panel assembly, liquid crystal material insertion, and other steps), which are the processes that require special care that dust contamination does not occur. We are convinced that the properties of fully automated lines that do not require direct human involvement will show their strengths even more clearly in association with increases in image quality."

AGV that can move about freely in the forward, sideways, and diagonal directions. The system decides automatically based on the state of the work progress whether to proceed to the next process or whether to move temporarily to a stocker. "When Sony President Ryoji Chubachi came to visit, he told us that it seemed to him to be a restrained and refined line. As manufacturing professionals, we thought those to be words of high praise." (Masuyuki Okuno, General Manager)

April 19, 2006: Ceremony marking the first shipment. The photograph was taken immediately after the truck carrying the first shipment had left. We assembled as many of our employees as we could and took this photograph from a crane truck so that each of their faces could be seen clearly.

An Unmanned System Made Possible by Our People

First Steps Towards a Production Line

Hayashi: We had many problems during the few months prior to starting the line, especially at the stage of determining the recipes, one by one, for each of the manufacturing units.

Tsuyuki: This is because if the manufacturing units were people, it's as though you had to tell them whether to start with the right foot or the left foot each time when you have them walk somewhere.

Hayashi: There are a phenomenally large number of parameters and even slight changes in the state of the materials being used can have unexpected results.

Okuno: In addition to there being large numbers of parameters in each individual unit, the process itself is a flow. Even if the variations are within the allowable ranges in a particular unit, those variations can cause problems in the next process.

Tsuyuki: This isn't like a combination throw in Judo; both parts must be just right or it doesn't work.

Hayashi: Ultimately, if you don't run product through the line experimentally, you won't know if it works or not. It's only when you actually run the line that you can determine if there is a problem if one particular state and another particular state are combined. What is important is how fast you can apply this feedback.

Okuno: In a certain sense, product design and manufacturing are a competition over margins. If you strive for designs that meet customer's needs or perk their interest, then the margins available during manufacturing are reduced.

Hayashi: The place where that trend is particularly strong is the process in which a polycrystalline silicon material is created by heating amorphous silicon with a laser. Exactly because this is an area that is directly related to LCD performance, this is an area where the requirements from the design department are the most strict. But this is something that is necessary.

Okuno: This is something that must be done. As someone who works in manufacturing, we understand this completely.

Tsuyuki: It certainly was a long and difficult process to set the margins and then teach each unit everything it needed to do. But in return, once you teach the units, unlike human workers, they don't falter or waver. They are exceedingly reliable and trustworthy.

Powerful Manufacturing

Okuno: I'm always telling the members of our manufacturing group that I want us to achieve "powerful manufacturing." If manufacturing is weak, then the technology group will always feel satisfied with the status quo. If the manufacturing is powerful, then the technology group will attempt to become even stronger. I believe that the manufacturing line will continue to develop and improve if we both work together towards that goal.

Tsuyuki: The operators working for General Manager Okuno are almost engineers. They are always on the lookout for better ways to keep up and improve the equipment, and they are extremely skilled. This sort of staff cannot be trained in a single day.

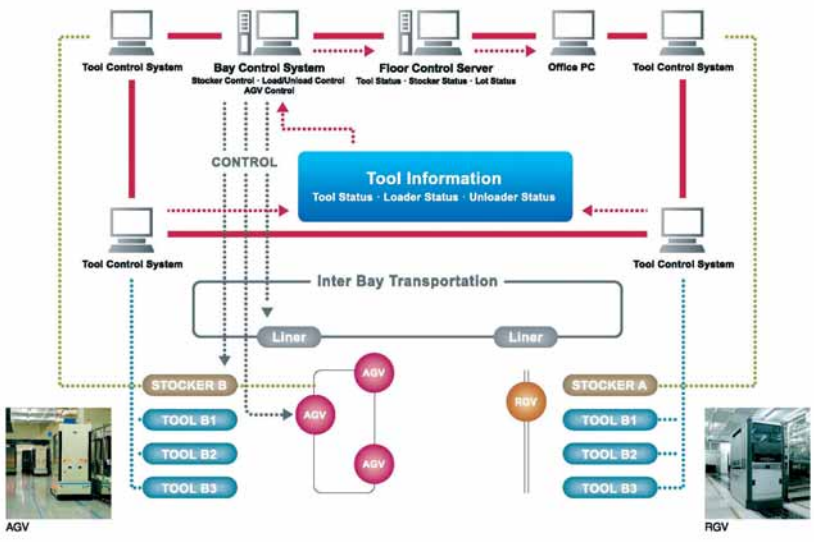
Okuno: What is the true nature of an operator's work? What is the true nature of maintenance work? I think that these two jobs became indistinguishable in the latter half of the 1990s.

■ Process Technology

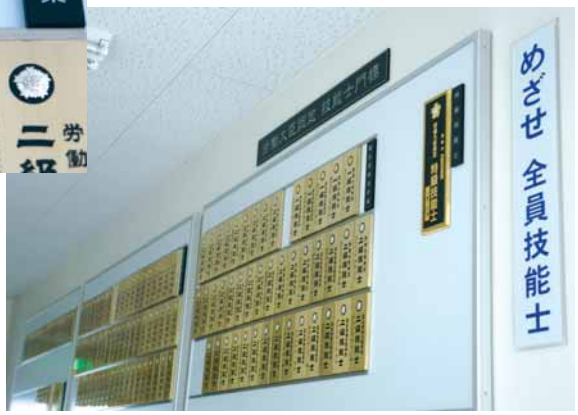
Based on the construction of a manufacturing line for high resolution/wide viewing angle displays and production technology capabilities nurtured through experience with mass production, Sony has fused together into a unitary whole the leading edge low-temperature polycrystalline silicon TFT LCD process technologies developed by the Sony Corporation Mobile Display Business Group. Sony is building a production line that can provide, in a timely manner, the high-performance, high-quality, and low-cost LCDs our customers demand.

■ Fully Automatic Production Line

In addition to reducing dust and the number of personnel required, we are moving forward with thoroughgoing automation of the production line. We are rebuilding the automated transport system and aiming for both maximum utilization of the production facilities and reduced production lead times.



As part of our goal of “powerful manufacturing”, we are aiming at having all of the almost 200 manufacturing employees acquiring certification as equipment maintenance and electronic equipment assembly professional engineers (under the jurisdiction of the Japanese Ministry of Health, Labour and Welfare).



Tsuyuki: This is, don’t you agree, a matter that as automation advances, the job position of “ordinary operator” is about to disappear?

Okuno: Because we think that everyone should be a qualified maintenance engineer, we are aiming at having everyone who works on the line acquire certification as a professional engineer. Then they can analyze failures and propose solutions as professional engineers when a unit fails. Also, they could learn about the process and analyze defective products. We really want them to be true “manufacturing men” who have at least one of these skills.

Hayashi: I think it’s important to keep emphasizing this direction. This is because if we don’t make the direction clear, our employees may not be able to understand the meaning of what they are doing.

Okuno: If the employee has equipment maintenance and process capabilities, then if a problem occurs, the employee will be able to handle the situation at least to a certain extent without waiting for an expert. If the employee has this level of knowledge, then he will be able to decide in about 70 percent of the cases whether to stop the line or whether to continue line operation. What we mean by “powerful manufacturing” is that each employee is “self contained”, that is, is a responsible autonomous actor. If you’d allow me to add one more point, it is important that the manufacturing line be robust to the point that it can withstand some amount of “pushing.” Which is to say, everyone must work together as a group during busy periods.

Hayashi: Even if it is a leading edge production line that is managed by a CIM system, I think that hardworking efforts are necessary.

Tsuyuki: Yes. This is because if we don’t keep in close communication with the employees on the line on a daily basis, it will be harder to ask them to put in extra effort (in busy periods).

Okuno: When I listen to what team leaders have to say, I make a point of going to the floor for those discussions. I think that it is important to have a shared view of the actual state of the floor while communicating with these team leaders.

Tsuyuki: It all comes down to people. And communication. We also hold a variety of events as corporate functions.

Okuno: The event we all participated in last year was a Chinese canoe regatta on Lake Biwa.

Tsuyuki: Although we said we entered with no chance or intention of winning, our team actually did quite well, so we in the management didn’t have to actually row ourselves.

Okuno: While I basically went to eat the barbeque, Mr. Hayashi, who was sitting next to me, spent the day drinking.

Potential that Gives Rise to Evolution

Tsuyuki: As our next step, when the process becomes even more complex and the number of parts increases, we must apply the Toyota “just in time” approach even more thoroughly to reduce the lead time.

Hayashi: Our sights is how efficiently can we manufacture a large number of products at the same time.

Tsuyuki: There is no royal road to a good production system. For example, manufacturing conditions will change.

Okuno: Although we have confidence in our accumulated knowledge from the standpoint of Monozukuri (the Japanese philosophy of skillfully producing quality goods), we must at the same time also be humble and modest. For example, system displays that integrate peripheral circuits is an area that we have no experience in using amorphous materials. Just as with our fusing of the previous company and Sony’s technology to form this new venture, moving forward, it may be necessary to introduce some other methods and techniques as well.

Tsuyuki: However, when that happens, it will not simply be a matter that such and such a method is good, but rather we must flexibly integrate the new method. Since we have become constitutionally stronger, both in personnel and in our facilities, I think that we have a very high potential for future evolution.

■ Real-Time Reporting System

At STMD, all data relating to production is managed by a computer system called a process management system. Quick and accurate assessment of conditions and actions that take advantage of online data are critically important for improving both productivity and quality. Towards that goal, we are implementing and operating a web-based real-time reporting system that aims at sharing across the whole company in a timely manner over 30,000 items of reports and information that are always updated to reflect the latest conditions.