<table>
<thead>
<tr>
<th>Title</th>
<th>ASM Pacific Technology Limited</th>
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<tr>
<td>Author(s)</td>
<td>Tang, Hung Kei</td>
</tr>
<tr>
<td>Date</td>
<td>2001</td>
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<tr>
<td>URL</td>
<td><a href="http://hdl.handle.net/10220/13676">http://hdl.handle.net/10220/13676</a></td>
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ASM PACIFIC TECHNOLOGY LIMITED

Tang Hung Kei

This case traces the corporate history and development of ASM Pacific Technology Limited (ASMPT), a public-listed “technology” firm in Hong Kong from 1975 to 1999. The company was founded in 1975 as a two-man outfit that sold encapsulation equipment from the Netherlands and USA-imported materials. By 1998, the firm was developing and mass-manufacturing award-winning semiconductor products, and had operations in China and Singapore.

The teaching objectives are:

i) to generate discussion on the technological and organisational (human resource, in particular) challenges that could present themselves as the company entered its next stage of growth, and strategies that could be implemented to meet these challenges;

ii) to contrast the working styles (cross-cultural differences) of ASMPT’s engineers in Hong Kong and their counterparts in the Singapore subsidiary.

Associate Professor Tang Hung Kei prepared this case. The case is based on public sources and interviews with key personnel from ASM Pacific Technology Limited. As the case is not intended to illustrate either effective or ineffective practices or policies, the information presented reflects the author’s interpretation of events and serves merely to provide opportunities for class discussion.

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Phone: +65-6790-4864/6790-5706, Fax: +65-6791-6207, E-mail: asiacasecentre@ntu.edu.sg
On 2 November 1998, employees and invited guests of ASM Technology Singapore (ATS) gathered at the company's multi-purpose hall to celebrate. Its latest gold wire bonder, the AB339, was named one of the best products by Semiconductor International, an industry trade journal. For the company, the successful market penetration of AB339, as evidenced by the award and early sales figure, was a significant achievement. Mr. Patrick Lam, Managing Director of parent company ASM Pacific Technology (ASMPT) of Hong Kong, was present at the ceremony. (See Exhibit 1 for the ASM Group Structure.) So was the Chairman of Singapore's National Science and Technology Board (NSTB), who graced the event as guest-of-honor. ASM Technology Singapore had received a total of S$8.5 million in grants from NSTB's Research Incentive Scheme for Companies from 1994 to 1998. In his speech, Mr. Patrick Lam described the company's performance:

ASM has been blessed with an international team of talented and committed employees, working harmoniously together to challenge global markets and producing wonderful results. Started as a small company providing die and wire bonders to niche markets such as chip-on-board and opto-electronics applications, ASM has grown to be among the world’s top 5-7 semiconductor assembly equipment manufacturers during the last few years with US$200 million in annual revenue.

Lam had been with ASMPT since its inception. While justifiably proud of the company's past achievements, he cautioned employees of new challenges to come.

Let us remind ourselves that product leaders do not stop for self-congratulation, they are busy finding new heights.

EARLY HISTORY

In 1975, Mr. Arthur del Prado, a Dutch national and founder of Advanced Semiconductor Materials (ASM) International of the Netherlands was in Hong Kong to visit its sole customer, Philips, the Dutch electronics company. He took the opportunity to survey the prospects for the semiconductor industry in Hong Kong, and decided to start off a small sales office there, named ASM (Asia). To keep overheads low, ASM (Asia) (later renamed ASMPT) was essentially a two-person outfit -- an electrical engineer Patrick Lam who was recruited by del Prado during his visit, and a secretary. The Hong Kong branch derived its main revenue from the sale of encapsulation equipment from the Netherlands and related materials from USA. (See Exhibit 2 for a glossary of semiconductor assembly terms and Exhibit 3 for some pictures of semiconductor assembly equipment.)

By 1977, the Hong Kong sales office had established a sizable customer base in the local semiconductor industry. ASMPT then moved into small-scale production of mold base, a component of semiconductor encapsulation mold that did not require great precision. The company relocated into a 2,000 square-foot premise, to which a 1000 square-foot attic was later added. Soon after, ASMPT was producing custom-designed trim and form tools for its customers.

In 1979, ASMPT made two landmark decisions. The first was to purchase a 10,000 square-foot industrial property to support its new venture into the mass production of leadframes. ASMPT had mastered the technologies for the production of high precision stamping dies and electroplating. In 1998, the leadframe business still accounted for about a quarter of ASMPT's turnover. The second major decision was the acquisition of a wire bonder manufacturing business in Hong Kong from an American company. ASMPT was keen to seek any potential synergistic benefits that would accrue with the acquisition as the business of semiconductor assembly equipment was quite related to ASMPT's core activities.

In 1980, ASMPT looked into designing its own automated equipment. While the manual wire bonder business provided a steady stream of income for the company, it was likely to change with automation. Customers would need automated products to compete in the future. To do so, the company had to develop new in-house capabilities including pattern recognition and motion control through electronics and software. To provide these capabilities, ASMPT decided to inject new "blood" and talent into the company.

PEOPLE, PRODUCTS AND PROFITS

In the early 1980s, the company went on an aggressive drive to recruit young engineering university graduates. Hong Kong, a vibrant financial and commercial hub, offered ample career opportunities for new graduates. During economic booms, engineering graduates were often lured into non-
engineering careers that provided them with better compensation and career paths. Notwithstanding competition from more established firms and the civil service, ASMPT was able to attract and retain good managerial and engineering talents. Many employees recruited from that period stayed with the company. Of these, a software engineer, a process engineer and an electronics engineer, would grow to become members of ASMPT’s core management team. For the company, this ability to attract and retain the essential engineering talent was one of its key success factors.

With the new recruits and talents on board, the company was able to move into product development. Since ASMPT was new to the game of research and development, the company chose a niche product- and-market strategy.

Instead of developing automatic wire bonder right from the start, ASMPT invented a conversion kit that enabled manual aluminum wire bonder to operate semi-automatically. Introduced to the market in 1981, the conversion kit became very popular with low-cost producers whose product volume per product type did not justify the more costly fully-automatic wire bonders. Following this early success as an equipment producer, ASMPT launched a complete semi-automatic aluminum wire bonder in 1982. The product became popular with customers who used it for chip-on-board assembly. In 1984, ASMPT finally launched its fully-automatic wire bonders that came in two models -- aluminum wire and gold wire. Keeping the frenetic pace, in the same year, the company launched the first semi-automatic and automatic trim and form machines. Keeping to its niche market strategy, ASMPT produced the first die bonder aimed at LED manufacturers in 1985. In developing the machine, the company worked closely with Sanyo, a leading manufacturer of LEDs in Hong Kong. The die bonder soon captured a lion’s share of the LED manufacturing market outside Japan. By the 1980s, the sales of leadframes and equipment provided two steady streams of profits for ASMPT.

Except for the initial (set-up) capital from ASM International, ASMPT’s growth was financed mainly through retained earnings and bank loans. However, to capitalise on the opportunities for more rapid growth, ASMPT decided to look for external sources of funding. The owners decided on the Initial Public Offering (IPO) route; ASMPT was to be listed on the Hong Kong Stock Exchange. A total of 90 million new shares of 10 cents each at $1.61 per share were issued in the IPO, at a price/earnings ratio of 7.5.

In January 1989, ASM Pacific Technology Limited was listed in Hong Kong with Arthur del Prado as Chairman and Patrick Lam as Managing Director. In 1997, 51 percent of the ASMPT equity was held by ASM International.

THE SEMICONDUCTOR ASSEMBLY INDUSTRY IN ASIA

The semiconductor industry grew out of the invention of the transistor by scientists of the Bell Labs in USA in 1948. From the US based semi-conductor assembly, it quickly spread to Europe and Japan, and later to the rest of Asia until it became a global industry.

In the 1960s, many American and European semiconductor companies began to shift their labour-intensive semiconductor assembly operations to Asia. Hong Kong, Singapore, Malaysia and the Philippines were popular destinations because of the availability of labour and the use of English as a working language. Typically, the semiconductor companies would bring in production equipment from their own countries and many of the early semiconductor companies also developed their own production equipment. In fact, early semiconductor companies, such as Texas Instruments and Philips, largely differentiated themselves from other companies by their more superior production equipment, which were able to produce better quality products and achieved higher yields.

As the semiconductor industry flourished, new companies specialising in semiconductor wafer or front-end processing and assembly, or back-end equipment emerged. The Americans were again the pioneers in this industry trend. One of the earliest independent manufacturers of semiconductor assembly equipment, Kulicke & Soffa (K&S) Industries Inc, established in 1951, continued to lead in this field in 1998. However, most semiconductor assembly equipment manufacturers in 1998 were either European or Asian.

With the emergence of these independent equipment manufacturers, traditional semi-conductor companies gradually gave up developing their own equipment and concentrated on the design and manufacture of semiconductor devices and integrated circuits. This was the beginning of the specialisation trend.

As demand for semi-conductors increased both in volume and variety, the “fabless” semiconductor
companies emerged in the 1980s. These companies focused on the design of narrow ranges of integrated circuits. The narrow focus differentiated them from traditional or merchant semiconductor companies, which tend to have wider range of products. As the term "fabless" implied, these smaller and more agile companies chose not to invest in wafer fabrication foundries. Instead, they relied on specialist setups called foundries, to fabricate the integrated circuits on silicon wafers. Most of the fabless companies were based in the US. However, a few Asian countries, namely Taiwan, Korea and Singapore, began to invest heavily in foundries.

Following this differentiation pattern in the industry, another important development was the emergence of contract manufacturers, who specialised in semiconductor assembly and testing. These companies converted wafers from foundries into integrated circuit or chips and other semiconductor devices.

With these developments, the traditional vertically integrated manufacturing value chain broke down into three separate components - "fabless" IC design-oriented companies, semiconductor foundries and semiconductor assemblers. Feeding this value chain were the equipment manufacturers and the suppliers of consumables such as chemicals and gases. Most of these semiconductor assembly contract manufacturers were based in Asia, especially Korea and Taiwan. ASMPT's Patrick Lam estimated that Asia (including Japan) accounted for 90 percent of the world's semiconductor assembly in volume. Excluding Japan, the figure was 75 percent. To Lam, an important contributing factor for ASMPT's success was its physical proximity and close relationships with Asian customers, many of whom were contract manufacturers. (See Exhibit 4 for ASMPT's sales by countries.)

SECOND WING

The British colonial government of Hong Kong had long adopted a laissez-faire approach in its economic policies. A case in point was its neutral stand on industrialisation. There was little government initiative to develop science and technology in Hong Kong. Industrialisation was purely a result of private initiative. In the early 1950s, industrialisation received a major boost when industrialists left Shanghai after the 1949 Communists' Takeover and moved to Hong Kong. Hong Kong's textile, plastics and other light industries boomed. Electronics, watch and toys industries emerged in the 1960s. By the 1970s, Hong Kong had quite a robust manufacturing sector.

However, in the 1980s, manufacturers were squeezed by high land costs and acute labour shortage, of both factory operators and professionals. At that time, China's new open-door economic policy and reform, combined with its abundance of low-cost land and labour, prompted many Hong Kong manufacturers to move their production operations to mainland China, especially southern China. Following this trend, ASM China set up a plant to fabricate parts and sub-assemblies in Shenzhen (a special economic zone just north of Hong Kong) at the end of 1989. The finished goods were then shipped to Hong Kong for final assembly and testing. ASM China employed about 2000 workers in 1998.

With the manufacturing issue resolved, ASMPT shifted attention to research and development (R&D), and channelled its resources into developing the company's technological competence. In 1989, the ASMPT's R&D staffing was 150, a feat by Hong Kong's standards.

In the second half of the 1980s, demand for real estate had again reached a crescendo. This led property developers to snap up industrial land and estates and redevelop them into residential and commercial properties. For many industrialists, it was a golden opportunity to cash in. The temptation to make a quick "bucket of gold" was too great. They began to sell off their industrial properties and poured the profits into property development and also speculation. In contrast, ASMPT avoided the lure of quick money. With increased R&D staffing, the company was able to focus on the very demanding task of turning out new products in a highly competitive industry. The company's efforts did not go unnoticed. In the 1980s alone, several ASMPT products garnered a number of awards from design competitions in Hong Kong.

The company considered locating R&D facilities in Canada or USA in order to be close to sources of technological advances. After some deliberation, the management ruled out this move as it felt that locating R&D facilities close to its customers was just as important. The remaining options for a R&D location were then narrowed down to Korea, Taiwan and Singapore. Although Korea had a vibrant semiconductor industry, the language barrier was seen as formidable. Singapore and Taiwan were regarded as the preferred options. Singapore was selected as the new R&D location largely because the Singapore government agency, the Economic Development Board (EDB), keen to attract foreign direct investments to Singapore, offered ASM Technology Singapore (ATS) Pioneer Status in the Republic. This Pioneer Status meant...
that ATS’s profits (arising from the manufacture of semiconductor equipment and materials in Singapore) would be tax-free for a period of ten years, beginning from 1992. EDB followed through with grants for ATS’s training programme of ATS’s Singapore engineers and technicians in Hong Kong, under EDB’s INTECH scheme.

To check the decline of Hong Kong’s manufacturing sector in the 1980s and 1990s, the post-colonial Hong Kong government began to consider innovation and technology seriously in its policy-making. Hong Kong’s Chief Executive established a Commission on Innovation and Technology in March 1998. The Singapore government continued to steadfastly promote the manufacturing sector in the late 1990s, especially the high-value-added type of manufacturing. According to EDB’s 1998 annual report, Singapore aimed to sustain the manufacturing sector’s contribution to the GDP at no less than 25 percent. (See Exhibit 5 for the GDP trends of the two countries.)

THE SINGAPORE AND HONG KONG ENVIRONMENT (ASM TECHNOLOGY SINGAPORE)

In 1990, a Hong Kong team of twelve led by company veteran, W. K. Lee, arrived in Singapore to set up ASM Technology Singapore (ATS). The new company started out in a flatted factory but later moved to its own stand-alone factory in northern Singapore in 1992. The company began recruiting young local engineering graduates, one of whom recalled his first impression of working in ATS:

The company’s activities then were centred around this prototype gold wire bonder as though the whole company’s future depended on its progress. It’s little wonder that the entire R&D team was so committed to working together. The company’s working style also left a lasting impression. Unlike many companies I’ve come to know, ASM adopted an open office concept. All engineers were seated in small groups, with no partitions or cubicles provided. Everyone, including the General Manager, could be seen by anyone at a glance. Initially, I found it a nuisance, as I often got distracted by impromptu discussions all around me. But after a while, the benefits set in. Without the walls, the management has intentionally created an environment for teamwork through active participation and serious discussions. Social chit-chats are tolerated, but these normally would not last long as they tend to draw curious and disapproving looks from all around. In consideration for others who may be deep in thoughts, the problem solving discussions are normally carried out in a soft, whispering fashion. This results in a tangential benefit whereby aggressive confrontations somehow could not take place. Hence, when civilised discussions take place, technical problems get solved through debates on technical facts and data. This practice continues to date, except that conference rooms are now available to cater for large group meetings.

In 1998, ATS’s managers moved into individual offices located close to their work group. However, the company’s culture of maintaining an ‘open-door’ policy for easy access and communication among staff remained unchanged. Secretarial support was pooled and managers shared such support services.

From the first few batches of engineers recruited by ATS, more than twenty were sent for work stints in ASM Assembly Automation (AAA), Hong Kong. Among them was an engineer who spent six months in AAA’s CAE department. He had previously studied and worked in USA. This engineer’s first impression of AAA was the flat management and decentralised decision-making. The working environments in both AAA and ATS were very similar except for the lingua franca. In AAA, it was predominantly Cantonese (a southern Chinese dialect) whereas in ATS, it was English. The workforce in AAA was also more homogeneous than that of ATS which was more multi-cultural and multi-racial.

ASMPT cultivated close links with selected universities through the R&D engineers. One engineer was recorded to have spent two years as a research scholar at the Hong Kong University of Science and Technology. These collaborative efforts were fruitful and beneficial for the company in developing its core capability in encapsulation mold design.

Having worked for ASM in Hong Kong and ATS in Singapore, company veteran W. K. Lee observed a distinct difference in working style between engineers
from the two locations. According to him, when a problem arose, Hong Kong engineers would push themselves hard to find a solution in the shortest possible time. Once they had an apparently workable solution, they would terminate the investigation, implement the solution and move on to something else. W. K. Lee said:

*Customers get the impression that Hong Kong engineers are very fast and efficient.*

On the contrary, customers’ first impression of the Singapore engineers is that they tend to be slower in dealing with problems. He went on to explain:

This is because, they tend to look at the roots of the problems systematically by taking more factors into consideration. So the solution they find at the end tend to be more effective.

He added that:

*I wish the two groups could learn the good points from each other’s working style – be agile and systematic.*

In 1998, ATS employed six hundred people, of which 150 were engaged in R&D. However, recruiting R&D engineers in Singapore was not an easy task. Soon after ATS started operations, W. K. Lee found the local supply of R&D engineers to be rather tight. However, Singapore had an advantage over Hong Kong in its ability to attract foreign talent. A multiracial society, it was culturally more cosmopolitan than Hong Kong. Although ethnic Chinese Singaporeans made up the majority, English was the working language. One benefit of this was that foreign talent found Singapore an easy place to adapt to and settle in. In fact, ATS recruited many engineers from abroad to make up the shortfall of local R&D engineers. In 1998, ATS employed over 150 engineers of different nationalities.

In his speech during the celebration for the AB339 gold wire bonder, W. K. Lee credited the importance of organisational teamwork to the company:

*Teamwork is the key for success. ASM's R&D center in Singapore consists of international talents from different countries including: Singapore, Malaysia, Hong Kong, China, USA, Germany, UK, Australia, India, the Philippines and Indonesia. Their technical expertise covers a wide range. The development of the AB339 gold wire bonders called for a cross-functional, multi-disciplinary project team. Engineers with different expertise and diversified background worked together to create the best in the world.*

According to managing director Patrick Lam, teamwork permeated all levels of the organisational hierarchy. Furthermore, he regarded the core group of long-serving employees as the ‘backbone’ of the company and the key to ASMPT’s growth and success. This core group provided continuity and stability amidst rapid technological changes in a highly competitive market. This continuity was reflected in the key managerial personnel, most of whom had worked in the company for up to twenty years.

ASMPT's early success depended in large part on its strategy of focusing on niche markets with specialised products. This strategy carried certain demands on the company’s capabilities. For one, the company had to work very hard to satisfy customers’ needs and stringent demands, such as short cycle time, low-cost and tough technical specifications. These demanded ASMPT to be an agile player. However, ASMPT was beginning to feel that it had outgrown the niche strategy and would need to compete for a greater market share. Consequently in the 1990s, ASMPT initiated a move to broaden its technological capabilities, product range and customer base.

To tackle the challenge of developing technologies that would satisfy broader market demands, ASMPT adopted an organisational structure that intertwined the technology group with the product groups. This was explained by Dr. Peter Liu, the technical director of ASMPT.

*Although I am the technical director, I double up for W. K. Lee in ATS and vice versa. I have a similar arrangement with Peter Lo in AAA/AAM.*

On the organisation chart, Peter Liu’s position in ATS’s technology group had a dotted line linking it with ATS’s product groups and W. K. Lee’s managing director position in ATS had a dotted line linking it to ATS’s technology group. Similar lines existed between ASMPT and AAA/AAM. ASMPT’s emphasis on developing technological capabilities was reflected in the high proportion of its engineers, with basic and higher degrees (see Exhibit 6 for a breakdown of engineers by education level) and R&D expenditure of about 10 percent of sales, a percentage which is comparable with many leading companies’ in the electronics industry in the world.
The financial record of ASMPT was something that Patrick Lam spoke of with glowing pride. Since its inception, the company had been profitable (see Exhibit 7 for annual sales turnover and profits). He reported that:

“Our company has the best financials in the industry. Compared to the leader K&S, we earned more in absolute terms in the last one, three, five and ten years. K&S’s revenues in equipment sales was 10 times ours in 1984, by 1998 it was only 1.9 times.”

The semiconductor industry suffered a cyclical downturn since 1996 and ASMPT was not spared. Turnover declined from its 1995 peak. Although 1998 was a difficult year for the industry, ASMPT recorded profits while competitors K&S (USA), ESEC (Switzerland) and BE Semiconductor (the Netherlands) went into the red. In the press release of its 1998 results, the company announced its gearing ratio was reduced from 18 percent in 1997 to 9 percent in 1998 and had HK$58 million cash on hand. In the same press release, ASMPT announced its intention to invest HK$112 million to further boost its technological capabilities. Despite the company’s consistently good financial performance and ability to bring out new and a broader range of products, Patrick Lam was not satisfied and felt the company had to improve on its marketing. Winning the Semiconductor International’s Editors’ Choice Best Products Award for the AB339 gold wire bonder was of great significance to him as it demonstrated that they were making progress in this direction.

ASMPT’s expansion and successful operations into Singapore significantly bolstered Singapore’s semiconductor assembly equipment industry. Two competitors, ESEC and K&S, followed its lead and moved into Singapore. K&S announced in early 1999 that it would transfer some of its wire bonder manufacturing to Singapore from Philadelphia USA and it expected to employ 200 engineers in its Singapore operation. This brought with it an ironic twist to the ASMPT story. ASMPT had expanded into Singapore because of difficulties in finding engineering talents in Hong Kong. Now that it had succeeded in Singapore, competitors were moving in and vying with ASMPT for the same pool of engineering talents. Competing for human capital looks set to become one of the future challenges facing ASMPT. Given ASMPT’s strong track record in meeting difficult challenges, it is likely that Patrick Lam and his team have already geared up to meet the challenges of thriving in a highly competitive market.
EXHIBIT 1

ASM GROUP STRUCTURE

ASM International
The Netherlands
(ASMI)

ASM Pacific Technology
Hong Kong
(ASMPT)

ASM Assembly Materials
Hong Kong
(AAM)

ASM Assembly Automation
Hong Kong
(AAA)

ASM Shenzhen, China
(AC)

ASM Technology Singapore
(ATS)

Stamped
Leadframes

Trim/Form
Systems
Al Wire
Bonders
Die Bonders
Chip size/
Scale
Equipment

Fabricated
Parts
Sub-assemblies

Gold Wire
Bonders
Automoulding
Systems
In-Line
Systems
Etched
EXHIBIT 2

FUNDAMENTALS OF SEMICONDUCTOR ASSEMBLY OR BACK-END PROCESS

Back-end assembly comprises the mounting of individual chips on leadframes and connecting them to appropriate electrical leads.

**Die Inspection**
Every die is inspected for proper performance before the next steps are undertaken.

**Material Supply**
- **Leadframe Stamping**
  Leadframes as mounting carriers for the individual chips are stamped from copper or iron-nickel alloy.

**Material Supply**
- **Leadframe Etching**
  For high precision (and fast turnaround purposes) leadframes are usually produced by an etching process. This is required when the space between the leads is finer than the thickness of the material.

**Material Supply**
- **Leadframe Plating**
  Before bonding the dies, the leadframes are plated with silver or gold on appropriate places for good electrical contact.

**Assembly**
- **Die Separation**
The individual dies on the wafer are separated by wafer saws.

**Assembly**
- **Die Bonding**
The good dies are usually bonded on leadframes, specially produced for this purpose.

**Assembly**
- **Unit Inspection**
Every unit is inspected for proper contacts before the next steps are undertaken.

Packaging deals with the housing of the chip to protect it from environmental influences and to finalize the product for industrial use.

**Packaging**
- **Encapsulation**
The chips are mostly encapsulated in an epoxy cover with the help of transfer molds.

**Packaging**
- **Trim and Form**
The chips are cut out from the leadframe and the leads are bent into the desired shape for further manufacturing purposes.

**Product Test**
This is a final product test before shipment.

EXHIBIT 3

SOME OF THE PRODUCTS OF ASMPT

IDEALine: Automated In-line System for Die Bonding, Snap Curing, Wire Bonding, and Encapsulation (moulding) of Leadframe I.C. Packages.

AB339: Fully Automatic Thermosonic Gold Wire Ball Bonder (right) with expanded view of fine-pitch bonding of wire to chip (left)

An Automatic Moulding System
### EXHIBIT 4

**ASMPT’S SALES BY LOCATIONS**

#### 1997

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<th>Sales in HK$'000,000</th>
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<td>Singapore</td>
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<td>USA</td>
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#### 1987

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<tr>
<td>Korea</td>
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<tr>
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<td>Thailand</td>
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<td>Japan</td>
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The Hong Kong Dollar was pegged to the US Dollar at US$=HK$7.8 since 1983

Source: Company 1997 annual report and 1988 IPO document
EXHIBIT 5
TRENDS OF THE MANUFACTURING AND FINANCIAL SERVICE SECTORS OF SINGAPORE AND HONG KONG

Singapore’s GDP for the manufacturing, and financial and business service sectors as percentage of total GDP

Hong Kong’s sector GDP as percentage of total GDP

Sources: Dept. of Statistics Hong Kong and Singapore
EXHIBIT 6
ENGINEERS IN ATS AND AAA/AAM AT THE END OF 1999

<table>
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<th>Degree</th>
<th>AAA</th>
<th>ATS</th>
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<tr>
<td>Ph.D</td>
<td>8%</td>
<td>4%</td>
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<td>Master</td>
<td>28%</td>
<td>21%</td>
</tr>
<tr>
<td>Bachelor</td>
<td>54%</td>
<td>53%</td>
</tr>
<tr>
<td>Diploma Holder</td>
<td>10%</td>
<td>22%</td>
</tr>
<tr>
<td>Total Number Engineers</td>
<td>263</td>
<td>150</td>
</tr>
<tr>
<td>Total Number of Staff</td>
<td>1000</td>
<td>600</td>
</tr>
</tbody>
</table>

EXHIBIT 7
ASMPT’S HISTORICAL SALES TURNOVER AND PROFITS

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales (US$ Million)</th>
<th>Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>26.3</td>
<td>3.6</td>
</tr>
<tr>
<td>1984</td>
<td>40.1</td>
<td>6.6</td>
</tr>
<tr>
<td>1985</td>
<td>30.7</td>
<td>3.1</td>
</tr>
<tr>
<td>1986</td>
<td>35.5</td>
<td>2.8</td>
</tr>
<tr>
<td>1987</td>
<td>42.4</td>
<td>4.4</td>
</tr>
<tr>
<td>1988</td>
<td>50.0</td>
<td>8.1</td>
</tr>
<tr>
<td>1989</td>
<td>62.9</td>
<td>11.8</td>
</tr>
<tr>
<td>1990</td>
<td>67.7</td>
<td>9.3</td>
</tr>
<tr>
<td>1991</td>
<td>70.9</td>
<td>9.4</td>
</tr>
<tr>
<td>1992</td>
<td>91.1</td>
<td>12.4</td>
</tr>
<tr>
<td>1993</td>
<td>132.2</td>
<td>18.9</td>
</tr>
<tr>
<td>1994</td>
<td>162.1</td>
<td>28.6</td>
</tr>
<tr>
<td>1995</td>
<td>202.6</td>
<td>42.8</td>
</tr>
<tr>
<td>1996</td>
<td>175.4</td>
<td>26.7</td>
</tr>
<tr>
<td>1997</td>
<td>189.1</td>
<td>28.2</td>
</tr>
<tr>
<td>1998</td>
<td>171.0</td>
<td>15.7</td>
</tr>
</tbody>
</table>
APPENDIX

RELATED WEBSITES FOR THE CASE

1. ASM homepage – http://www.asm.com


5. Semiconductor industry website – http://www.semi.org