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MASS. LAY-OFFS

In 1985, employment in Massachusetts' computer and electronic components manufacturing industries dropped 10,000. In addition, over 22,000 workers experienced wage-cuts and/or involuntary furloughs. In *What Ever Happened to Job Security*, members of the High Tech Research Group have listed twenty-three firms which cut back more than 50 workers each, for a total of 7,278.

Even companies which have avoided lay-offs are reducing their payrolls. Digital Equipment (DEC), the state's largest computer firm, announced plans in 1985 "to trim its 28,000 manufacturing workforce by 5,000 workers without lay-offs. Digital claims that 3,000 have already left the company."

The High Tech Research Group anticipates that non-military electronics production employment in Massachusetts is not likely to grow, at least in the near future. Large employers are automating mature production lines and shifting work overseas.

Most important, the authors present Commerce Department data illustrating that the *rate of increase* in U.S. capital spending on domestically made electronics equipment is steadily falling. That is, manufacturers and other enterprises that buy industrial and office automation equipment are increasing their electronics purchases. However, since electronics industry employment growth depends to a large degree upon a more rapid rate of increase - to offset more productive electronics manufacturing - the future is bleak for high-tech manufacturing employment.

The rapid growth in electronics imports is a major cause. During 1981-84, imports of electronic equipment capital goods increased \$4.9 billion, averaged annually, compared to a \$3 billion annual rise in U.S.-made electronic capital goods. Consequently, while U.S. investment in domestic electronic equipment rose 21% per year over the late 1970's, that rate fell to 6% in the early 1980's. (*What Ever Happened to Job Security? The 1985 Slowdown in the Massachusetts High Tech Industry*, High Tech Research Group, Box 441001, Somerville, MA, 02144, US\$6.00)

To some degree, the Research Group's dismal predictions are a function of the dominant role of mini-computer manufacturers in Massachusetts. Producers of components and consumer electronics - including individually purchased personal computers - play a minor role in the state's economy. Consequently, new or growing markets for electronic equipment, beyond

capital equipment, may do little for the state. The software industry is growing in Massachusetts, but it offers essentially no manufacturing employment.

Breakthroughs in electronics technology or the application of that technology may prove the Research Group wrong. As the wizards of integrated circuit production continue to squeeze more and more components onto a single flake of silicon, they make possible new generations of products. Historically, those new products have stimulated whole new areas of consumption, increasing sales volume despite the falling cost of the circuitry.

In addition, the widespread adoption of GM's Manufacturing Automation Protocol may accelerate capital purchases by eliminating organizational obstacles to the automation of factory work. MAP creates a common language to link "islands" of automation. (See *Global Electronics*, October, 1985)

We still believe that the displacement of workers by high-tech machines in other industrial sectors will continue to drive production employment growth within high-tech industries, but the statistics and analysis provided by the High Tech Research Group at the very least should lead observers to carefully examine such trends.

ENVIRONMENTAL PROTECTION

Gradually, as the truth about the environmental hazards of high-tech production leaks out, public officials and community activists throughout the United States are asking what can be done to prevent electronics industry pollution. A team lead by Susan Sherry of Sacramento's Golden Empire Health Planning Center has prepared an excellent handbook designed to introduce concerned citizens to the policy problems of cleaning up high-tech, *High Tech and Toxics: A Guide for Local Communities*. In fact, the book provides important background and useful insights for those who are already involved in campaigns and deliberations over high-tech toxics.

The report contains detailed descriptions of the industrial processes that require and generate toxic substances and wastes. It reviews the known health impact of hazardous substances and the difficulties in determining health and environmental risk. It provides case studies of both high-tech disasters and successful public policy responses.

Most important, it lays out a strategy for limiting

(continued on page 2)

high-tech pollution that may prove valuable, not only to public officials and community activists, but to industry executives as well. Sherry argues that firms using hazardous materials should construct detailed mass balances for each plant, tracking hazardous material from entry through use or disposal. It describes the "Hazardous Waste Management Hierarchy," which stresses the need to reduce the generation of hazardous wastes at the source. The second element of the hierarchy is recycling, followed by waste treatment and finally, only as a last resort, disposal. That is, it is environmentally responsible, and in many cases already financially sensible, to solve toxics problems before they develop.

The report provides descriptions of various technologies, specifically relevant to high-tech production, for source reduction, recycling, and treatment. Though (it acknowledges) some sections are too technical for the average reader, the report generally succeeds in transforming a complex subject into a comprehensible, as well as comprehensive, text. It may not contain all the answers, but it is convincing: Something can be done. (Available from Conference on Alternative State and Local Policies,, 2000 Florida Ave., room 408, Washington, DC 20009, \$19.95 to individuals)

O.P.I.C. INSURANCE

Congressional restrictions on the operation of the U.S. Overseas Private Investment Corporation (OPIC), insurer to U.S. companies in the Third World, may affect future high-tech investments. OPIC projects in recent years, listed in the agency's annual reports, have included numerous electronics ventures, including:

<u>Company</u>	<u>Country</u>	<u>Amount (US\$)</u>	<u>Year</u>
AM Cable TV	Philippines	\$895,000	1983
AVX Ceramics	El Salvador	6,100,000	1984
Applied Magnetics	So. Korea	4,335,000	1984
Dynamics Tech.	Taiwan	250,000	1983
ESI	Taiwan	560,000	1983
General Electronic	Malaysia	8,300,000	1983
Harris Corp.	Malaysia	29,489,000	1983,4
Harris Corp.	Sri Lanka	20,000,000	1983
Honeywell	Thailand	2,500,000	1984
Intel	Philippines	4,500,000	1985
Int'l. Stand. Electr.	Taiwan	3,000,000	1983
Motorola	So. Korea	7,150,450	1984
Slater Electric	Jamaica	1,657,000	1984,5
Solid State Scient.	China	988,300	1985
Standex Int'l.	Haiti	750,000	1984

In addition, in 1983, OPIC actually provided financing to two Caribbean electronics assembly plants owned by PICO Products of New York. It loaned \$2.5 million for a factory on St. Christopher and \$800,000 for another on St. Vincent. In 1985 it backed Haiti's first printed circuit fabrication plant, Allied Circuits, with a \$350,000 loan.

OPTICAL FIBERS

The application of efficient new technologies to telecommunications systems is stimulating vast new investments not only in capitalist industrial countries, but throughout the world. In particular, communications utilities are relying increasingly upon optical fibers for the transmission of voice, data, and video. To prepare policy-makers in the Third World for this shift, the United Nations Industrial Development Organization has published a somewhat technical, 269-page study of *Optical Fiber Production* (UNIDO/IS.542, July 22, 1985, by Ernst Bonek, Bernhard Furch, and Heinrich Otruba, all from Austria).

Optical fibers, strands of glass or plastic that channel pulsed laser light, have several advantages over copper cables. They weigh one twenty-fifth of copper wires with comparable capacity, and they are one-tenth the size. Signals do not stray, so interference is negligible and eavesdropping is difficult. Fibers last longer than copper cable. Since light, not electricity, is conducted, systems are much safer. In fact, "Fibers can be repaired in the field even when the equipment is turned on."

In many cases, copper is still cheaper, costing US\$.02 per meter compared to \$.30 to \$1.50 for high quality fiber. But prices are falling, and "where the communication capability would require coax [coaxial copper cable] rather than copper wires, or where interference would require special shielding for metallic wire, fiber links can be competitive even at today's prices."

A typical plant produces 100,000 kilometers of

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gross fiber per year, yielding perhaps 50,000 km of usable fiber. It requires 63 persons to operate, a permanent supply of electrical power, rated at about 1500 kW, and supplies of ultra-pure gases. Factories and storage areas also need strict internal environmental controls on temperature, humidity, and dust. The authors barely mention problems associated with hazardous materials, but plants should also be built and maintained to control atmospheric emissions, occupational exposure, and land and water disposal of toxic substances and wastes. Factory equipment costs over \$9 million, and building construction is estimated at more than \$1.5 million. Wages account for only 30% of average production costs.

To produce 5,000 km/year of 10-fiber optical cable from bare fiber, it takes about 30 employees. A new factory costs more than \$1.6 million, but re-tooling a copper cable factory to make optical cable would cost only a half million dollars.

Presently, a handful of companies dominate the supply of cable fiber. Low-quality fibers are available in surplus quantities. Global fiber production capacity already exceeds current sales.

The authors recommend that relatively advanced "threshold" developing countries form joint ventures with foreign corporations if they wish to begin optical fiber production. They consider production inappropriate for least developed countries, however, and they recommend that such governments insist upon the establishment of fiber manufacturing allow foreign firms to operate plants outright.

HIGH-TECH LOCATIONS

The application of computer-based automation to electronics manufacturing is unlikely to lead semiconductor producers to close down Third World assembly plants, but through the direct reduction in labor requirements it will keep high-tech production from playing an important role in employment generation.

German scholar Dieter Ernst reviewed the U.S. assembly operations of Motorola, Intel, Fairchild, and Applied Micro Circuits: "at least in the cases of Motorola and Intel, the move into automated onshore assembly and final testing can by no means be mechanically equated with a real transfer of production capabilities to the U.S. It can in fact be shown . . . that both firms perceive the design and implementation of automated assembly and testing facilities in the U.S. as an *experimentation field for developing modules of automated assembly and final testing* which could be transferred subsequently to locations outside the U.S. including some growth poles in the Third World." Those sites offering plentiful, low cost engineering, technical, and skilled workers are "priority candidates for such transfers."

Ernst generalizes, "automation and industrial redeployment to developing countries are no longer alternatives. Rather they are taking place as complementary

processes and automation is increasingly the driving force." ("Automation, Employment and the Third World - The Case of the Electronics Industry," Institute for Social Studies, The Hague, Working Papers Series No. 29, November, 1985)

Richard Gordon and Linda Kimball's general study of high-tech spatial patterns, "Industrial Structure and the Changing Global Dynamics of Location in High Technology Industry" (Silicon Valley Research Group Working Paper No. 3, University of California, Santa Cruz, CA, 95064, January, 1986, \$4.50) contains revealing new data on the spread of high-tech to Santa Cruz County, just south of Silicon Valley on the California coast.

They conclude, "Santa Cruz is not a 'spillover community' whose geographic proximity to Silicon Valley has simply encouraged external financial investment or branch plant location. None of the variables routinely cited [local amenities, land, labor, business climate, university/colleges] to explain the locational decisions of high technology firms proved determinant, or even significant in the county." Rather, more than three quarters of the 122 firms surveyed by the authors cited "personal considerations" as their primary reason for locating in the county.

When those personal considerations are explored, however, the importance of proximity and the industry's dependence on brainpower re-emerge in another form. Kimball and Gordon conclude, "the primacy of personal reasons derives from the objective integration of Silicon Valley and Santa Cruz high tech economies. This regional linkage gives rise to a unique pattern of work-life decisions among certain skilled and professional workers. Attracted initially to employment opportunities, they (re-)locate their residence in Santa Cruz County and, subsequently, choose to transfer their work to Santa Cruz, either starting their own company or finding employment in other local firms. These indigenous firms - two-thirds of all Santa Cruz [firms] were founded within the county - tend to complete the circle by establishing direct business links with Silicon Valley operations."

Texas researchers have found an entirely different pattern, based upon the fact that many electronics firms have located assembly plants in small communities there primarily to reduce labor costs. Texas A & M Geographer Robert Bednarz writes, "it must be recognized that the overwhelming majority of high tech employees fall into the blue collar and clerical categories," clearly not the profile of the high-tech workforce in centers such as Route 128 (Massachusetts) and Silicon Valley. He adds, "a community's average income will probably not receive a large boost due to the addition of high tech employment," and he asserts that high-tech is unlikely to attract many new workers or professionals into an area. ("Is High Technology the Answer," report prepared for the State of Texas, Office of the Governor, February 15, 1984)

SOUTH KOREA

The efforts of South Korean conglomerates (*chaebol*) to break into the world sweepstakes for integrated circuit markets is running into difficulty. The low prices of random access memory chips have made it difficult for anyone anywhere to turn a profit in advanced semiconductor production, and South Korean firms appear to be learning production techniques more slowly than their more established American and Japanese competitors.

Korean manufacturers have also had difficulty building hardware requiring precision machining, such as printer and disk drives. Samsung, for example, had to discontinue the production of floppy disk drives.

Japanese companies have been reluctant to transfer technology to their lower wage-cost Korean competitors. To overcome this obstacle, Korean firms have hired "high-tech guerillas," Japanese engineers who commute to Korea on week-ends. Korean firms have set up research centers in Silicon Valley, and the government-run Korean Institute of Electronics Technology also set up a center in the Valley. This Overseas Technology Engineering Center has recruited over 100 Korean-Americans for government service.

Korean companies have been most successful in the

production of monitors and terminals, but Daewoo's \$400 million contract with Leading Edge for IBM PC-clones has made the country a major supplier of personal computers. (See Ashoka Mody, "Korea's Computer Strategy," Harvard Business School Case Services, 1985)

Korean Computer Production & Exports (US\$ Millions)

	<u>Production</u>		<u>Exports</u>	
	<u>1983</u>	<u>1984</u>	<u>1983</u>	<u>1984</u>
Minicomputers	8	12	-	-
Microcomputers	20	17	16	17
Personal Computers	39	108	19	65
Word Processors	6	3	-	2
Floppy Disk Drives	5	8	-	2
Printers	13	15	-	-
Terminals	113	249	85	198
Total	204	422	120	284

(The data and categories were supplied by Electronics Industries' Association of Korea)

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