


“ We’ve got to beat our competitors in launching this product on three continents in six months...”



SOLECTRON

Quality Solutions • Global Partnerships



“All we’ve nailed down are the product specifications...”



SOLECTRON

Quality Solutions • Global Partnerships


“What can you do for us
this time?”



It's challenges like this that make being a program manager at Solectron so rewarding. Part of it is sharing the excitement of bringing a new electronics product to life. And part of it is the satisfaction of finding ways to do things smarter, faster and more cost effectively in today's fiercely competitive marketplace.

But with more than 25 locations on four continents, and more than 30,000 associates worldwide, you know you've got the people and resources to succeed.

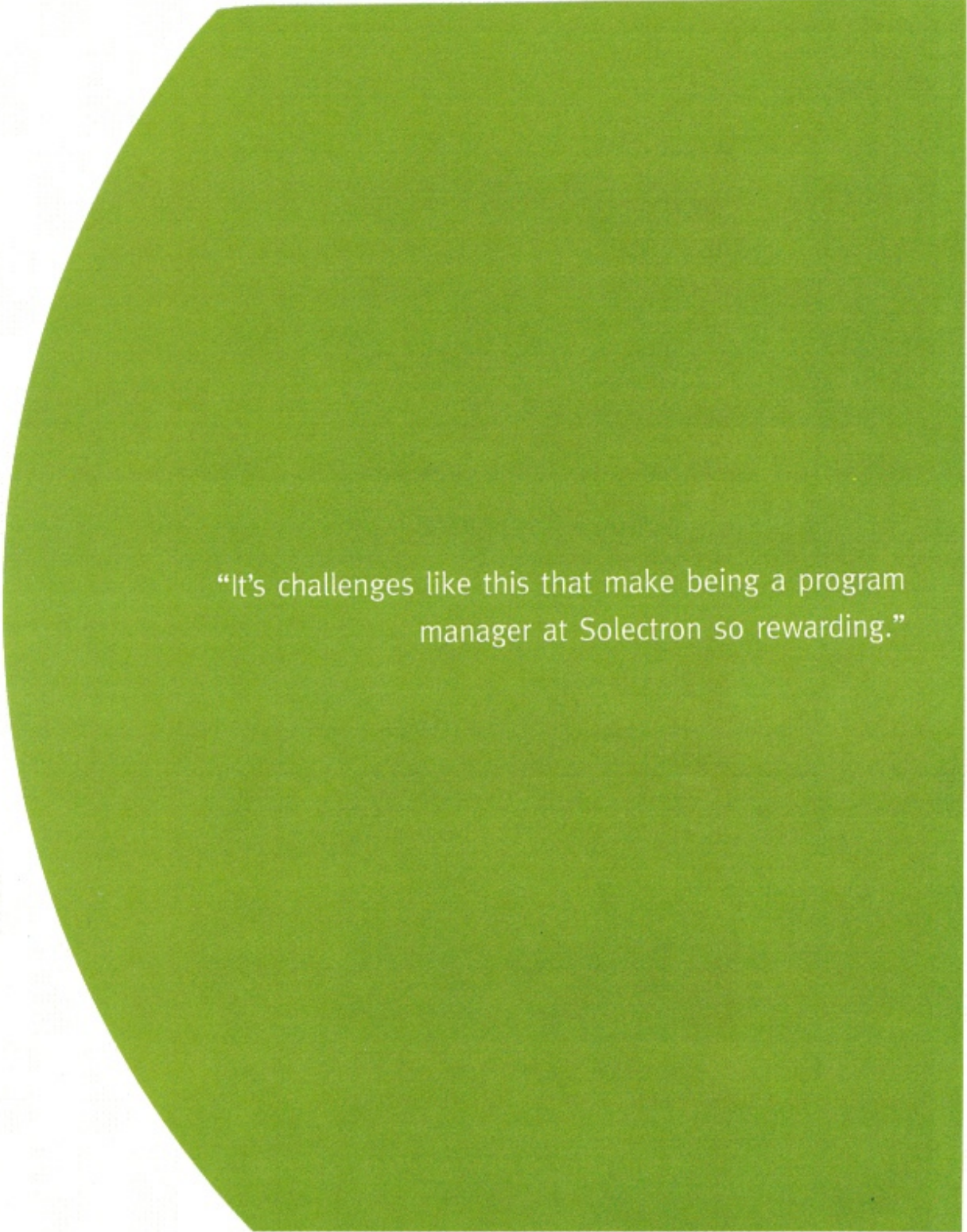
You also know the approach you're going to take. Work with the customer every step of the way, and never compromise on quality. Because that's the approach that



has seen Solectron grow from a regional electronics printed circuit board (PCB) assembler to a global, multi-billion-dollar leader in providing electronics outsourcing solutions that span every stage of a product's life. All in just over 21 years.

The story I'm about to tell covers each step in the process that has made us the outsourcing partner of choice for original equipment manufacturers around the world — and the recipient of more than 180 quality and service awards, including two Malcolm Baldrige National Quality Awards.

To protect our customers' confidentiality, it's not the exact story of any one customer project or customer team. It's a story about them all.



“It’s challenges like this that make being a program manager at Solectron so rewarding.”

Technology

Design

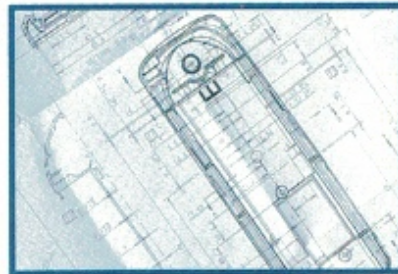
Product Development

Manufacturing & Distribution

Support Service



“So, where are you going to start?”



Day 1:

“Good morning – or afternoon or evening, as the case may be.”

As global program manager, I've called a meeting of the customer focus team, the core action group for all projects we handle for this customer. This team – representing technology, product design and development, manufacturing, distribution and product support – will help launch a new product for our customer, a large telecommunications company.

Our group is linked via teleconference with our regional program managers in our selected manufacturing facilities in North Carolina, South Carolina, Scotland and Ireland. And Suresh, our Malaysian program manager, has joined us by videoconference.

Ling, the customer's project manager, is with us in California and starts the ball rolling.

“Our last product collaboration was a real success, and we appreciate Solectron's ongoing support on all of the projects we're running.

“But you've seen the specifications for our new product. This is something entirely different – a desktop wireless device designed to a much smaller scale for a whole new market. And it needs to be produced at a market-competitive price and

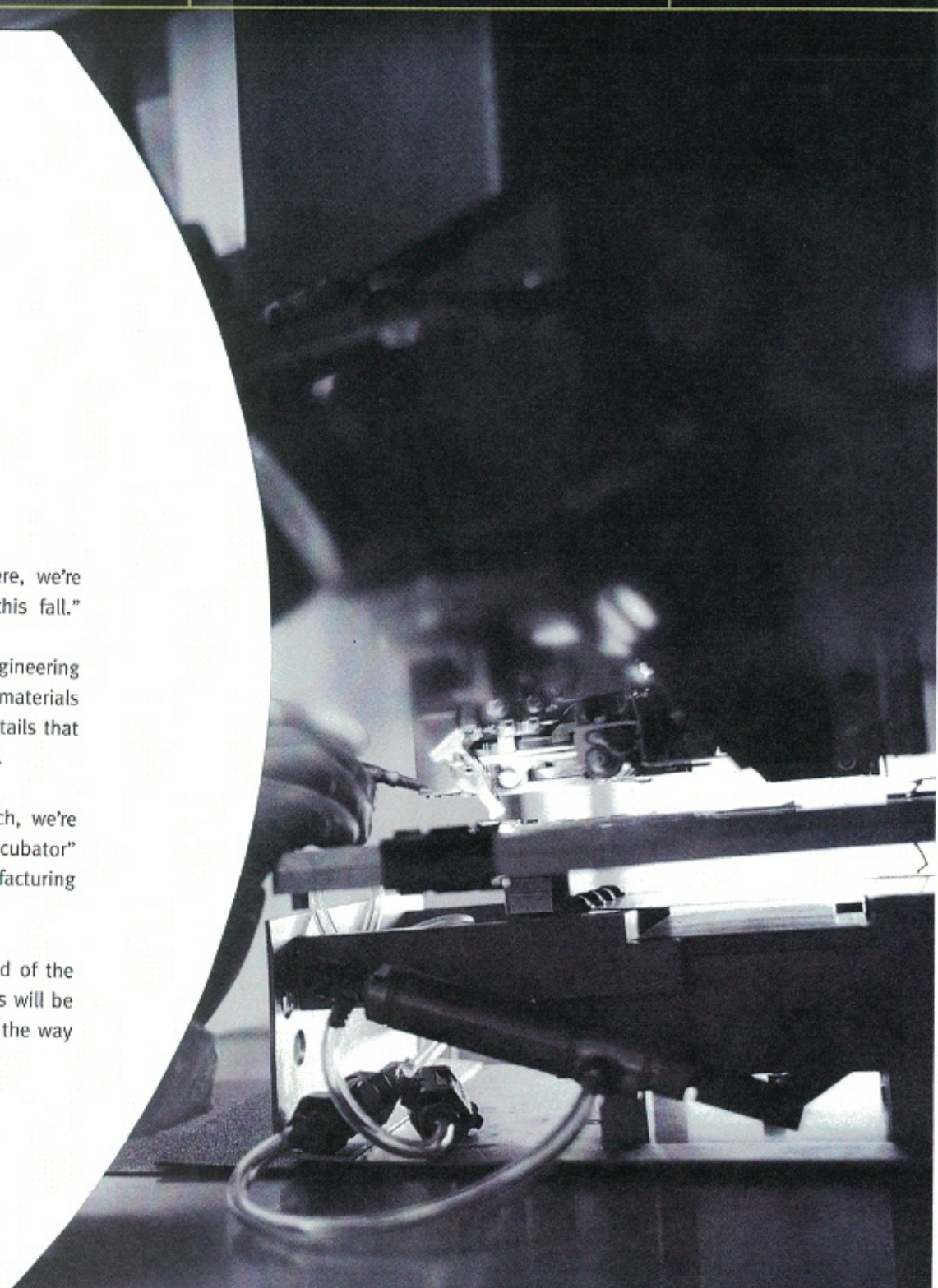
delivered fast. To secure market share before our competitors get there, we're looking at a simultaneous release in Europe, Asia and the Americas this fall."

I can see Jane and Helmut, our production and manufacturing engineering managers, scribble the words "six months." Purdip, in charge of materials management, is making notes about product type, size and application details that our global supply base will need to deliver the best component solutions.

To meet Ling's requirement for a fast and efficient global product launch, we're going to initiate the new project in California, using this site as the "incubator" development location. Once it's running smoothly, we'll transfer the manufacturing simultaneously to Solectron facilities within Ling's targeted market areas.

Slowly, all faces turn to Ramone, the technical program manager and head of the engineering services team. Since more than 70 percent of the product costs will be fixed by the end of the design phase, design decisions have an impact all the way through the product's life cycle.

He grins. "Let's get down to work."



“Our last product collaboration was a real success,
and we appreciate Solectron’s ongoing support on all
of the projects we’re running.”



“We need a design that meets our specified functionality, gives us high-volume manufacturing at a reasonable cost — but is still compact enough to appeal to the customer.”

Stage 1: New Product Introduction (NPI) Process

Weeks 1 – 2: Project Planning

“This is where we begin the process of saving you time and money,” I hear Ramone say to the customer’s new technology manager, who is also new to our NPI process, as they head off to a teleconference with our technology team.



Integration is the key – and our NPI process is one of the things that sets us apart. During this stage, we apply our expertise in advanced technologies, industry and market trends, design and concurrent engineering, testing and process development, materials management and prototyping to give the customer the edge before their product starts to roll off the manufacturing line.

I hear from Ramone shortly after his teleconference with the technology team, which offers consulting on everything from interconnection and packaging, to process development and reliability, to failure analysis.

“The technology team agrees with our preliminary approach for the PCB design. Ali will be available to work with us to ensure we achieve the product’s reliability targets. And I’ve confirmed that our targeted board manufacturing sites – Penang, Malaysia; Dunfermline, Scotland; and Charlotte, North Carolina – can handle the ball-grid array

placement we’re considering. The systems engineering and services locations in Johor, Malaysia; Dublin, Ireland; and Columbia, South Carolina are also up to speed.”

Week 2: Design Phase Begins

Some people call it concurrent engineering.

But every visit to the design engineering group makes me think of a giant jigsaw puzzle that everybody’s working on at once, putting different pieces together and communicating constantly, in person or via electronic commerce, to see if their piece fits with everybody else’s.

The design phase encompasses both the functional aspects of the product – the circuitry and systems – and the physical, from PCB layout to built-in keypads and the product chassis. It also includes component engineering, where materials leveraging comes into play: design-for-manufacturability, -testability and -serviceability, test

development and qualification. The design team will create a complete development plan with an interlocking schedule to serve as the measure for all development activities leading to the product's release.

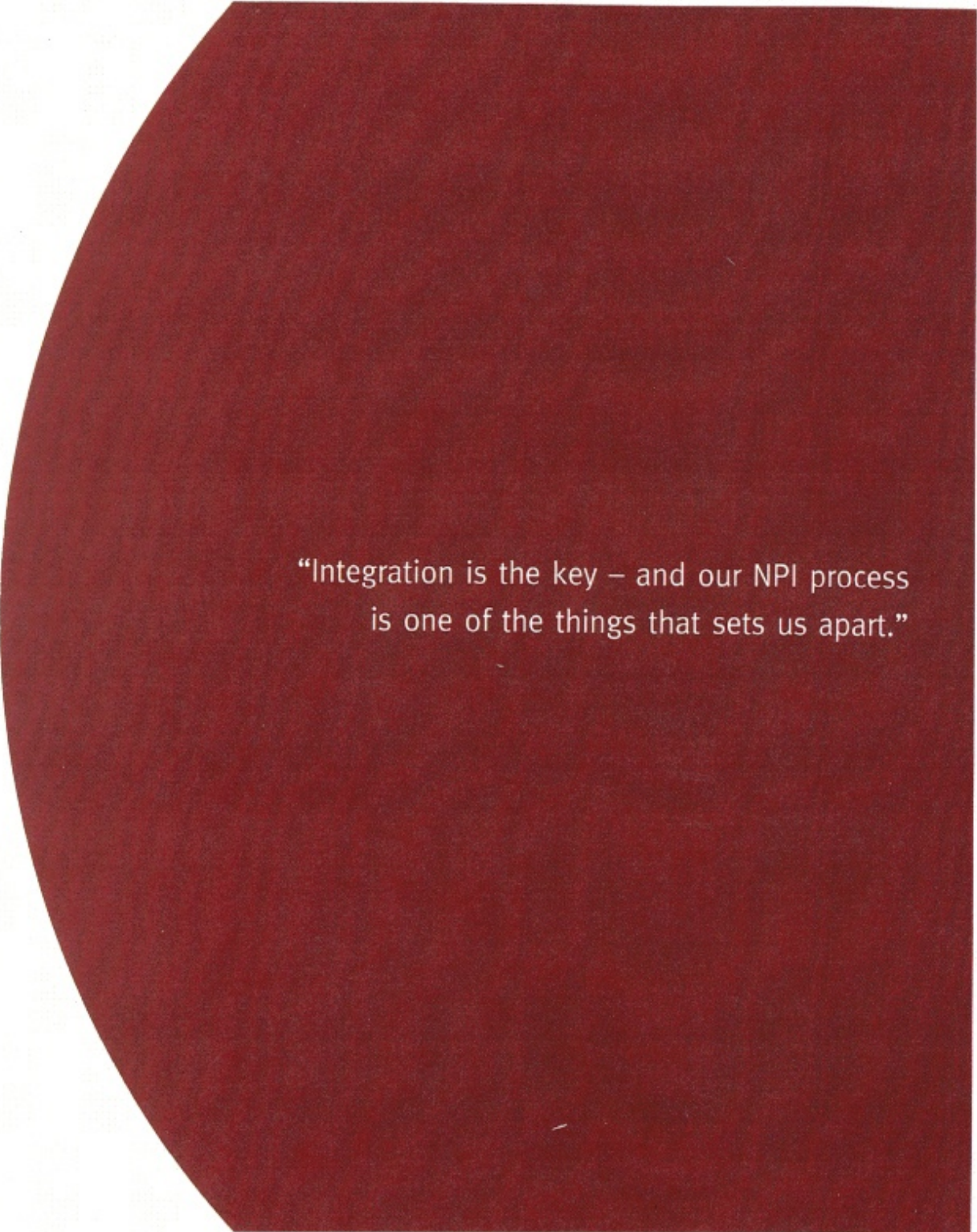
"We need a lot of functionality out of very little real estate on this product," says Ramone. "The micro ball-grid array chip packaging will help us there. The component engineering team says an off-the-shelf solution isn't possible, so our Austin group is designing an ASIC to meet some of our functional requirements. But to keep on schedule, we'll use field-programmable grid arrays (FPGAs) in the initial design for quick-turn development. Then we'll bring in the ASIC to give us cost and space reductions in the ship version.

"We're also making progress on the technology verification board that will be used to validate process and reliability objectives. And the mechanical design team is into the concept phase of the housing design."

He assures me the component engineers are looking at component alternatives and sources that can help meet the tight deadlines at the right cost – and carry us through to end of product life.

"The team is already working with Solectron's recommended parts and supplier database, which puts a wealth of expertise at their fingertips. We've also got our plastics and sheet metal suppliers looking at alternatives. I'll keep you posted."





“Integration is the key – and our NPI process
is one of the things that sets us apart.”

Technology

Design

Product Development

Manufacturing & Distribution

Support Services



“ In creating the design, keep in mind that we need **continuity of materials supply** through the end-of-product-life. But we don't want to carry a lot of inventory. And we expect build-to-order capabilities for the post-launch phase.”



Week 2 – To Product End-Of-Life: Systems/Materials/Information Management

“It's a challenge, but we can do it,” says Stephan, our systems assembly manager, at a sit-down with myself, Purdip, our materials management supervisor, and Murielle, our information technology (IT) team leader.

“There's no doubt that build-to-order and configure-to-order capabilities are having a positive impact on our customers' ability to minimize inventory risk. Our team has begun to develop the bill of material structure to ensure we meet all production and procurement requirements.”

Even at this early stage, it's critical for Stephan's systems group to work with those of Purdip and Murielle and with the design engineers during the NPI process to make sure that the right materials and capabilities are in place to give the customer the desired end result.

“There's going to be more variability to my supply base and on my ability to predict inventory. I'll also need some very specific shop floor controls so we can build, test and inspect numerous versions of the product,” Stephan adds.

Providing global supply-chain leverage to accommodate build-to-order production, as well as initial launch production, adds to the task facing Purdip's materials management team. Since materials can account for between 75 and 90 percent of the total cost of the product, their work is crucial to the NPI phase as well as to later phases.

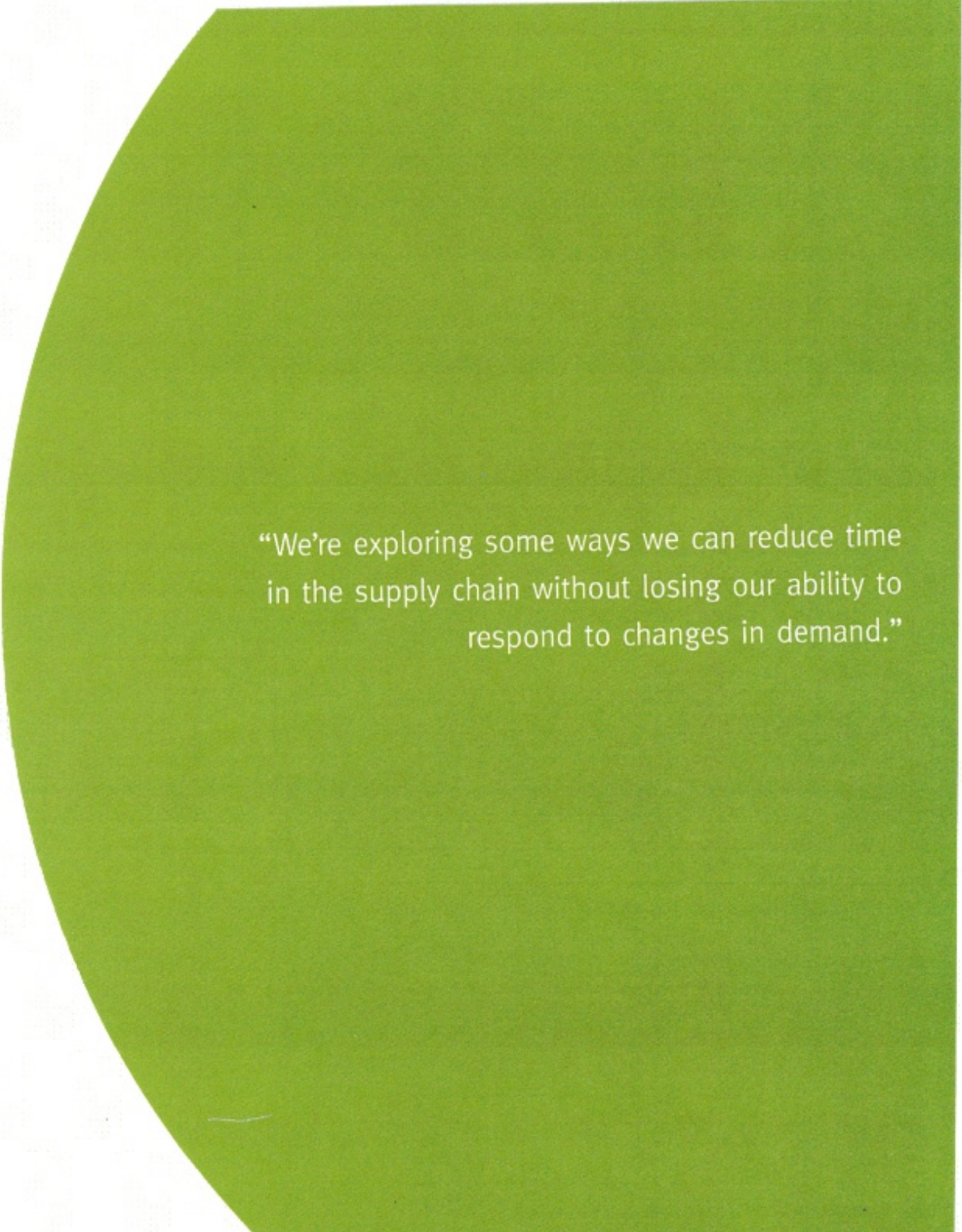
“We'll be ready for you, Stephan,” says Purdip. “Our customer supply-chain team and Ling's procurement group will jointly develop the approved vendor list and alternate components. The supply-base management crew is already working the long lead-time issues for both the board and systems level components, which require customized tooling management. On the logistics side, we're exploring some ways we can reduce time in the supply chain without losing our flexibility to respond to changes in demand.”

"So, what's the latest from IT?" Purdip asks Murielle, whose team has already worked with the customer's IT, procurement and materials management people to develop transparent electronic commerce capabilities for gathering, receiving and analyzing information related to every stage of the process.

"The teams are already exchanging design data for the engineering change process and design reviews. Once we're into production, we'll be able to give you and the customer fingertip access to every chip, board and plastic piece ordered for this product, as well as a record of every supplier, every invoice, every customer order, every bill of lading and every delivery date."

Murielle adds, "Our new Enterprise Resource Planning System allows a pass-through of information all the way through the supply chain back to our supplier. The end result is going to be quicker response to changes in demand and market conditions – and a shorter, more efficient and more cost-effective supply chain."





“We’re exploring some ways we can reduce time in the supply chain without losing our ability to respond to changes in demand.”

Technology

Design

Product Development

Manufacturing & Distribution

Support Services



“ We’ve been hearing rumblings from the competition. We want to move up our product launch by two weeks and increase our launch volume. What can you do? ”



Week 9: Design Development Continues

We're well along in the design development when we get the call from Ling about the new urgency. I arrange another team teleconference.

“We can shorten the systems integration cycle by including more resources from the Malaysian team,” Ramone tells the group.

By electronically sharing their work with their Malaysian and European counterparts at the end of each day, the design team will be able to perform the regional certification testing in parallel.

“We can release the product to manufacturing two weeks sooner – and give the customer quick response to meet their development deadline.”

Week 16: Prototyping

Our NPI rapid prototype specialists have been working closely with our internal teams and the customer's technical people. After they built process verification assemblies and the initial prototype, both the designers and Purdip's materials management team made some quick changes to accommodate the best material choices for size, durability, function, cost and manufacturability.

The team has also completed the final cost review to ensure that the customer's market-price targets can be met. With the ASIC now integrated into the final PCB assembly, the NPI team is showing Ling the final prototype with all the qualification hardware.

"We used the same equipment and processes that will be used for volume assembly, so the transition to full production will be as smooth as possible," explains Rob, the prototype team leader, as he unveils the final prototype.

Now it's all come together in a product that looks great sitting on top of the conference room table.

"We'll reconfirm our data and there'll be some fine tuning during our final functional testing," Rob tells the customer. "But we're confident this will work to your specifications – and it will cost less than we originally predicted."



“We can release the product to manufacturing two weeks sooner – and give the customer quick response to meet their development deadline.”

Technology

Design

Product Development

Manufacturing & Distribution

Support Services



“How will you handle simultaneous manufacturing on **three different continents?**”



Week 19: Manufacturing Release

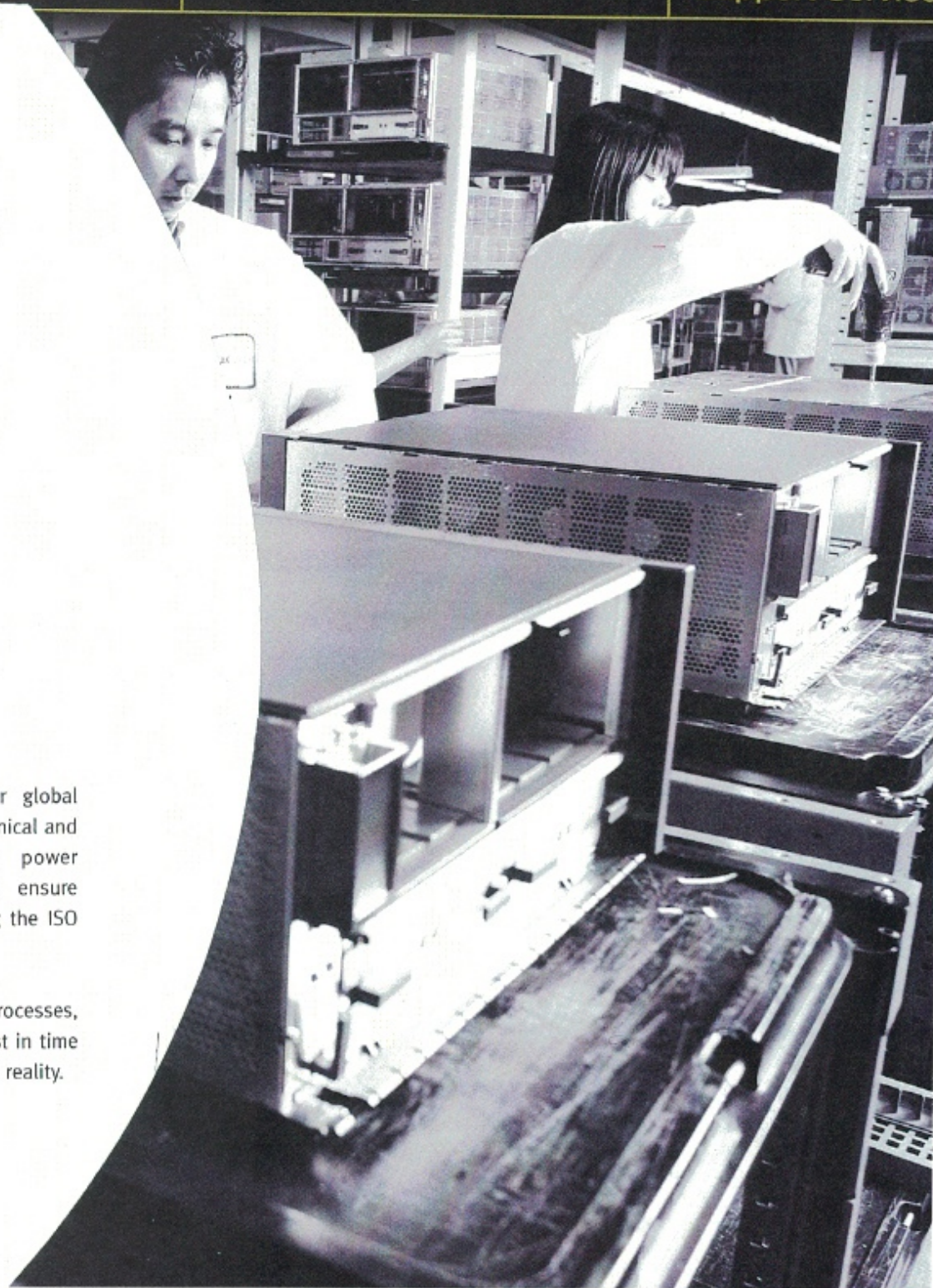
I'm now hearing daily from the program managers gearing up for production in America, Europe and Asia.

Time is of the essence, and nobody has been sitting still. There's lots of front-end work involved in delivering quick, responsive and complete manufacturing services – from PCB assembly to systems assembly, testing, custom packaging and fulfillment.

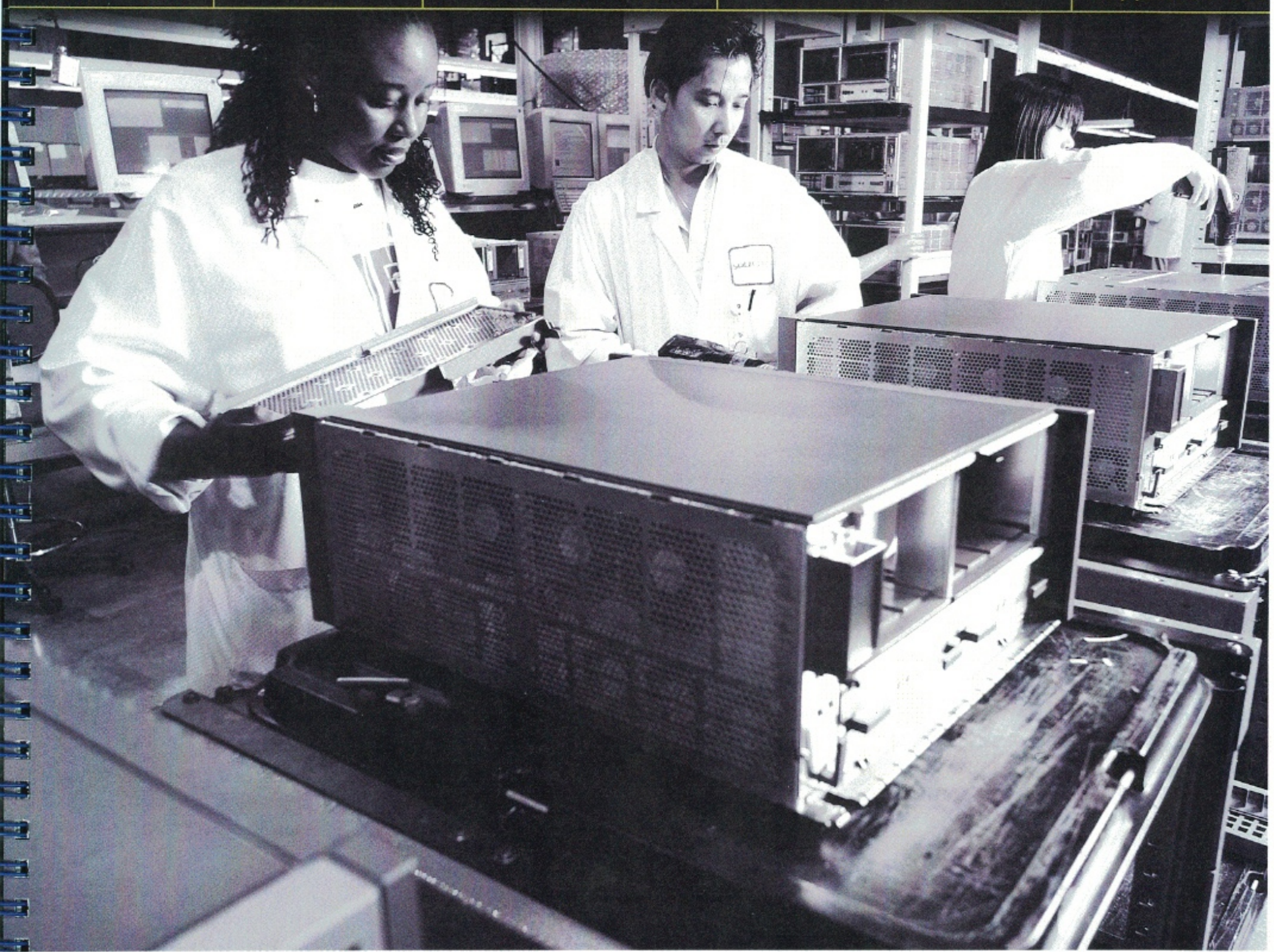
From the Milpitas NPI Center, Stephan has worked closely with the materials and manufacturing engineering teams in each region. This attention to detail ensures the supply chain is ready and assembly, test processes and teams are in place which lead to a smooth release and quick ramp to volume on a worldwide basis.

For the customer, another key benefit of having Solectron as their global outsourcing partner lies in our intimate knowledge of local regulatory, technical and contract requirements. Whether it involves integrating different power configurations, safety procedures or manufacturing approaches, we ensure compliance and obtain the required agency approvals – while maintaining the ISO standards our customers expect.

As the NPI process winds down, the people, engineering and test processes, materials, agency approvals and schedules are in place at all locations. Just in time for turning the approved and tested final prototype into a mass-produced reality.



“Time is of the essence, and nobody has been sitting still. There’s lots of front-end work involved in delivering quick, responsive and complete manufacturing services – from PCB assembly to systems assembly, testing, custom packaging and fulfillment.”



“Let’s get the product rolling!”

Stage 2: Manufacturing & Distribution

Week 20: Pre-production Run – Milpitas, California

At all manufacturing sites, the procurement, manufacturing and test engineering functions come together for a last minute check on material inventory, machine programming, process tooling and controls.

Since Milpitas has been the development hub for the product, a limited manufacturing run begins here so any complications can be identified and adjustments made before rollout to the regional sites. During the pre-production run we discover a compatibility issue and immediately notify the design and engineering teams of this. Within a matter of hours, the team decides to change a part in the PCB assembly. After customer approval, material availability and logistics are verified we can begin the pre-production run again since we found a standard component with ample availability. It was lucky that we caught the compatibility issue early, since only 100 units will need to be reworked. These units will then be re-tested and we can get back on track, four days behind schedule, but we’ll be able to make up the lost capacity over a weekend or extra shifts. I check out the line – racks of completed PCB assemblies from the adjacent building at one end, packed out systems at the other end – ready for shipment. It’s a good feeling to see what we’ve accomplished so far. The next step will be the real test.

Week 22: International Rollout

Monday, 7:00 a.m. “We’re in full-scale production, and it’s going great,” says our jubilant program manager in Ireland, where the working day is just coming to a close. “The PCB assemblies arrived just in time from our facility in Scotland – we’ll be getting daily shipments from them for

the launch phase of the project.” To keep on schedule, he planned an earlier start than our other two facilities to accommodate a national holiday and avoid overtime labor costs.

Monday, 4:00 p.m. Production is up and running smoothly in South Carolina. Our program manager tells me that the PCB assemblies made this morning in North Carolina were trucked to Columbia. They arrived in time to be used for today’s swing shift assembly – just as we planned.

Tuesday, 12:00 a.m. That’s the time my e-mail shows for a successful start in Malaysia. Must thank Suresh for not calling. I’ll check in with him later.

Week 23: Launch Quotas Reached

All of our planning has paid off. Manufacturing volume hits its peak at all locations, with initial production quotas achieved by the end of the week.

Our Milpitas customer contact, Ling, meets with our California team to iron out final plans to proceed with the build-to-order phase. “Of course, as with our other products, we’ll have our Internet and direct response orders come directly into Solectron for fulfillment.”

“Not a problem,” says Purdip. “We’ve negotiated some demand-pull contracts with key suppliers so they are ready for our materials requirements. Our electronic commerce linkages are in place so they

can respond quickly to fill orders as they come in. We've also shortened the supply chain by setting up several regional supplier hubs, or managed warehouses, where suppliers can place material that's still on their books and we can draw on as necessary. And we've begun the feedback process with our suppliers to ensure they are meeting the customer's and our expectations.

"Once the build-to-order sales start up, we'll be able to rationalize further based on analysis of which components are most popular."

Week 23: Distribution

Because we've chosen manufacturing facilities within the key launch markets, we're that much closer to the delivery destinations.

Thanks to the hard work of Murielle's IT team, configuring, shipping and invoicing the launch products directly to the customer's distribution outlets goes quickly and smoothly – including the online flow of customs and other documentation needed for international shipments within each continent.

End of Week 23: Shipment Complete

The customer has full launch quantity of a product designed to give them a competitive edge – and give their customers what they want.

Week 25: Customer Satisfaction Report

The regional program managers forward me their weekly Customer Satisfaction Index reports – a tool we use to gain our customer's insight on our performance in quality, delivery, responsiveness, communication, service, flexibility and technical support. If a concern emerges, we're ready to take quick corrective action at the site level. I'll get involved if an issue arises at multiple sites.

With the new project now in global manufacturing, I need to know that relations are going well at the local level. I'm glad to see our high marks – I'll share the news with everyone during our weekly teleconference.



“All of our planning has paid off. Manufacturing volume hits its peak at all locations, with initial production quotas achieved by the end of the week.”



“ We need to focus our resources on next-generation development.
We're counting on you to support this product to end-of-life and to let us know
if there's a problem you think should be addressed. ”

Stage 3: **Support Services**



From now to end-of-life: Product Support

Anthony, our support services manager, is pleased the customer has asked Solectron to provide the full range of services to support the new product, and is eager to share his plans with the rest of the customer focus team.

“We built the product originally, so it's very cost-effective for us to provide the ongoing support during the product life,” he points out. “The customer has already given us responsibility for product enhancement, reliability improvements and the associated test development – so why wouldn't they ask us to take on warranty service, repair and end-of-life support services?”

Purdip, who will handle the logistics of service returns, agrees with the benefits of handling not only enhancements and repairs, but also warranty services.

“We can give the customer improved speed from the service pipeline by taking direct receipt responsibility for returns from the end user and making use of various buffer stock and inventory mechanisms,” he adds. “We can also minimize shipping costs and time by handling repairs at various international locations.”

Anthony jumps in with another benefit: the Solectron data collection system provides invaluable information to analyze product reliability.

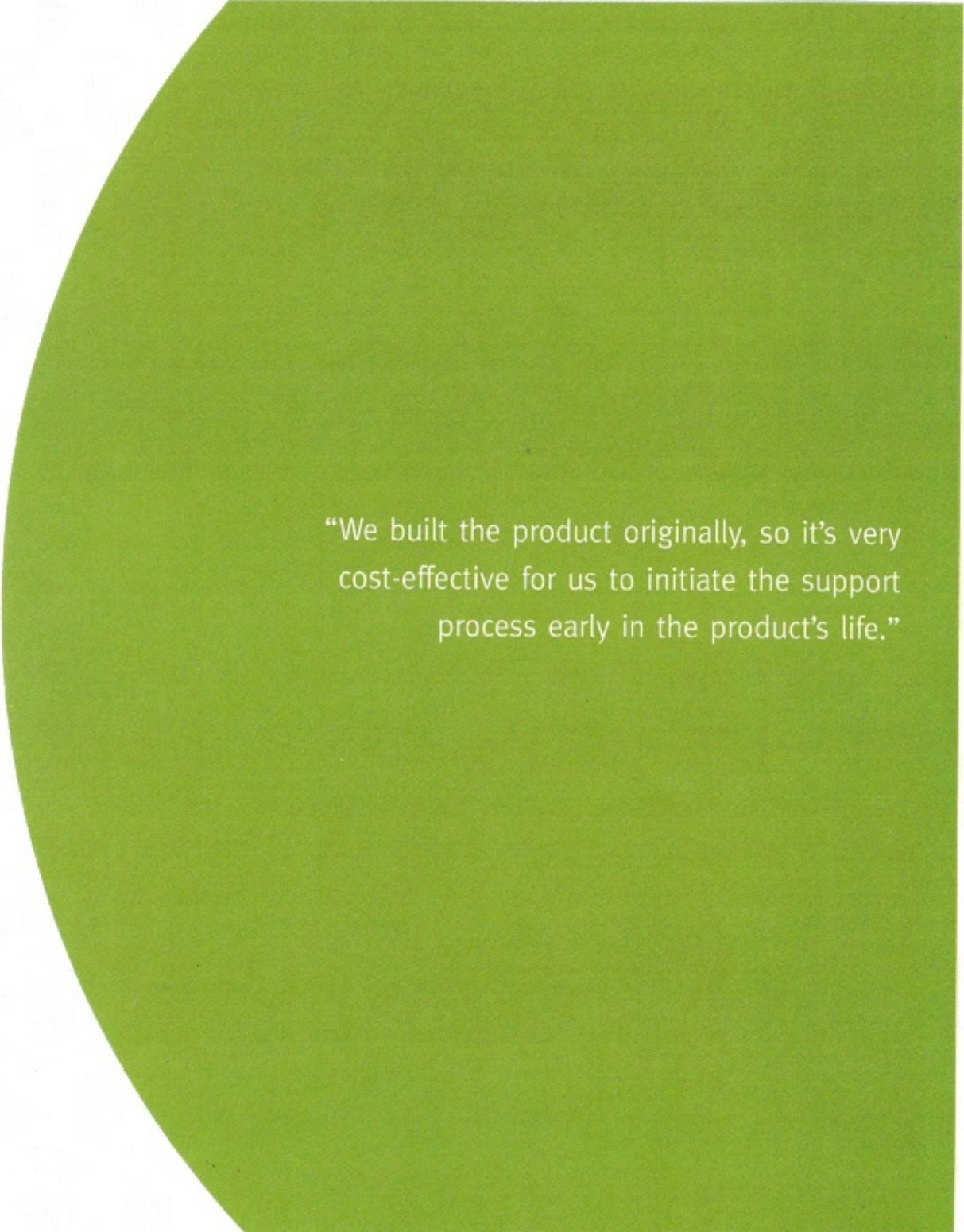
"By identifying areas for improvement, we can recommend changes to make this product and future products more robust. So we can help keep this product alive in the market and also improve the customer's long-term competitive position."

I'm amazed at the enthusiasm that still surrounds the project. It's one of the reasons I enjoy being part of Solectron's team.

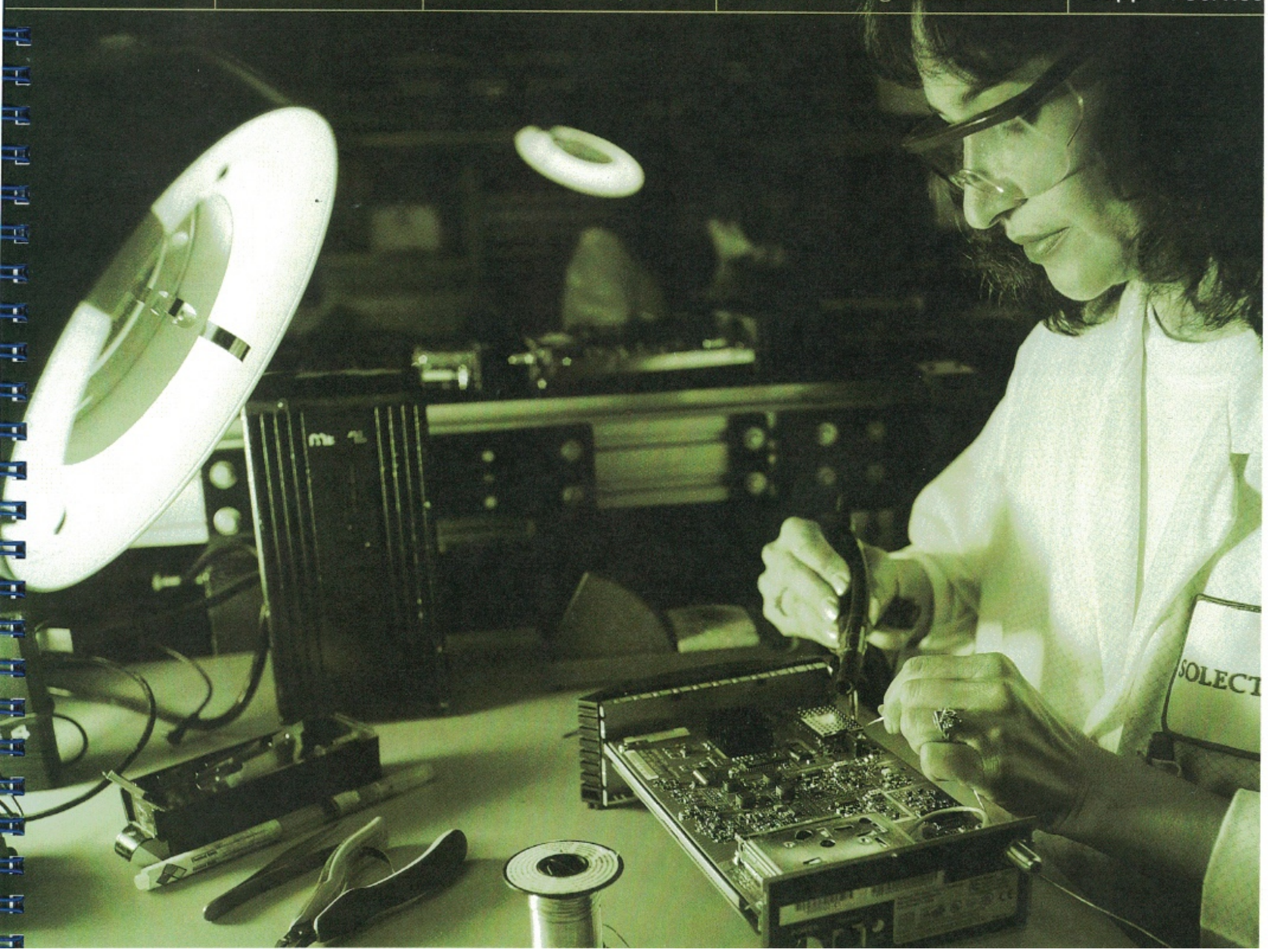
I expect discussions will continue right through the celebration lunch I've arranged. I know everyone present is still focused on the current project, but I also know they're already looking ahead.

Because there's always another new product challenge waiting around the corner.





“We built the product originally, so it’s very cost-effective for us to initiate the support process early in the product’s life.”



Quality Solutions. Global Partnerships.

Americas



São José dos Campos, Brazil

- Full-service manufacturing and fulfillment center for PCBA and systems assembly
- Depot Repair Center
- 327,096 square feet (30,388 square meters)
- ISO 9002



Milpitas, California

Corporate Headquarters

- Full-service design, manufacturing and fulfillment center for PCBA and systems assembly
- NPI Center
- Depot Repair Center
- 1.4 million square feet (130,064 square meters)
- ISO 9001, BABT



San Jose, California

Fine Pitch Technology, Inc., A Solectron NPI Subsidiary

- Quick-turn product development solutions including component engineering, test development, prototype services and path-to-volume solutions
- 30,000 square feet (2,787 square meters)
- ISO 9001



San Jose, California

Force Computers, A Solectron Subsidiary

- Embedded computing products including single-board computers and systems
- 72,426 square feet (6,729 square meters)
- ISO 9001



Atlanta, Georgia

- Medium- to high-volume build-to-order and configure-to-order systems assembly and low-volume, high-mix PCBA
- 544,000 square feet (50,539 square meters)
- ISO 9001, Weights and Measures



Westborough, Massachusetts

- Quick-turn product development solutions, including component engineering, test development, prototype services and low- to medium-volume, highly complex PCBA
- 173,900 square feet (16,156 square meters)
- ISO 9002, TUV – Product Service, TUV-Rheinland, UL



Guadalajara, Mexico

- Low-cost, high-volume manufacturing center for PCBA, build-to-order and configure-to-order systems assembly
- 412,500 square feet (38,322 square meters)
- ISO 9002



Charlotte, North Carolina

- Full-service design, manufacturing and fulfillment center for PCBA and systems assembly
- NPI Center
- 835,000 square feet (77,574 square meters)
- ISO 9001, BABT, CSA, TUV, UL



Columbia, South Carolina

- Customized systems design, build-to-order, configure-to-order and complex systems assembly
- 207,600 square feet (19,287 square meters)
- ISO 9001



Austin, Texas

- Full-service design, manufacturing and fulfillment center for PCBA and systems assembly
- NPI Center
- Depot Repair Center
- 1.1 million square feet (102,193 square meters)
- ISO 9001



Everett, Washington

- Very low- to medium-volume, high-mix, highly complex PCBA
- 178,000 square feet (16,537 square meters)
- ISO 9002



Europe



Bordeaux, France

- Full-service design, manufacturing and fulfillment center for PCBA and systems assembly
- NPI Center
- Depot Repair Center
- 327,350 square feet (30,412 square meters)
- ISO 9001, ISO 14001, BABT, CSA, EMAS, UL, VALEO 1000



Herrenberg, Germany

- Prototyping, NPI management, and low- to medium-volume, highly complex PCBA
- 110,645 square feet (10,279 square meters)
- ISO 9002



Munich, Germany

Force Computers, A Solectron Subsidiary

- Embedded computing products including single-board computers and systems
- 167,617 square feet (15,572 square meters)
- ISO 9001



Dublin, Ireland

- Build-to-order, configure-to-order and complex systems assembly and integration
- 120,000 square feet (11,148 square meters)
- ISO 9002, ISO 14001, BABT



Tel Aviv, Israel

- Solectron Program Office
- ISO 9001



Timisoara, Romania

- Low-cost, high-volume manufacturing center for PCBA and systems assembly
- 111,000 square feet (10,312 square meters)



Dunfermline, Scotland

- Low- to very high-volume manufacturing of PCB assemblies, subassemblies and systems
- 228,000 square feet (21,182 square meters)
- ISO 9002, BABT, MIL-STD-200



Norrköping, Sweden

- NPI Center
- 32,000 square feet (2,973 square meters)
- ISO 9001

Asia



Suzhou, China

- Low-cost, high-volume manufacturing center for PCBA and systems assembly
- 340,000 square feet (31,587 square meters)
- ISO 9002



Tokyo, Japan

- Solectron Program Office
- Far East supply-base management



Tokyo, Japan

- Force Computers, A Solectron Subsidiary
- Japanese Headquarters



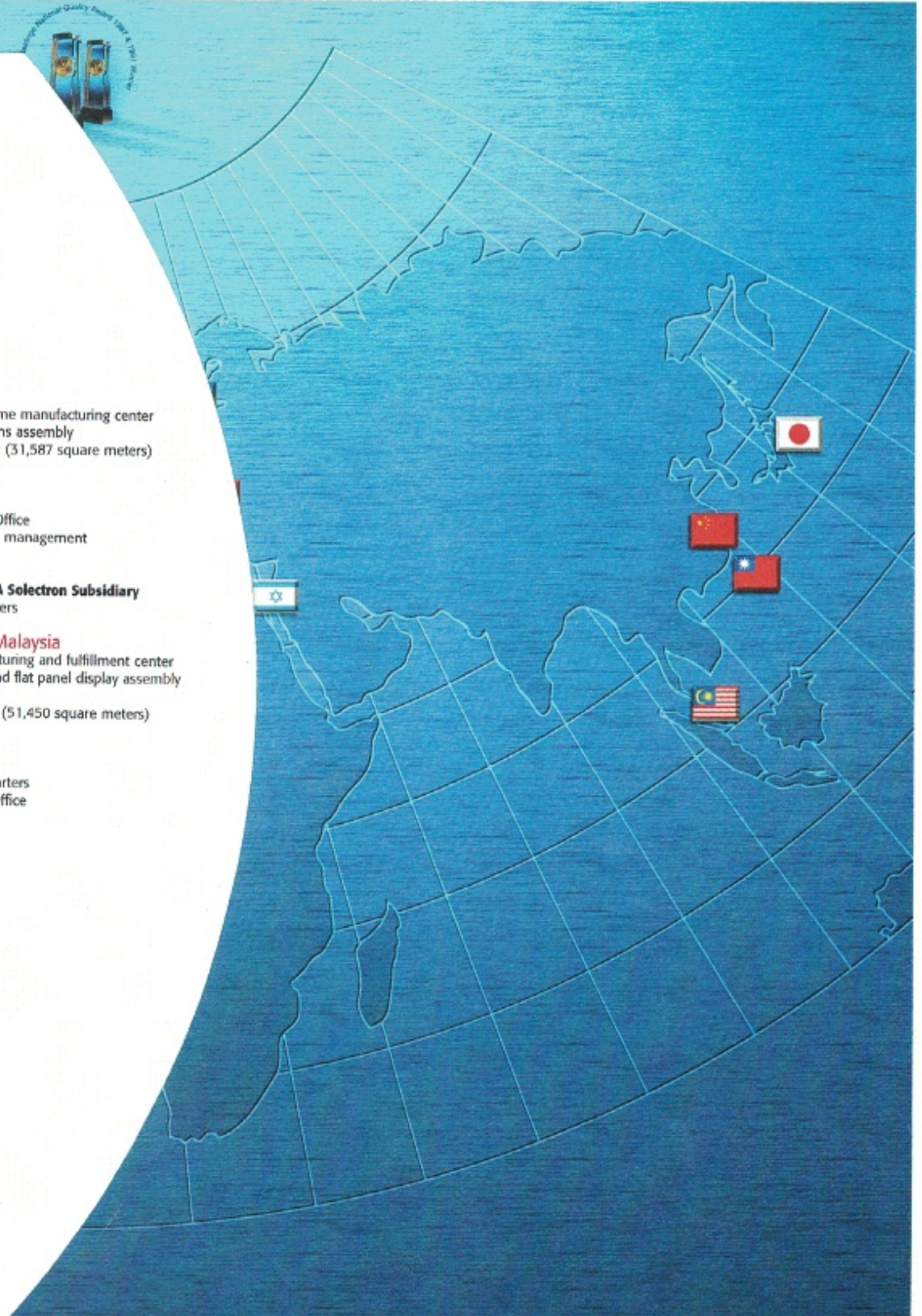
Johor/Penang, Malaysia

- Full-service manufacturing and fulfillment center for PCBA, systems and flat panel display assembly
- Depot Repair Center
- 553,800 square feet (51,450 square meters)
- ISO 9002, BABT



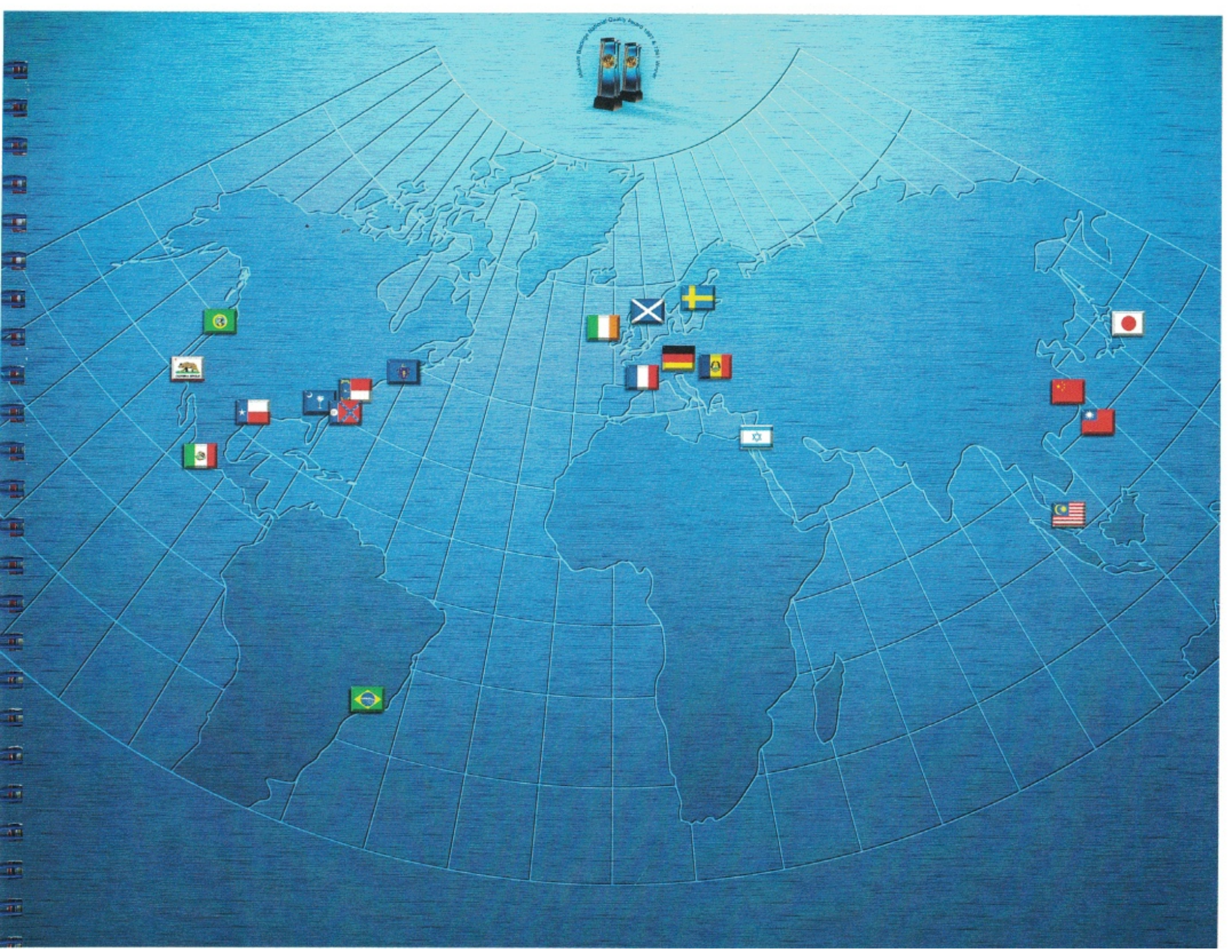
Taipei, Taiwan

- Asia/Pacific Headquarters
- Solectron Program Office



Soletron Services Capability Matrix

	Americas	Europe	Asia
Technology			
Interconnection & packaging consulting	•	•	•
Process development	•	•	•
Reliability & failure analysis	•	•	•
Manufacturing technology roadmap	•	•	•
Test technology roadmap	•	•	•
Design			
ASIC design	•		
Circuit design	•	•	
RF & wireless design	•		
Mechanical design	•	•	
Systems design	•	•	
Test process design	•	•	
Design validation	•	•	
Product Development			
New Product Introduction (NPI) management	•	•	•
Component engineering	•	•	•
Design-for-manufacturability	•	•	•
Design-for-testability	•	•	•
PCB layout	•	•	•
Test development	•	•	•
Quick-turn prototyping	•	•	•
Quick-turn testing	•	•	•
Manufacturing & Distribution			
Supply-base & logistics management	•	•	•
PCB assembly	•	•	•
Flexible circuit assembly	•	•	•
Complex systems assembly	•	•	•
Build-to-stock systems assembly	•	•	•
Build-to-order systems assembly	•	•	
Configure-to-order systems assembly	•	•	
Channel assembly	•	•	
Systems integration & reconfiguration	•	•	
Testing	•	•	•
Environmental stress screening	•	•	•
Custom packaging	•	•	•
Logistics & distribution management	•	•	•
Support Services			
Repair - systems & PCBs	•	•	•
Product refurbishment/remanufacturing	•	•	•
Asset and logistics management	•	•	•
Product upgrades	•	•	•
Sustaining engineering	•	•	•
End-of-life manufacturing	•	•	•
Warranty processing	•	•	•





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