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WASHINGTON ECONOMIC & POLICY
TRENDS

A Report by Jerry J. Jasinowski, Executive Vice President, National Association of Manufacturers

August 1987

Why Manufacturing Is Essential to the American Economy

It was nearly two centuries ago that Alexander Hamilton, in his famous Report on Manufactures, pointed to the path whereby the United States was to attain wealth and power beyond the dreams of its founders:

> *"Not only the wealth but the independence and safety of a country appear to be materially connected with the prosperity of manufactures."*

These words are still true today: Manufacturing industries are still the foundation of America's economic strength and national security. Yet as we headed for the largest trade deficit in our nation's history, the president's 1984–85 Trade Report sounded a different note, one that rationalized the decline of American manufacturing:

> *"The move from an industrial society toward a post-industrial service economy has been the greatest change to affect the developed world since the Industrial Revolution. The progression of an economy such as America's from agriculture to manufacturing to services is a natural change."*

Implying more than it states, this "post-industrial" premise has served to explain away economic policy mistakes that created huge federal budget deficits, raised interest rates, overvalued the dollar, raised the cost of capital and, in the end, lessened the competitiveness of American industry. The implication is that the consequent erosion of manufacturing is simply part of the process by which the United States moves on to a higher stage of development. The uncritical acceptance of this dubious proposition threatens the nation with serious and lasting harm.

Challenging what seems to have become conventional wisdom, this study is an effort to clarify some widespread misconceptions about how the American economy works. It begins with a capsule history of the idea of post-industrialism and shows that its current use is a misapplication. More importantly, it presents a factual profile of manufacturing that demonstrates its benefits to the American economy, particularly in terms of technology, productivity, growth and the nation's ability to compete in world markets.

A close study of the statistical evidence demonstrates clearly why manufacturing remains essential to our economic health and national security. It also puts a new perspective on the damage that the recent mismanagement of economic policy has wrought, symbolized by the unprecedented explosion of the trade deficit. And it leads to some definite conclusions as to the means by which this potentially permanent damage should be repaired.

The Post-Industrial Myth

Today's "service economy" bias evokes echoes from the early days of economics. Some people trace the concept all the way back to the 17th century and an Oxford medical professor, Sir William Petty, who turned to economics in his middle age. Noting the limited agriculture of Holland —then the richest country in Europe— Petty declared that "There is much more to be gained by *Manufacture* than by *Husbandry*; and by *Merchandise* than by *Manufacture*." His view is balanced by the French physiocrats of the 18th century, who thought only agriculture contributed to national wealth and by Adam Smith, who dismissed services with this comment:

> *"Services which perish generally in the very instant of their performance . . . does not fix or realize itself in some such vendible commodity which can replace the value of their wages and maintenance."*

The contemporary debate is not about intrinsic worth but the process of economic development. In 1940, the Australian economist Colin Clark predicted that just as the early part of the 20th century brought a shift in the composition of the labor force in advanced countries—from a predominance of farm workers to an increasing proportion of factory workers—the remainder of the century would see a relative shift in employment from production of goods to production of services. More than three decades later, Harvard University sociologist Daniel Bell wrote a best-selling book, "The Coming of Post-Industrial Society: A Venture in Social Forecasting." By that time, in the most meaningful sense of the term, the United States had been a "service economy" for almost a generation; since 1950, the service sector has employed more than half of all U.S. workers.

The trend that Clark first spotted continues; services now account for fully 70 percent of the labor force. Yet few of those who talk about this as "the greatest change to affect the developed world since the Industrial Revolution" seem to know how it came about. The service sector has grown and prospered mainly because manufacturing has provided support in terms of technological devel-

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opment and growth of real income. The vast increase in service employment has not been because of that sector's inherent superiority but because its built-in inefficiency has generated a higher manpower requirement.

Unlike the earlier decline in the farm population, however, manufacturing employment is not withering away in any absolute sense. Since 1950, manufacturing's *share* of jobs has declined from 30 percent to roughly 20 percent, but its *level* of employment continued to grow, adding about 6 million jobs to factory payrolls to a peak of 21.2 million in 1979. The reduction of 1.8 million jobs since then is not, therefore, the continuation of a trend but a reversal caused primarily by misdirected macroeconomic policies that ignore the essential role that manufacturing plays in the health of the American economy.

Having allowed ourselves to have been misled about what caused the erosion of our manufacturing position and, at the same time, underestimating the benefits manufacturing yields to our economy, it's time to focus on the elements of why manufacturing is essential to the American economy.

1 Manufacturing Is Essential to Healthy Economic Growth

Healthy growth in manufacturing almost always seems to go hand-in-hand with healthy growth in the economy at large. From 1960, right up to the 1973 oil shock, as you can see in Exhibit 1, growth in manufacturing output ran well ahead of overall economic growth in most developed countries. Since then, there has been a marked slowdown in economic growth that, with the single exception of Japan, has been accompanied by an ever steeper slide in manufacturing output. In general, the stagnation of manufacturing that took place on a worldwide basis during most of the 1980s has cut average growth rates in half for most countries.

Robert Z. Lawrence of the Brookings Institution estimates that growth in manufacturing draws even with growth in economic output at about the 3-percent level and that, above this level, manufacturing seems to pull the economy along. It is probably a case of positive feedback: Rapid growth in overall demand draws manufacturing industries forward in its wake and then the more rapid growth in manufacturing—through effects on productivity, income and investment—further drive the growth of demand. The converse is also true; service-led expansions do not seem to generate adequate investment or gains in real income needed to accelerate growth above average levels. The lackluster economy since mid 1984 provides ample evidence for the principal conclusion of a 1985 study by Data Resources, Inc.:

> *"Without a strongly advancing manufacturing industry, the U.S. economy is hardly likely to maintain its progress in the decades ahead."*

Exhibit 1

GROSS DOMESTIC PRODUCT AND VALUE ADDED IN MANUFACTURING: REAL GROWTH RATES FOR SELECTED COUNTRIES

	(Average Year-to-Year Percentage Increases)				
	1960-68	1968-73	1973-79	1979-84	1960-84
U.S.					
GDP	4.5	3.3	2.6	2.0	3.3
Mfg.	5.6	3.9	2.0	2.0	3.3
Japan					
GDP	10.4	8.4	3.6	3.9	6.9
Mfg.	13.5	12.7	3.6	7.7	9.6
Germany					
GDP	4.1	4.9	2.3	0.9	3.1
Mfg.	5.0	5.5	1.7	0.2	3.2
U.K.					
GDP	3.1	3.2	1.5	0.6	2.2
Mfg.	3.1	2.9	-0.7	-1.7	1.1
All OECD*					
GDP	5.1	4.8	2.7	1.9	3.7
Mfg.	6.2	6.0	2.2	1.7	4.2

*The Organization for Economic Cooperation and Development is composed of 24 industrial countries.

Source: OECD, *Historical Statistics 1960-84*; and Bureau of Economic Analysis (BEA), *Survey of Current Business*.

2 Manufacturing Is Essential to Service Growth

The central irony in this "post-industrial" debate is that far from being in the process of supplanting manufacturing, the service sector is increasingly dependent on it. Historically, the demand for services has increased as a direct consequence of rising wages and rapid productivity growth in manufacturing. Modern services don't flourish until manufacturing has built an economy capable of affording them.

Manufactured goods are also the primary means through which new technology comes to services. Without new drugs, diagnostic instruments and other equipment, recent advances in the quality of medical services would have been impossible. Computers, satellite communications and fiber optics have created a revolution in banking and financial services. Even in retailing, computers have

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produced major gains in efficiency by improved inventory control.

Manufacturing industries are among the service sector's best customers. General Motors' largest single supplier doesn't make auto parts; it sells health insurance. The President's Trade Report itself notes that fully a quarter of U.S. gross national product "originates in services used as inputs by goods-producing industries." A similar pattern exists in Europe. According to the Common Market Commission, a third of all service sector growth between 1975 and 1982 represented purchases by manufacturers.

"Manufacturing Matters: The Myth of Post-Industrial Economy," a recent book by Stephen Cohen and John Zysman for the Council of Foreign Relations, documents the "tight linkages" that make service employment dependent on domestic manufacturing. For services such as trucking or retail sales, it does not matter much whether goods are made in the United States or abroad. But many business services represent the professionalization of what used to be in-house functions and are so tightly linked to manufacturing operations that when imports grow they are likely to shrink. According to the authors:

> *"If we lose control and mastery of manufacturing production...the high-paying service jobs that are directly linked to manufacturing will, after a few short rounds of industrial innovation, wither away, only to sprout up offshore."*

Even when foreigners substitute U.S.-based production for exports, the implications for U.S. service producers are adverse. When Toyota decided to build an auto plant in Georgetown, Kentucky, it hired a Japanese engineering firm to coordinate the construction. And the Japanese firm that regularly transports Toyota's vehicles has established a new U.S. operation. Meanwhile, Toyota's major financial backers, the Bank of Tokyo and Tokai Bank, set up offices near the plant to handle its business. Noting the close connections between Japanese banks and Japanese corporations, MIT economist Lester Thurow predicts that "if American industry declines, the financial institutions that serve it will also decline."

Exhibit 2

MANUFACTURING SHARE OF GNP 1960-85

Current and Constant Dollars

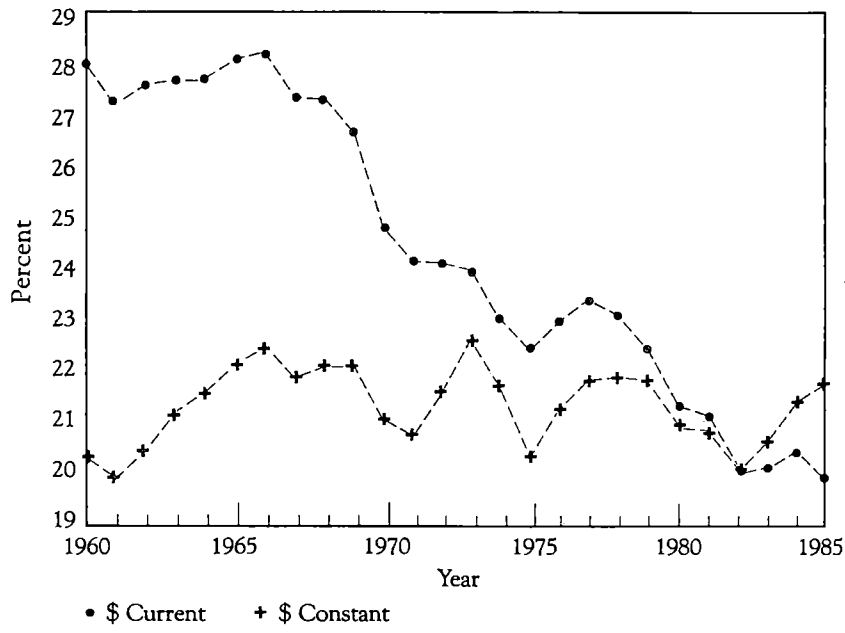
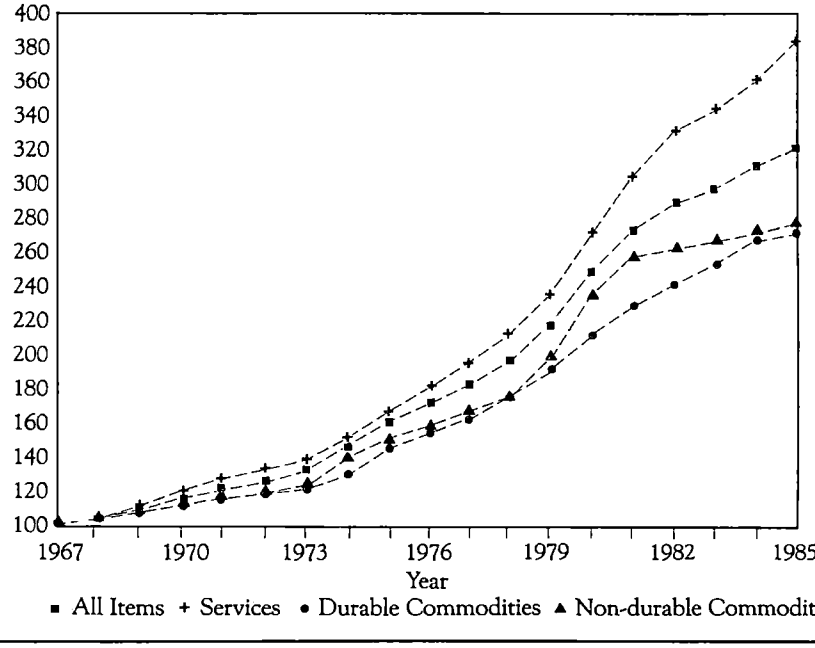


Exhibit 3

CONSUMER PRICE INDEX: 1967-85

(1967 = 100)



3 Manufacturing Is Essential to Price Stability

There is another little-noted fact about manufacturing in this so-called "service economy": While its share of nominal GNP has declined from 28 percent in 1960 to roughly 20 percent today, its share of real GNP has remained remarkably constant. The only significant movement has been the effect of the business cycle, to which it is more sensitive than services. Between peaks and troughs it oscillates in a range between 20 percent and 23 percent (*see Exhibit 2*).

What accounts for the difference in the share of nominal and real GNP is the superior inflation record of manufacturing (*see Exhibit 3*). Since 1976, the Consumer Price Index has just about doubled. Most of this rise was located in the service

sector, where prices rose a total of 122 percent. The rate of inflation for goods was 40 percent less. Services have always led the upswing in prices that generally accompanies booms, and manufacturing has always led the moderation that is bought with economic slowdowns (*see Exhibit 4*).

The contrast in price behavior has been particularly sharp since 1981. Goods prices have gone up over this period by only 12 percent while the price of services has risen by more than 30 percent. Differences in productivity (*see point 4*) account for much of the superior price performance of manufacturing, but exposure to overseas competition is also a factor. A recent study by the United Nations estimated that only 8 percent of services are traded internationally compared with 55 percent of manufactured products. But much of the low inflation in manufacturing is also explained by the superior productivity performance of American manufacturers.

4 Manufacturing Is Essential to Productivity Gains

If manufacturing is a nation's economic foundation, the sector's inherent productivity advantage is clearly its cornerstone. In most major developed countries, productivity in manufacturing has increased more than twice as fast as in services (*see Exhibit 5*).

With the notable exception of communications, which have benefited from the steady stream of improvements in electronic equipment, service industries have consistently experienced meager gains in productivity. Over the past 25 years, output per manhour has increased at an average annual rate of only 1.1 percent for retail trade, 0.8 percent for miscellaneous business and personal services, and 0.6 percent for finance, insurance and real estate. In the nonmanufacturing sector (primarily services), productivity has actually stagnated since 1973 (*see Exhibit 6*).

The productivity gap between services and manufacturing has been greater in the United States than in any other country and seems to be getting wider. Indeed, the massive restructuring of the 1980s has brought one of the best productivity performances on record: increased manufacturing output per manhour at an average annual rate of 4.1 percent since 1981. This is the first period on record when productivity has increased rapidly with output remaining essentially unchanged.

Exhibit 4

CHANGES IN IMPLICIT PRICE DEFLATORS OVER BUSINESS CYCLES—1957-84

(Percent)

Sector	Peak to Trough Average	Trough to Peak Average
Manufacturing	5.4	3.5
Services	5.9	5.5

Source: Department of Commerce, BEA.

Exhibit 5

WORKER PRODUCTIVITY* IN MANUFACTURING AND SERVICE INDUSTRIES—AVERAGE ANNUAL GROWTH RATES—1960-84

(Percent)

Country	Manufacturing	Services
United States	2.5	0.9
Japan	7.7	4.2
Germany	3.7	2.5
France	5.0	2.3
United Kingdom	2.9	1.1
Italy	4.9	1.9
Canada	2.6	1.0

*Real value added per person employed.

Source: OECD, *Historical Statistics: 1960-84.*

5 Manufacturing Provides High Living Standards

Greater productivity generally means higher real incomes. Relative to other sectors of the economy, pay rates in manufacturing are significantly higher. Higher compensation in manufacturing raises average compensation levels for the nation as a whole and contributes to overall growth in demand for both goods and services. Since 1960, average compensation levels in manufacturing have run from 10 percent to 20 percent higher than for the economy as a whole. Interestingly, in the 1960s and early 1970s, the wage premium for manufacturing seemed to be narrowing. After 1973, this trend began to reverse itself as an increasing proportion of new workers were absorbed by low-wage service industries, where compensation levels are now almost 20 percent less than the manufacturing average (*see Exhibit 7*).

To be sure, pay rates in manufacturing industries such as autos and steel were once too high relative to aggregate labor costs. But the era of concession bargaining has brought a fundamental adjustment that, while not yet complete, seems irreversible. Still, the 1980s, with declining employment in manufacturing, have caused some concern about possible erosion of the middle class whose mainstay has been the affluent factory operative.

Exhibit 6

AVERAGE ANNUAL GAINS IN PRODUCTIVITY

	1948-1973	1973-1981	1981-1985
Business economy	2.9	0.6	1.1
Farming	4.6	5.2	2.8
Nonfarm sector	2.4	0.4	1.0
Manufacturing	2.8	1.3	4.1
Durable	2.4	1.1	4.7
Nondurable	3.4	1.7	3.2
Nonmanufacturing	2.2	0	0

Source: Bureau of Labor Statistics, U.S. Department of Labor.

It should be noted here, however, that all of the decline in manufacturing jobs has been cyclical in origin. During the recessionary period, 1980-82, manufacturing employment fell by about 2½ million. Since that time, it has increased by some 600,000. In other words, while manufacturing jobs are not currently declining, they have failed to regain their 1979 levels.

Exhibit 7

COMPENSATION IN MANUFACTURING vs. ALL DOMESTIC INDUSTRIES—SELECTED YEARS

(Percent by which wages and salaries and total compensation per employee in manufacturing exceed the all-industry average)

Year	Wages and Salaries	Total Compensation
1960	15.2	17.7
1966	12.2	14.7
1973	7.6	10.7
1979	13.2	17.3
1985	16.2	18.6

Source: Department of Commerce, BEA.

6 Manufacturing Is a Major Source of Savings and Investment

Although manufacturing accounts for only a fifth of GNP, it regularly does about a third of business saving which, in 1985, amounted to more than half a trillion dollars (*see Exhibit 8*). It is able to do so because manufacturing leads all other sectors in profitability, accounting for more than 45 percent of pretax profits.

As a rule, profitability in manufacturing is dominated by the business cycle, rising rapidly in the early years of a recovery and trailing off as capacity shortages raise costs and, later, as the economy loses momentum. In the 1960s and 1970s, return ratios were healthiest three to five years after an economic upturn. In the current recovery, however, the ratios have behaved differently. Three years into the recovery, net income relative to sales and return on assets were at their lowest levels in 25 years (not counting the deep-recession year of 1982).

Profitability is important because, for the most part, retained earnings are used to finance investment. According to the federal government's investment survey, manufacturing companies have accounted for roughly 40 percent of total spending on plant and equipment for the past couple of decades.

Another set of statistics records spending specifically directed toward manufacturing operations. These figures show that manufacturing investment tends to vary with the business cycle, such as increasing toward a fourth during the decadelong expansion of the 1960s and declining toward a fifth during less bullish times (*see Exhibit 9*).

The 1980s have brought a troubling accentuation of this pattern. Manufacturing's investment share fell sharply after the recessions of 1980-82 and hovered at a post-1960 low of around 18 percent despite three years of general economic recovery. One possible conclusion is that manufacturing companies were beginning to redirect their investment toward nonmanufacturing activities. There has also been a shift in the composition of manufacturing investment away from structures and toward equipment. Confusing changes in the tax treatment of investment, strong preference for labor-saving machines, and a worrisome reluctance to increase capacity are other factors that have altered the composition of investment.

Exhibit 8

MAJOR COMPONENTS OF GROSS SAVINGS—1985

($Billions)

Personal Saving		$ 129.0
Business Saving		566.0
Government Saving		-140.0
	Total	$ 554.9

Source: Department of Commerce, Bureau of Economic Analysis (BEA).

7 Manufacturing Spurs Technological Development

Manufacturing accounts for the overwhelming bulk of technological development in our society. Indeed, it is difficult to think of any major examples in high-tech services. Even technically sophisticated services get that way by employing sophisticated equipment obtained from manufacturers. Manufacturing is central to technological development for several reasons.

Exhibit 9

INVESTMENT IN MANUFACTURING AS A SHARE OF GROSS INVESTMENT IN ALL INDUSTRIES

Period or Year		Investment Share (Percent)
1961-69	Avg:	24.1
1970-73	Avg:	21.1
1974-75	Avg:	23.5
1976-79	Avg:	22.5
1980		23.0
1981		22.1
1982		21.7
1983		18.0
1984		18.4
1985		18.2

Source: Department of Commerce, BEA, *Wealth Data*. The underlying data are reported in constant dollars.

In the first place, it is the capital equipment of manufacturing firms to which technology is most effectively applied. One part of this process involves economies of scale. The average manufacturing plant employs about twice as many people as the average mine or public utility. Close to 40 percent of all manufacturing employment is located in plants of 500 or more, twice what the proportion is for the economy as a whole. Bigger plants mean fuller and more efficient use of capital and other factors of production, larger production runs, more automation and greater job specialization. Adam Smith's famous example of the pin factory still holds in the computer age.

It is also true that production of goods offers both more opportunity and more bottom-line incentive to develop and apply new technology than does the production of intangibles. According to a recent study by the Organization of Economic Cooperation and Development (OECD), services providers in the major industrial countries account for well over half of all economic activity but provide only 5.3 percent of all spending on research and development. The figure for the United States, which has the largest service sector of all, was 4.1 percent in 1981, the year selected for the study.

By contrast, U.S. manufacturers have funded a large and increasing share of this nation's research and development—half by 1986, compared with a third in 1960. This increase has offset the lessening of support from the federal government. Even in basic research, where the federal government used to provide the lion's

share, industry funding has been growing at an annual rate of close to 10 percent—three times that of federal funding. Washington still outspends private industry in university-based R&D. Since 1978, however, industry support has been growing at an annual rate of 18 percent compared with a 10 percent rate of growth for government programs.

In addition, nearly three-quarters of all U.S. scientists and engineers work for manufacturing concerns which perform the same proportion of all research and development, both civilian and military. Manufacturing concerns spend the most money on R&D and employ the greatest number of technical personnel. Indeed, most of our technological development and 90 percent of the associated costs and risks occur *after* research has been completed, during the innovation process. By and large, this has been in the labs, pilot plants and factories of manufacturing concerns. Here, the difference between British and Japanese experience is a rich lesson. Britain has a solid record in basic science but lags in translating laboratory discoveries into marketable products. Japanese don't do much basic research but (as Westerners have had reason to find out) are wizards at turning ideas into products, in large part because they have a stronger manufacturing sector.

History has shown repeatedly that the economic benefits of innovation go to the countries with the strongest manufacturing sectors. It is the wellspring by which technology is diffused throughout society, raising living standards and enhancing the long-term ability to compete in international trade. Even technological advances in services are heavily dependent on manufactured products.

8 Manufacturing Is Essential to a Strong National Defense

There is a critical link between U.S. industrial strength and our ability to influence international events—diplomatically and, if need be, militarily. On one level, the connection has been clear. America's ability to build planes, ships and tanks faster than Germany and Japan was the basis of the Allied victory in World War II. Today, our ability to build technologically superior weapons helps to maintain the balance of military power in the face of more numerous Soviet and Warsaw Pact forces.

Defense production is also a major part of the economy, particularly for certain industries such as electronics and transportation equipment. Government purchases of military hardware currently account for a little less than 5 percent of total U.S. manufacturing output. For the past few years, however, the military has taken 11 percent of durables output and, in many industrial lines, percentages run a great deal higher (*see Exhibit 10*).

Because America's defense has been based primarily on sophisticated equipment, our industries must operate on the very frontiers of technological development. We cannot import large quantities of semiconductors, computers and sophisticated equipment without incurring serious problems, most importantly our ability to maintain weapons reliability and confidentiality. Without domestic expertise, in fact, we could not even maintain the technical standards to know for sure that we were buying the best products.

Exhibit 10

SHARE OF OUTPUT ACCOUNTED FOR BY DEFENSE PURCHASES IN 1985—SELECTED INDUSTRIES

Industry	Percent
Aircraft	66
Radio and TV communications	50
Machine tools, cutting	34
Truck trailers	29
Engineering instruments	28
Nonferrous forgings	25
Transmission equipment	24
Optical instruments	24
Turbines	23
Aluminum, primary	22
Zinc, primary	22
Electronic components	20

Source: Henry and Oliver, "The Defense Build-Up," *Monthly Labor Review*.

A strong industrial economy also contributes to national security in more subtle ways. By demonstrating the benefits of American economic and political ideals, it supports our moral leadership in the world. It also gives American leaders more freedom to pursue domestic and defense policy objectives simultaneously. And, by reducing the pain of sectoral and regional decline, a competitive military industrial sector makes it easier for the United States to cope with protectionist pressures that strain our international alliance system.

Given these eight substantial benefits in technology, productivity and many other areas, one has to ask: Why hasn't the performance of manufacturing been better in recent years? The reason is that our competitive position in international trade—which has historically been another major benefit to our economy—has been severely damaged by government mismanagement of economic policy.

How the Crisis in Trade Damaged Manufacturing and the Economy

The decade of the 1980s is an object lesson of what can happen when policymakers forget the essential role of manufacturing in the American economy. Clearly, the "post-industrial premise" has led to an international trade crisis that threatens not only the health and stability of the United States but also the rest of the world. This crisis can be traced directly to the collapse of U.S. international trade in manufactured goods which, in turn caused an explosive growth in the overall trade deficit (*see Exhibit 11*).

This does not mean that manufacturing is the major *cause* of the problem; it is merely the *locus*. Manufactures are the principal medium of our competition with the rest of the world, comprising most of our international goods and service transactions. On average, over the past 15 years, manufactures have accounted for 66 percent of our merchandise exports and 59 percent of merchandise imports. Reflecting the healthy historical position of manufactures in trade, from 1970 through 1979, manufactures averaged a modest $250 million annual surplus and exports never fell more than $12.23 billion below imports.

The stunning recent deterioration in our trade position, by the same token, can be traced directly to the collapse in our trade in manufactured goods. Between the four short years of 1982 and 1986—led by a deterioration in our manufacturing trade from approximate balance to a deficit of -$145 billion—our trade deficit skyrocketed to $168 billion (*see Exhibit 11*).

In 1986, manufactured goods accounted for 80 percent of this nation's trade deficit. In four short years, the United States created cumulative trade deficits of roughly $500 billion. Most of this recent surge was due to macroeconomic mismanagement.

Even in high-tech manufactured goods, where the United States historically has held a tremendous comparative advantage, the surplus peaked in 1980 and, by 1986, had recorded a deficit for the first time in history (*see Exhibit 12*).

Exhibit 11

U.S. MERCHANDISE AND MANUFACTURING TRADE BALANCE

($Billions)

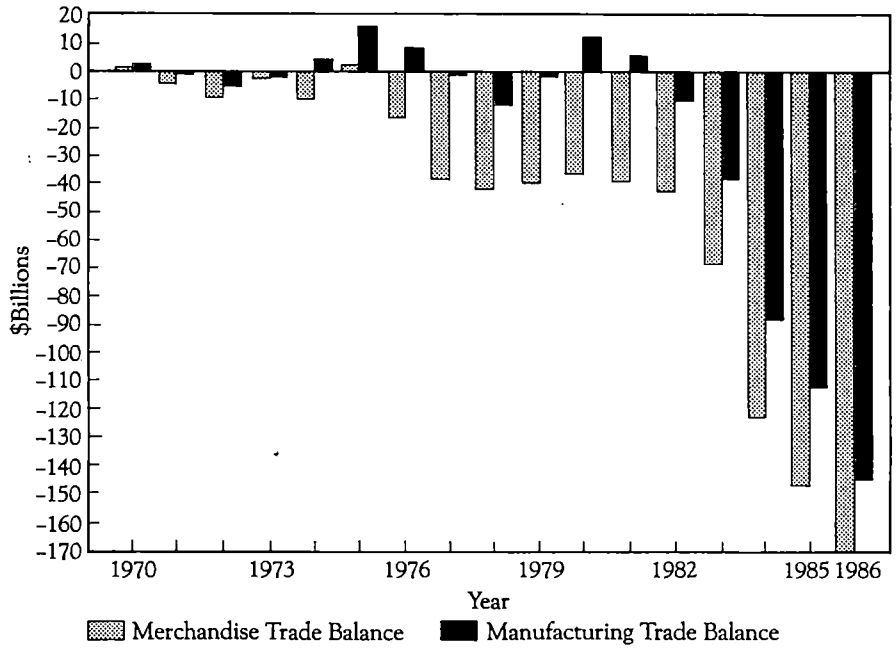


Exhibit 12

SELECTED U.S. TRADE BALANCES—1978-86
($Billions)

Year	Total Manufactures	High-Tech Manufactures
1978	$ -8.4	$ 14.4
1979	2.2	20.6
1980	17.4	26.6
1981	11.4	26.4
1982	-3.3	23.4
1983	-31.2	18.8
1984	-80.7	6.2
1985	-107.6	3.6
1986	-145.0	2.6

Source: Department of Commerce, International Trade Administration.

The rapid growth of the U.S. trade deficit, dominated by a massive surge of imports into the United States, stifled the manufacturing sector's recovery from twin recessions in 1980 and 1981-82. The post-recession rebound ended abruptly in mid-1984, leaving industrial production just above its pre-recession peak. Manufacturing output has shown little growth for the past three years. This, in turn, has cut in half the normal GNP growth rate. Some estimates place the effect on manufacturing employment as high as 2.4 million jobs, slightly more than the gap between the present level and the 21.2 million peak of 1979.

There has been a lot of misleading talk attributing most of this decline of competitiveness to managerial ineptitude. But observing that U.S. multinational manufacturing firms have maintained or increased their share of world export markets, Robert E. Lipsey and Irving B. Kravis—who, over the years have teamed up on numerous cross-country comparisons of production costs for the National Bureau of Economic Research—have concluded:

> *"If we wish to explain our national trade problems, we should look for reasons other than the decline of our companies' technology and management. We should be asking whether developments and policies specific to the United States have been making the country less attractive as a location for manufacturing."*

The most obvious explanation is the effect of the sudden rise of the dollar in the early part of the 1980s. According to another recent NBER study, about two-thirds of this rise was indirectly attributable to the rise in the federal deficit. This enormous swelling of what economists have come to call the "structural deficit" was also responsible for two-thirds of the increase in interest rates during the 1983-85 period.

The consequences of this macroeconomic mismanagement and, in particular, the misalignment of currencies, raised American manufacturing costs by as much as 75 percent relative to those in other countries. The effects of these self-inflicted wounds were enormous and will be long-lasting because foreign competitors have established a beachhead in the United States. With foreigners now supplying so much of U.S. demand for manufactured goods, our profitability and investment falter. This, in turn, erodes the competitive position of U.S. manufacturers and lowers the growth trajectory for the economy at large.

The evidence that macroeconomic factors were the principal cause of our manufacturing trade deterioration does not absolve management from the corporate competitive deficiencies that have also contributed to our trade problems. Bloated cost structures, poor quality, insufficient attention to upgrading the manufacturing process, a certain slowness in adapting to technological and market changes, to name just four of the most important corporate shortfalls, also contributed to our manufacturing difficulties.

In addition, the indulgent values of American society—our preference for consumption over savings and production, the attraction toward shorter- rather than long-term gains, the low priority we place on education and training, and the lack of a national commitment to compete in world markets—have also contributed to our falling behind competitively.

It would be a serious mistake to underestimate the size and complexity of the trade problem we have created for ourselves. But it is equally important to recognize that substantial progress in improving our international competitiveness has been made over the past several years. The trick at this stage is to appreciate the progress we have made while recognizing that the bulk of the challenge lies ahead.

Recent Progress in Manufacturing

The recent decline of the dollar has improved the price competitiveness of American manufacturers, particularly with respect to Western Europe. In particular, industries producing paper, lumber, chemicals and other commodity-like products have seen dramatic improvements in their export opportunities.

Consequently, real net exports began to rise sharply in the fourth quarter of 1986 and have shown an improvement of roughly $30 billion through the first quarter of 1987. We have turned the corner on the trade deficit and can expect that moderate progress this year and next will add roughly one percentage point to real GNP growth.

Here at home, we have seen a massive restructuring of manufacturing industry aimed at significantly reducing the cost of production and improving productivity. Firms have closed obsolete plants, reduced overhead costs, developed more effective supply relationships, employed outsourcing more effectively, flattened organizational hierarchies and moderated wage increases. Over the past five years, most companies report that, as a result of these actions, their costs have been reduced about 10–15 percent. Partly due to this cost-cutting, but also for broader reasons, manufacturing productivity growth has doubled.

Today, improving quality is even more important for most manufacturing firms than cutting costs. Total quality control has become the driving force, encompassing statistical process control, zero defects, improved vendor relationships and new systems. Most importantly, this total quality thrust has shifted responsibility from quality control departments to employees involved in production details. This has meant a stronger commitment by management and employees to do it right the first time.

Streamlining inventory and materials management is also a key priority in most manufacturing firms, since components and materials account for more than 50 percent of manufacturing costs. Significant changes are taking place in how corporations deal with production planning and inventory controls. Materials Requirement Planning (MRP), which has been the dominant method for controlling inventory and material flows, has given way to the new technique of Just in Time (JIT) systems. Challenging some of the basic assumptions about manufacturing, JIT broadly encompasses purchasing, material flows, vendor execution and shop floor performance.

Using technology to speed up innovation is yet another key priority. As noted earlier in this study, the bulk of private R&D spending is done by manufacturing firms. While a substantial proportion goes to improving the production process, the major emphasis is on the timely introduction of new products. As manufacturers are listening more carefully to customers and recognizing they must adapt to new market conditions, they are moving to higher value-added products that have a lucrative market niche.

An important by-product of the corporate restructuring that has occurred in recent years is that small, innovative manufacturing firms have increasingly challenged the dominant firms, establishing important niche markets. Part of this trend reflects management's view that the giant corporation was not flexible enough to meet today's competitive demands, leading to an enormous number of divestitures during this period. The strong entrepreneurial spirit of American capitalists was also a factor in the rapid growth of small and medium-sized firms.

As a result of these and other favorable developments, some analysts are beginning to see positive trends in manufacturing performance. MIT professor David Birch, for example, finds that 40 out of the top 50 most innovative business segments in the economy are in manufacturing. Many of these are smaller, highly motivated firms that are focusing on high value-added products in niche markets. Wall Street is now recommending "lean and mean" manufacturing stocks.

Even economic forecasters are beginning to see favorable trends in manufacturing. Contrary to past trends, the Bureau of Labor Statistics now predicts a brighter outlook for durable manufacturing products. Of industries projected to have the most rapid growth through 1995, eight of the top 15 are in manufacturing. These include materials-handling equipment, plastics, communications equipment, electronic components and computers.

Looking at these positive developments, it's my judgment that we have come a substantial distance toward reestablishing the competitive position of American manufacturing in world markets. But moving the rest of the distance will be a formidable task.

How to Regain Our Competitive Edge

In the years immediately following World War II, the United States achieved steady growth and high living standards without much international trade. Now, however, insulating American markets from foreign competition is a high-cost, high-risk option for solving the nation's trade problems. There are other options, but none that are simple and none that are without major costs.

The decline of the dollar since the spring of 1985 won't restore the pre-1981 status. The overvalued dollar of the early 1980s gave foreign firms an opening and they are now entrenched in our markets. Thus far, as the dollar has declined against many (but not all) currencies, these firms have sacrificed profits for market share. It will be a long, hard fight to win back our markets.

One factor that will make reducing the trade deficit harder is the United States' unusually strong appetite for imported goods: our marginal propensity to import is much higher than in most of the other industrial countries. This means that to make a real dent in the trade deficit, our principal trading partners would have to grow substantially faster than we.

But even major progress on the trade deficit would not suffice to balance our international accounts since we have lost our net-investment cushion. In the 1970s, when U.S. overseas investments exceeded foreign investments here, our relatively modest merchandise trade deficits were largely offset by income from abroad. Since 1981, the massive inflows of foreign investment financing both our trade and budget deficits have made us the world's largest net external debtor. This year, exports would have to exceed imports by $20 billion just to pay interest on this international debt.

Some people have suggested that because America is such an attractive place to invest, we can pile up debt indefinitely. Indeed, in recent months, Japanese purchases of U.S. assets have surged despite a 40 percent drop in the yen value of existing Japanese assets. At the same time, however, the threat of continued dollar depreciation has prompted foreigners to demand high interest rates on long-term investments in this country. In any case, even if foreigners continue to be forthcoming, the resulting foreign presence in our economy would become politically intolerable.

The solution offered by believers in our "post-industrial destiny" is the export of services. Such help would likely be marginal. In 1985, business services comprised only 14 percent of our nonfinancial transactions with the rest of the world (17.4 percent of exports and 11.7 percent of imports). Net, service trade reduced our overall deficit on current account by a scant $200 million.

U.S. negotiators at the new GATT round will be working for an agreement that lowers barriers to trade in services. But most countries would prefer to develop their own service industries instead of depending on foreign banks,

insurance companies and engineering firms. Just getting services on the agenda for the new round has been a major achievement.

Of course, we could bring the trade balance closer to zero by further depreciating the dollar—but at the risk of incurring higher inflation through the channel of rising import prices. We could also stem demand for foreign imports by implementing slow-growth monetary and fiscal policies—in effect, by letting unemployment rise.

We could also try to inflate away our mounting foreign debt. The damage to our national credit rating, however, would force up interest rates and once again we would face the hardships and economic distortions that we paid dearly to escape in 1981-82.

The ripple effects of such policies could, moreover, be devastating. A serious economic slowdown, self-induced or otherwise, would surely intensify pressure for general import protection. In turn, a major protectionist step by the United States might disrupt the international trading system, strain our alliances, destabilize governments in developing countries and put Americans in export industries out of work. The consequences of such developments are unfathomable, both politically and as a matter of national well-being.

It is clear that there are no simple, quick-fix solutions to our trade and competitiveness problems. A recent NAM paper on "Competing in the Global Economy," (*available from NAM's publications coordinator*), based in part on a survey taken of NAM's Board of Directors in late 1986, set forth a tough-minded agenda for regaining our international competitive edge. Concluding that the situation is so urgent that it requires all segments of society to work together, the paper focuses on these key areas:

1. Getting our macroeconomic house in order by reducing budget deficits. This is the single most important step government can take to make the United States more competitive. Our huge budget deficits drain national savings, raise interest rates, distort exchange rates, retard investment and reduce productivity improvement.

2. Reversing the traditional American tendency toward overconsumption and repairing the damage done by the consumption excesses of "tax reform." Saving and investment must be increased to raise our level of productivity growth, which is the fundamental foundation of our long-term capacity to compete.

3. Keeping a sharp focus on international economic policies such as exchange rates, growth differentials among countries and the fairness of trade policies. Continued pressure must be maintained on countries where there has been little exchange rate improvement, such as South Korea, Canada, Taiwan, Brazil and Mexico. Strong trade legislation should be passed by Congress that improves U.S. access to foreign markets, promotes U.S. exports and strengthens our import laws.

4. Corporate competitiveness should continue to be improved at all levels through further cost reductions, productivity gains, quality improvements, advances in the manufacturing process, a stronger employee commitment to competitiveness, a more rapid application of technology and more aggressive marketing abroad.

5. The United States should also stop shooting itself in the foot with actions that clearly harm our ability to compete, such as export controls, rigid plant closing requirements and mandated benefit programs that substantially raise costs. A standard of competitiveness should be applied to corporate and public policies to ensure that every effort is made to increase our competitiveness. A competitive impact statement should be required prior to the enactment of major new legislation and imposition of regulations that could substantially affect our ability to compete.

6. Most importantly, undertaking a national commitment to excellence and progress in manufacturing.

As *The Washington Post* noted recently:

> *"American performance in manufacturing is going to set the country's standard of living as it struggles out of its gigantic trade deficit."*

Former Federal Reserve Chairman Paul Volcker goes a step further, suggesting that manufacturing output will have to grow more than 30 percent over the next five years to correct our trade imbalances. "The implication is that our manufacturing output will have to rise about 15 percent to close the trade deficit on top of normal growth of, say, another 15 percent to meet the needs of a growing domestic economy. . . It implies a much more rapid growth in industrial production—maybe about 5 percent a year—than we have sustained for a long time. And that growth has to be concentrated in new products and advanced products where we can have an edge in world markets."

Chairman Volcker is clearly correct about the need to increase our manufacturing vitality and output to deal with the trade challenge. The fundamental strength of manufacturing makes the goal possible if we take the public and private actions outlined here. As we approach the 200th anniversary of Alexander Hamilton's vision of America, it is time to reject—as a dangerous myth—the notion of a "post-industrial" economy for this nation.

—Jerry Jasinowski

MANUFACTURING CREATES AMERICA'S STRENGTH

MANUFACTURING TRENDS

A report by Jerry J. Jasinowski, NAM executive vice president, on forces affecting manufacturing and how companies are responding

October 1988

Achieving Manufacturing Excellence

A special report on how successful manufacturers are meeting the competition of today's global economy

The first stage of manufacturing's drive to become more globally competitive succeeded, through a 40 percent exchange rate improvement and a 10-25 percent reduction in business costs. The second stage will be more difficult, requiring the federal government to commit to a national agenda to improve our competitiveness, while companies vigorously pursue actions aimed at achieving production and operational excellence. The checklist of 10 steps that follows is my way of categorizing what most successful manufacturing firms are doing to become world-class competitors.

1. Leadership. The best firms are headed by leaders who recognize that manufacturing excellence starts at the top, with a commitment by the CEO that the production side of the house matters and that the other key elements of the corporation — strategy, finance and marketing — must make manufacturing excellence a top priority.

2. Strategy. Successful firms use the strengths of manufacturing to formulate and execute a strategy aimed at worldwide competition. Manufacturing excellence creates competitive advantage by reducing costs, improving quality, creating new products and providing a more timely and flexible response to customers.

3. Cutting Costs. In the first stage of cost-cutting, manufacturing firms focused on downsizing: reducing direct labor costs, cutting inventory levels, outsourcing and shutting down inefficient capacity. Now firms are turning to more sophisticated forms of efficiency, such as cutting overhead costs, better purchasing and materials management, quality cost-cutting and energy cogeneration.

4. Quality. Today's top corporate priority has shifted from reducing costs to building world-class quality into every product. The key elements leading to success are understanding how the customer views quality, incorporating new quality standards into the corporate culture and implementing a total quality improvement program.

5. The Manufacturing Process. The best of today's manufacturing companies also strive for excellence in every facet of the manufacturing process, focusing on just-in-time principles of eliminating waste, simplification of product and process design, improved quality, better materials handling, integration of manufacturing and other corporate functions and a dedication to continuous streamlining of production flows.

6. Capital Investment. While production automation can yield substantial benefits, getting the basics right in preparation for new capital investments yields the biggest payoffs. The most successful firms debug the entire production process before they jump to automation. Firms then phase in capital investments according to a clear concept of integration for all components of the manufacturing firm.

7. Technology. Successful firms are striving to put technology to work more quickly to create new products and processes. They are doing this by investing more in research and development, eliminating organizational barriers between the labs and manufacturing and shortening product development time.

8. Human Capital. Successful corporations are finding creative ways to make employees part of the manufacturing excellence team by showing respect for the individual, involving them in improving the work process, emphasizing performance-based compensation and putting a high priority on training.

9. Marketing. Successful manufacturing firms know that selling to today's fast-changing global markets requires tying together marketing and manufacturing to respond to segmented markets and time-based competition with a flexible production response. The tough competitors make a commitment to sell abroad.

10. The Corporate Culture. The final step — and really the most important — is to build a culture committed to continuous learning and improvement, fostering values that make manufacturing a priority, properly measuring what contributes to a firm's long-term competitive position and developing managers who understand the dimensions of achieving manufacturing excellence.

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Achieving Manufacturing Excellence

This is a personal report on the comeback of American manufacturing, the status of the comeback and what remains to be done. Its premise is that the competitive circumstances at work in American industry have changed fundamentally and that success in today's global marketplace demands comparable changes in the way we think about and organize production. The essence of these changes is total commitment to achieving manufacturing excellence.

Where We Stand

The dollar is down; exports are up; and so are the earnings of U.S. manufacturing companies. *Fortune* magazine reports that America has suddenly "seized the lead in the race for global competitiveness." But witnesses to the ordeal that U.S. industry suffered in this decade have a right to be skeptical. Is victory really at hand? What are the facts?

The chief fact is that American firms *are* more competitive than they were three or four years ago. Since the peak of the real trade deficit in the third quarter of 1986, real exports have improved by $112 billion (in constant 1982 dollars), while real net exports (exports less imports) have improved by $66 billion.

The most pervasive and powerful reason for this improvement is depreciation of the dollar relative to the currencies of our major trading partners —

- Between the first quarter of 1985 (the peak value of the dollar) and the first quarter of 1988 (the trough value of the dollar), the exchange rate depreciated by 45 percent on a multilateral basis, while falling by 50 percent against the yen and the mark, and 31 percent against the pound. Since January 1988, however, it has appreciated about 10 percent on a multilateral basis.
- In industry after industry, America is becoming the low-cost producer. In dollar terms, Japan's unit labor costs rose by 43 percent in 1986; Germany's rose by 40 percent; while American labor costs remained stable.

Much of the recent export surge, however, is also the result of relentless self-discipline and cost-cutting by American firms determined to meet the challenge of international competition —

- Since 1982, U.S. manufacturers have moved aggressively to consolidate production capacity, slash unemployment costs, increase out-sourcing and reduce inventory levels. Sectorwide production costs are down 10-15 percent, with leading-edge firms scoring even more impressive gains, *e.g.*, Caterpillar cut employment by 40 percent, inventories by 50 percent and overall costs by 25 percent.
- In 1986, the United States led all major industrial countries in manufacturing productivity growth. From 1982 through 1987, output per hour in durable manufacturing industries surged nearly 40 percent; productivity in the manufacturing sector at large grew 25.5 percent.

The benefits of these gains ripple through the entire economy. Strong manufacturing industries are dynamic contributors to overall growth. They are a major market for services, and a key source of saving and investment. They are responsible for nearly all the nation's civilian R&D spending and most technological advancement. They provide a reservoir of well-paid jobs. They are the foundation of a strong national defense.

"An administration and Congress that fully understand the importance of manufacturing excellence to our national well-being should make manufacturing competitiveness a national priority."

So how much progress have we made? We are clearly on the way back. On a 10-point scale, U.S. manufacturing is now at "4" and climbing. But getting to be a "10" won't be easy, because our competitors aren't standing still —

- To hold market share, foreign firms—especially Japanese firms—have not raised export prices to match shifts in exchange rates. Between 1985 and 1987, the yen gained 45 percent against the dollar, but relative Japanese-U.S. export prices increased by less than 20 percent.
- Foreign firms have also been driving hard for greater efficiency. Toyota has managed to cut the yen cost of building a Corolla by an estimated 31 percent. Since 1985, Toshiba's labor costs are down by 40 percent. Some Japanese firms claim that they can be price-competitive in international markets even if the yen appreciates to 90 to the dollar.
- In addition, foreign firms have been investing heavily in advanced manufacturing technology. In the past five years, Japan has outspent the United States 2-1 on automation. During that time, 55 percent of the machine tools introduced in Japan were computer-numerically-controlled machines. The U.S. figure was 18 percent. Per worker, the United States has one-sixth as many robots as Japan. We are not even up to the figures for Germany and Sweden.

Becoming world-class competitors requires major changes in the ways that U.S. manufacturing firms compete. But it will also require a national commitment to compete and government actions to support that goal.

A National Commitment

An administration and Congress that fully understand the importance of manufacturing excellence to our national well-being should make manufacturing competitiveness a national priority. They should be aggressive and pragmatic in promoting U.S. manufacturing interests. Above all, they should appreciate their ability to damage the economy by passing legislation that could harm our ability to compete. They should make no economic policy without full consideration of the likely effects on our ability to compete in the global economy.

The next administration and Congress will need to take steps in at least the following six major areas:

1. *Reducing the budget deficit* is priority number one. The federal deficit eats into individual and business savings, raises capital costs and increases our dependence on foreign creditors. The administration and Congress must continue to hold the line on nonessential domestic spending (though new spending may be needed for education, commercially significant R&D and public infrastructure). Tax policy must identify sources of additional revenue that favor savings and investment, such as a broad-based consumption tax.

2. *Avoiding actions that harm manufacturing competitiveness* is priority number two. Washington needs to have a clear sense that industrial strength is a vital national interest, especially in a number of areas where we seem intent on shooting ourselves in both feet. I'm referring to

situations such as export controls, costly environmental and health care legislation and mandated benefits.

3. *Tax policy* is central to encouraging savings and investment. An administration committed to rebuilding U.S. competitive strength must consider restoring differential treatment for capital gains and providing more incentives to lower the cost of capital. Tax increases on capital must be avoided.

4. *Trade policy and administration* have to be more aggressive to adapt to the realities of international competition. We need to deal more effectively with unfair foreign trade practices. Vigorous implementation of the new trade bill must be pursued by the next administration.

5. *Taking a long-term view* is another key objective for competitiveness policy. We must take a hard look at establishing rule changes that would rein in corporate raiders without undermining the constructive influence of an active acquisitions market. We also need to take another look at other measures that would encourage stability and long-term investment by financial markets.

6. *Education and training* are the bedrock of national productive capacity. Long-term prospects for industrial strength hinge on improving the quality of American education and training.

While action in these areas will not guarantee manufacturing excellence, inaction will make it next to impossible for American industry to continue the gains it has made over the past few years.

How to Compete Better

When it comes to choosing how to compete better at the company level, manufacturers have three basic options: **(1)** establishing a competitive edge through manufacturing excellence; **(2)** winning by application of pure marketing muscle; or **(3)** diversifying through mergers and acquisitions. Each of these strategies has some validity and has enjoyed periods of popularity among American companies.

In the years when the United States was just beginning to build its industrial might, the most successful industrial entrepreneurs were people who exploited the production potential of new technologies. Their competitive strategies were based on manufacturing efficiency and scale. American industry was built on what was, by the standards of the day, very large-scale manufacturing excellence.

As America grew as a mass market, firms drifted away from the notion that first-class manufacturing was the central element in business success. Marketing driven strategies began to dominate. Companies began to "sell the sizzle."

By the 1970s, however, the old certainties of business were disappearing under the pressure of rapid technological change, growing international competition, the mounting presence of government in the economy and increasing sophistication in financial markets. Mergers and acquisitions became an increasingly attractive route to corporate growth and profitability, and that continues.

But, each day, I see new signs that American firms are getting back to a strategy predicated on manufacturing excellence. One reason for the change is that, with some important exceptions, the other two strategies have lost a lot of their magic. Experience shows that products cannot be sold by marketing power alone, without regard to price and quality. You can't just "sell the sizzle" when the competition dishes up a better product every time, often for less money.

"Competitive success depends on how effectively and efficiently a manufacturing firm performs its most fundamental task: making products."

These days, companies that do win with marketing-based strategies succeed by finding or creating market segments—special niches—in which they can achieve cost or quality advantages over their competitors.

Mercedes, of course, is the premier example of this type of firm. But some U.S. firms have also proven to be shrewd and aggressive niche marketers (*e.g.*, Rubbermaid). The key lesson in their experience is that successful niche marketing depends on efficient and/or highly flexible manufacturing. Markets may be narrower, but products still have to appeal on the basis of price and quality, or because they are more responsive to evolving consumer tastes.

In the past decade or so, diversification strategists have also had a pretty rough ride. To be fair, the record shows diversification can still be profitable if it results in a collection of closely related businesses within a single company. Diversification built around a common expertise or corporate capability can work. Indeed, companies are sloughing off alien businesses to get back to bundles of interrelated businesses. Examples include —

- TRW's sell-off of $800 million worth of low-growth, low-return subsidiaries and product lines in order to concentrate on core automotive, defense and electronics businesses; and
- General Mills' shedding of low-return or peripheral units and concentration on three basic business segments.

Far more often, however, competitive strategies based on acquisitions, mergers, or the latest financial chicanery have resulted in disappointments and divestitures. Michael Porter of Harvard Business School, for example, studied 3,800 diversifications (acquisitions, joint-ventures and start-ups) by 33 major U.S. corporations selected at random from 1950 to 1986. On average, these firms divested more than half their acquisitions in new industries and divested an astounding 74 percent of their acquisitions in totally unrelated industries.

Porter attributes this outcome to a failure by many diversifying firms to appreciate the costs and constraints that diversification can impose on firms. He argues that acquisitions must increase the competitiveness and value of individual business units; otherwise, they may prove to be costly mistakes.

Another reason why U.S. firms are refocusing on production is that if you don't handle production well, chances are you'll begin to lose the capacity for good work in other areas too, *e.g.*, product design and marketing. To design for manufacturability, you must understand production. To market effectively, you must understand production. And to understand production you must do it. A world-class manufacturing corporation cannot be hollow at the core.

American firms are being driven back to the basics of manufacturing excellence by forces that are affecting manufacturing firms everywhere in the world. Increasingly, firms are coming to the competitive fray with similar attributes and capabilities. Among the major industrial countries, labor cost differentials are becoming less significant as labor becomes a less important component of production costs. Capital markets are internationally linked. Knowledge about advanced management practices and new products and processes is quickly transferred across national boundaries. Differences in distribution systems and practices are diminishing. Markets are becoming saturated, buyers more demanding.

Under these conditions, competitive success depends on how effectively and efficiently a manufacturing firm performs its most fundamental task: making products. Competitive advantage is increas-

ingly dependent on production strengths.

What does the move to manufacturing excellence mean, in practice, for top management? It means giving operations a lot more attention and status. It means integrating production and other corporate functions to coordinate the execution of competitive strategy. It means staying away from "quick fixes" and paying enough, but not too much, attention to quarterly income statements. And it means mobilizing and cultivating people. In short, it means observing the 10 principles I want to discuss next: my checklist for manufacturing excellence.

The checklist that follows is my way of categorizing what the most successful U.S. manufacturing firms are doing, on a practical level, to make themselves world-class competitors. But first, I will outline three underlying themes that are pertinent to the effort.

The first theme is that there are *no single quick fixes.* Rebuilding and sustaining competitive strength entails nothing less than an open-ended and broad-based campaign of incremental improvement in every facet of production: a determined, methodical, neverending pursuit of world-class performance.

The second theme is that manufacturing firms face a *constantly changing and complex competitive environment.* What worked competitively yesterday is no guarantee for success tomorrow, as the personal computer market vividly illustrates.

The third theme is *the importance of people.* All the talk about advanced manufacturing technology notwithstanding, the way firms use people will determine more than anything else the extent to which they achieve production excellence.

Getting down the experience curve is one of the things that makes a winner and so far only people can do it. Good machines work the same way every time. Use doesn't make them more productive. Good people, on the other hand, get better with practice. They learn to use machines more efficiently; they find ways to improve processes and products. Challenges make them try harder.

This acknowledged importance of people is good news and bad news. The good news is that competitiveness doesn't demand massive investments in advanced production machinery and control systems, at least at first. There is no magic bullet that is too expensive to buy or too complicated and mysterious to use.

The bad news is that people are harder to retool than machines. Moreover, changing people's behavior may mean rebuilding a company's philosophy and the basic way it works: a pretty tall order.

Now for the checklist:

1. Manufacturing Excellence Starts at the Top

The environment facing today's managers is clearly much more difficult than in the past because of greater competitive intensity in a more complex setting. Deregulation, the movement toward the global economy, the maturation of certain markets and the increasing speed of technological development are the factors that have raised the level of competition. The world has also been made more complex by globalization, the increased number of firms or products available, and the increased use of more sophisticated technologies (see Kotter, *The Leadership Factor*). In this world of intense competitive activity among complex organizations, the need for leadership has increased and, in my view, this is even more the case if one is pursuing a strategy of manufacturing excellence.

"To endure, the commitment to excellence must be part of the CEO's vision and priorities... he/she must play a critical integrating role."

Winning with a production-based competitive strategy demands total dedication to building top-quality products that are competitively priced and delivered on time, and to developing new products in step with shifting market opportunities. In short, it demands a commitment to what has come to be called "manufacturing excellence."

Manufacturing excellence is the outgrowth of continuous effort to beat the competition by purging the production chain of operations and people that do not add value to final products. It means drastic reduction in inventories everywhere in the production system. It means aggressive simplification of products, processes and organizations. It means integrating design, manufacturing and marketing functions, and cultivating teamwork throughout the firm. It means heavy investments of time and money in the continual enrichment of human and physical capital. It means making the measurement of manufacturing performance the principal indicator of company success. And it means everyone "from the top floor to the shop floor" sharing a personal sense of responsibility for customer satisfaction.

The CEO's role in all this is crucial. To endure, the commitment to excellence must be part of the CEO's vision and priorities. Since it involves pulling together most of the activities of the organization, he/she must play a critical integrating role. By personal example and by exercising the power to shape corporate institutions, he/she must ensure that this commitment is woven into the cultural fabric of the firm so that continuous improvement is achieved.

2. Helping Define Competitive Strategy

Without a strategy for competitive success, you are likely to fail unless you are lucky. Without integrating manufacturing into your strategy, you are putting yourself at a big competitive disadvantage.

Competitive strategy defines the way a company makes a success out of whatever individual business or businesses it is in, how each business unit in the company identifies and exploits advantages over actual and potential competitors.

Competitive strategies come in different shapes and sizes. For example, Harvard's Mike Porter identifies three generic approaches that businesses can take to master their competitive environments: **(1)** achieving low-cost leadership; **(2)** building a reputation or product that is perceived as unique in the industry; and **(3)** targeting a particular market segment and achieving cost leadership or product differentiation within that segment.

Harvard Professor Robert Hayes, in the NAM-endorsed video tape "Manufacturing Strategy," emphasizes that firms can compete on the basis of five factors: cost, quality and performance, dependability and service to the customer, flexibility, and innovation.

Whatever the strategy, it is better if tailored, not bought off the rack. Each firm must define its own strategy based on its circumstances and ability to discover or create advantages in the key dimensions of competition: cost, quality, on-time delivery, product development/flexibility, sales and service. Each firm must decide how it is different from its competitors and how it can best compete.

The important aspect about competitive strategy that many firms seem to forget is that its focus is the marketplace. It is a plan of attack (or defense) that aims at exploiting advantages and neutralizing disadvantages in the general competitive environment.

The focus is: How do we beat the competition? For example, cost-cutting by itself may be simple scrimping. Carried to excess, it may sap a firm's competitive

strength. Alternatively, and much more positively, cost-cutting may be part of a strategy aimed at achieving or sustaining an overall low-cost position.

Of course, the success of such a strategy might also depend on *not* cutting costs. Achieving a low-cost position could entail heavy front-end investments in new process technology and employee training. So, *strategic* cost-cutting could translate to higher operating costs, at least over the short haul.

Moreover, since the competition is no longer only homegrown, the question is really: How do we beat the competition worldwide? Winning worldwide demands at least two challenges. One is making excellent products at competitive prices, delivering them on time and giving solid after-sales service. When it comes to excelling here, it isn't good enough any more to be "the best in Indiana." The only safe position is to be "the best manufacturer in the world."

The second challenge is "taking it to the competition." By itself, being the best isn't good enough, isn't safe enough. Our major overseas competitors have shown us clearly that the way to build world-class competitive capability is to go for world market share.

For example, regarding Honda North America's plan to export 70,000 cars in 1991 (50,000 of them to Japan), company President Tetsuo Chino asserts: "It is not enough that our U.S. operations are competitive only in the United States. It is the world arena where the competition will be won."

Exporting to, or manufacturing in, all of the world's major markets usually means larger profits, more investment and greater overall financial strength; it creates opportunities for scale economies; it increases production and marketing flexibility.

Worldwide operation may also increase "company learning." Marketing innovations and new process or product technologies developed overseas may contribute to greater success at home.

Moreover, by contesting all markets, U.S. companies help to keep the competition honest. Challenging the competition worldwide limits profits by foreign companies in non-U.S. markets. As a result, foreigners may be weaker financially and have less price flexibility when they contend with U.S. firms in the United States.

Whatever competitive strategy is chosen, it is essential that the manufacturing part of the organization consistently support that strategy. Decisions about facilities, equipment and sourcing must share the same focus. Similarly, policies for quality improvement, inventory control, organizational structure and the use of human resources must be consistent with the overall competitive and manufacturing strategy.

3. Cutting Costs and Improving Productivity

Cost-cutting has been American industry's first answer to the competitiveness challenge. U.S. firms have attacked high production costs with determination and with considerable success.

Companies have taken two basic approaches to cost-cutting: **(1)** rationalizing, *i.e.* sharpening the firm's focus on core operations; and **(2)** taking a variety of steps to increase productivity.

Rationalization. Companies that drifted into broad diversification in the 1960s are now ruthlessly shedding operations not central to their basic competitive capabilities. Put bluntly, companies are getting rid of businesses that don't fit their core focus.

"Whatever competitive strategy is chosen, it is essential that the manufacturing part of the organization consistently support that strategy."

Recent examples of corporate rationalization include the TRW case cited earlier and Monsanto's sell-off of its loss-incurring commodity petrochemical businesses and concentration on more competitive specialty petrochemical products.

To enhance manageability, rationalizing companies are also downsizing their core businesses. Downsizing concentrates resources and management attention and eliminates excess or inefficient capacity. In mature industries, especially, reductions in capacity have been remarkable.

Since 1982, U.S. raw steelmaking capacity has been cut by 27 percent. When you combine capacity reduction with plant modernization, you get striking productivity gains. USX now makes a ton of steel in less than four man-hours, down from 10 man-hours a few years ago.

Efficiency. The second general approach firms have used to cut costs is to boost efficiency and productivity in existing or modernized plants and offices.

Widespread automation accounts for some of the improvements. Even more important then automation, however, has been the introduction by American firms of literally hundreds of productivity improvement measures and techniques.

Common to all these is a new attitude: a commitment by management and workers to continuous improvement. When management and workers together approach manufacturing with the attitude there has to be a better way to do everything, and when they apply imagination, the solutions are almost unlimited. Without enormous outlays for fancy new equipment, but with careful attention to the human side of work, companies are finding they can achieve 20-40 percent gains in labor productivity within several years.

Further, management and labor are *both* taking a more realistic view of what companies can afford in the way of pay raises. Manufacturing compensation increased about 10 percent per year during the 1970s; it is increasing at about 2.5 percent per year during the 1980s.

Many manufacturing companies have made dramatic strides in reducing direct labor costs. In several of today's most competitive firms, it is not uncommon to hear of plants with direct labor costs as low as 5 percent of total product costs. As a result, the main focus of cost-cutting attention is shifting from direct labor to other cost drivers—especially indirect labor and headquarters staff costs—and materials costs.

By simplifying and tightening up their manufacturing processes and raising quality, companies are dismantling what experts call "the hidden factory": all the checkers and controllers who keep track of things, but don't make anything.

Also, managements are discovering that they really can run companies—quite big ones—without in-house staff assistants for everything. Companies are laying off staff. When they occasionally need specialized expertise, they contract outside for it. Some firms are letting line managers decide the types of corporate staff they want or don't want.

Since materials costs are becoming more important, firms are following two tracks to cut these costs. First, they are trying to reduce the materials content of products. Second, they are trying new approaches to sourcing. Some companies are turning to worldwide sourcing. Some are emphasizing quality-assurance sourcing. And still others are emphasizing the timeliness of delivery. Managements are rediscovering the purchasing function, insisting on better purchasing, and integrating purchasing into the mainstream of the manufacturing process.

Companies are cutting costs in lots of other ways, too—

- *Preventive Maintenance.* Better main-

tenance of machinery extends machinery life, thereby reducing capital costs.

- *Quality Cost-Cutting.* Raising quality can lower costs by reducing waste, rework and warranted service.
- *Cogeneration.* Despite softness in energy prices in the past several years, companies with an eye on long-range competitiveness are still working to cut energy costs. Cogeneration — which is the equivalent of killing two birds with the same stone — is getting a lot of attention.
- *Health-Care Cost Control.* According to an NAM survey of CEOs, their number one concern this year is the skyrocketing cost of health insurance. Companies are trying to contain these costs by changing benefits and financing, and by turning to more efficient health-care providers.

Since the late 1970s, manufacturing has gone through two stages of cost-cutting. The first focused on direct labor costs in the plant; companies cut labor and capacity. But in recent years many companies have moved into a second stage of cost-cutting, paying more attention to overhead and letting the cost-cutting broom sweep through all company operations.

We're still in stage two. We have to keep it up, but we must also do more. In particular, we must exploit the opportunities for increased productivity inherent in product and process improvement: the subjects of the next three categories on the checklist.

4. Top Priority: Building In Quality

Starting in the mid-1980s, American industry rediscovered quality with a vengeance. Companies participating in the 1987 survey of Boston University's Manufacturing Roundtable identified programs for quality control as the single most important element of manufacturing strategy through the end of the decade.

There are at least six reasons why. First, largely because of the Japanese, quality has become a major element in global competition. Second, U.S. companies have discovered that markets are increasingly attracted to quality; quality has tremendous selling power and creates loyal customers. Third, in light of the accumulating evidence, U.S. manufacturers have finally admitted to themselves that they have not been quality-competitive. Fourth, U.S. manufacturing companies that started quality improvement programs have discovered that the costs of bad quality are far higher than they had assumed, often running more than 20 percent of sales. Fifth, U.S. manufacturers have learned the pursuit of quality is a potent device for making the entire manufacturing process more efficient. And sixth, U.S. firms are learning that quality has great motivational power. Quality engages the hearts and minds of managers and workers.

To become a top quality producer, a company must understand some basic principles about quality control:

- Quality is defined by the customer, not the producer.
- Quality control is based on prevention, not inspection.
- Quality control means doing things right the first time.
- Quality control is more than an attempt to make better products; it is a search for better *ways* to make products.
- Under total quality control, inspection should occur throughout production, not just at the end.
- Quality control requires making operations as fail-safe as possible, *i.e.*, reducing deviation from zero defects.
- Quality control is an ongoing process; it never ends.

"Many companies have moved into a second stage of cost-cutting, giving much more attention to overhead and letting the cost-cutting broom sweep through all company operations."

CEOs who are serious about quality must build the emphasis on quality into the culture of the firm. Quality must be a principal measure of firm performance. Employees must be deeply and genuinely involved. Their advice about manufacturing improvements must be heeded. Their responsibilities for production must be expanded.

Companies dedicated to quality do extensive training. High quality production requires workers who can use, maintain, fix and experiment with production equipment. It also requires workers who understand the basic principles of problem-solving and who can communicate effectively. Quality workers make quality products.

In addition to operating on these principles, companies are making quality gains by reorganizing manufacturing processes and, in particular, by adopting cellular or modular production methods. As one expert notes, no one in a module can hide bad work.

Though superior quality is now a goal for most American manufacturers, actual results still lag behind.

The American Society for Quality Control estimates that the costs of bad quality in U.S. companies are three times those in Japanese companies. J.D. Powers' annual assessment of auto owners' satisfaction indicates that U.S. quality remains below that of the Japanese. A Department of Defense study shows that nonconformance and rework rates in the Japanese electronics industry run 0.5-1 percent, compared with 8-10 percent in the United States. Ernest Hugh and Alan Anderson, authors of *The Spirit of Manufacturing Excellence*, claim that Japanese companies are driving down defects to 10 per million, while there are still U.S. manufacturers operating at 10,000 to 20,000 defects per million.

For U.S. quality leaders, the firms that have made remarkable advances, quality has had tremendous payoffs. Quality sells. It's profitable, too.

5. Improving the Manufacturing Process

The best of today's manufacturing companies strive for excellence in every facet of the manufacturing process. Although there are many ways of looking at it, the technique most widely associated with manufacturing excellence is "just-in-time" manufacturing, or JIT.

Some people think of JIT as simply an inventory control system or a means to achieve stockless and small-lot production. But it really is a system of enforced problem-solving aimed at reducing lead times and waste. With waste—like buffer stocks—eliminated, problems of quality or scheduling immediately become apparent. The inadequate worker, the poor machine, the inefficient work layout cannot be hidden.

JIT is just one of the many techniques used to achieve manufacturing excellence. When all are applied, the results can be spectacular.

- Some experts claim that the best practitioners in Japan and the United States have achieved 50-100 percent finished goods inventory reductions; 70-90 percent work-in-process reductions; 40-70 percent space reductions; 30-50 percent capacity increases; 70-90 percent shorter lead-times; 30-50 percent overhead cost reductions; 30-50 percent product cost reductions; and rejects reduced from 2 percent to .001 percent.

A common view holds that manufacturing excellence is based on four general principles: **(1)** elimination of waste; **(2)**

elimination of complexity; **(3)** integration of activities inside manufacturing and between manufacturing and all the other functions of the firm; and **(4)** continuous improvement. Two of these principles require some explanation.

Elimination of Product and Process Complexity. Product complexity pushes up scrap costs, reduces yields, keeps setup costs high, impedes automation, hinders inventory reduction and drives up the number of transactions that have to be dealt with in engineering, production, marketing and administration.

Minimizing product complexity starts with a carefully thought-out product strategy. The aim should be to reduce the breadth and turnover of the product line while protecting high-value differentiated products. The elimination of product complexity blends into the elimination of *process* complexity right when products are first designed.

A rule of thumb in the defense industry seems to be that as much as 60 percent of avoidable manufacturing costs are created during the design phase. That percentage may be lower for standard products, but the basic point remains: The most effective way to simplify production is to simplify products.

Another step toward elimination of process complexity is the focused factory approach. The focused factory reduces complexity by devoting a single facility to a single purpose. Alternatively, focus can be increased by creating discreet minifactories within regular plants.

Under the new plant configurations, complexity diminishes for two main reasons. First, there is far less material movement and clutter. Materials have less distance to travel. The arrangement permits small-lot production and quicker throughput. Less material is needed in production. Second, control is much easier. Combining manufacturing cells with pull production techniques can sharply reduce the need for fancy computerized scheduling systems.

Mistake-proof production is another way to eliminate process complexity. The Japanese call it the "poka-yoke" system. You immobilize everything on machinery that is adjustable and not essential to the immediate task. Then you install all sorts of guides and fixtures to assure tasks can be performed only one way: the right way.

Success breeds success. Reducing complexity reduces the need for supervision. Good plants tend to be thin plants, thin in layers of supervision. Reduction in the numbers of supervisors cuts costs. Speed-up in decision-making cuts costs, too. Maybe even more.

Integration. Companies achieving manufacturing excellence also seem to be very good at integrating engineering, production and marketing.

The classic symptom of a lack of integration is a high number of engineering change orders. In a recent survey of the engineering change systems in 30 U.S. industrial firms, Booz Allen found that more than 50 percent of the firms processed 2,000 engineering changes annually: *one change per working hour*. There is no way to achieve efficient production under such circumstances.

Integration of engineering, production and marketing paves the way for further integration within production. It is then possible to link manufacturing, materials handling and control systems. Integration is not the same as putting the entire plant in a straight jacket, with every activity tightly coupled to every other. The aim of integration is flexibility, which means all parts of the plant operate in harmony, not in lock step.

"The aim of integration is flexibility, which means all parts of the plant operate in harmony, not in lock step."

Manufacturing excellence also calls for another important type of integration, that with suppliers. Successful supplier/buyer relationships require much top management involvement on both sides; the sharing of product, process and specification change information; technology exchange; and joint involvement in design, not to mention multiyear commitments on the buyer's part.

The measures used to improve the manufacturing process are increasingly being targeted at inventory and materials handling. That is because materials now account for the largest share of manufacturing costs, often 50 percent or more. The attack on materials is occurring on three fronts: **(1)** reducing the materials content of products; **(2)** substituting materials, which allows for whole new approaches to manufacturing; and **(3)** adopting improved techniques for materials handling.

Regarding the first approach, products can be designed to require less materials content. Parts can be machined with less scrap or they can be formed initially according to net shape principles. Either way, there is less waste. Lighter or sturdier products also require less packaging. Again, materials are saved.

There is a saying that the best materials handling system is no materials handling. Cellular plant layouts and JIT manufacturing can come close to this. Still, for many categories of production, materials handling remains inevitable. In those instances, tasks once assigned to hand feed, conveyors or forklift trucks are now being assigned to robots, automated guided vehicles, and automated storage and retrieval systems. Though effective when properly fitted into a production system, these high-tech techniques should be carefully integrated into the simplest production operation possible.

Among U.S. manufacturers, how many are striving for excellence? One hint is the extent to which they are adopting JIT. A 1986 survey of suppliers to U.S. auto manufacturers reveals that more than 80 percent of them had begun to implement JIT programs.

While these facts show that JIT programs are now common — at least among auto component manufacturers — other facts from the same survey suggest that the companies are not applying JIT principles comprehensively. Of the companies with JIT programs, 56 percent reported reduced inventories, 45 percent better customer relations and 43 percent improved quality. That's encouraging. On the other hand, only 33 percent reported improved productivity, only 23 percent reduced setup costs and only 22 percent better employee relations. JIT—if it is really seen as part of a total manufacturing excellence program—should lead to better results than these.

6. Retooling the Factory and Automation

The first step toward the factory of the future is a step back to basics. Advanced manufacturing technology offers extraordinary opportunities for improvements in the areas of cost, quality, flexibility and deliverability. But to benefit from these opportunities, companies planning to install sophisticated equipment and systems must devote enormous energy to simplifying their manufacturing practices.

We've all seen the reports on how the Japanese are outspending us on advanced manufacturing technology. But it's important to understand that Japanese manufacturers have also directed a great deal of investment at improving equipment already in place. As recently as 1980, as much as 60 percent of Japanese capital spending went for improving old machines. At the same time, only about 25

percent of our investment dollar went to improving existing equipment. In contrast with the Japanese, U.S. industry's first reaction to the competitiveness challenge was to try to buy manufacturing excellence off the shelf.

What's becoming clear now is that investment in advanced manufacturing technology is usually not a good first step in the movement to manufacturing excellence. The preparatory steps have to be product and process simplification, and continuous and substantial upgrading of workers' skills.

The authors of *The Spirit of Manufacturing Excellence* advocate what they call "grind-it-out" automation, which for them means reducing set-up times to a few minutes, getting machine uptime to 99 percent, designing all complexity out of products and processes and getting the most out of existing equipment. They think the grind-it-out strategy is simpler to implement, demands relatively little front-end capital, keeps risk low, and builds in-house capabilities to design and implement customized process that cannot be duplicated by competitors.

In highly automated environments, workers must be real-time hands-on technicians capable of adjusting the system to obtain steady minor improvements. Here the distinction between the U.S. and Japanese approach is startling. With a big automated system, we say get it going right and then don't touch it; the Japanese say get it going right and then tamper with it all the time to make it even better.

Studies of companies that have put in fairly ambitious automation projects come up with some fascinating results. As much as 50 percent of the benefits of the projects seem to be attributable to improvements in basic manufacturing practices required to accommodate automation. Another 20 percent of the benefits come from manufacturing-driven product redesign. Only about 30 percent of the benefits seem attributable to the automated system itself. In short, successful automation forces manufacturers to do the fundamentals right, and that's where the big payoff comes from.

Once the fundamentals are right, companies can deepen their investment in advanced manufacturing technology. Among experts, the predominant view is that this involves adding new hardware and software on a cell-by-cell basis. The aim is to strive for perfection within each individual cell. If business expands, capacity is added by replicating cells. The extent to which cells are automated depends on the tasks accomplished within the cells. Avoided is automation for automation's sake. Once cells are perfected, they are integrated. In this way, the factory incrementally works toward computer integrated manufacturing.

This approach would seem to fly in the face of systems principles, according to which management's aim should be to optimize the efficiency of the entire plant, not activities (cells) within it. While the theory is good, manufacturing managers have come to appreciate that the try-to-optimize-everything-at-once approach is next to impossible, especially given the complexity of modern manufacturing. If the parts are not running smoothly, all that the systems approach boils down to is the integration of chaos.

"With a big automated system, we say get it going right and then don't touch it; the Japanese say get it going right and then tamper with it all the time to make it even better."

The most successful U.S. manufacturing firms seem to be urging the rest of us, by example, to remember these simple rules: basics first—simple-tech before high-tech; get everything possible out of existing equipment; then automate; and, lastly, integrate.

7. Increasing the Payoff From R&D

Most observers seem to agree that America's dominance in industrial R&D is seriously eroding. To make matters worse, this erosion has occurred just as R&D is becoming an increasingly important determinant of winners and losers in global competition. Though product and process innovations have always been key to business success, emphasis everywhere on innovation now makes them key to survival. And the ability to manage R&D—to innovate quickly and repeatedly—is as important as the product or process innovations themselves.

Moreover, R&D and production are becoming increasingly interdependent. It no longer suffices for a company to be the best at designing products unless it is also very good at making them. What the Japanese have shown, and what a few U.S. companies have confirmed, is that superiority in production is now a prerequisite for superiority in product development. The relationship between the lab and the plant has been turned on its head. The ability to make now gives firms an edge in the ability to invent.

What does all this mean for U.S. manufacturers? First, we simply will have to spend more on R&D. The recent record of industry expenditures on R&D shows why. Corrected for inflation, industry spending on R&D increased about 5.5 percent during the 1980-84 period. Since then, it has gone up by about 2.5 percent a year. Starting a few years ago, business spending on R&D in Japan and Germany exceeded such spending in the United States. Also, American manufacturers must stop treating R&D as discretionary expenditures. In too many cases, the R&D spending patterns of companies have fluctuated with the swings of business cycles.

Second, U.S. industry must speed up the rate at which it commercializes technology. Studies constantly demonstrate that the United States is more inventive than Japan, but most studies also show that the Japanese convert new ideas into marketable products faster than we do.

The challenge for U.S. industry is to get a bigger payoff from its product development efforts. Step one here is keeping the customer in mind throughout the product development process. But beyond this, the experiences of foreign and domestic firms indicate that it is possible to increase significantly the productivity of corporate research and development.

Successful managements create specific mechanisms to break down the organizational barriers between company labs and company sales personnel. In fact, the companies with the best product development records appear to mix up all the functions that have a role in designing, making and selling a product.

All sorts of devices can be used to ensure interaction between R&D and manufacturing personnel. For instance, R&D personnel can be made responsible for managing innovations beyond the prototype stage or the pilot plant stage. Or company policies and incentives can be aimed at encouraging internal entrepreneurship. Small teams of innovators can be turned into miniature firms within larger enterprises.

Successful high-tech companies also seem to have an organizational readiness to live with the improvisation and experimentation inherent in getting new products or processes to market. In Japan, products get developed through a repetitive try-it, improve-it, try-it-again process. Gains come through lots of little advances rather than the one big technical fix. U.S.

companies can match this, but again management must provide the organizational signals that encourage the experimental approach to product development.

Regardless of how much companies push up the productivity of R&D, it remains costly. What companies cannot afford to do alone, they are starting to do in collaboration with other high-tech companies. Cooperative ventures in R&D are becoming more common.

Managements must become much more familiar with cooperative research arrangements—how to structure them and how to manage them. Successful ventures will most likely be directed at solving problems common to an industry or to several firms, whereby each participant can exploit the results according to its own competitive strategy. The arrangements will have to be designed and managed to assure that everybody wins.

Today, innovation involves many activities outside the normal bounds of R&D. It involves organizational experimentation. It involves lots of training. It involves new relationships outside the firm, from suppliers to customers. It is the area where some U.S. companies are making tremendous strides. But it is an area where many U.S. companies still face an uphill climb.

8. Making Employees Part of the Team

American manufacturing firms cannot keep pace with the world's best unless workers and managers, together, take personal responsibility for winning. The task is immense. Attitudes have to change. Teamwork, not individualism and not "adversaryism," must be the principal mode of operation.

What that means in practice is that managers must treat production workers as a major competitive resource, not a necessary evil.

Many American firms already do. Omark Industries' 1984 annual report carried the names of all Omark employees: more than 4,000 names. Ford received 1,401 employee suggestions for building Taurus better. In every case, management got back to the people who made the suggestions.

Employee involvement starts at the top of a company. Management must demonstrate by repeated acts that it values and respects employees. It must define and explain the mission of the firm in ways that elicit enthusiasm and support from employees. And management must invest in employees.

This last point means that employee involvement begins with careful recruiting and selection of employees, followed up by thorough entry training. Once on the job, training must become a way of life. Workers need opportunities to upgrade their specific job-related knowledge, their skills at applying that knowledge, their problem-solving skills and their communications skills.

At the minimum, 3 - 5 percent of shop-floor workers' total work time should be devoted to training, whether formal or on the job (OJT). For workers assigned to specific problem-solding teams, the number should be more like 10 percent. In very advanced factories—FMS plants, for example—where traditional workers have been replaced by programmers and highly skilled maintenance personnel, training is almost constant. Doing and learning are inseparable.

"American manufacturing firms cannot keep pace with the world's best unless workers and managers, together, take personal responsibility for winning."

At its best, employee involvement means well-trained people are putting their skills to work in teams. Building team spirit means giving workers substantial responsibility for manufacturing excellence. Some companies combine operations and maintenance functions. Production workers who maintain their equipment know about it and care more about it. Companies that practice TQC integrate quality and production responsibilities, empowering production workers to shut down the line when they spot a quality problem and encouraging them to suggest process and product improvements.

Changing people's attitudes and expectations about their work means, in many cases, changing the way work is organized. People don't really get team spirit without the opportunity to work in teams, and unless team achievements are measured and rewarded.

Thus, whenever feasible, employee involvement translates to giving small groups of workers the responsibility for producing whole components, or families, of components.

For example, teams of five to 11 people build entire sections of the Buick Reatta. There is only one formal job classification in the Reatta plant and workers are free to rotate jobs or change teams. Each worker may perform 55 or 60 tasks on a car, while it is at his station. Each team has a given set of operations to perform and team members decide who does what.

When it comes to rewarding teams as well as individuals, U.S. firms have been fairly cautious. Rarely do companies tie compensation to team performance. U.S. firms have been more active, though, in using reward systems to prepare the ground for better teamwork. Some companies, for example, now use pay-for-knowledge systems; they pay higher wages for the mastery of new skills and the assumption of expanded responsibilities.

Despite the hundreds of techniques that can be applied to promote employee involvement, one truth always must be kept in mind. No technique will work unless management believes employees are knowledgeable, trustworthy, willing to accept responsibility and concerned with improving operations.

9. Meshing Marketing and Manufacturing

A great Confederate cavalry commander once said that winning is mainly a matter of "getting there firstest with the mostest." The same principle applies in global competition. Winners get there "firstest with the mostest" of what markets really want.

Getting there "firstest" means tying together marketing and manufacturing to meet time-based competition. Increasingly, competitive success depends on shortening the time it takes to convert a laboratory idea to a product on the shipping dock; then ensuring that delivery is quick, on time and exactly according to specs.

Getting there "firstest" also depends on making manufacturing more flexible, *i.e.* achieving efficiency with shorter product runs and cutting down the time it takes to shift from producing one product to producing another. The demand for flexibility is market-driven. Mass markets are crumbling; niche markets are becoming more important. The globalization of competition means that products must now be tailored to diverse national tastes. Product life cycles are shortening; new products must fill the gap left by quick-dying products.

Since flexible manufacturing is so important, it is worth reemphasizing what American firms have learned about it in the past few years. Flexible manufacturing doesn't necessarily mean putting in big, expensive, computer-controlled machines. But it does mean rearranging existing

layouts to allow for shorter production runs and faster throughput. It means adapting *existing* machines and organizing work stations to reduce set-up times and cut down on rework. It means designing products and parts for flexibility and saving customization touches until the end of the assembly process.

Getting there with the "mostest" adds the idea that manufacturing companies must match their products with their processes if they are to have true marketing clout. The days of product development divorced from attention to process are gone. These days, in fact, the traditional product-process relationship is often reversed. The best Japanese manufacturers, for example, concentrate on perfecting manufacturing processes. Once these are as good as possible, the companies design products that are compatible with the process advantages. Providing flexibility is built into the processes. The Japanese know how they can deliver the "mostest" because products have been designed with manufacturing capability in mind. This approach goes beyond the concept of "design for manufacturability." Its aim is to design to exploit manufacturing strength.

Linking manufacturing to changing market needs also calls for building bridges between plant personnel and customer personnel. Effective marketing requires closer ties between sellers and buyers, between marketing people and customers, between engineering and customers, and even between production people and customers. At Chaparral Steel, every production worker — indeed, everyone in the company—is part of the sales force.

Another thing U.S. firms are finding is that they must do a better job understanding how the market perceives quality. To illustrate: Japanese semiconductor manufacturing equipment generally requires less set-up time and breaks down less often than American-made equipment. By contrast, U.S. machines can perform a broader array of tsks. Both Japanese and American machines meet high quality standards in their own terms. The problem is most buyers seem to value speed and reliability more than flexibility.

The foregoing points add up to one central fact: Without the right manufacturing system, firms cannot be serious contenders in today's fast-moving marketing environment.

10. Building a Culture for Improvement

Internalizing the commitment to manufacturing excellence—making it a permanent part of the day-to-day life of the firm from top management to the shop floor—cannot be done on command. Rhetoric alone won't change the attitudes of veteran U.S. workers toward their work or their workmates and supervisors.

New attitudes need new institutions to sustain them. For U.S. firms on the leading edge of advanced manufacturing technology, these new institutions take varying forms. Some are tangible, *e.g.*, blended work responsibilities on the shop-floor, reduced managerial hierarchy, and measurement and reward systems that reflect long-term competitiveness objectives. Some, like the values embodied in corporate culture, are less tangible.

Corporate Culture. In all organizations, shared values, objectives and expectations are a precondition of quick and concerted action. In a modern corporation, these qualities are partly a function of concrete institutions, *e.g.*, measurement and reward systems. They are also an outgrowth of the CEO's personal style and example. In either case, the CEO's role is critical. He must believe, and he must make everyone else in the corporation believe, that the factory is a key *competitive* resource—not a black box, not a set of buildings and machines whose only requirement is that they be kept running smoothly. Similarly, he must believe and make others believe that labor is a resource for problem-solving and a key to increased productivity through continuous learning.

"Increasingly, competitive success depends on shortening the time it takes to convert a laboratory idea to a product...then on ensuring that delivery is quick, on time and exactly according to specs."

Belief, however, is unlikely to spring from rhetoric alone. In practice, this means that the corporate fast track has to be rerouted through operations. Manufacturing must be represented in the highest echelons of corporate decision-making. Moreover, this new status must be reflected in salary scales and in more symbolic ways—in perks, in lines and boxes on the organization flow chart, in office geography. Even when people read between the lines, the message has to be that manufacturing is important.

Measurement and Reward Systems. Measurement systems define success in every sphere of corporate activity. The right measurements, reinforced by the right rewards, make the commitment to excellence credible.

Good measurement means, first and foremost, measuring the right things. Some American managers have had a tendency to measure the wrong things, to assess the performance of their companies in operational rather than strategic terms. The ultimate measure of success, however, is the firm's performance in the dog-eat-dog world of global competition.

An implication of this assertion is that bottom-line success measures—quarterly profits, stock values, price/earnings ratios—must become less dominant. Toyota's precept is "Win first. Profit later." Profiting later may be easier in Japan than it is here because Japanese firms are less dependent on equity markets and their capital costs are lower. But the point of the precept applies everywhere. If competitiveness is the goal, market share must be factored into the bottom line.

Good measurement is also critical at the operational level. Effective cost-cutting, for example, depends on knowing how costs accumulate in the value-added chain. Conventional accounting systems tend to report operating costs without getting at underlying cost drivers, matters such as product design and product line breadth, process technology, plant scale and sourcing policies.

In a similar vein, conventional applications of investment-return and discounted-cash-flow analysis may fail to capture important benefits (and costs) of investments in advanced manufacturing technology, *e.g.*, longer equipment life, higher product quality, preparation for the next advance in production technology and increased "factory learning." Manufacturing excellence may require new measures, or new applications of old measures, especially in the areas of cost accounting and financial analysis.

On the shop floor as well, new performance measures, *e.g.*, measures of individual learning and measures of work-team performance, reinforced by appropriate rewards, are essential to making "commitment to manufacturing excellence" more than a catch phrase.

- Sherwin-Williams gave employees at one of its automotive paint plants a wage increase for each new skill learned. A year after the program started, 95 percent of the work force had developed new skills.

The point here is not only to create a foundation for teamwork, but to foster continuous learning—almost paradoxic-

ally, to bring manufacturing back to an idea of individual craftsmanship that prevailed in a simpler age.

- Huge and Anderson suggest four ways to institutionalize continuous learning: Make learning objectives part of each worker's performance appraisal; train in-house experts to design and deliver courses; designate on employee involvement teams, experts in particular processes to educate other members of the team; and pay workers for the mastery of additional skills. Firms must also train workers to operate successfully in teams and give them the technical preparation necessary for effective problem solving.

Organizational Changes That Foster Teamwork. For many U.S. companies, a first step toward creating scope for teamwork has been an effort to break down narrow and rigid work rules, thereby giving people the opportunity and the skills to help each other.

In many firms, as noted earlier, scope for teamwork also means giving individual production workers greater control of the production process, and greater responsibility for process improvement, quality control and even customer service. It means a blurring of traditional divisions between workers and supervisors.

It can also mean blurring the line between staff and line responsibilities. In the most advanced Japanese and U.S. manufacturing plants, for example, teams of process and product designers put their ideas into practice on the shop floor, becoming production workers until these ideas are "debugged," up and running.

At Xerox, Ford, Kodak, and Hewlett-Packard, teams of people from production, engineering, marketing and design work together from the point that a new product is conceived until the product gets to market.

"The point is...to foster continuous learning, almost paradoxically, to bring manufacturing back to an idea of individual craftsmanship that prevailed in a simpler age."

In sum, on a scale of 1 to 10, world-class manufacturers score a 10. That's where American companies should be. We're part way there. I've suggested that attaining manufacturing excellence requires work in 10 different areas. The most competitive U.S. companies seem to make progress on all counts. It all seems to fit. The way you get to 10 is by tackling the 10 challenges on the checklist.

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see "W.H." (Pres. memo)

for surely our standard of living depends on this

int'l trade (& competit) is the consequence of individuals

- & felt by individuals (i.e., when a plant closes...)

- their ability to adapt, outwit, outmaneuver, & outproduce the competit.
incr. in productivity; aggressiveness in new markets bringing products to market

whether _____, or High density TV

↳ loss of a min. of a million jobs

- & the types of jobs -- semiconductor & chips tech. - we're still out front.
mid & upper level, techno-level.
- very important

[Tech. creates jobs]
new
[productivity creates jobs]

A compact -- cut a deal

I'll preserve your profit freedom, avoid regs. but undercut you -- if you'll make direct, comprehensive investment in future.

wage $ lowest ever - "5%

walking down a road together

- Why not ourselves of a initiative that embraces local negotiation, creative solution.

a journey together
year 2000

I'll keep mkt unfettered -- you tap the pool of labor.

Also, as part of my bargain, will work on educ, ___

(1)

not easy to get your arms around these issues; ~~they're tricky~~ they may not make for great sound bytes; but

... answer some of the questions with farther-reaching implications ... [~~these are relevance~~; fundamental, key, central, vital, essential; prosperity or planning?] 21st C less than a doz. yrs. off. [days 3]

you want. are known to build a better workshop. Let me ask you, today, ~~as you~~ to think about ... what it's going to take, to build a better America.

~~Encourage sound investment and a higher saving rate~~

illiteracy, homelessness; ~~drugs, crime~~ the abuse of soc. by drugs; the prospect of a hard-core class of "unemployables"; stresses + threats to the family; ~~violence~~ the [threat] of acid rain, most fundamental fun. instit

Bayarlove waste, global warming

INVESTMENT
ENTREPRENEURSHIP
THE FAMILY
EDUCATION & TRAINING
DRUGS
ENVIRON.
VOLUNTARISM

-- ~~but~~ these are fundamental, far-reaching questions. We're going to need to find answers to, ~~now.~~ soon. And they're central to my agenda for the new/next fun. Century.

And they're why the reasons we must keep looking forward, and confront the energies problems of the future. Only by building this ~~I~~ for our ~~future~~ will be to ~~encourage~~ savings and long-term investment -- and get our fiscal house in order. This means, first off, bringing down the deficit.

Youknow, the other day I saw a bumpersticker -- one of those great barometers of our time. And the bumpersticker said, another couple in a sportscar, with

"Were ~~spending~~ our kids' inheritance."

~~The~~ well
~~Individuals~~ can spend their money as they like.
But ~~government~~ this will not mortgage the next generation's future to a mounting national debt. ~~The budget~~ ~~we submitted~~ Fast month I
to Congress. [smith pp 4-5]

... and yes, here I go again: No New Taxes

~~Bear in mind that~~ [dragon SMITH 6]

~~to~~ this can make fun. more competitive than restoring the cap. gains diff.

~~Do~~ encourage long-term investment, ~~close loopholes~~ it's time we restored the capital gains differential. This is another case where less means ~~the~~ more. More revenue to the Federal ~~Govt~~ -- $43 billion more, acc. to Treas. estim; more savings, more investment, more growth, more competitive, more opportunity; more jobs for Americans. There is no tax break for the rich -- it's a proven path to greater economic

(2)

Spur investment in basic research - tax credit for R&D.

We will

1 Encourage personal savings, by keeping inflation in check.

It will be vital to help ease the pressures that most important on families, the building on families, by promoting choice and options in child care. Last week I sent legislation to Congress that puts money in the hands of parents, rather than bureaucracies; without bias in favor of any particular C.C. solution. It empowers all families: dual earners, single parents; those who choose to remain at home; those who prefer informal, neighborhood arrangements; and especially those struggling to be self-sufficient. on low incomes,

Education is a long-range planning at its best - a solution for the next C, for problems we haven't even begun to recognize, & key to our competitive position

Yet no one suggest that education is a minor matter in our national agenda. It is vital to everything we are, and can become. It will take collective effort at all levels, public & private, to get it right. Those who get involved with local schools — getting right on the line, developing the workforce at its source — stand to reap the greatest rewards.

~~Two days ago Secretary Bennett~~

There are no quick fixes here, no stop-gap solutions. Like most of the long-term issues on the national agenda, these won't be fixed with a bolt of lightning here, a puff of smoke there. I've proposed

For those workers already on the line, we must build flexibility or jobs skills & change. By one estimate, 75% of all people now working will need retraining before the century is over.

are making fail-safe investments.

Labor: ~~It~~ will

The ___% gains in productivity you've achieved can be pushed much further. skill deeper, but it will take more than upgraded plant & equip.

comprehensive, coordinated job training, through partnerships in PICs, JTPA, ~~By~~ special programs; pub/private

a way to end vacuum

(3) ~~Your~~ The NAM policy you adopted last year ~~said that~~ "investment in R&D is at least as important as investment in equip & technology." (the hr guy (watermelon))

That's true. Most of the productivity gains in this country, ever since the 1920s, can be traced to [dev. skills & product. of people -- see Productiv. symposium].

OIC FTA

This admin. will continue to look for ways to stimulate these partnerships & prov. incentives for educ. & training that create market demand.

Cavazos (21st) unveiled plan for voc. train. 2000:1?

Another issue where we plan to play a key role: getting drugs out of the workplace, and out of our schools. ~~With everything else going on,~~ the prominent American policy maker [H.K.] once said, "There cannot be a crisis next week. My schedule is already full." Well, we're ~~going to be~~ there to ~~your~~ our schedule. Drug abuse in the workplace costs $100 billion every year -- puts productivity and lives at risk.

added

Bill Bennett is off to a fast start. Employers should teach workers to recognize the signs of substance abuse in their co-workers; understand that it ~~costs~~ affects profits, and ~~our lives at risk~~, and how to help them; where testing is ~~mandated~~ used, it should be seen as a way out of trouble -- not a way out of work.

17.6 million more people at work.

19.4 million total new jobs

19 million jobs over 18 total

net new

Reitsch:

Since '82 U.S. created 15.4 million jobs:

2.5 x the 6.3 in O.E.C.D. Europe

3.5 x the 4.3 in EC.

4.0 x the 3.7 in Japan

3.7 | 19.4 (5x)
18.5
.90

In Japan, the cost of golf club membership as high as $2.5 million – advertised in stock mkt. pages.

Krag

Gross dom. product per employed person
(total output of the econ.)

1987 (most recent): Japan's GDP per empl. person was 70% of ours

– in dollar terms

$27,613 Japan $39,209 U.S.

1988/Italy. comp costs for manuf. produc. workers – in Japan 95% of U.S.

– Back in '87, was 83%

Japan's relative level of unemployment (which incl. underutilized + P.T. workers) is ~~[illegible]~~ ours.
virtually the same as

Small Manufacturers Forum

Director	Christian Braunlich	3046

INDUSTRIAL RELATIONS DEPARTMENT

Vice President	Randolph M. Hale	3127

Employee Benefits & Compensation Policy Committee

Assistant Vice President & Director/Employee Benefits	Sharon Canner	3124

Employee Relations Policy Committee

Director/Employee Relations	Pete Lunnie	3129

Risk Management Policy Committee

Director/Risk Management	Susan Spangler	3128
Associate Director/ Risk Management	Phyllis H. Eisen	3135

Human Resources Council

Vice President	Randolph M. Hale	3127
Director/Human Resources & Legislative Affairs	Renee Reymond	3132

CUE

CUE provides the staff services necessary for bringing together, planning and implementing programs that represent the best thinking on how to develop and maintain honest, solid and straightforward employer-employee relationships.

Executive Director	Bernard Trimble	3043
Coordinator	Jill Henderson	3042
Administrator/CUE Membership & Meetings	Nancy Fullerton	3040

INTERNATIONAL ECONOMIC AFFAIRS DEPARTMENT

Vice President	Lawrence Fox	3143
Assistant Vice President	Howard Lewis	3144

International Investment & Finance Policy Committee

Director/International Investment	Stephen Cooney	3141

International Trade Policy Committee

Director/International Trade	R.K. Morris	3145

RESOURCES AND TECHNOLOGY DEPARTMENT

Vice President	Richard Seibert	3157
Director/Program Development	Daniel W. Cannon	3154

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Energy & Natural Resources Policy Committee

Assistant Vice President & Director/ Energy & Natural Resources	Jana Oakley	3153
Associate Director/Energy & Natural Resources	Lisa Kazel	3161

Environmental Quality Policy Committee

Director/ Environmental Quality	Theresa Pugh	3175

TAXATION AND FISCAL POLICY DEPARTMENT

Vice President	Paul Huard	3075
Assistant Vice President	Gordon Richards	3078

Taxation Policy Committee

Director/Taxation	Peggy Duxbury	3074

Fiscal & Monetary Policy Committee

Director/Fiscal Policy		3076

MEMBERSHIP AND PUBLIC AFFAIRS DIVISION

Senior Vice President/ Membership & Public Affairs	Lee Hamilton	3010

ASSOCIATIONS COUNCIL

The NAM Associations Council is composed of approximately 130 manufacturing associations each representing a single industry or the producers of a single product line.

Executive Director	Michael D. Lane	3102
Associate Director	William G. Morin	3103

LEGISLATIVE ANALYSIS DEPARTMENT

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Senior Associate Director	Lisa Axel	3080
Associate Director	Sylvette Bardach	3186
Associate Director	Douglas R. Kurkul	3081
Analyst	Patricia Morgan	3083

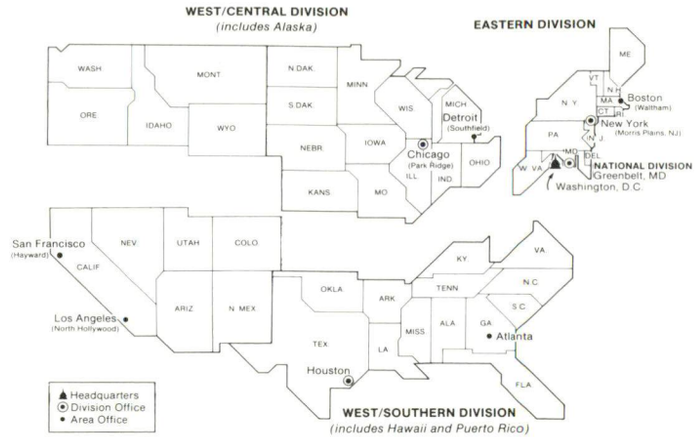
MEMBERSHIP DEPARTMENT

Director/Member Programs	David W. Rohn	3123
Director/Member Services	Ramon B. Dixon	3116

PUBLIC AFFAIRS DEPARTMENT

National Director/Public Affairs	Ann Duff	3117
Manager/Political Education	Jean Herbage	3119

NAM OFFICES



EASTERN DIVISION

201/539-4100
(NAMNET ID NAM022)

51 Gibraltar Drive, Suite 2A
Morris Plains, NJ 07950

Vice President/Division Manager	Thomas W. Estler
Assistant Division Manager	Patricia S. Koziol
Senior District Manager	Arlene Deskus
Senior District Manager (Philadelphia, Pennsylvania)	Thomas E. Newman 215/363-1955
District Manager (Pittsburgh, Pennsylvania)	Jerry A. Hodge

235 Bear Hill Road
Waltham, MA 02154

617/890-6813
(NAMNET ID NAM023)

Senior District Manager	Jan L. Follansbee
District Manager	Kim Sandler

WEST/CENTRAL DIVISION

312/698-3838
(NAMNET ID NAM018)

315 S. Northwest Highway
Park Ridge, IL 60068

Vice President/Division Manager	C. Thomason Bishop, III
Assistant Division Manager	Daniel A. Varroney
Senior District Manager	David W. Walker
District Manager	William G. Gill
District Manager	Kevin O'Brien
District Manager	Jean Ellen Wilson
District Manager (St. Paul, Minnesota)	Ann E. Heins 612/292-4691

4000 Town Center, Suite 540
Southfield, MI 48075-1406

313/355-0630
(NAMNET ID NAM019)

District Manager	Charles J. Streeter
Senior District Manager (Cleveland, Ohio)	Leo J. Burby 216/932-8525

WEST/SOUTHERN DIVISION **713/863-7575**
1225 N. Loop West, Suite 432 (NAMNET ID NAM020)
Houston, TX 77008

Vice President/Division Manager	Perry J. Owens
Assistant Division Manager	Eileen M. Campbell
Senior District Manager	Richard D. Allen
District Manager (Joplin, Missouri)	Mary Jo Wade 417/782-6755

1422 W. Peachtree St., NW, Suite 612 **404/892-0530**
Atlanta, GA 30309 (NAMNET ID NAM021)

Regional Manager	Frank Steinbruegge
Senior District Manager	Hadley Hury, Jr.
District Manager	Roland F. Korbesmeyer, Jr.
District Manager	Wylie L. Nowman

4605 Lankershim Boulevard, Suite 300 **818/509-0731**
North Hollywood, CA 91602 (NAMNET ID NAM016)

Assistant Division Manager	Joseph M. Byrnes

22300 Foothill Boulevard, Suite 510 **415/881-8816**
Hayward, CA 94541 (NAMNET ID NAM017)

Senior District Manager	Lisa Hansen

NATIONAL DIVISION **301/441-2000**
7855 Walker Drive, Suite 660 (NAMNET ID NAM015)
Greenbelt, MD 20770

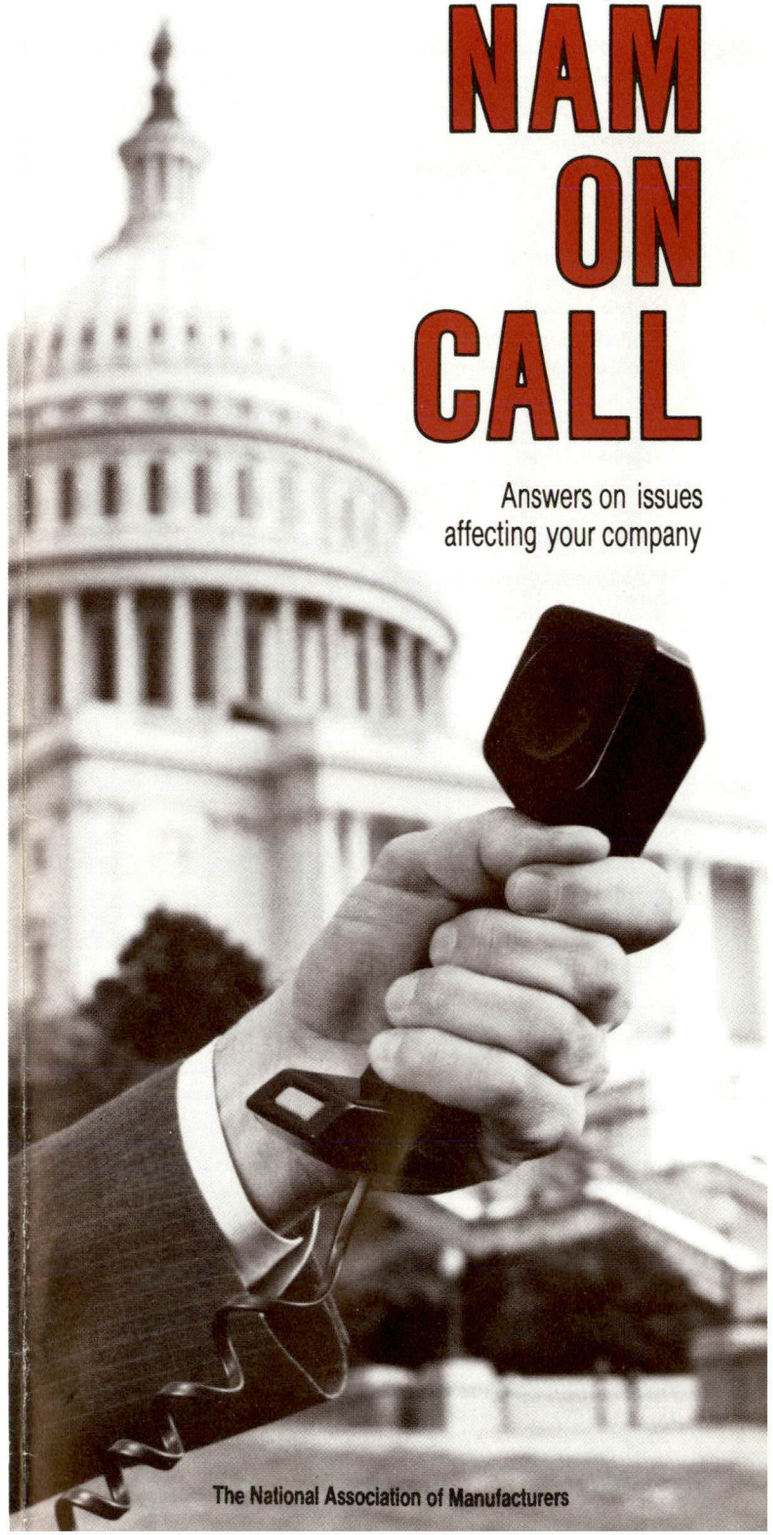
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Manager/Member Relations	James A. Herbert
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For federal income tax purposes, membership dues and contributions to NAM are deductible as business expenses, not as charitable contributions. NAM's Taxpayer I.D. Number is 13-1084330.

National Association of Manufacturers
1331 Pennsylvania Avenue, NW
Suite 1500 - North Lobby
Washington, DC 20004-1703
202/637-3000

NAM ON CALL

Answers on issues affecting your company



The National Association of Manufacturers

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Senior Vice President/ Finance & Administration Division	William E. Blasier	3014
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Assistant Vice President & Deputy General Counsel	Quentin Riegel	3058
Treasurer	William P. Martin	3029
Vice President/Meeting Management & Corporate Secretary	Joni C. Hodgson	3065

NATIONAL INDUSTRIAL COUNCIL (NIC)

The National Industrial Council is a voluntary organization of 125 independent business associations at the regional, state and local levels. They represent 120,000 employers with a work force exceeding 21 million people. These state and local organizations help to shape and promote industry views on national public issues through NAM.

Executive Director/ Industrial Relations Group	Argyll Campbell	3052
Executive Director/ State Associations Group	Barry Buzby	3054

POLICY & COMMUNICATIONS DIVISION

Executive Vice President and Chief Economist	Jerry J. Jasinowski	3105

COMMUNICATIONS DEPARTMENT

Vice President	David B. Bowes	3089
Assistant Vice President	Sara Ross	3099

GOVERNMENT REGULATION, COMPETITION & SMALL MANUFACTURING DEPARTMENT

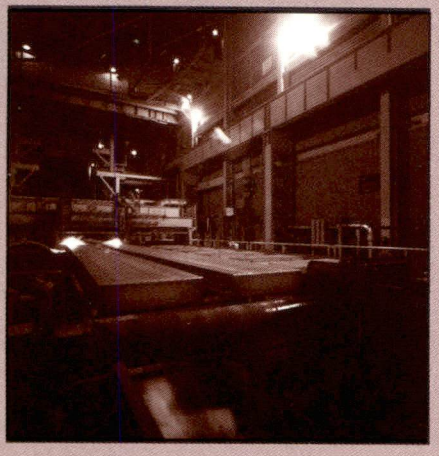
Vice President	James P. Carty	3047

Corporate Finance & Management Policy Committee

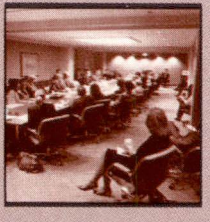
Director/Corporate Finance	John Pilcher	3048

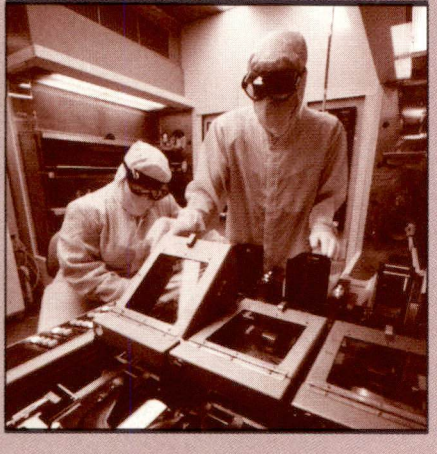
Regulation & Competition Policy Committee

Director/Regulation & Competition	Lawrence Fineran	3051









NAM

Advocate for Manufacturing Excellence

National Association of Manufacturers



The National Association of Manufacturers earns and warrants your support.

NAM is the foremost voice for industry in Washington, D.C. It speaks for more than 13,000 member companies that account for 85 percent of the manufactured products and manufacturing jobs in the United States. Since its founding in 1895, NAM has advocated policies that promote economic growth and efficiency in American industry. Today, as the nation moves inevitably toward a global economy, the association continues to advocate sound public policies that will enable industry to strengthen its competitive position.

The National Association of Manufacturers is located in the heart of Washington, D.C., and communicates the views of its members to policy makers through personal visits, letters, telephone calls and congressional testimony. Member companies and staff testify before congressional committees an average of once every four days that Congress is in session, and meet constantly with executive branch leaders.

The association's experienced policy staff maintains close working relationships with Congress and the administration. Besides advancing the interests of industry on Capitol Hill, these specialists are just a phone call away when you need policy information.

Public policy is increasingly being influenced by carefully orchestrated grassroots campaigns. NAM's staff in the nation's capital and in regional offices throughout the country provide the timely information you need to generate an effective grassroots effort in concert with thousands of other companies.

As a member of the National Association of Manufacturers, you have the opportunity to join other business leaders in developing NAM's positions on policy issues that will affect your company's performance. This brochure describes the work of NAM. After reading it, I'm certain you will agree that your company's membership in NAM will ensure that your company's interests are fully represented before all branches of the federal government.



Alexander B. Trowbridge
President
National Association of Manufacturers

YOUR NEXT STEP

Do you have questions about public policies that affect your company? Do you have questions about the status of specific legislation? Do you know how your members of Congress voted on key issues? Call the nearest NAM office to get the answers. Our offices are listed on the following page.

You also can join the NAM right now. Call your district manager, whose telephone number is on the business card inserted on the opposite page.

At a minimum, membership in the National Association of Manufacturers offers your company these benefits:

- ☐ prospects of a better bottom line
- ☐ the leverage of numbers
- ☐ participation in policy development
- ☐ free market solutions
- ☐ credibility
- ☐ information on national trends and issues
- ☐ local involvement.

Why not make that call now?

BENEFITS OF NAM MEMBERSHIP

☐ **Prospects of a Better Bottom Line** — Bad public policies add to the cost of doing business. NAM promotes sound policies for industry that will increase productivity and the competitiveness of American companies in a global economy.

☐ **The Leverage of Numbers** — When NAM testifies on legislation, lobbies Congress or the executive branch, or files statements with federal regulatory agencies, it does so as the representative of more than 13,000 companies. Policy makers listen.

☐ **Participation in Policy Development** — The association is member led through its board of directors and policy committees. NAM staff provides information. NAM members formulate policy positions.

☐ **Free Market Solutions** — NAM promotes free market solutions to federal legislative and regulatory issues.

☐ **Credibility** — NAM represents companies of all sizes, from every state and industry, on issues ranging from labor to taxes to the environment. This collective voice increases the credibility of industry's positions on public policies that affect companies not only as producers but also as consumers of goods and services.

☐ **Information on National Trends and Issues** — NAM is a ready source of issues information in formats you can use. The information we make available saves your government affairs staff time and money.

☐ **Local Involvement** — Participation in grassroots lobbying, meetings with your elected officials, local issue briefings and informative seminars are coordinated by regional NAM staff.

The following pages explain what NAM is and how your company will benefit from NAM membership. Take a few moments to read them over, then decide: "Can you afford not to join the National Association of Manufacturers, the association that **best** represents the interests of business and industry on a broad range of issues?"

OUR PURPOSE

Since our founding in 1895, the National Association of Manufacturers has been the collective voice for American industry. We represent member companies to government leaders and lawmakers on legislative and regulatory issues, and before the United States Supreme Court.

NAM's mission is to:

☐ Promote economic growth and competitiveness in manufacturing;

☐ Increase the role of industry in forming public policy; and

☐ Help members develop policy positions by supplying relevant, timely information.

NAM's objectives follow from its mission:

☐ Communicate the viewpoint of business and industry on public policy issues to government and the public;

☐ Evaluate public policy trends;

☐ Foster improved relations and cooperation between employer and employee, government and industry, and the public and industry; and

☐ Help promote the benefits of a free competitive enterprise system.

Membership in NAM gives your company a way to help shape public policies that will meet today's reality and tomorrow's challenge.



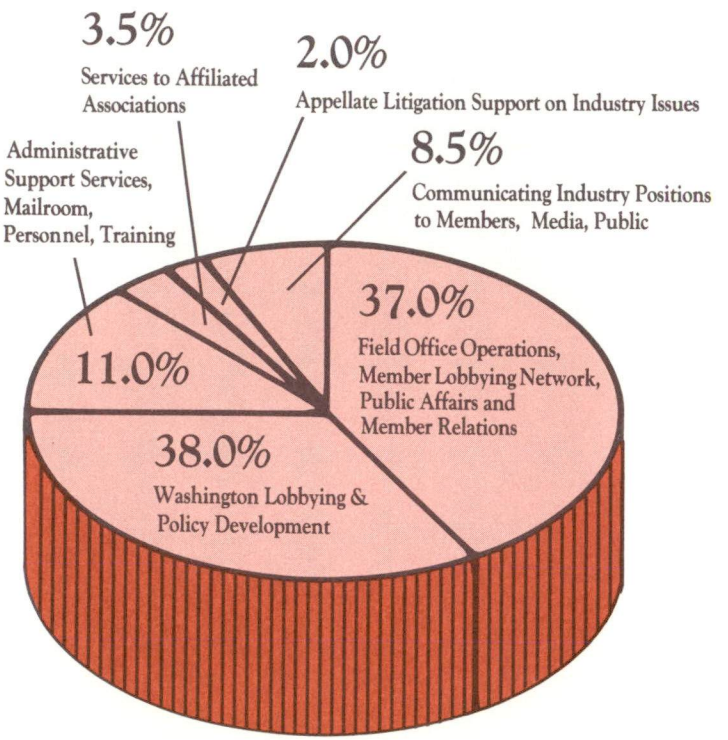
Members of NAM's Defense Forum exchange information and discuss common concerns relating to public policies affecting the defense industry.

YOUR DUES DOLLARS AT WORK

The annual dues you pay to NAM are an investment. You are investing in an association that will represent your interests in Washington.

Here's how your NAM dues dollars are allocated by various functions:

NAM Annual Budget Distribution



Dues Schedule. Annual dues are based on the net worth of your company, (up to a maximum annual dues cap of $100,000). Your NAM district manager will explain the dues schedule.

"Congratulations to NAM for its outstanding job in defeating ...the High Risk Occupational Disease Notification Act. Success in any endeavor, be it in business or on Capitol Hill, requires more than simply having talented individuals and resources. It demands leadership and the skill to direct and coordinate the individual efforts of many people to achieve collective objectives."

Walter F. Williams
Chairman and Chief Executive Officer
Bethlehem Steel Corporation

"Sometimes we win them, and sometimes we lose them, and on this one [Senate Bill, High Risk Occupational Disease Notification and Prevention Act], I have lost."

Sen. Howard Metzenbaum (D-OH)
Bill Sponsor

"NAMNET gives us a running start on research projects. Many of the issues on NAMNET are issues we follow. NAMNET gives us another resource to turn to...and sometimes a perspective we haven't considered."

Andrew Takacs
Vice President, Government and Public Affairs
Whirlpool Corporation

"In my opinion, the Congressional Dialogue[s] which give NAM members an opportunity to both visit with and hear from our Texas delegation in Congress is not only unique, but helps make NAM more attractive than other associations."

J. Virgil Waggoner
President
Sterling Chemicals, Inc.

"I was pleased and honored to participate in the National Association of Manufacturers SARA Title III Compliance and Communications Seminar. The seminar was very well organized and was carried out in a professional manner. I believe it was successful in providing the attendees with the inspiration to comply with both the spirit and letter of Title III. I look forward to working with NAM again in the future."

Thomas J. Marriott, Jr.
Corporate Safety and Environmental Director
Air Products and Chemicals, Inc.

WHO WE ARE

NAM is a voluntary organization of more than 13,000 member companies located in every state and representing industries of all sizes.

NAM is effective because it is *member led*. The **board of directors** comprises industrial leaders from every state —representing all types of industries and every size company—bringing a manufacturing perspective to the issues.

NAM **policy committees** give members the chance to help set policy positions. These committees "formulate and recommend" to the board of directors positions on policies that affect the general membership. Committee-developed policy positions guide communications on behalf of members with Congress, the administration, other trade associations, the media and the public.

NAM Policy Committees

☐ The **Regulation and Competition Committee** supports policies that produce a climate favorable to business and industry in areas of antitrust, transportation, telecommunications and regulatory issues.

☐ The **Corporate Finance and Management Committee** promotes the interests of industry on securities reforms, hostile takeovers, corporate governance powers and the rights of manufacturers in financial markets.

☐ The **Employee Benefits and Compensation Committee** advances policies that strengthen the relationship between management and its workforce on issues affecting the well-being of employees.

☐ The **Employee Relations Committee** fosters sound employment practices and seeks to prevent federal legislative/regulatory initiatives that reduce the ability of companies to adapt to changing competitive conditions.

☐ The **Risk Management Committee** supports balanced policies on product liability, OSHA and workers' compensation that help industry produce competitively priced goods without compromising the legitimate safety concerns of workers and consumers.

☐ The **International Trade Committee** promotes trade policies that foster the international competitiveness of U.S. manufacturing on both domestic and international fronts.

☐ The **International Investment and Finance Committee** advocates a stable international investment climate and supports policies that stimulate overseas investment by U.S. companies.

☐ The **Energy and Natural Resources Committee** fosters federal policies that will ensure adequate supplies of energy and raw materials now and in future years.

☐ The **Environmental Quality Committee** advances policies that are cost effective and offer equitable approaches to environmental issues.

☐ The **Taxation Committee** supports tax policies that promote the economic growth of business and industry in America.

☐ The **Fiscal and Monetary Policy Committee** advocates sound fiscal and monetary policies.

In addition to policy committees, NAM has a number of **special councils and forums, and** works with **affiliated organizations**. They cooperate with NAM to promote the interests of industry on a wide range of concerns.

Special Councils, Forums and Related Organizations

☐ The **Small Manufacturers Forum** defends the interests of small manufacturers on legislative and regulatory issues.

☐ The **Defense Forum** encourages cooperation among defense industries on issues affecting their industry. The forum fosters an exchange of information among prime- and subcontractors on common concerns within the defense sector.

☐ The **Council on High Technology** assesses the impact of NAM policy actions on the technology sector and initiates policy recommendations through task forces on patents, copyrights and trademarks, and technology regulations.

☐ **CUE** is an educational subsidiary of NAM that encourages positive employee relations.

WHAT OTHERS SAY

"...NAM is doing a job in Washington that *must* be done and one for which NAM is uniquely qualified because of our broad-based membership. NAM represents your company and mine on those macroeconomic issues that affect not only our costs of doing business, but the way we do our jobs in our plants and in our offices."

Donald W. Davis
Chairman
The Stanley Works

"Increasing competitiveness is a top priority for Hewlett-Packard as well as all of American industry. We applaud the leadership role of the National Association of Manufacturers in shaping public policies needed by U.S. companies competing in a global market, and in carrying the message across the country so effectively."

John A. Young
President and CEO
Hewlett-Packard Company

"There's a difference between the corner barber shop and my manufacturing plant—differences in taxes, personnel problems, government regulations. That's why NAM is so important to me as a small manufacturer. No other organization works on the broad-based issues affecting us like NAM does."

Ronald P. Sandmeyer
President and CEO
Sandmeyer Steel Company

"The National Association of Manufacturers is a strong and effective advocate for American industry. For example, I've been involved for many years in the struggle for product liability reform, and their active grassroots campaign and influence with legislators in Washington have made NAM an invaluable ally in this effort."

Robert H. Malott
Chairman and Chief Executive Officer
FMC Corporation

Organize Congressional Dialogues and Issue Briefings. NAM field staff organize Congressional Dialogues and Issue Briefings throughout the country. These gatherings are informal give-and-take sessions. Congressional Dialogues give company executives a chance to meet with their elected representatives. *Congressional Dialogues and Issue Briefings bring Washington to you.*

Conduct Seminars. NAM conducts local seminars for members on many topics. Seminars may be an outgrowth of regulations, legislation or other industry concerns. *Seminars are NAM's way of trying to ease the compliance burden, explain key features of new statutes or share information on major subjects of concern to industry.*



Congresswoman Beverly Byron (D-MD) responds to questions from NAM members at an NAM-organized Congressional Dialogue.

Provide Political Resources. In recent years corporate political action committees (PACs) have grown in number. They wield substantial influence and play a major role in elections.

NAM provides political information such as voting records of members of Congress; the outlook for congressional races; and a special newsletter, *PAC Manager*. The latter includes information on candidates, upcoming elections and other facts that a company's PAC manager needs to know. In addition, we offer political education programs for your employees. *NAM's political resources give companies the information they need to support candidates sympathetic to the positions of business and industry.*

☐ The **National Industrial Council** is a voluntary organization of independent state, regional and local business associations that fosters maximum cooperation and communication among associations on all matters in which their interests are aligned. The NIC is composed of two separate groups. The *Industrial Relations Group* includes local and regional employer associations interested in employer/employee and industrial relations issues. The *State Associations Group* comprises state manufacturers/business associations.

☐ **The Associations Council** enables vertical manufacturing associations to join forces with NAM to promote common interests. Membership is open to all industry-related associations. Members have the chance to help set priorities as well as develop legislative, regulatory, economic and educational strategies that transcend their specific agenda.

NAM Staff

NAM employs approximately 180 **professional staff members**. Two-thirds work in Washington, D.C. The remainder are in regional offices that serve our members across the nation.

Washington Staff. NAM Washington staff represents member companies in the nation's capital. They are responsible for keeping members active in public policy advocacy through a comprehensive program of policy committee meetings, Capitol Hill and executive branch lobbying, and communications with the media.

Regional Offices. Staff in NAM regional offices provides a personal link between individual member companies and the association. They organize local meetings where members can discuss priority legislation with elected officials. They arrange issue briefings and seminars for NAM members on a range of topics. They coordinate requests for grassroots action by companies when a legislative issue "heats up" in Washington. With offices throughout the country, NAM's staff is never far away, either by personal or telephone contact.

WHAT WE DO

NAM represents its members in Washington on issues affecting business and industry, serving as their collective voice to government leaders and lawmakers. We keep members informed and involved in the public policy arena in a variety of ways.

Track Legislation. The status of legislation may change daily or even hourly. NAM Washington staff continually follows the progress of proposed legislation that will have a major impact on industry. They react to such changes, alerting NAM regional offices and members. Because NAM represents a broad-based constituency, our efforts keep members from being "blind sided" on peripheral issues they may not follow so closely. *Even if you have a Washington office, NAM can expand your capability.*

Testify and File Statements. Other groups, each with their own message, are trying to be heard. NAM makes sure the message of industry is heard when there is pending legislation that will significantly affect manufacturers. Executives of member companies and NAM staff articulate our policy positions for the public record. *NAM sees that industry's message gets through the information clutter.*

Executives of NAM member companies testify on product liability reform before a house committee.

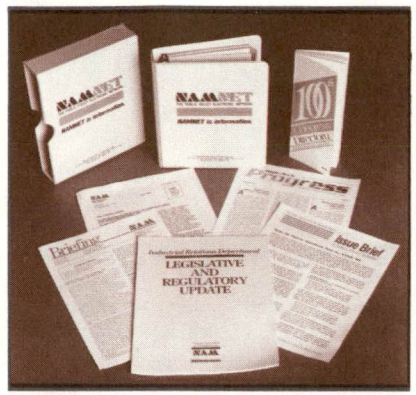


Lobby on Capitol Hill. NAM staff lobbyists are issue experts, respected by legislators for their expertise. This enables them to effectively communicate industry's position on legislation to Congress. In addition, the efforts of NAM lobbyists are frequently augmented by government affairs staff from member companies. *NAM has an impact on legislation.*

However, lobbying in Washington is only half the story. Equally important is "grassroots" lobbying by NAM members that is coordinated with Washington lobbying efforts.

Coordinate Grassroots Lobbying. Members of Congress take notice when a groundswell of opinion surfaces in their state or district. When a legislative issue is on the "front burner" and it is important for companies to get involved in lobbying, NAM staff gets the word out through *Legislative Alerts*. Members are asked to call or write their legislators and urge a vote for policies that support industry. *NAM helps members to increase their influence with Congress.*

Communicate. Issues are often complex and it's vital that companies receive pertinent information:
—How would this legislation affect my bottom line?
—Whom do I contact to make my position known?
—What else can I do?



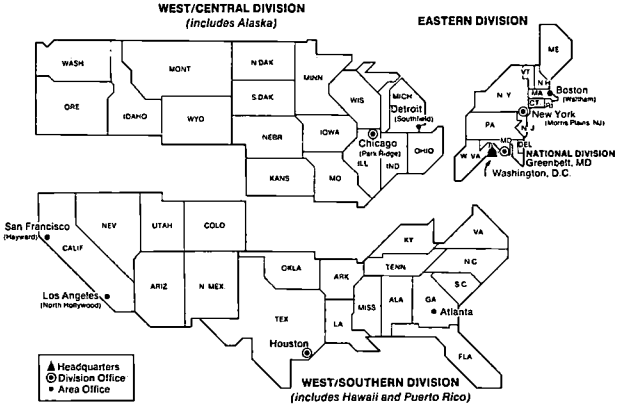
NAM members receive legislative and regulatory information through a variety of NAM publications and information services.

Members receive legislative and regulatory information through a variety of NAM publications and information services. *Briefing* is a weekly legislative newsletter offering up-to-the-minute information on the status of legislation. *Issue Briefs* are one-page summaries of public policy issues important to manufacturing. Policy analysis papers, newsletters, special publications and quarterly letters from NAM's president and chairman of the board are additional ways members are kept up-to-date on critical information.

NAMNET is NAM's electronic public policy network. It includes important information in a format your company can use. Among the system's most valuable features are *Capitol News*, a daily legislative update; *Legislative Action Alerts*; and *NAMTRAK*, a federal legislative tracking system.

Our members don't waste time searching for the facts they need. *NAM publications and information services give companies the vital facts — the who, what, when, where, why and how of key issues that affect them.*

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U.S. Manufacturing

Back and Getting Better

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The economic health and security of America depend on a strong manufacturing sector, fostered by further improvements on the factory floor and an active program to shape public policies in Washington. Join now in NAM's continuing campaign to bring world-class, competitive excellence to manufacturing and greater understanding of its importance to every person in this nation.

U.S. Manufacturing

Back and Getting Better

NAM



Alexander Trowbridge discusses quality with Wayne Kerekes in the melt shop at Timken's Faircrest steel plant.

COURTESY OF THE TIMKEN COMPANY

National Association of Manufacturers

It is clear that manufacturing is vital to America's economic health and security. It is the "industrial strength solution" that will put this country back on top by nourishing economic growth, contributing to price stability, promoting higher living standards, bolstering trade with the rest of the world, spurring technological advancement and contributing to a strong national defense.

The National Association of Manufacturers represents more than 13,000 American manufacturers of all sizes. Through NAM, those manufacturers speak in a strong, united voice to government leaders and lawmakers.

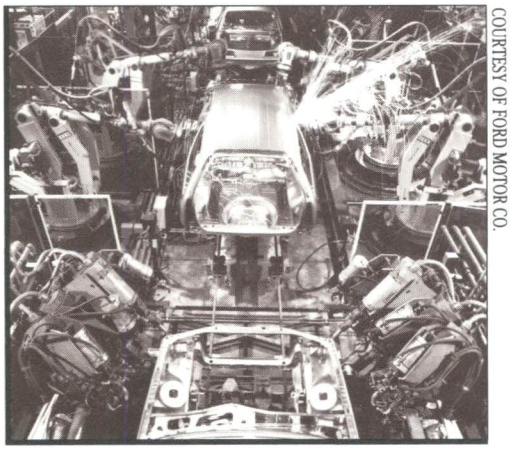
One of the association's greatest strengths is that it is *member-led.* Manufacturers get involved in a number of ways: through membership in and input to policy committees; by participating in local congressional dialogues and legislative issue meetings; and by serving as members of the association's grassroots lobbying network. All members have an active responsibility to promote policies that will advance the cause of manufacturing in America and permit manufacturers to achieve competitive excellence.

The association's headquarters are located in Washington, D.C., but NAM draws its strength from members located throughout the United States. NAM's staff at headquarters and in the field is prepared to work with you toward the best interests of American manufacturing. Division offices serve NAM members in the following locations:

in excess of $125 billion. Mandating benefits with such a high price tag, as well as restricting labor markets and adding costly new environmental regulations, will force employers to raise costs and cut back the number of jobs they can provide.

Initiatives to reduce the federal budget deficit and stimulate savings and investment must also be pursued. Federal spending must be reduced and serious consideration given to restoring tax incentives for investment in new plants and equipment. And we need financial reform to restore confidence that capital markets are focused on serving the long-term investment interests of the nation.

In short, we need to subject each major policy proposal to a competitive "litmus test," a cost/benefit calculation of its impact on the nation's ability to compete. And manufacturing firms must work together through NAM to push for public policies that enhance manufacturing excellence.



COURTESY OF FORD MOTOR CO.

After some troubled years, U.S. manufacturing began a comeback in the mid-1980s. Adjustments to the exchange rate, vigorous cost-cutting by firms and dramatic changes in manufacturing practices spurred improvements in productivity and competitiveness. The fundamental role of manufacturing in the nation's strength and security began once again to shine through.

Though we're moving ahead, the country—especially government and manufacturers—still faces formidable challenges.

- Americans must understand the link between manufacturing and U.S. economic strength and national security.
- Government must recognize the challenges of global markets and enact laws and policies to make the nation more competitive.
- Manufacturers must continue striving to produce the best products in the world.

Each of these challenges demands action by manufacturing companies and their trade association, the National Association of Manufacturers. Taken together, their achievement will result in a commitment to excellence that is essential if industry is to survive and thrive.

This booklet tells the story in more detail. It is the story of a manufacturing comeback: where and how it began and how to ensure that it continues.



Alexander B. Trowbridge
President
National Association of Manufacturers

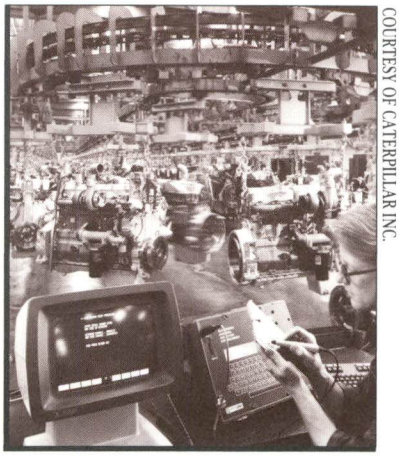
A Myth Dispelled

Not long ago, pundits had the manufacturing sector on its deathbed. How times change!

Today, *National Journal* says "The Key Is Manufacturing." The *Los Angeles Times* refers to it as "The Great American Revival." *U.S. News & World Report* calls manufacturing's alleged demise "the obituary that should not have run." And the U.S. Labor Department predicts that eight of 15 top growth industries through 1995 will be in manufacturing.

Gone is the myth of a "post-industrial" society, where services supposedly replace manufacturing as the engine that drives the American economy. Manufacturing has better productivity, better quality, better technology, better profitability and better wages for workers than the service sector. Stated in the simplest terms, something must be made before it can be serviced.

Manufacturing is coming back, stronger and better than ever. But we're not at the top yet. Attaining manufacturing excellence will demand a continuous commitment from all sectors of our society.



COURTESY OF CATERPILLAR INC.

August 1984, we presented our views to then-White House Chief of Staff Donald Regan. In mid-1985, seven NAM corporate leaders marched into Treasury Secretary Jim Baker's office, documenting the case for why the federal government must act — and soon.

In September 1985, the Group of Five finally did act. Today, the dollar has adjusted to realistic and competitive levels. And trade legislation is pending, with exchange rate provisions that might not have appeared had your association not kept on the pressure.

This is the type of service that NAM alone can provide to all manufacturers. We are also proud of our successes in specific policy areas: defeating an occupational risk notification bill, removing mandatory plant closing and layoff provisions from the trade bill, advancing federal product liability reform, preventing enactment of costly new health care legislation and reforming export controls. We keep an eye on Washington to carry through on long, often difficult, battles and to buttress corporate efforts to make American manufacturing strong.

The challenge ahead is to convince government policymakers that they have a key role in fostering manufacturing excellence and competitiveness. Such excellence depends a great deal on moves that only government can make: creating a fair trading system; improving education and training; sharply reducing the federal deficit; and encouraging the growth of small entrepreneurial manufacturing firms. NAM makes the manufacturing case, but government ultimately must legislate laws that help do the job.

Government must also avoid laws that hamper flexibility and load massive new costs and restrictions on American business. The total cost of health care legislation considered by Congress in mid-1988, for example, was far

Shaping Public Policy

Even with what companies have done to become more competitive, government policies are often critical for creating an economic environment in which manufacturing can excel. In these cases, manufacturers must help shape policies to make the nation more competitive. That's where the National Association of Manufacturers serves you best.

The misalignment of exchange rates wreaked havoc on American manufacturing during the early and mid-1980s. Without recent changes, we would still be struggling to compete in an out-of-balance world trading system. While government policymakers deserve credit for finally addressing the problem, it was NAM that focused attention on and pushed for exchange rate reform.

Back in 1982, NAM began speaking out on the need to coordinate government policies on the exchange rate. Manufacturing leaders such as Richard Heckert of **E.I. du Pont de Nemours & Co.**, Dexter Baker of **Air Products and Chemicals, Inc.** and Donald Davis of **The Stanley Works** joined NAM staff in presenting our case. Over a period of several years, the arguments became stronger and more specific. They were spelled out in testimony on Capitol Hill before dozens of congressional committee hearings; preached at numerous gatherings of world leaders both here and abroad. In the winter of 1983, we spoke out in *Foreign Policy* magazine, one of the world's most respected international affairs publications. In February 1984, the NAM board of directors passed a strongly worded resolution endorsing exchange rate actions.

At the same time, we worked with reporters to focus media attention on the issue. Letters, speeches and visits to the White House augmented NAM's policy communications. In

Manufacturing on the Upswing

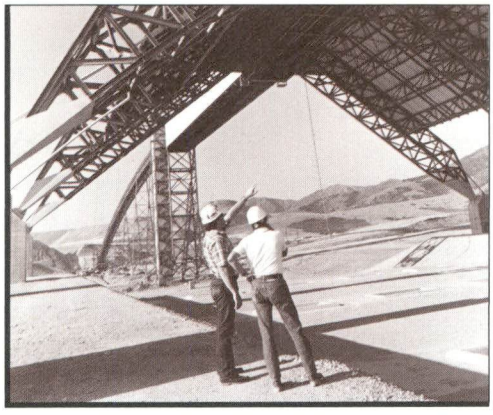
Faced with a flood of imports and an overvalued dollar, U.S. industry met the challenge. Companies restructured operations, closed inefficient plants, reduced inventories and cut costs up to 25 percent, emphasizing the most productive parts of their businesses.

For example, **TRW Inc.** sold more than $1 billion worth of low-growth, low-return subsidiaries and product lines to concentrate on core automotive, defense and electronics businesses. And **Monsanto** sold off commodity petrochemical businesses to focus on higher-value specialty petrochemical products.

Meanwhile, companies invested in new equipment, retrained workers, involved employees, developed new technologies and products, and zeroed in on quality. These changes spurred one of the best productivity performances on record: Manufacturing output per worker hour has increased, on average, 4 percent a year since 1981.

U.S. manufacturers also found relief from the overvalued dollar, which accounted for at least half of our lost international market share. Measured against major industrial competitors, the dollar has fallen 50 percent from its 1985 high. While some problems persist, this adjustment greatly enhanced the price competitiveness of U.S. products. Our trade position began to improve in 1987, with projected gains of $40 billion in 1988.

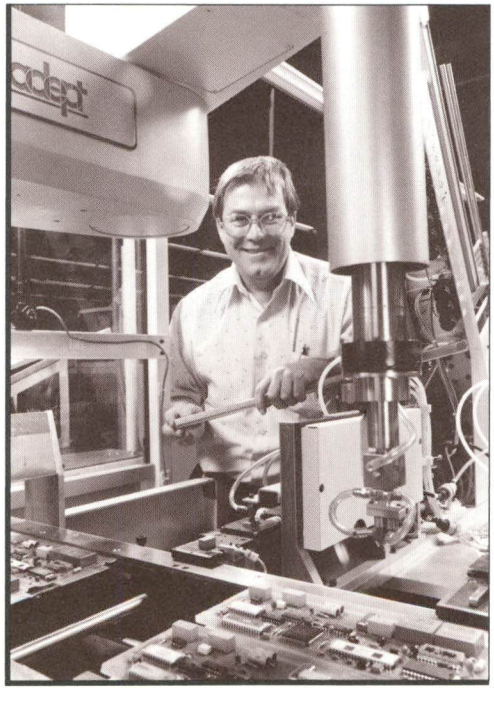
Improvements in the industrial outlook have, in turn, illuminated the key role of manufacturing in a dynamic and secure American economy. Now it's up to NAM and its members to make sure our lawmakers understand that vital role.



COURTESY OF GOODYEAR TIRE & RUBBER CO.



COURTESY OF KENNAMETAL INC.



COURTESY OF AT&T NETWORK SYSTEMS

The Road Ahead

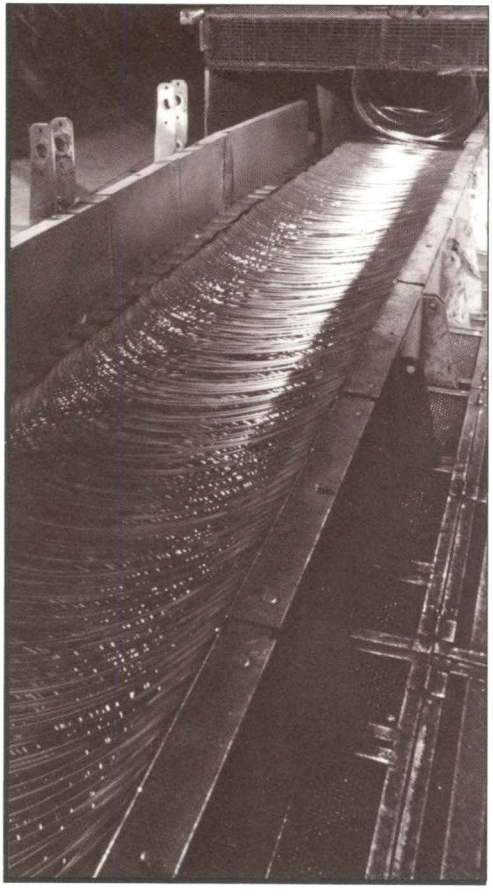
The Corporate Challenge

Manufacturing still has much to accomplish. Corporate leaders must continue to cut costs, increase productivity, involve employees, improve quality, focus on R&D, develop technology and market aggressively abroad.

America's workers must also dedicate themselves to the effort. It all boils down to teamwork. And teamwork pays off.

- In 1980, the management and employees of **Rubbermaid Inc.** cooperated to boost sales from $350 million to $1 billion in 10 years through improved productivity and cost control. Since 1983, the company has added more than 1,000 new products. In 1987, it topped $1 billion in sales.
- In 1981, the **Timken Company** invested $500 million in a new Ohio steel plant, focusing on training and motivation. By 1986, the payoffs began: two labor hours per ton of ingot production compared with the industry average of seven; electricity and natural gas costs down by 22 percent and 27 percent; and cleaner alloy steel.
- **Harley-Davidson** faced a threat from heavyweight motorcycle imports in 1981. Its response? Employee involvement programs, advanced manufacturing methods, new emphasis on statistical process control and a completely reengineered product line. The result? In-process inventory at its assembly plant fell by more than $20 million; inventory turnarounds rose from six to 22; machine set-up times dropped on average 75 percent; and productivity rose by almost half.

American employers and employees are clearly striving with determination to outpace the competition.



COURTESY OF NORTHWESTERN STEEL AND WIRE CO.

1.

Manufacturing Drives Economic Growth

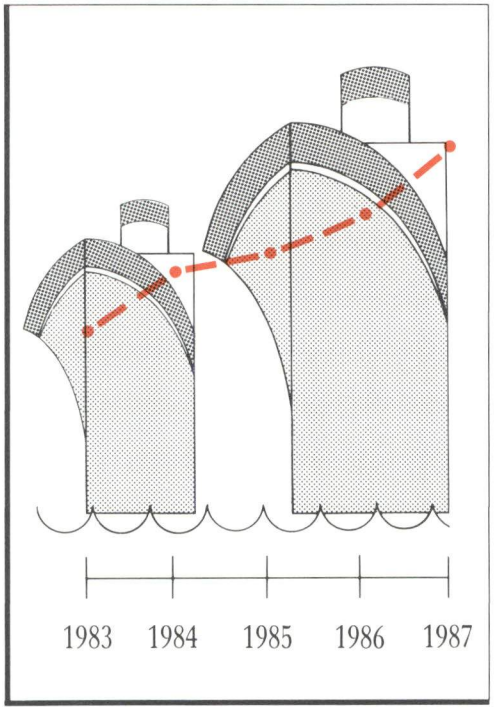
Look at the evidence:

- Manufacturing is the driving force behind America's current economic expansion and will account for roughly three-quarters of GNP growth in 1988. It has been the key to avoiding a recession this year.
- Manufacturing is the lifeblood of service industries. Services depend heavily on manufacturing: to build an economy capable of affording them and to buy more than 25 percent of what they sell. And manufacturing provides the new technology that has enabled medical, financial and other services to modernize and become more efficient.
- Manufacturing is the greatest contributor to price stability. Productivity improvements have been much more impressive in manufacturing than in services, which translates to lower costs and inflation. Since 1981, goods prices have risen a modest 12 percent while the price of services has soared more than 30 percent.
- Manufacturing provides high living standards. Its pay scales are significantly higher than in other sectors of the economy, resulting in more purchasing power and a better quality of life. Manufacturing jobs consistently pay 20 percent more than nonmanufacturing jobs and nearly 30 percent more than service sector jobs.

Growth, dependability, high living standards. Manufacturing truly drives the American economic engine.

U.S. Manufactured Exports

up from $149 Billion in 1983 to $200 Billion in 1987



(Source: NAM from U.S. Commerce Department Statistics.)

6.

Manufacturing Builds a Strong Defense

A strong defense means a secure country, and manufacturing provides the materials and know-how to keep us strong. America's ability to build planes, ships and tanks faster than the Axis powers led to the Allied victory in World War II. Today, our ability to build technologically superior weapons helps maintain the world's balance of power.

Because America's defense is based primarily on sophisticated equipment, industry must spearhead technological breakthroughs. We cannot depend on other countries for critical defense parts and still expect to keep our weapons systems reliable and secure.

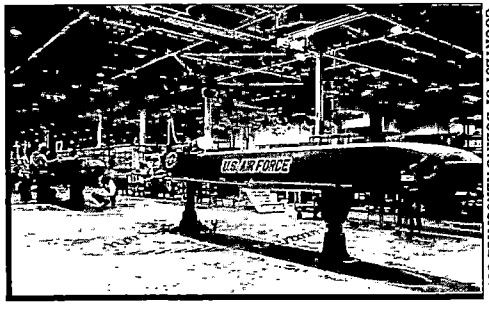
Defense production is also a major part of the economy, particularly for such industries as electronics and transportation equipment. More than one of every 10 manufacturing workers in the United States is involved in defense production.

A strong industrial economy also benefits national security in more subtle ways: by demonstrating to the world the benefits of U.S. economic and political ideals; by inhibiting regional economic conflicts; and by helping the nation cope with protectionist pressures that strain our international alliance system.

2.



COURTESY OF INLAND STEEL INDUSTRIES



COURTESY OF BOEING AEROSPACE CO.

Manufacturing Is Key to Trade

Since manufactures make up most of America's trade with the rest of the world, more competitive manufacturing is clearly the key to solving our trade problem.

And more competitive manufacturing *is* working, partly because of improvements in the exchange rate and cost-cutting by corporations, and partly because of a new recognition by both management and labor that American wage scales must reflect the realities of foreign competition.

U.S. exports increased by almost 15 percent in real terms in 1987. Industries such as chemicals, paper, computers, and electrical machinery and parts are showing signs of an export boom. This could lead to trade gains of $40 billion in 1988 which, in turn, will boost capital spending, expanded capacity and improved efficiency.

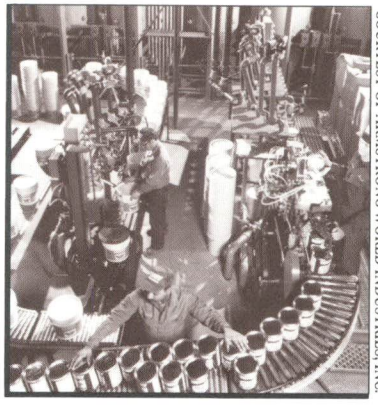
Some companies *are* in high gear. **Prime Computer** derived 47 percent of sales from exports in 1986. In 1987, 27 percent of **Caterpillar's** gross income came from exports.

And large companies aren't alone. In 1988, Missourian Walter Kisling of **Multiplex Company, Inc.** received the president's "E" award as an exporter of the year. And, though it didn't exist 12 years ago, Michigan-based **Azon Systems Inc.** is today a multimillion dollar enterprise with a client list made up mostly of foreign companies.

Yet a mere 250 U.S. companies account for more than 80 percent of this country's exports. U.S. business must learn to "think export," if it is to continue its resurgence in world markets.



COURTESY OF HUGHES AIRCRAFT



COURTESY OF ARMSTRONG WORLD INDUSTRIES, INC.

5.

Manufacturing Strives for Quality

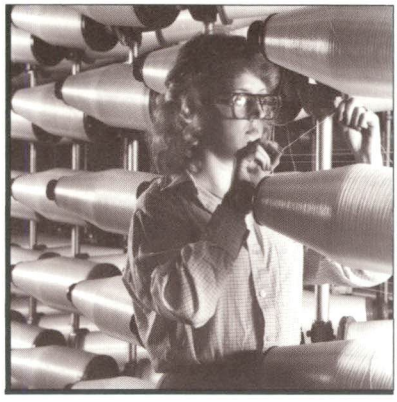
Today, improving quality is truly "Job 1." It makes sense: Quality is good business. To achieve improvements, companies must engage the hearts and minds of all involved, from top management to line worker. For example:

- Much of **Ford Motor Company's** 40 percent jump in profits in 1987 was due to a joint effort by employees, suppliers and dealers to produce high-quality, value-for-money products.
- Through automation, **NCR Corporation** reaped an 80 percent improvement in quality and a 75 percent reduction in assembly time in West Columbia, S.C.
- At a **Kennametal Inc.** metal-cutting insert plant in Ohio, the work of one employee group enabled scrap, lead time and inventory to be reduced two-thirds, while on-time delivery to customers improved 25 percent.
- **Xerox,** under assault from the Japanese, raised copier quality by two-thirds and cut manufacturing costs in half.
- The work of assembly-line operators at **Eastman Kodak** resulted in a newly-designed capping machine for 35 mm film magazines. It reduced the imperfection level from 15,000 parts per million to less than one part per billion; and increased yearly salable product $16 million — from the same production line.

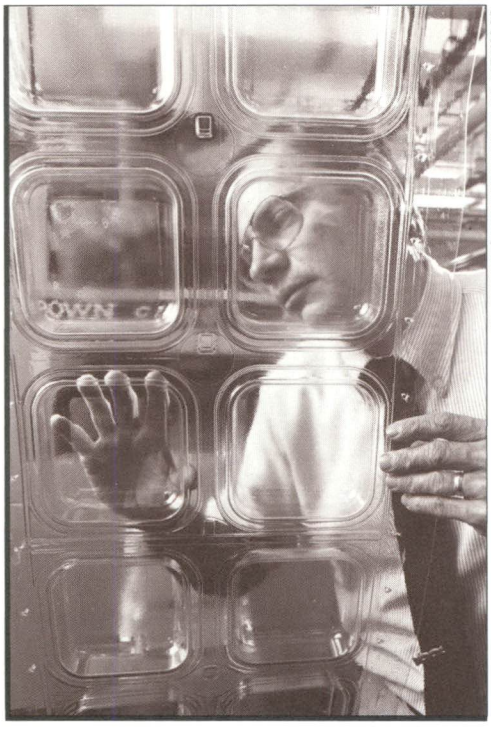
But some American products still need to be improved. Will our competitors win the quality race? Not if U.S. manufacturers continue to make sure quality tops the list of corporate priorities.

3.

Manufacturing Is Most Productive



COURTESY OF OWENS-CORNING FIBERGLAS CORP.

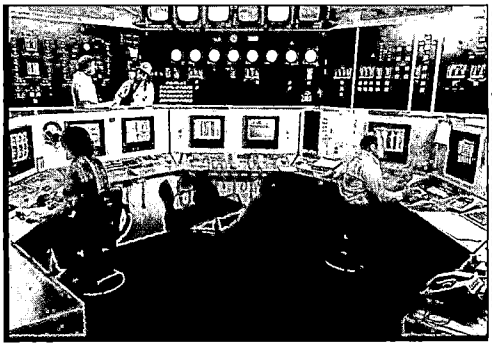


COURTESY OF GOODYEAR TIRE & RUBBER CO.

Manufacturing is where productivity enhancement can really be demonstrated. Massive restructuring and dramatic changes are paying off in spectacular productivity gains of 4 percent annually.

- Since 1982, productivity at **The Stanley Works** in New Britain, Conn., has grown at a compound annual rate of more than 7 percent. Sales per employee (in 1987 dollars) jumped from $74,900 in 1983 to $92,100 in 1987.
- Pittsburgh's **USX Corporation** now makes a ton of steel in fewer than four worker hours, down from 10 a few years ago.
- A **Westinghouse Electric Corporation** plant in Sumter, S.C., installed new equipment, formed quality circles and retrained workers. The plant has doubled sales since 1983, fills orders faster and has 14 percent of its space left for expansion.
- During the past two years, workers at **The Budd Company** in Troy, Mich., have halved the time needed for die transition at the company's steel stamping plants — without major capital expenditures.

Manufacturing employers and employees are working harder and smarter. By focusing more sharply, increasing investment, adding flexibility on the factory floor and encouraging worker involvement, American companies will continue to improve productivity.



COURTESY OF INLAND STEEL INDUSTRIES



COURTESY OF NCR CORPORATION



COURTESY OF TRW INC.

4.

Manufacturing Spurs Technology

Without new technology, the United States will never regain its lead in the world marketplace. Manufacturing genius is the wellspring of advances in technology.

FACT: Most technological breakthroughs since World War II have occurred in manufacturing: computers, drugs, chemicals, aerospace, advanced materials, telecommunications, plastics, medical instruments, etc.

FACT: Technically-sophisticated service companies depend on advanced manufacturing equipment. Without new drugs and diagnostic instruments, recent advances in medical care would have been impossible. Computers, satellite communications and fiber optics sparked the revolution in banking and financial services.

FACT: U.S. manufacturers foot the bill for more than half the nation's total research and development. Industry currently performs 73 percent of the nation's R&D.

FACT: Manufacturing employs the greatest number of highly-educated technical experts: nearly two-thirds of all U.S. engineers; more than one-third of the nation's scientists; and almost 40 percent of our science and engineering technicians.

FACT: Industry, as a whole, is the fastest growing source of financial support for university research, growing by an impressive 75 percent from 1980-85.

Our future competitiveness will depend in large measure on manufacturing's role in stimulating and rapidly commercializing our technological muscle.

CORPORATIONS FIND MANY YOUNG APPLICANTS LACK BASIC SKILLS
Scripps Howard News Service
Release date: 5-21-86
Two takes
By KENNETH ESKEY
Scripps Howard News Service

WILMINGTON, Del. -- Can you look at words like ``stregnth'' and ``defalt'' and know they are misspelled?

Can you divide $187.56 by 6 and get $31.26?

If you can't, you're not alone. At least half the high school juniors who apply for work-study office jobs at the Du Pont Co. headquarters here are unable to pass a simple, eighth grade test with questions like those above.

``A lot of students can't even spell `Du Pont,''' says Penny Goode, who supervises the hiring of about 5,000 temporary employees each year.

Predictably, she says, the boys are weakest in spelling and the girls are weakest in math. ``Some can't follow directions,'' she says.

Her view is that high school is too late to begin worrying about basic skills. ``You can't wait until ninth grade and say, `Hey, these kids can't spell,''' she points out.

Penny Goode isn't working for a fly-by-night company operating in some rural backwater. She is working for one of the nation's more technologically advanced corporations. ``We can cherry pick. We can skim. We can select the very best,'' says Richard Heckert, Du Pont's chairman and chief executive officer.

But the Du Pont experience with office hiring is a good indication of how poorly prepared many young people are for the world of work.

To call them illiterate, or even functionally illiterate, may be an exaggeration. To call them unemployable may be close to the truth.

Heckert, a rugged, plainspoken chemist whose father taught education philosophy and ran a teacher training school at Miami University of Ohio, deplores the lack of basic skills among millions of high school graduates.

A case in point: The son of a successful, well-educated neighbor bluffed his way through high school without ever learning to read. ``How could that happen?'' Heckert wants to know. ``The fact that he really could not handle reading -- and I dare say had some deficiencies in other areas -- is just almost criminal.''

Two years ago Heckert issued a report for the National Academy of Sciences in which a panel of 20 corporate executives glumly concluded that too many high school graduates lack the ``intellectual skills'' to find and keep jobs.

The report argued that vocational and technical training -- even computer training -- are no substitute for learning how to read, write and reason.

``Sure, you can get by without reading and writing well. You can get by speaking something other than the king's English,'' says Heckert, ``but you can't be a full-fledged, productive member of society without these basic skills.''

Heckert contends that lack of such skills is ``as serious as any general problem our society faces.'' It's ``almost immaterial,'' he says, to try to assess blame.

``Obviously, there are some teachers who do a superb job and some who probably shouldn't teach. There's plenty of blame for all of us. Nobody's home free. I'm partly responsible because somehow I haven't reached out and done some of those things that needed doing.''

Experts say the problem may be worsening. What we have, they say, is a shrinking pool of young workers at a time when the percentage of disadvantaged blacks and Hispanics is expanding.

Heckert suggests that young Hispanics should be immersed ``right off the bat'' in English and not be allowed to limp along in Spanish. ``Underline the word English,'' he says. ``It isn't practical to be just functional in another language.''

MORE
SHNS

3/15/89

Ms. Martin:
By coincidence I got today this copy of a 1986 interview by Dick Heckert on the need for basic skills.

D Bowes 3/15

National Association of Manufacturers

His own experience as manager of a Du Pont plant in Circleville, Ohio, convinced him that functional illiteracy is a difficult handicap to overcome. ``Sometimes we were able to train them to a level of literacy. Sometimes we simply had to give up,'' he says.

The report issued by Heckert two years ago, and a more recent report on ``disconnected'' youth by the Education Commission of the States, tend to refute the widely held notion that Americans are getting better educated all the time.

In fact, 30 of every 100 ninth graders fail to graduate with their class -- and the dropout rate has been increasing since 1968, according to figures compiled by the National Center for Education Statistics.

The dropout rate is much higher than 30 percent in some Southern states and in cities like New York, Chicago, Detroit and Washington.

``I am appalled by the extent of the problem of illiteracy in this country and by our apparent inability to stem its growth and its size,'' William Woodside, chairman of American Can Co., told a congressional committee last year.

Woodside noted that companies are spending ``hundreds of millions of dollars'' each year to operate basic skills and literacy programs for their workers and trainees.

``Various levels of illiteracy seriously reduce the pool of competent persons that businesses can hire and restricts the promotability and mobility of many of our current workers,'' Woodside told the committee.

He said the cost of illiteracy is reflected in ``low productivity, workplace accidents, absenteeism, poor product quality and lost management and supervisory time.''

Arthur Gunther, who employs 85,000 workers in his Pizza Hut chain, was so dismayed by the inability of young people to fill out job applications that he started a national reading incentive program to encourage students in grades 1 through 6 to read books.

The program, which rewards book readers with free pizzas and honor diplomas, is available this year to 7 million students, many of them in California, Texas, Pennsylvania, Florida and Ohio.

In a tight job market, lack of reading skills can be deadly.

Du Pont, which has 146,000 employees in the United States and foreign countries, has become increasingly selective in filling its Wilmington office jobs. It found several years ago that not everyone who passes an eighth grade aptitude test has the savvy to rise through the ranks.

So it decided to give high school seniors a more difficult test to see if they had the potential to become secretaries. Only 35 percent pass, and those who do are sent to nearby Goldey Beacom College for a year of part-time business courses.

The bottom line is that only about one in 10 applicants has the typing and shorthand skills to become a secretary.

Harold Flood, employee relations manager at Du Pont, is particularly disappointed in his inability to attract competent black candidates for the better secretarial jobs.

``If you could find me an applicant with the right skills, I'd give her a job, even if we had a hiring freeze,'' he says.

One basic skill that rates a high priority with Du Pont and other companies is a positive attitude toward work. In too many cases, says Penny Goode, the attitude is: ``I'm out of school now. Where's the $40,000 job?''

Richard Heckert, who feels strongly about attitudes, wants to hire people who show up on time, get along with each other and are willing

to put in long hours.

``There's no such thing as free lunch,'' he says. ``Sooner or later, you have to get off your backside and go to work.''

(Kenneth Eskey covers economics for Scripps Howard News Service.)
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Mishaps That Mothered Invention

By Bob Gatty

***Nation's Business* is observing its 75th anniversary in 1987 with an anniversary issue in September and special articles like this one in other issues.**

3M chemists Samuel Smith and Patsy Sherman saw product possibilities when a laboratory fluid, unintentionally dropped on a sneaker, kept the shoe free of soil and stains. The result: Scotchgard.



PHOTO: STEVE WOIT—PICTURE GROUP

Children around the world today try to figure out new ways of playing with the Slinky, that bouncy coil of wire that hops, skips and jumps with the slightest push. When you look at the thing, you might wonder: Who on earth dreamed up a product like that?

Actually, it was dreamed up on water. In 1943, during World War II, Naval Engineer Richard James was on a new ship's trial run. A torsion spring fell off a table and bounced. James picked it up, dropped it deliberately. It bounced again. When he got home after the voyage, he told his wife, Betty, about the incident. "I think I can do something with this," he said. "I think it will make a good toy."

James obtained a patent, and in 1945 he and Betty went into business. But nobody wanted to buy the toys, Betty James says today. "Then we took 400 of them one evening to the Gimbel's store in Philadelphia. They were in rolled-up sheets of paper with the instructions, not even any boxes. We put them on the edge of a table and knocked them off. We sold 400 in 90 minutes."

Since then, James Industries, Hollidaysburg, Pa., has sold millions of Slinkies. Betty James, now 68 and a widow, has run the company since 1960, raising six kids in the process. How much money has the Slinky produced since that evening at Gimbel's? She replies with a laugh: "Let's just say, enough."

The Slinky's story stems from Richard James' capitalizing on a mishap—seeing in a bounce after an accidental fall the potential for a new product.

Wendell Dunn, an invention buff who teaches a Wharton School M.B.A. course in entrepreneurship at the University of Pennsylvania, says it was not "invention by mistake," but "invention by serendipity" or "invention by happenstance." Dunn, a former president of the American Society of Inventors, says ability to recognize the value of the unexpected is essential to the success of invention after invention.

The Kellogg Company, Battle Creek, Mich., was born in 1894 when Dr. John Harvey Kellogg, superintendent of the Battle Creek Sanitarium, and his brother William Keith Kellogg, the hospital's business manager, were experimenting with boiled sheets of wheat. Unexpectedly called away from their laboratory, they made a startling discovery on their return the next day: Wheat dough, when placed between rollers, no longer came out in sheets, but broke into small flakes. Four years after the creation of flaked ready-to-eat cereal, the brothers marketed what would become America's best-known breakfast cereal—Kellogg's Corn Flakes.

Coca-Cola was developed in 1886 by Atlanta pharmacist John Pemberton, who was concocting a headache remedy. Rather than helping soothe pain, it turned out to help to soothe a thirst.

Scotchgard, a 3M product, is the world's top-selling protective finish for textiles, carpeting and leather. It has been adapted for wood surfaces and is turning up on wood furniture.

It all began in the 1950s at the 3M Center in St. Paul, Minn., when a laboratory assistant spilled a substance being developed for aircraft use. Fluid landed on one of her canvas sneakers. She noted not only that it was almost impossible to remove, but also that the wet canvas resisted soil and stains and stayed cleaner than the rest of the shoe. Patsy Sherman and Samuel Smith, chemists in the lab, thought there were product possibilities in the fluid, and research convinced them.

They are Scotchgard's co-inventors. Spurred by their findings, 3M established a program to develop the substance's capabilities and in 1956 launched it commercially. At first its use was limited to apparel, rainwear and upholstery. Today more than 25 formulations are used in manufacturing or by the consumer.

Crucial to Scotchgard's success was the ability of Sherman and Smith to see the product potential when that chemical was spilled on the lab assistant's shoe. Without such perceptiveness, there would be no Scotchgard for carpets, for furniture, for clothing, for anything.

The same is true of another 3M product, Post-it Notes. Spencer Silver, a 3M

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Wendell Dunn

Some of the most successful products in history have resulted from mishaps that meant opportunity to creative thinkers.

For Betty James, a torsion spring's accidental bounce has led to sales of millions of Slinkies.



PHOTO: ROBIN ROMBACH

scientist, was looking for a superstrong adhesive in 1970. Instead of coming up with one, he developed an adhesive that was superweak. Nobody could figure out what to do with such a glue until one 1974 Sunday when Art Fry, a research chemist colleague of Silver's, was singing in the choir at St. Paul's North Presbyterian Church.

Fry always had a heck of a time keeping his place in the hymnal. He would mark the pages with little slips of paper before the service began, but some would always fall out—so that when he got up to sing, he couldn't find his songs. This time, Fry got to thinking about Silver's glue that would just barely hold a piece of paper to another. Why not use it for bookmarks?

He made samples, daubing them with some of Silver's glue, and used a couple for notes in which he explained his idea to his 3M colleagues.

"Then it dawned on us," Fry recalls, "that the broad application was for notes—not bookmarks." Fry papered colleagues at 3M with samples, drumming up support, and by late 1975 the product was an in-house hit.

"We had to work out some bugs," Fry recalls. For example, when the paper was stuck down and then lifted up again, some glue stayed behind. "That was one reason people didn't like it in the beginning," Fry says.

By 1977, manufacturing techniques had been worked out, and Post-it Notes were test-marketed in four cities. The product flopped. But 3M marketing experts noticed that in areas where office supply stores offered samples, Post-its sold well. So in 1978 Boise, Idaho, was blitzed with introductory dealer kits, heavy advertising and personal sampling. There were immediate results.

"Not since we introduced Scotch Brand Magic Transparent Tape more than 20 years ago have we had a product that is so simple, yet so amazingly versatile," says Chuck E. Harstad, vice president of 3M's commercial tape division.

Fry acknowledges today that the product succeeded because 3M people not only were able to recognize its potential, but also to effectively market it.

That, says Dunn, is where all too many inventions fail. "Inventors come up with a product, but they can't carry it through," he explains. "It takes very different kinds of people to develop a new product and then find a place for it in the marketplace."

Dunn likes to tell the story of GORE-TEX, an expanded use of Du Pont's Teflon. In 1958, W.L. Gore resigned from Du Pont, where he headed operations research. The company had decided against getting into end-use aspects of Teflon, and he wanted to spend full time developing uses for the product. He set up shop with his wife in the basement of his house in Newark, Del., to develop interconnecting wiring for computers and other electronic devices using Teflon as the insulation.

Gore's son, Bob, who went to work for his dad after getting a Ph.D. in chemical engineering, spent months in 1969 slowly and painstakingly stretching and pulling Teflon—trying to create a strong filament capable of being woven. One day, frustrated, he jerked a rod of extruded Teflon, intending to break it. Instead of breaking, it stretched and became strong and porous. That was the key to making expanded Teflon, now called GORE-TEX.

Computer signals travel up to 90 percent of the speed of light on GORE-TEX fibers—compared with 70 percent on solid Teflon—increasing data processing capacity. Microwave guides using the product are being made for satellite communication and in defense systems to produce laser beams of microwave energy. Placed in the human body, GORE-TEX reduces rejection reaction, thus increasing the success of implants of artificial arteries and ligaments and of catheters. GORE-TEX fabrics are used in rainwear, skiing clothes and running wear.

The base product, Teflon, was also discovered serendipitously—in 1938 at a Du Pont laboratory—by Roy J. Plunkett, who was named recently to the National Inventors Hall of Fame.

Plunkett was experimenting with gases to find a new fluorocarbon refrigerant. He and his associates noticed that gas in a cylinder that had been stored in dry ice had polymerized spontaneously into a white, waxy solid. Further testing showed that the solid was resistant to practically all chemicals, was not affected by temperature extremes and was extremely slippery.

"It did not occur to me right away what possibilities the material might have," says Plunkett. "That had to wait for some lab tests."

Today Teflon fluorocarbon resin is used in cookware, wire insulation, automobile gaskets, space suits, even in buildings. The Pontiac Silverdome, home of the National Football League Detroit Lions, has a 10-acre glass fabric roof covered with Teflon. New York City's subway cables are insulated with Teflon.

"Frequently," says the Wharton School's Dunn, "somebody will be in a situation where something doesn't work the way it's supposed to. Then he starts thinking, 'I could do this with it or that with it.' Sometimes, that's where it all begins." NB

To order reprints of this article, see page 69.

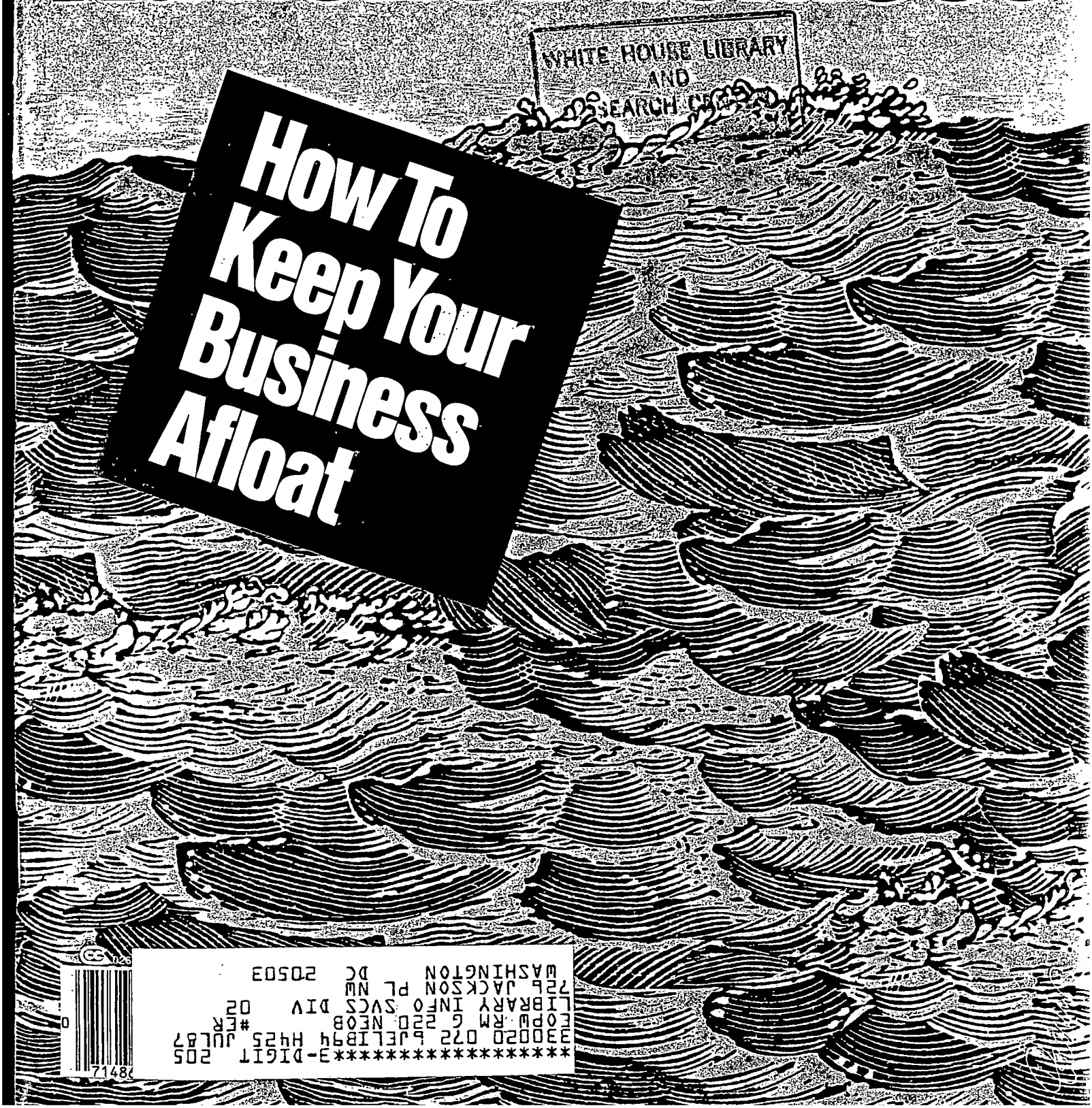
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Quizzical eccentricities:
Are you as mad as a great inventor?

GAMES

By Scot Morris

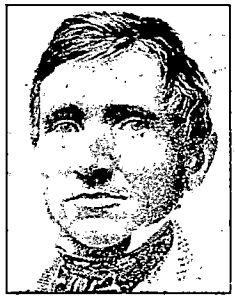
The light bulb, the telephone, and the phonograph are such ordinary parts of our lives that we take them for granted. Their creators, however, took *nothing* for granted. Eccentric individuals with peculiar visions of the world, they entertained ideas that others considered radical or just plain crazy, concludes Bryan Mattimore, a new-products consultant in Stamford, Connecticut.

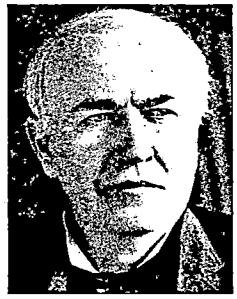
"Great success comes only to those willing to risk great failure," says Mattimore, who has studied inventors' lives for a creative-thinking seminar he conducts.

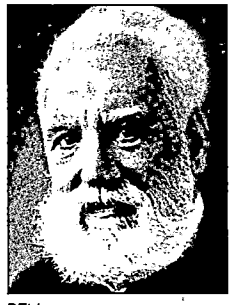
Devising a multiple-choice test concerning inventors, Mattimore mixed their truly bizarre ideas with a few of his own. He gave *Omni*'s edited version to members of the Inventors Association of Connecticut (IAC) and to a group of gifted seventh graders. One point was awarded for each correct answer, with a maximum score of 12 points. The scores among IAC members ranged from 0 to 8, with an average score of 3.9. The students did better: The average was 4.4, with a low of 3 and a high of 6. What surprised us was the frequency with which the correct answer turned out to be the one considered least likely.

If you have the courage to risk failure, try this quiz. Mark +1 beside your first choice as the answer to each question, and −1 beside the one you think is most probably false. Then total your results: Give yourself one point for each correct answer; subtract a point every time your "false" choice turns out to be the right answer.


DIESEL


GOODYEAR

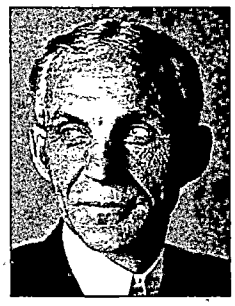

EDISON


BELL


BORDEN


EASTMAN


HALL


FORD

Of 34 IAC members who were asked to score their choices for each question in the same way, only 14 registered positive totals. The average was just a little better than −1. The best score was +5; the worst, −7. If you score lower, don't be ashamed. Perhaps your thinking is so eccentric, so far beyond the ordinary, you might have what it takes to be one of "those crazy inventors," yourself!

GREAT ECCENTRICITIES

1. As part of his grooming regimen, Henry Ford would:
a) add particles of sand to his toothpaste to increase its abrasive, tartar-removing qualities.
b) dye his hair with rusty water.
c) keep the balls of his feet soft by applying a coating of his own saliva to them nightly.

2. Thomas Edison proposed to his second wife by:
a) recording the marriage proposal on his newly invented phonograph and playing it for her during a candlelit dinner.
b) tapping out the proposal in Morse code, from his hand to hers.
c) making a movie of himself proposing on bended knee.

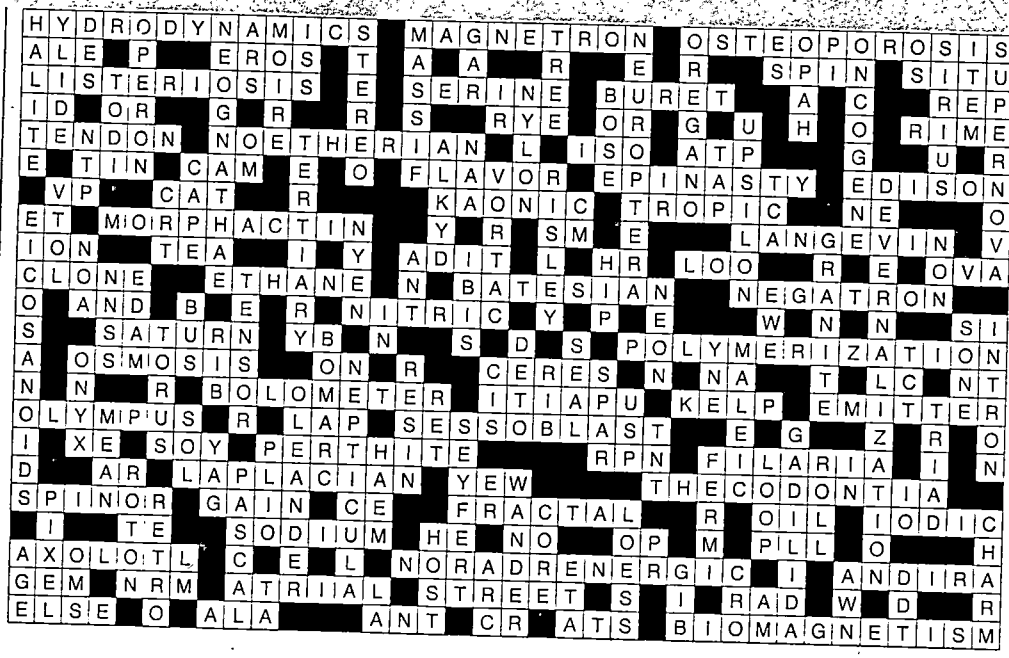
3. Because he thought it would benefit his health, Ben Franklin would:
a) walk barefoot through the mud, believing it helped pragmatic thinking.
b) drink water only from a glass container that had been left out in the sun for hours.
c) take "air baths" by sitting naked in front of an open window and inhaling deeply.

4. Nikola Tesla, who invented the alternating current (AC) motor, once tried to invent a device that:
a) diagnosed people's health by electronically reading their auras.
b) elicited memories when applied to various parts of the head.
c) photographed thoughts on the retina of the eye.

5. George Eastman, inventor of the Kodak camera:
a) was a supporter of the 13-month calendar.
b) took a photograph of himself every day from age thirty-one to seventy-two.
c) invented a camera that when swallowed by cows took pictures of each of their four stomachs.

6. As a health precaution, Alexander Graham Bell:
a) covered his ear with gauze every time he used the telephone.
b) covered the windows in his home to block out the harmful rays of the full moon.
c) drank his own urine.

7. Edison was convinced



a) the Germans were using a "thought ray" during World War I to control President Woodrow Wilson's mind.
b) there were submicroscopic entities, or "little people," living in his brain.
c) he would someday invent a pair of "electronic goggles" to see into the future.

8. Vulcanized rubber inventor, Charles Goodyear:
a) considered making rubberized water beds for the ill.
b) proposed that newspapers be printed on rubber.
c) foresaw rubber parasols, rubber carpets, rubber blackboards, and even rubber bank notes.
d) all of the above.

9. Milkman Gail Borden:
a) had his tomb built in the shape of a condensed-milk can.
b) tried to sell condensed cow's blood as an ingredient in a salad dressing.
c) filled a public pool with milk to promote the idea that milk baths were good for the skin.

10. Charles Hall, who invented a practical way to produce aluminum, theorized:
a) a daily diet of seaweed could cure asthma.
b) aluminum eyeglass frames would enable the wearer to better predict the weather.
c) tobacco had snuffed out creative impulses during the previous 200 years.
d) all of the above.

11. Alexander Graham Bell:
a) tried to get his dog to talk by teaching it to growl as he manipulated its mouth.
b) charted the vibrations of his own voice on a piece of smoked glass by talking into a mounted ear with a piece of hay stuck in it.
c) recommended that aspiring inventors reflect a *smell* and measure its velocity of transmission.
d) all of the above.

12. Hating unnecessary suffering, Rudolf Diesel once invented:
a) an ammonia bomb that would confuse the enemy instead of killing him.
b) an adhesive-wire fence as an alternative to barbed wire.
c) a bog-creating mud plow to trap soldiers in the mud instead of shooting them.

Answers appear below.

CROSSWORD RESULTS

The entries for last November's *Omni*–McGraw Hill Crossword Puzzle poured in. After each was reviewed, the grand prize- and three first prize-winners were randomly selected from an impressive 24 perfect scorers. The fact that the clue for number 120 across was incorrectly labeled 118 had little effect on our readers' ability to complete the puzzle (left), based on information in our grand prize, the sixth edition of the *McGraw-Hill Encyclopedia of Science and Technology*.

Our grand prize goes to Donnell Tinkelenberg of Santa Rosa, California. Our three first prize-winners—Roger J. Dornberger of Saline, Michigan; John and Amy Pearson of Austin, Texas; and William Sales of Marion, Illinois—each receive the *McGraw-Hill Concise Encyclopedia of Science and Technology*, worth $98.50.

We originally announced there would be *five* runner-up prizes, but we think anyone getting a perfect score deserves to be rewarded. So each of the following receives $25: Sheila Bishop, Youngstown, Ohio; David Czarnetzki, Belgrade, Montana; Cynthia Destaffany, Friday Harbor, Washington; Walter Dragon, Bristol, Wisconsin; Suzy Lewis Ewell, Colorado Springs; David Fowler, Gaithersburg, Maryland; Cindy Garletts, Bridgewater, Virginia; Rita Garletts, Harrisburg, Virginia; Terry Garletts, Bridgewater, Virginia; Maude Kerby, Midlothian, Virginia; James MacDonald, Elkton, Maryland; Glen Martin, Eau Claire, Wisconsin; Thomas Reynolds, Tampa; Don Rickenbaugh, Energy, Illinois; Michael Roa, Sebastopol, California; Eric Tentarelli, Andover, Massachusetts; Ann Thomas, Ames, Iowa; Keith Thomas, Rapid City, South Dakota; Je Yackovich, Naperville, Illinois; Richard Youngblood, St. Louis, Missouri.

ECCENTRIC ANSWERS

1-b, 2-b, 3-c, 4-c, 5-a, 6-b, 7-b, 8-d, 9-a, 10-c, 11-d, 12-a

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NUCLEAR RENAISSANCE

REACTORS ARE BACK AND REACTIONS ARE GOOD

SACRED ARCHITECTURE OF THE NEW AGE

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"When I had 1,900 models, I knew every one by its first name," says Petersen, showing off favorites in his Beverly Hills living room.

HAVING COLLECTED 40,000 WACKO GADGETS, CLIFF PETERSEN IS PATENTLY ONE BIG MOTHER OF INVENTIONS

Collectors

Cliff Petersen figures he knows a good idea when he sees one. Like a rocking chair with a built-in 10-note accordion so that "if you know a tune with 10 notes or less, you can put everybody to sleep." Or a combination bootjack-burglar alarm that'll remove your Wellingtons at night, then thwack your bedroom door should a burglar try to intrude. Or a fire alarm with springs and wires that strike a match that lights a gas jet that produces a flame to alert you to the fact that there's a blaze in your bungalow—provided you haven't been fricasseed in the meantime, of course.

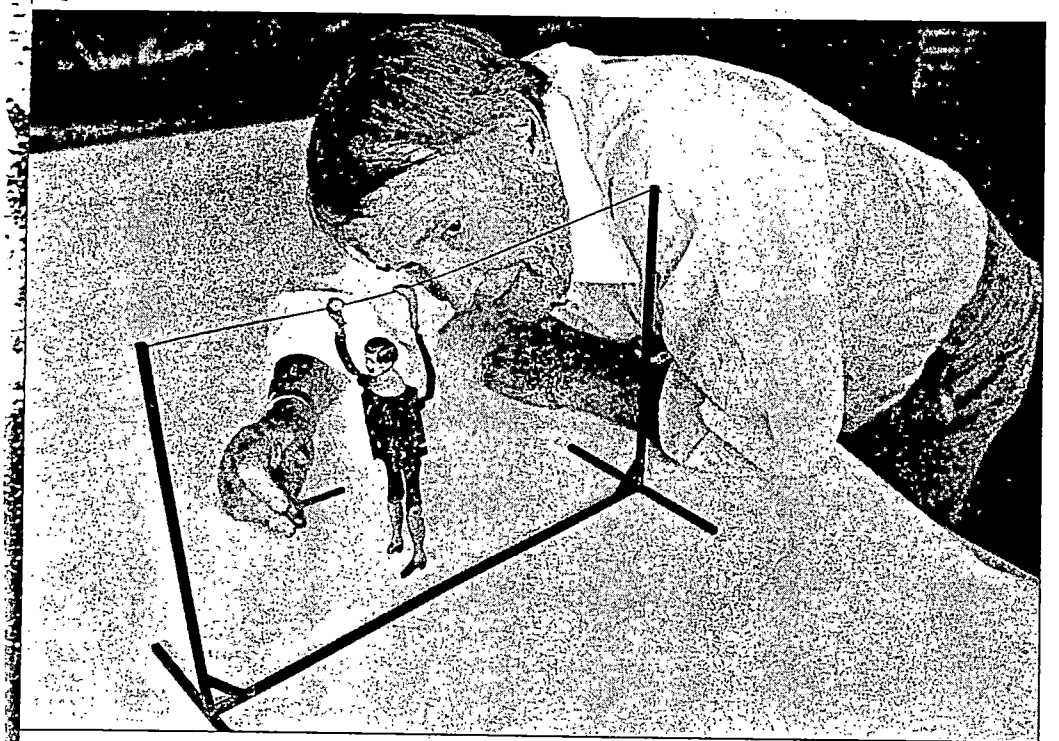
Petersen, a wealthy engineer of 65, has collected 40,000 good ideas like these, many of them stashed in his 15-room Beverly Hills home. They are scale models that had been submitted, as required by law until 1878, to the U.S. Patent Office as working illustrations of new inventions. Petersen's aging artifacts represent the largest single collection of patent models in the U.S., more than three times the size of that owned by the Smithsonian Institution. Some folks call the Smithsonian "the nation's attic"; that's probably because they haven't seen Petersen's attic.

Among Petersen's oddities are 1,200 different model washing machines, 38 types of typewriter, 300 kinds of curtain rod and 23 pieces of funeral equipment (including a refrigerated coffin, presumably for use when there may be considerable delay before interment). There's also a billiard table side rail co-designed by tire man B.F. Goodrich, a cavalry saber holder invented by Confederate Gen. Jeb Stuart, a "Carbonizer for Electric Light Filaments" from Thomas Edison and a half-size all-wood model of the now-famous Gatling gun.

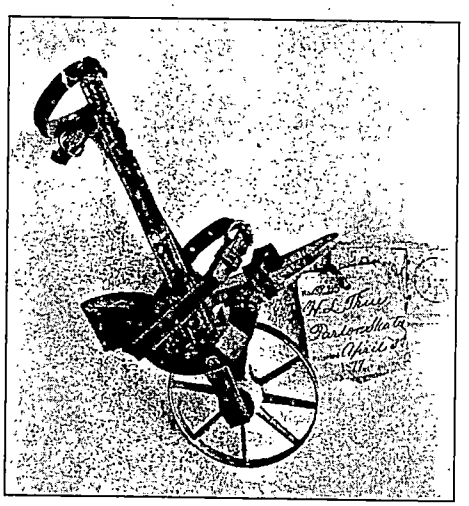
Before the turn of the century, some 200,000 such models had been sent to and displayed at the Patent Office in Washington, D.C. Then in 1876, a massive fire destroyed about half of them. The surviving models proved too expensive to maintain and store, and so in 1926 thrifty Calvin Coolidge ordered the remainder sold off. The Smithsonian took some, independent retailers scooped up others, and finally in 1942 an auctioneer couple bought the last 50,000 with plans to open a museum.

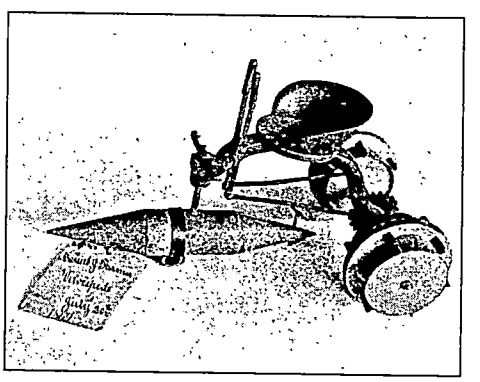
The museum never happened, and 30 years later the couple began selling off samples in small lots. In 1979 Peter-

Photograph by Curt Gunther



Playing with a "Wire-Walker" model made in 1876, Petersen proudly proclaims, "You could sell these toys today."





The 1869 "Velocipede" (above) was a design for an amphibious vehicle, while the 1877 prototype (left) was one visionary's notion of a single-wheel roller skate.

Collectors

sen spotted their tiny ad in *Smithsonian* magazine offering "original U.S. patent models for sale." Says Petersen: "When I found out some were being listed for well under $100, I put in a bid of $25 and got 12 of them." He didn't realize it immediately, but an addiction had begun. "I couldn't believe it. Here were the original tags; these were the actual models that had been sent to the Patent Office!"

Over the next six years Petersen acquired about 1,900 of the couple's models at auctions and set about restoring some of them to original condition. While his son, now a 24-year-old computer science major at Arizona State, and his late wife helped with the restorations, Petersen made some shrewd sales to help support his habit. For $15 he bought the model for a "Pickle-Sorter" invented by J.H. Heinz (brother of the more famous H.J.), then sold it to the Heinz company for $450. After that transaction, " 'Boy', I thought, 'I've got a winner,' " says Petersen, who quickly anted up $500,000 for the rest of the auctioneer couple's extensive collection.

Raised in Queens, N.Y. (his father was a Norwegian-born shipwright, his mother a housewife), Petersen recalls starting the collecting habit early with "odds and ends, stamps and coins and a few mechanical things." After earning a civil engineering degree from Manhattan's Cooper Union, he helped design jet engines for the defense industry and even invented an artificial larynx but had no luck marketing it. In 1955, bankrolled with money acquired in a venture into land developing, he founded his real "profit-making business," an engineering consulting firm that now "rents engineers to the aerospace industry."

Petersen has now left the running of his company to a longtime partner while he concentrates on his mania for models. Those that aren't in storage in New York—where three full-time assistants have been cataloging them on a computer—fill the servants' quarters over his four-car garage and clutter almost every corner of his house. Even his kitchen provides space for a model bib holder, a fly-shooing device, an old ice-cream maker and a doll-size contraption for cutting and "panning" (removing) cakes. "Everything in the collection is unique," says Smithsonian consultant Robert Johnson, an expert on 19th-century technology. "Many of these things never went into production and remained forever just dreams of their inventors."

Sometimes for good reason. Consider "Dr. Brown's Electro-Vapor Medicated Bath," which promised to cure all ailments by adding an electric current to a sit-in steam bath. Or Warren Wasson's "Teeter-Totter Shower House" in which, the inventor claimed, "a normal-size person and four children, aged, respectively, 9, 8, 6, and 4, have comfortably bathed at the same time."

Petersen admits that his fascination with such would-be wonder products has become "a hobby gone awry." Says his second wife, Diane Bueché, who separated from Petersen two years ago and now owns a Eureka, Calif., bakery: "As long as there was a scattering of them, it was extremely pleasant and very interesting. It was a real conversation piece. But as the collection grew, it was just overwhelming. They were literally everywhere. I could live comfortably with 500. But 40,000? That's a lot of little toys."

Although a Japanese consortium has offered him $15 million for the lot, Petersen wants to sell his models to museums and libraries in the U.S. in hopes of inspiring future Edisons. But sell he will, one way or the other. "I have been working 80 to 100 hours a week," says Petersen, just a bit wearily. "It's really time for someone with greater resources to do something with the collection."

—Ned Geeslin, and Stanley Young in Beverly Hills

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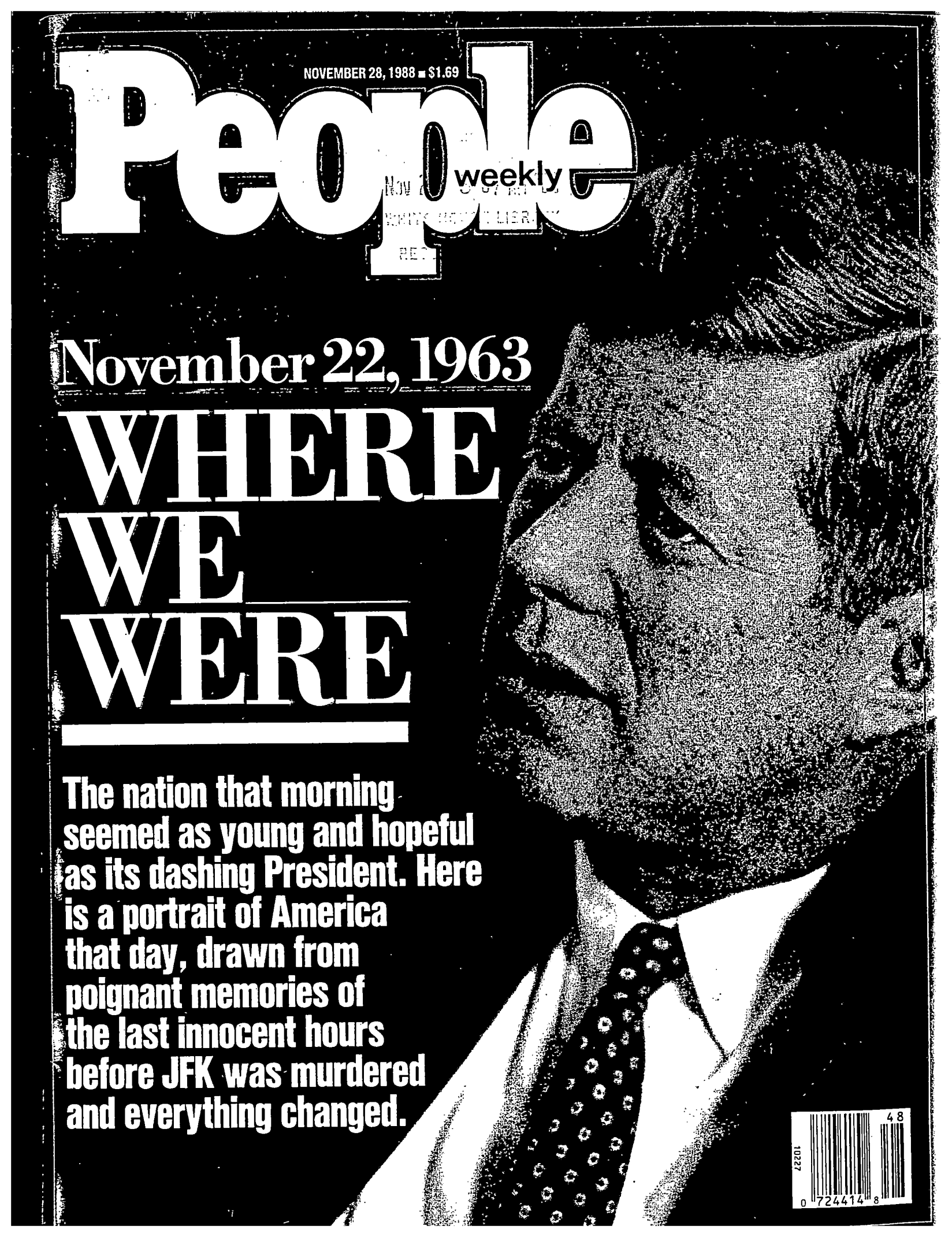
People weekly

Nov
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November 22, 1963

WHERE WE WERE

The nation that morning seemed as young and hopeful as its dashing President. Here is a portrait of America that day, drawn from poignant memories of the last innocent hours before JFK was murdered and everything changed.



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Mosbacher — prior to lunch — Head Table
Brady — morning — w/ Pres
Dole — TBD
Alexander [Sandy] Trowbridge
Quayle — Previous Day

(Lange/Martin)
March 17, 1989
5:45 p.m.

PRESIDENTIAL REMARKS: NATIONAL ASSOCIATION OF MANUFACTURERS
WASHINGTON, D.C.
THURSDAY, MARCH 23, 1989

Advance does walk thru at 10:45 or 3-20 → Dignitaries

↳ Heckert - doing intro

Thank you, [Dick]. You know, I understand a few of you were concerned about the 1984 Trade Report, heralding the arrival of the "post-industrial" society. And I have to confess, that whenever anyone talks to me about some "post-industrial" society, (I have doubts of my own.)

(TRENDS) → Washington Economic & Policy Trends Aug. '87

Would such a place get along without plumbers, for instance. And if such a society could exist, I wonder if either its pipes or its theories would hold water.

For now, I'm willing to bet my last dollar on manufacturing in America. At least until somebody can show me how to wear a piece of information, or parallel-park a concept.

Karen Horowitz 272-5221 Charles Brown 272-5383 Karen's Boss

BLS → American manufacturing has been -- and continues to be -- the backbone of this economy. It's been estimated that every new manufacturing job creates three other jobs here at home.

supporting ? → Very iffy. Could be overseas.

Colby Chandler CEO Kodak The Case for Manufacturing in America's Future

David Dewes 523-6094 Policy DOL

I've been a great admirer of the export-driven, rust-belt renaissance you've kicked off. Last year, the merchandise trade deficit dropped by a fifth. Exports surged to an all-time high. And manufacturing productivity is also now at record levels. The

quality of American exports is arguably better than it has ever been. And in terms of sheer output, American factories have never done better.

Now, there's a lot of talk about competitiveness going around these days -- and these facts and figures are all ways of measuring it.

But competitiveness is more than just the latest trade figures, the latest quarterly earnings -- or the latest poll, the latest election, or the latest Nielson ratings, for that matter. Surely our success can be measured by better methods than these. In your industry, as in mine, this may be a good time for us to look toward a longer horizon.

We stand at a special moment in American history. We are prosperous... and we are at peace.

At such a point, we are empowered -- even required -- to set our sights higher. To look farther ahead. It is a time to make choices. A time to answer those questions that will have the farthest-reaching impact on our success as a society.

The 21st century is less than a dozen years away now.

You've called this conference "The New Leadership Summit." Well, whatever else you think about leadership -- or vision, for that matter -- it's not lofty rhetoric, charisma, or clairvoyance.

No, it may be as simple as understanding where an organization finds itself, right now; seeing where it wants to go; and knowing how to get there. Above all, it's playing the long game, whatever the odds -- and playing for keeps. So today I'm like to outline my agenda for the next American century.

To build a better America, one of the most important priorities for this government will be to build savings and long-term investment -- and get our fiscal house in order. This means, first off, bringing down the deficit.

Last month, I submitted a budget to Congress with a clear agenda to cut the Federal deficit, and enhance business' ability to plan, expand, and build. My friends, next year alone, Federal tax revenues will rise by more than $80 billion -- and yes, here I go again -- with No New Taxes. Our plan will hold the line on spending, using that revenue to slash the deficit by more than 40 percent -- bringing it down below the mandated targets.

To encourage long-range investment and entrepreneurship in businesses of all sizes, it's time we restored the capital gains differential. This is another case where less means more. More

revenue to the Federal government -- $4.3 billion more, according to Treasury estimates. More savings, and more investment. More competitive, flexible businesses. More opportunities for innovation. And more jobs for all Americans.

This is no tax break for the rich. It's a fair shake for America.

To spur investment in basic research, we've proposed a permanent extension of the research and experimentation tax credit. A 13 percent increase for science and technology programs. And we intend to stay on track in our effort to double the National Science Foundation's budget by 1993.

To support capital formation, we will encourage personal savings, and restore the integrity of our nation's savings and loans institutions. Our plan has been well-received on both sides of the aisle on Capitol Hill -- and I've asked for action within 45 days.

We want to ease the pressures now building on the most important organization in America -- the family -- by promoting choice on issues like child care. So last week I sent legislation to Congress that puts money and options in the hands of parents, rather than bureaucracies. Our plan empowers all families: dual earners, single parents, those who choose to

remain at home; those who prefer informal, neighborhood arrangements; and especially those on low incomes, struggling to be self-sufficient.

Lasting self-sufficiency, of course, means quality education. And I see education as long-range planning at its best -- a solution for the next century, for problems we haven't even begun to recognize yet. It is an essential key to our competitive future. Let no one suggest that education is a minor matter on the national agenda. It is vital to everything we are, and can become.

But there are no quick fixes here, either. No stop-gap solutions. Like most of the long-term issues on the national agenda, American education won't be fixed with a bolt of lightning here, a puff of smoke there. It will take collective effort at all levels, public and private, to get it right. Those businesses that are involved with local schools -- developing the workforce at its source -- are making fail-safe investments. And they stand to reap the greatest rewards.

For those workers already on the line, we must build new skills and flexibility as jobs change. By one estimate, 75 percent of all people now working will need some kind of retraining before this century is over. The NAM policy position you adopted last year said that "investment in human resources is

at least as important as investment in equipment and technology." And you're absolutely right.

The astounding gains in productivity you've already achieved can be pushed still higher -- but we'll have to look beyond upgrades to plant and equipment. Ever since the 1930s, machine capital has contributed only about 20 percent to productivity. Most of this country's productivity improvements -- and most of our growth in national income -- have been directly linked to labor quality: and that means training, and retraining.

I'm reminding you of something you already know: machinery and technology alone don't improve productivity. People do.

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1.) Since 1948 capital investment has been responsible for about 36% of growth of output

Since 1948, investment in plant and equipment has been responsible for only about 36 percent of growth in ~~productivity~~ output.

Any long-term agenda must ask how we can leave the earth we've inherited a little better than when we found it. And, you know, this is no political litmus test. I think of Teddy Roosevelt as one of the great conservationists -- one of the great environmentalists. Our grandchildren should be able to fish on the same lakes we've enjoyed.

The time has come to set aside the partisan approach to these enormous environmental questions. We must devise a global answer to the problem of ozone depletion and global warming. We intend to make rapid progress on acid rain, and see that a new clean air bill is produced. And we've already broken ground in joining with other nations to call for the elimination of CFCs -- as well as adopting a tough new policy on the export of hazardous waste.

In this agenda for a new American century, I've asked you to consider a broad vision: long-term savings and investment; support for the family; education and retraining; stopping drugs; and cleaning up the environment. But we must rely on more than legislation.

We must rely on the dynamic spirit that is America. The spirit that says: Houses should not stand empty, while people lack shelter. Jobs should not go unfilled, while young men and

women stand idle on street corners. No one should go hungry, in the richest nation on earth.

We must promote local efforts to assure that every American can seize a share of prosperity -- and help to create more of it. Whether through the constellation of local community groups already at work -- or through new ideas, like our program for Youth Engaged in Service -- we will rely less on the collective wallet, and more on collective will.

But this does not mean lowering our sights, or our expectations. Just the opposite. In an era of tight budgets, we are not going to simply "make do with less." We're going to learn how to do more with less -- and do it better.

Yes, we are prosperous. And we are at peace. But such quiet moments often become pivotal in a nation's history.

My friends, the choices we make now will determine whether the door to the next American century is closing -- or opening wide, for all who dare to dream.

Thank you. God bless you. And God bless America.