

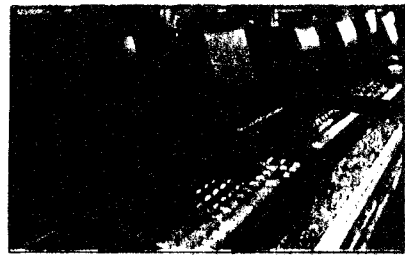
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STEVE SLOVIC/For The Times

Henry Lewinsohn, left, is chief executive of an Oregon-based company that aims to use sophisticated chips to add color to ordinary black-and-white displays. Laptop computers such as those in a South Bay CompUSA store, below, are one of many products expected to create huge demand for flat displays.



LARRY DAVIS/Los Angeles Times

Japanese Companies Dominate the Market for LCD screens. But U.S. Electronics Firms Belatedly Are Gearing Up for Flat Out Competition

By LESLIE HELM
TIMES STAFF WRITER

BEAVERTON ORE

Some call it Flat Panel Flats. This region, carved out of woodlands south of Portland, is the focal point of an infant electronic display industry whose healthy growth may be critical to the future success of the entire U.S. electronics industry.

The nation's largest manufacturer of flat panel displays—Planar Systems Inc., which builds displays for medical equipment—is based here. Not far away, Tektronix is working on technology that one day may be used to produce large televisions thin enough to hang on walls. Motif Inc., a local start-up, is constructing what soon will be the nation's largest factory producing screens for laptop computers.

But as significant as these companies are by American standards, they are Lilliputian on a worldwide scale.

Planar's sales last year came to just \$46 million. By contrast, Sharp Corp., the industry's world leader, is a \$13.6-billion company with more than \$1 billion in flat panel display sales alone.

And together, Japanese companies hold an iron grip on 95% of the world market for flat panel displays—a dominance they are committed to maintaining, no matter what their late-starting American competitors undertake.

Still, it is the U.S. display industry's strategic importance, far out of proportion to its size, that has turned it into a test bed for American industrial policy.

From computers and telecommunication to autos, broad sectors of U.S. high technology will depend increasingly on these thin glass screens to give their products portability and pizzazz. How well the federal government promotes panel manufacturing may not only determine those sectors' success, but also shape future debates over Washington's appropriate role in the development of other emerging industries.

"We are competing in a world economy," says

Malcolm Thompson, who heads display efforts at Xerox's Palo Alto Research Center. "This is either going to be jobs for Americans or jobs for someone else."

During the Reagan and Bush administrations, the United States government publicly opposed industrial policy—the idea of selectively backing important industries as Japan did after World War II in its drive to catch up with the West.

Now, the Clinton Administration is openly promoting a stronger government role as unavoidable in a competitive global economy in which virtually every advanced power promotes frontier industries at the expense of American industry—whether Europe's support of aircraft manufacturing or Japan's promotion of semiconductor.

Over the next few weeks, officials at the Department of Defense will put the finishing touches on an inter-agency plan that, drawing a page from the Japan's own targeting policies, will determine how best to nurture a competitive American flat panel display industry.

Among the proposals under consideration are innovative financial incentives designed to spur the large corporate investments necessary to make this country an international player. American companies, once wary of government intervention,

now are enthusiastically backing a bigger government role.

Companies such as AT&T, IBM and Xerox chose not to invest in liquid crystal display (LCD) technology a decade ago, concluding it was too expensive and the manufacturing process too complex.

Today, they have woken up to discover that displays are critical to a broad range of the products they plan for the future. Yet, they are completely dependent on Japanese suppliers—most of which are also their competitors.

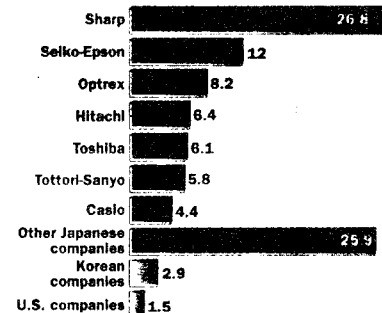
Recent shortages of color displays and the high prices that companies have had to pay for them have underscored American firms' vulnerability. Companies like Apple and Compaq have found themselves with little alternative but to subcontract key products to

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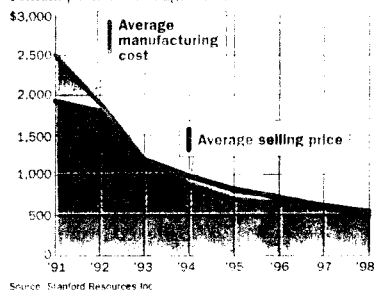
Japan Dominates the Flat-Panel Market...

With a long head start on U.S. and Korean competitors, seven Japanese manufacturers—led by Sharp—hold 95% of the world market for liquid crystal displays. Figures are for 1992.



...but Makers Are Only Beginning to Show Profits

After years of losses on every screen sold, flat-panel display manufacturers are expected to begin making money this year on liquid crystal displays, with margins projected to fluctuate but remain positive throughout the decade.



Japanese manufacturers to assure supplies of the screens.

"There is a feeling that the computer and electronics industries could go down in flames if they are vulnerable to [supply] delays and [discriminatory] pricing," says Jeffrey Hart, a political science professor at Indiana University who has studied the industry. Japanese companies' advanced knowledge of how the latest generation screens will be produced, Hart argues, would give them a competitive advantage in a wide range of new products.

Big U.S. companies are taking their first, cautious steps into the white-hot business.

Xerox has put together a consortium, including AT&T, that is asking for government support to build a commercial-size, color-display production plant. IBM hopes to join the consortium and persuade it to use technology developed by Display Technologies Inc., an

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FLAT: Test Bed for New American Industrial Policy

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IBM joint venture with Toshiba, AT&T and Xerox also reportedly are moving ahead with pilot plants of their own to build color displays.

Efforts to promote a domestic display industry are "good for the country, for the economy and for the job market," says Jim Dornbusch, manager of business operations at AT&T's high resolution technology division. "It's an industry that will produce an enormous amount of revenue and jobs."

According to Japanese think tank Nomura Research, the flat panel display business is expected to be worth about \$15 billion by the end of the decade—triple its size today.

The business is worth most to companies that can use the screens to produce high-value electronics products. For example, Sharp Corp., once a laggard in the camcorder business, became an industry leader overnight when it began selling a camcorder that features a large color LCD as the viewer.

"The perception of the quality of a machine is dependent on what the display looks like," says Steven Depp, IBM's director of subsystems technology. Demand for IBM's new ThinkPad laptop computer, for example, has been driven by the rich colors of its LCD screen. IBM's joint-venture plant in Japan gave IBM an important head start in designing the product and securing supplies of the screens, Depp says.

Playing catch up actually may put America at an advantage. "For the first time, the Japanese have

pioneered first-generation manufacturing," says Peter Mills, head of the U.S. Display Consortium, an industry group that is trying to develop more advanced display manufacturing equipment with government aid. "And like any first generation, it doesn't work very well."

In pursuit of the holy grail of the display business—color screens with video capability—Japanese companies have spent upward of \$1 billion perfecting a complex technology called active matrix liquid crystal display.

The technology requires cramming hundreds of thousands of tiny transistors onto a single plate of glass slightly smaller than a sheet of paper. Each transistor switches liquid crystal shutters on and off, allowing light to pass through color filters and appear as points of colored light.

With a few defective transistors, the entire screen is useless. And the back lots of Japanese color display factories are piled high with the glass of rejected displays.

Because of the high reject rates and the high cost of materials—color filters cost \$120 per screen—color screens for laptops sell for as much as \$1,400. But while high manufacturing costs once appeared as a window of opportunity for American companies, the window is closing fast.

In 1991, a government study by Lawrence E. Tannas, an Orange, Calif.-based consultant, highlighted Japan's problems manufacturing color displays. But Tannas has a new study that concludes Japan's toughest problems have been

overcome.

Japanese companies, he says, are about to make a quantum leap in productivity, using a new generation of manufacturing equipment that is three to five times more efficient.

"We have lost the chance of becoming an international player in this round," Tannas says, adding that only a major shift in technology will give America another chance to break into the market.

In recent months, Japanese firms have made a show of renewed confidence in the business by announcing plans to spend \$2.3 billion to quadruple production of color displays with the new equipment over the next three to four years.

Stanford Resources, a San Jose-based consulting firm with wide expertise in displays, predicts that Japan will start making money on color displays this year, a full year ahead of earlier forecasts.

"Japan has had such a tremendous head start, it is going to be difficult to catch up," says Joseph Castellano, president of Stanford

Resources. "Any new technology will take five years to develop."

But nobody is talking about giving up.

At the first Display Manufacturing Technology Conference held in San Francisco earlier this month, 400 people showed up to talk about technology trends in what participants called an "upbeat" atmosphere.

One key source of the optimism: The Pentagon's Advanced Research Projects Agency boosted its budget for display research to \$125 million this year, up sharply from \$25 million just two years ago. And many believe more money is on the way.

Not all the money will be spent efficiently. Taunton, Mass.-based Kopin Corp. has been working for more than a decade on technology it promised would cut the cost of making active matrix LCDs. The company's founders made small fortunes last year when they went public, with no

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FLAT: American Industrial Policy

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product and little more in earnings than the company's two-year, \$9.3-million ARPA contract.

But even if the government makes some mistakes in its effort to promote the industry, the amounts of money involved pale, in any event, in comparison to past defense spending that failed to pan out in usable technology. Most industry analysts say ARPA has done an effective job coordinating the resources of universities, national laboratories, start-ups and large corporations to promote promising technologies.

With dozens of new display technologies vying against each other, there are still hopes that one will emerge that will enable America to make an end run around its Japanese competitors.

"This is an industry in its absolute infancy," says Xerox's Thompson. "It's a long ways before we will find who are the winners and who are the losers."

On Thursday, ARPA awarded Xerox \$21.4 million for work on a technology that produces the world's crispest color images—but involves a costly, expensive manufacturing process. Silicon Video, a small Cupertino firm, is using ARPA money to work on field emission displays, which combine thousands of microscopic television tubes to create bright color images.

"With the right processing approaches, it could be very low cost, low power, [with] beautiful color and full video," says Bob Duboc, vice president of operations. But he acknowledges that the technology is at least two years from market.

More promising, near term, is Motif's approach, which uses so-called passive matrix screens—now commonly used for mono-

chrome displays—and adds sophisticated chips that enable the displays to handle color and video.

Henry Lewinsohn, one of two chief executives at Motif, says his factory will be producing 300,000 panels a year within 12 to 18 months. The plant will cost less than \$70 million—one-eighth the cost of an active matrix factory. Analysts agree that the technology is promising for certain segments of the market—including mid-range laptops—where customers may be willing to sacrifice the bright colors and contrast available on active matrix screens in exchange for lower prices.

One problem with the government's decision to sponsor numerous alternative technologies is the difficulty the industry will face agreeing on standards that will allow low-cost manufacturing. Japanese industrial policy, by contrast, has encouraged industry to focus early on the technology with the best potential. The result has been a quicker move to mass production.

The federal government's biggest help to U.S. industry may be the \$20 million it is investing to cover two-thirds of the annual budget of the U.S. Display Consortium. The group's goal is to create an infrastructure of suppliers of advanced display manufacturing equipment and materials so that the emerging American industry is not dependent on Japanese suppliers.

But an equally important function for the consortium will be pushing for an industry consensus on the key technologies that ought to be pursued.

The group was established only last summer. But learning from the

experiences of its sister organization in the semiconductor industry, Sematech, it has moved quickly to focus its research efforts on a dozen key manufacturing technologies with the biggest potential for cutting production costs.

With closer coordination, officials hope they can avoid the divisiveness created in 1991 when a group of display makers filed dumping charges that resulted in a 63% tariff on display imports. That drove production of laptop computers offshore without doing much to help American producers.

But there's still a chicken-and-egg dilemma: There is no point in supporting equipment manufacturers if companies aren't building factories.

Earlier this year, ARPA gave \$50 million to Optical Imaging Systems Inc. of Troy, Mich., to help build a small factory that will produce active matrix color displays for jet fighters. The company will work with American equipment makers working under contract to the U.S. Display Consortium.

But none of these investments will result in any significant production—unless major corporations with money to invest get involved.

Although AT&T and Xerox insist they are serious about the business, they have yet to offer details of their plans. And while government subsidies may make it less risky for the companies to build pilot plants, it is far from clear the companies will follow through with money for additional plants. David Mentley of Stanford Resources estimates that if American companies want a 20% share of the \$12-billion-plus market in the year 2000, they will have to invest nearly \$2 billion.

Companies may be particularly wary of making large investments because huge new Japanese plants are coming on line over the next two years, Mentley says. The re-

sulting overcapacity could set the stage for the kind of predatory pricing that once devastated U.S. semiconductor makers.

Important questions remain. Just how much will the Clinton Administration propose spending on incentives for U.S. production? How will the incentives be structured to avoid the appearance of pork barrel?

The rationale that probably will be offered for expanded government investment is that a commercial industry exposed to market forces will be more likely to supply low-cost displays for both military and civilian use. Such an industry, promoters say, would be more efficient than dependence on a small corps of high-cost military contractors.

Scott Holmberg, who helped build one of the first prototypes for a color active matrix LCD way back in 1982, is skeptical that U.S. companies can be convinced to make the substantial investments necessary. Although he had a pilot production plant for color displays in 1989, his key backer—Honeywell—pulled the plug.

"We were ahead of the Japanese but we couldn't get the financing to put up manufacturing facilities in the U.S.," says Holmberg.

Today, Holmberg is chief executive of Image Quest, a Fremont, Calif., company that is developing production technology to build color displays for a company with deeper pockets—Korean conglomerate Hyundai.

When the technology is perfected, it will be transferred to Korea, where Hyundai is committed to pouring in the huge investments necessary to produce world-class facilities by the end of 1995.

"You have to be in it for five years just to break even," Holmberg says. "U.S. investors aren't willing to sit tight for that long."