Avaplas Ltd

Cultivating Change Fostering Growth

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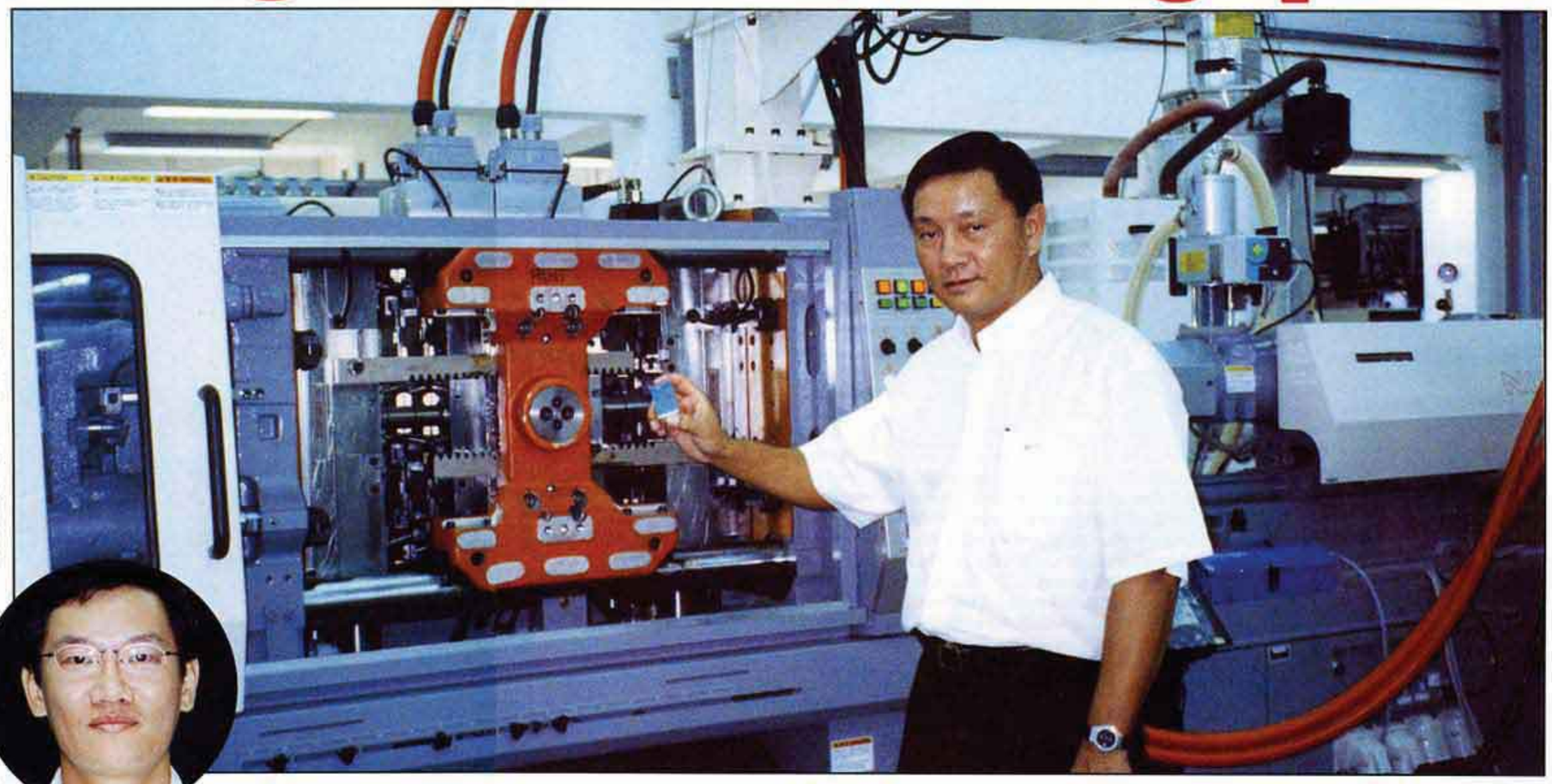
STACK MOULDING

Stack moulding slides into Singapore

A team of moulding specialists is pioneering the introduction of stack moulds with multiple slider technology into south-east Asia.
Mark Pilling ***and*** *Wira Sulaiman* ***report.***



Hewlett Packard's Jeff Lim who kicked off the project over 12 months ago.

The first test-run of a new mould is often a nail-biting time. For the team involved in bringing one of the first stack mould projects to fruition in Singapore this was definitely the case.

Stack moulds present a whole new raft of challenges to part designers, mould-makers and moulders alike. A stack mould consists of two or four levels of cavities and cores assembled in one mould frame *(see IMA, June 1998, page 12)*. The aim is to increase output while using the same injection press.

This was the case in this project, with the stack mould being run on the same sized machine as the original single mould. However, there were concerns about damaging the injection press by running it with the heavier stack tool.

But the team had done its homework well. "In the first test the tool ran non-stop for two hours," explains Jeff Lim, Principle Procurement Engineer, Asia Operation, Inkjet Imaging Solutions, of Hewlett-Packard Singapore. "It was fantastic to see it work first time."

The story starts with the part in question: a lever clamp used on H-P's world best-selling Deskjet DJ 720/722 and 895 inkjet printers. Many thousands of these popular personal and office printers are produced a month in Singapore alone.

The motivation for Mr Lim to pursue a stack moulded part was simple: cost-reduction. "We needed a breakthrough to bring the cost down, and I had in mind a stack mould to achieve this," he tells IMA.

"It has always been my intention to do a stack mould project. I had seen it in Europe and the US, but in Asia we had never had an opportunity for the type of parts (suitable for stack moulding)," says Mr Lim.

When a part change opportunity came up for the lever clamp, Mr Lim saw the chance to use a stack mould to make it. But experience in making and using stack moulds with multiple sliders in Singapore was virtually non-existent. There were not many operating locally, and nobody had ever made one.

H-P Singapore's requirement for the stack mould was also extremely demanding. Traditionally stack moulds are used to make thin-walled flat parts that are fairly simple in shape, such as microwave trays.

In this case the lever clamp is a small and much more complicated part, and has undercuts. To form these undercuts each cavity of the stack mould requires three sliders, an additional complication and fairly unusual in itself. The slider requirement makes even greater demands on the tool-maker.

"I called various parts of H-P worldwide to get information on stack moulds," he says. "Some had experience of stack moulds, but not the sliders."

There is a hefty investment needed to bring such a ground-breaking project to reality. With this in mind Mr Lim decided to bring in all of the parties involved at the start.

Firstly, H-P brought in Avaplas, the moulder that was familiar with the lever clamp part as its current supplier, and a firm prepared to take part in the extensive testing such a project entails.

Avaplas is part of the Univac Precision Engineering group, and specialises in the high precision moulding of connectors and computer related products.

Secondly, H-P contacted one of Singapore's top mould-makers – Univac Precision itself. Univac has a reputation for being able to manufacture high quality, sophisticated moulds *(see IMA, June 1999, page 14)*.

Thirdly, H-P brought one of its main suppliers of conventional hot runner systems, and one with extensive experience in stack moulds, Husky.

Mr Quek, Managing Director of Avaplas, alongside the Nissei press with the stack mould clearly showing the orange coloured vertical mould support from Husky.

"A partnership like this is needed otherwise the project would not succeed," says Mr Lim. Discussions between the various parties began in early 1998, with the project formally launched in July that year.

The original lever clamp was being moulded by Avaplas on an 180 tonne Nissei press in an eight-cavity mould. "It was no good going to more cavities, the cost would go up," says Mr Lim.

"Our other alternative was to use two injection presses, but that is not economical and not as challenging as using a stack mould," adds Mr Quek, the Managing Director of Avaplas.

"Furthermore there are two parts, and if we were to stick to the conventional ➡

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In a class of its own

ISO9000-certified Avaplast was established in 1993 and specialises in the production of high volume, precision plastic components, as well as sub-assemblies for the computer, consumer electronics, and telecommunications industries.

Managing Director Mr Boone Quek explains that the company was established with only one aim in mind – to cater to the high precision market. "Six years down the road we are proud to claim that we have achieved our initial targets," he tells IMA.

There are hundreds of plastic processors around the region, but what differentiates Avaplas from the rest is its ability to take up new challenges. "That explains why we were so bold in moving into the stack mould technology," he says.

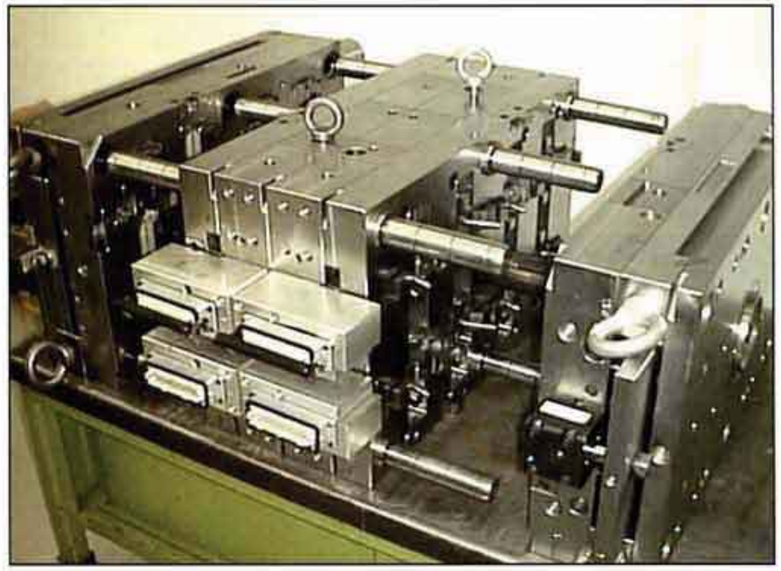
Avaplast is on the preferred supplier list of Hewlett Packard, Motorola, Sony, GE and various other Singapore-based multi-nationals.

"Our strength is centred on our ability to produce high end engineering plastics, such as thinwall parts of 0.4mm and parts with tolerances of down to five microns," says Mr Quek.

Its 65,000 square foot facility, located near the Changi International Airport, is equipped with 45 injection presses, most from Engel, Nissei and Sumitomo. These range from 40 to 360 tonnes in clamping force.

The move into stack moulding has prompted Avaplas to invest in its first Krauss Maffei machines.

Avaplast's 175 workers undertake their jobs in a highly automated factory. The company's turnover has never fallen since it started up and has recorded on average growth of 25-30% in sales annually. Last year the company achieved a turnover of S$30 million.



Univac has built two stack moulds for the project. This is the first one clearly showing the two mould faces (photo: Avaplas).

method then Avaplas would have to buy four machines and more resources are required for the upkeep and handling of the machines. This would be way too expensive," says Mr Lim.

The only option to cut costs was to double the number of cavities to 16 (and therefore 48 sliders) while using the same machine, ie a stack mould. Some modifications to the Nissei press were needed because it was not originally designed to handle a stack mould.

The task for Univac was in essence very simple – to build a stack mould that would run on the 180 tonne press. But this was a major challenge.

"There were a lot of discussions about how to make the mould as compact as possible. The aim was to try and do it in the same size as the original mould size," he says.

Univac supplied the mould blocks, while the manifold came from Husky. Furthermore a Husky I-shaped vertical mould support, especially designed for stack moulds, was also brought in.

To reduce the size and thickness of the mould, the mould plate was hardened. The shortest possible nozzle height – about 40mm – was specified for the Husky hot runners.

The hot runners used had standard hot tip nozzles. The hot runners were already gated directly onto the surface of the lever clamp part in the original eight-cavity production runs.

The mould features a centre entry sprue bar instead of an offset sprue bar because of the small nature of the parts.

Univac has built two moulds for this project, one for a black lever clamp, and one for a colour lever clamp. The first has the Husky mould support, while Univac has designed a dedicated one for the second mould.

The mould was extremely complicated to design and manufacture, with a lot of detailed work to make and fit the three sliders per cavity.

So much stress was put on making the mould as compact as possible that it actually got smaller from the first to the final design. A Moldflow analysis on the mould gave it the green light to enter the test phase.

"The mould was built in 14 weeks, a longer time than usual (on average moulds are built in 8-10 weeks), to ensure the quality is perfect. We wanted to see a result in the first test," says Mr Lim, which took place in November 1998.

"The cycle time on the original (eight-cavity) machine was 27 seconds," says Mr Lim. "We thought we might see a 30 second time with the new mould due to the additional opening stroke required.

"But we were getting 20 seconds on the stack mould in the first test – it was a shock, but the best Christmas gift I could get."

Based on the new 16-cavity mould and the cycle time saved, H-P estimates it will save about US$280,000 per year in producing each clamp. This equates to a payback time of less than four months, says Mr Lim.

The success of the test run left everyone in little doubt that the stack mould project could go ahead.

As expected there were some adjustments to be made. For example, it was found that the vertical mould support mechanism was too tight, and the mould was torn down to adjust this. It was decided to slightly adjust the dimensions of the part itself.

The power of the injection machine's hydraulic part ejection system was found to be too low, and this was boosted.

The first parts were taken away by H-P to be thoroughly tested and for the product qualification process to begin. "Before fully approving the product we perform a multiple risk-run. This checks on the product, the mould, manifold and consistency of the process," says Mr Lim.

The first risk-run of 40,000 parts was in March, and these parts were used in production line printers. One of each of the lever clamps is used in every printer, and there are three printer models that feature this part.

Another risk-run took place in mid-May and production started on the Nissei press soon after. A new Krauss-Maffei machine, especially bought for this project, took over from the Nissei in June.

Avaplas is actually spendng S$500,000 buying two KM200-700C2 presses, one for each lever, with the second being delivered in August. Until then the first machine will run for two weeks with one of the stack moulds, and then swap over and run the other mould for two weeks, says Mr Quek.

One of the clamps weighs about 4.5 grammes, while the other weighs 8 grammes. Both clamps are about 2.5mm in thickness.

The K-M press is believed to be more suitable to run these heavy stack moulds compared to the Nissei. It is sturdier, comes with a larger tiebar, and gives the mould optimum support, he says.

"The Japanese machine can be used but in the long-run it will be damaged," he says.

Precision moulder Avaplas has 45 presses from Engel, Sumitomo and Nissei. To cope with the stack moulding project it is buying Krauss-Maffei machines (photo: Avaplas).

There were no modifications to the K-M press other than an additional shoe support, needed because of the weight of the mould (about one tonne). The press has an injection speed of 300mm/sec, but can go up to 1,000mm per second depending on the part being processed.

H-P specifies that Avaplas uses GE Plastic's Lexan polycarbonate for the clamps. Avaplas bought a dehumidifying drier from Piovan to ensure the resin was perfectly dry prior to being injected.

At present, following moulding, the parts are ejected and free-fall to be collected. "There are no plans to use a robotic part removal system as both HP and Avaplas want to reduce the cycle time. The mould opening has to be bigger for the robot to go in, and the aim is to limit the opening time. There are no suitable robots small enough to go into the mould and pick the parts up," says Mr Quek.

The spin-off for Avaplas getting involved in such a demanding project so early in its lifetime is obvious. Not only does it sustain its activity in a part it has been moulding for several years, it enables it to enter another area of technology.

"There are obviously risks involved in moving into stack mould technology," explains Mr Quek. "But as costs escalate drastically we are left with no choice. Furthermore it is in line with our ambitions of moving into the next level of technological breakthrough."

HP is also looking at introducing stack moulding for other parts. If this comes about it is likely that Avaplas will do the job.

For Hewlett Packard the project achieves two things: it emphasises the company's desire to introduce new technology where appropriate, and it cuts costs, says Mr Lim.

"The company empowered me to look at the risk and calculations needed to make this technology breakthrough. I had the opportunity to initiate the whole project and bring it to fruition." ■

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