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THE MANUFACTURING INDUSTRY

**MANUFACTURING INDUSTRY STUDY
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MANUFACTURING

ABSTRACT

The United States (US) is the world's largest producer of manufactured goods, enabling the military and other government agencies to meet national security requirements while employing millions of Americans. The manufacturing sector is comprised of disparate sub-sectors that compete domestically and globally. The Manufacturing Seminar visited manufacturers specializing in the production of goods from battery and body armor production to automobiles and ships. We met with domestic and foreign industry leaders, academic institutions, and research organizations, and learned that the sector's breadth and diversity make it difficult to obtain consensus and direction for the industry as a whole. Nevertheless, most US companies face similar challenges: high structural costs, increased foreign competition, and inadequate US trade, tax and monetary policies. These challenges have contributed to a decline of the sector's dominance from previous decades; however, it remains relatively healthy and productive. Our national challenge is to protect sub-sectors we must retain for national security and to devote our remaining resources to sectors where we are most competitive (e.g., nanotechnology, biotechnology, etc.). This paper summarizes the Seminar's research, defines manufacturing, and describes the current conditions of, challenges, and outlook for the industry. It also addresses the roles and responsibilities of government, industry and academia (to include recommendations). The paper includes four essays and provides a conclusion that discusses US competitiveness and national security. While manufacturing contributes less to US employment and the Gross Domestic Product (GDP) today, it will continue to be a vital sector for the economic health, and consequently, the national security of our nation.

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PLACES VISITED

Seminar Briefs:

Defense Contract Management Agency
Defense Logistics Agency
National Association of Manufacturers
National Council for Advanced Manufacturing
National Institute of Standards and Technology
National Science Foundation
McNamara & L'Heureux, P.C.
South Korean Embassy Brief
Tompkins Associates
US Department of Commerce

Domestic Travel:

Boeing Company, Decatur, Alabama
East Penn Manufacturing Company, Lyon Station, Pennsylvania
Ford Motor Company, Norfolk, Virginia
Milton Steel, Milton, Pennsylvania
NASA Marshall Space Flight Center, Huntsville, Alabama
National Institute of Standards and Technology, Gaithersburg, Maryland
Northrop Grumman Newport News Shipbuilding, Newport News, Virginia
Pennsylvania State University, State College, Pennsylvania
Point Blank Body Armor, Inc., Pompano Beach, Florida
Pratt and Whitney, West Palm Beach, Florida
Protective Materials, Miami Lakes, Florida

International Travel:

General Electric Healthcare, Beijing, China
Honeywell (Aerospace, Automation Controls, R&D, Transportation), Shanghai, China
Hyundai Heavy Industries (Ship building), Ulsan, South Korea
Hyundai Motors, Ulsan, South Korea
Inter-Max, Hong Kong
Korea Industry Brief by Korea Institute for Industrial Economics and Trade, Yeoksam-dong, Seoul, South Korea
Samsung Electronics, Suwon, South Korea
US Embassy Country Brief, Beijing, China
US Consulate General Brief, Hong Kong
Joint US Military Assistance Group Brief, South Korea

INTRODUCTION

"The tragic flaw in free trade is that only the US practices it." -- Wilbur Ross, US economist.

"The United States (US) is the world's largest producer of manufactured goods. Standing alone, the US manufacturing sector would represent the fifth-largest economy in the world – larger than China's economy as a whole."¹ The manufacturing sector enables the military and other government agencies to meet US security requirements while employing millions of Americans. While its contribution to employment and the Gross Domestic Product (GDP) is declining, manufacturing will continue to be a vital sector for the economic health, and consequently, the national security of this country. Manufacturing makes the US an economic powerhouse and leader in the global economy.

The manufacturing industry is not as dominant as it was in previous decades. At a crossroads, the sector lacks leadership and consensus on which way to focus its efforts. Manufacturing spans the spectrum from "no-tech" to "high-tech." The US's legacy-based, manual processes are struggling due to noncompetitive practices, high structural costs, and decades of inadequate trade, tax and monetary policies. These conditions have made domestic products expensive and have driven some firms to relocate overseas. Increased foreign competition has compelled US manufacturers to develop efficiencies that have resulted in higher output with fewer employees. Innovation, leveraged by science and technology (S&T), has created opportunities within the manufacturing sector.

This paper summarizes the Manufacturing Seminar's research, defines manufacturing and captures the current conditions, challenges, and outlook of the industry. It provides conclusions from our domestic and international travel, including China, which is quickly becoming the major global competitor to US manufacturing. It also addresses the roles and responsibilities of industry and the US Government (USG), includes four individual essays, and provides a conclusion about US competitiveness and national security.

THE INDUSTRY DEFINED

Due to the breadth and diversity of manufacturing, precisely defining the sector is not possible. The Standard Industrial Classification System and the North American Industry Classification System differ in their definition of the term manufacturing.² From research, the Manufacturing Seminar defined the sector as follows: "manufacturing includes establishments (e.g., plants, factories, or mills) engaged in the transformation of materials into new products."

CURRENT CONDITIONS

General: The US manufacturing industry is generally healthy and continues to recover from the 2000 economic downturn while forging its future role in the international market. From the early 1990s through 2003, manufacturing contributed 22% to US growth.³ In contrast, by 2004 manufacturing accounted for only 13% of US GDP, but also accounted for 11% of all US employment.⁴ Because of the importance of manufacturing to the US, the industry will continue to influence the US economy and standard of living.

Contribution to GDP: Manufacturing is a critical element of US GDP, to which it contributes both directly and indirectly. According to the Department of Commerce (DOC) Bureau of Economic Analysis (BEA), every \$1 spent on a final good contributes \$.55 of GDP in the manufacturing sector and \$.45 of GDP in the non-manufacturing sector.⁵ As an aggregate percentage of GDP, the total goods production (including mining and agriculture) share was up to 39.4% in 2000. That share is even higher than in the 1940s and 1950s.⁶

Manufacturing contributes indirectly to GDP in various ways. For example, a recent University of Michigan study concluded that every direct automotive manufacturing job created more than 6.5 “spin-off” jobs (e.g., trade, service, and indirect manufacturing).⁷ Manufacturing, together with non-manufacturing industries linked directly to manufacturing, account for about 45% of GDP and 41% of national employment.⁸ Therefore, manufacturing is not just an industry that provides jobs, but also a multiplier that fuels the entire economy.

Productivity: “Productivity is the amount of output produced (per person, per time period) by a unit of input.”⁹ From 1977 to 2003, productivity in the economy rose 53%; manufacturing productivity rose 109%. The 2004 year-end US manufacturing productivity levels rose 4.9%, as output grew 4.8%.¹⁰ Historically, the US has led all countries in the absolute level of productivity, both per hour and per employee. This fact has enabled the US to maintain a labor cost advantage despite the higher wages/benefits paid to US workers. While prices in the overall economy have increased over 140%, prices of manufactured goods increased only 60%.¹¹ (For a description of process improvements undertaken by US manufacturers to improve their efficiency, refer to the essay by Lieutenant Colonel Dawson Oslund and Ms. Janet Calahan)

Output: Manufacturing output experienced a 4.3% average annual growth rate from 1995-2000, with durable goods maintaining a 6.8% average annual growth rate over the same period. Output took a sharp downturn in mid 2000 and continued for 18 months with an annual rate of -4.6%.¹² However, current forecasts predict a 3.3% average annual growth rate, faster than the 2.3% growth between 1992 and 2002.¹³

Capacity: Recent US Census data shows a steady increase in manufacturing plants’ capacity utilization since 2002. Three out of four plants (76.7%) report that total production output (unit volume) increased in the last 12 months, and just 13.1% indicate that volume decreased. The average output 12-month change, based on grouped data, was a 7.9% increase. Plants in the automotive, construction and pharmaceutical/biomedical value chains reported the highest capacity (75%), and plants in the aerospace defense chain reported the lowest capacity (60%). The high-tech value chain shows a year-to-year volume increase of 22% points.¹⁴

Employment: US manufacturing jobs have been in a steady decline for the last 35 years at an average rate of .4% annually.¹⁵ The economic downturn of 2000 compelled US manufacturers to become more efficient. This increased productivity among US workers has resulted in a requirement for fewer workers within the industry while actually increasing overall output. In January 2004, manufacturing jobs in the US “stood at 14.3 million, down by 3.0

million jobs since July 2000.”¹⁶ As manufacturing becomes more productive, it requires less employees as a proportion of given output to produce the same level of goods.

Research and Development (R&D): US manufacturers face competition from foreign manufacturers not only in the sphere of low-cost products, but also from increasingly higher-cost products of greater technical sophistication. Therefore, US manufacturers face constant pressure to lower prices and increase the value and quality of their products. Those US firms the Seminar visited indicated that research is critical to innovation and competitiveness to cope with foreign competition. Manufacturing firms account for 60% of the \$193 billion that the US private sector invests annually in R&D, resulting in innovations that benefit society more widely.¹⁷

Investment: Capital investment is a clear indicator of projected increases in sales and overall productivity. Over half of the US manufacturers surveyed stated that they planned to increase capital investment over the next year.¹⁸ Of those surveyed, 53% claim they will increase capital equipment and 42% plan to increase purchases of IT equipment. Robotics reported a record new order rate in 2004, in an effort to become more efficient and competitive.

Trade: Although the US manufacturing sector has increased productivity, and indicators are that growth will continue, the trade imbalance with other nations continues to widen. Import penetration into US markets has risen substantially since 1980 from 23% of sector GDP to over 67% by 2002. Additionally, US export penetration has fallen from over 12% of the global merchandise trade in 1998 to 10.7% in 2002. Nevertheless, manufacturing provides the bulk of US exports (62%), thus contributing positively to the trade balance. According to the 2003 World Trade Organization (WTO) report, the US is the second largest exporter (after Germany). The US ranks as the number one importer with 16.8% of total world imports. However, some of these imports include subassemblies, components, and materials used in the manufacture of US-made end items. The US is suffering from the combination of slowing export demand with a growing domestic demand for imports.

Strategic Consequences to the US for Lost Manufacturing: Although the US remains the most economically competitive nation in the world,¹⁹ the decline in the US manufacturing sector’s share of world trade has had consequences beyond lost jobs. It has also contributed to the US trade deficit and the current account deficit. By 2002, manufactured imports to the US outstripped exports by 25%. By the end of 2004, the US current account balance (i.e., a measure of trade and debt transfers) totaled \$665.9 billion.²⁰ Since 1991, America’s debt to the rest of the world has risen by \$2.1 trillion to a record \$2.4 trillion, or 22% of GDP. In nominal terms and as a percentage of GDP, the trade deficit is historically high. Much of the current account deficit relates to foreign financing of US consumer and government debt rather than to the trade deficit. The current account deficit, combined with the fiscal deficit and concerns about the war on terrorism, has reduced confidence in the US economy and contributed to a devalued dollar. The greatest concern is the potential for global competitors to drive US companies (particularly those critical to national security) out of business entirely. The production transfer of consumer-only goods away from the US is not necessarily a serious problem. However, cheaper foreign production threatens sensitive US industries (e.g., shipbuilding where the Seminar witnessed the efficiencies of South Korean over US shipbuilders). If US manufacturers move their production offshore or close their operations completely, US national security could be at risk.

CHALLENGES

General: Although the US continues to manufacture more goods than any other nation in the world, more countries have entered the international market resulting in a decline of the US share of trade. There are a number of inter-related challenges associated with this shift:

US Structural Costs: US manufacturers confront domestically imposed structural costs that add at least 22.4% to their cost burden.²¹ Among the most costly are those related to employee compensation. US companies face annual double-digit increases in healthcare costs (with little relief in sight) and pay a higher percentage of insurance coverage for their workers than European and Asian firms. Pension benefits are another area the sector is struggling to get under control. Most of the US companies the Seminar visited in Asia referred to lower employee compensation costs as a reason for moving production away from the US.

The US manufacturing sector is more highly regulated than other sectors.²² The Office of Management and Budget (OMB) estimated that regulatory costs amounted to almost 4% of GDP in 1997, and these costs are rising.²³ According to the DOC, environmental requirements accounts for half of these costs, while the rest is devoted to workplace safety and completing government paperwork.²⁴ Work place safety issues raise costs in the US with over 25 statutes, and executive orders, which cost the industry \$32 billion in 2000 (twice the 1997 figures).²⁵ The National Association of Manufacturers (NAM) figures show that regulatory compliance costs manufacturers \$160 billion annually, amounting to a 12% excise tax on their production, a 15% increase since 1999.²⁶

Furthermore, “the US corporate income is taxed at a higher rate than its major trading partners.”²⁷ Typically, US manufacturers face a corporate tax rate of approximately 40%, which includes an average 34% federal tax rate and an average 6% state rate. American manufacturers pay 25% of all corporate taxes yet only generate 7% of US corporate profits, a burden many consider disproportionate.²⁸ Meanwhile, many foreign governments tax consumption rather than income, giving their producers a marked advantage.

Tort liability system in the US costs more than double than other industrial nations. Tort costs reduce US manufacturing cost competitiveness by at least 3.2%.²⁹ Manufacturers are also concerned about civil liability due to the large increase in claims and awards. Rising insurance rates and legal fees further undermine the competitiveness of US companies.³⁰

Foreign Competition: Foreign manufacturers often benefit from the actions and policies of their governments, which frequently contravene international agreements. Additionally, “competition in manufactured goods has been largely driven by low-cost competition in Asian markets.”³¹ India, for example, with its educated workforce and low labor costs is now a serious competitor to US manufacturing.³² Korea is increasing its exports to the US even more quickly than India, 24% in the past year alone.³³ The Seminar’s visit to several trading Korean firms demonstrated the competitive challenge they pose to US manufacturers. (For a review of foreign competition, refer to the essay by International Fellow Colonel Herzi Halevi below.)

China has also become a major US manufacturing competitor, having invested heavily to create jobs for its immense population. From 1980 to 2001, when China joined the WTO, its manufactured exports rose from less than 1% of the world total to 5.3%.³⁴ Over the past ten years, China's GDP has grown by nearly 10% per year and its exports have risen by nearly 20% annually. China is now the third largest trading partner of the US and the fourth largest exporter in the world (although subsidiaries of non-Chinese companies produce 50% of its exports).³⁵

Some significant forms of government intervention and associated challenges include:

Tariffs and Quotas: The US has one of the lowest tariff burdens in the world for imports (on trade-weighted basis) at less than 1.7% of the value of imports.³⁶ Most remaining US subsidies and quotas are in the agriculture sector and do not affect manufacturing significantly. However, many countries, particularly in the developing world, impose far higher tariffs on manufactured imports.³⁷ Some countries also set quotas on imports to protect domestic producers.

Testing and Standards: Foreign governments frequently impose onerous standards, testing, labeling, and certification requirements on imports. These requirements ostensibly protect consumers, but they can also keep competitive goods out of their markets. These protectionist rules are an impediment to the importation of US manufactured goods. Many manufacturing sub-sectors are not the subject of an international agreement on testing and standards; the USG is attempting to gain acceptance for many US standards in order to promote equal rules for trade.

Offsets: Foreign governments, especially those wanting to create jobs, often require firms wishing to sell goods in their markets to invest directly in production facilities within their territory (i.e., offsets). Between 1993 and 2003, 36 countries entered into 466 offset agreements with US companies. "Offset related to those export contracts were valued at \$50.7 billion, or 73.8% of the export contract value, up from 65.7% for the period 1993-2002."³⁸ The US sometimes insists on offsets when the item is related to defense (e.g., Beretta 9mm pistol).

Intellectual Property Protection: Manufacturers in some countries do not protect intellectual property and derive enormous profits from illegally manufacturing and/or selling goods created by others. Meanwhile, foreign governments, which have a WTO obligation to outlaw piracy, frequently fail to enforce the international agreement.

Subsidies: Foreign governments often promote their own producers' exports with preferential financing. "The US is far less likely to subsidize its manufacturers directly than many other countries."³⁹ Nevertheless, the US occasionally provides indirect benefits to US manufacturers (e.g., Boeing tax breaks). Although WTO rules prohibit subsidies for export markets, many countries subsidize domestic production, which spills over into export markets.⁴⁰

Environmental Regulations: In 1999, 83% of total global pollution abatement requirements fell to US manufacturers. In fact, US manufacturers' expenditures on compliance with environmental issues cost 7.6% of the value of the final manufacturing output – the highest rate among its main competitors.⁴¹ Meanwhile, developing countries continue to damage the environment while gaining a competitive advantage in manufacturing and exporting goods.

Education Policies: Foreign governments frequently subsidize higher workforce education in areas critical to manufacturing. In 2002, 56% of degrees awarded in China (in all but free public universities) were in engineering and the physical sciences, compared to only 17% from all US institutions in the same period.

R&D: Innovation remains critical to maintaining competitiveness. The US accounts for 44% of the combined R&D expenditures in all Organization for Economic Cooperation and Development (OECD) countries, devoting 2.7% of its GDP to R&D.⁴² However, US investment in manufacturing R&D is declining; 2005 is the fourth year of decreases out of the last five.⁴³ Some US manufacturers are also moving their R&D overseas, using qualified workers at lower wages. By some estimates, US manufacturers may perform 90% of their R&D in China and India by 2010.⁴⁴ (For a thorough review of R&D, refer to the essay by Mr. Ken Rackers.)

Exchange Rate: Some countries peg their currencies to the dollar at an artificially weak exchange rate in order to ensure continued access to the US market on favorable terms. China is the primary country of concern in this area: manufacturers argue that China keeps the Yuan undervalued by 40 %.⁴⁵ As learned during our Beijing brief, however, the USG believes the Yuan is undervalued, but less than the 40% figure.⁴⁶ Japan, Korea, Taiwan and India also manipulate their exchange rates to promote exports and discourage imports.⁴⁷

Corruption: According to the 2004 Transparency International Corruption Perception Index, 106 out of 146 countries surveyed scored less than 5 against a clean score of 10.⁴⁸ The US Foreign Corrupt Practices Act makes it illegal for US individuals or companies bribe foreign officials in connection with a business transaction. OECD countries recently reached a similar agreement, though manufacturers from many other countries do not face these restrictions. In addition, recent US corporate scandals have generated new legislation (i.e., Sarbanes-Oxley) which, while necessary, is adding additional structural costs to US companies.

OUTLOOK

General: Despite the challenges posed by globalization, in macroeconomic terms, US firms also benefit from the opportunities presented by greater international trade in manufactured goods. Globalization raises US consumers' purchasing power by 2.8% of GDP, or \$300 billion a year, while keeping inflation low.⁴⁹ Meanwhile, US manufacturers import cheaper inputs, export more of their production, or shift part of their production overseas to reduce their costs and increase their markets. "Imports enhance domestic productivity by providing lower-cost inputs and capital equipment for US producers. In 1998, more than half of the \$919 billion in goods Americans imported were not final consumer goods, but capital goods (\$270 billion) or industrial supplies and materials (\$203 billion). Lower costs lead to higher productivity and increased sales domestically and abroad."⁵⁰ Globalization's overall effect on US consumers and producers is approximately an 8.6 % increase in GDP -- or around \$1 trillion a year.⁵¹

The economic advances enjoyed by our trading partners also benefit US producers. Although their growth is at the cost of some US production, growing middle classes in Mexico, China, South Korea, and others also create significant new markets for US producers. In

addition, countries with secure, prosperous populations are more stable and more likely to be good partners across the board for the US. Globalization should continue to affect the US manufacturing sector's microeconomic prospects, as follows:

Contribution to GDP: Total industry growth is projected to expand to \$23.3 trillion by 2012 -- an increase of \$6.4 trillion from 2002. This projected growth rate is roughly equivalent to that achieved by the sector over the past decade, and compares favorably to the 3.0% annual growth expected in the goods-producing sector overall.⁵² Individual manufacturers are generally optimistic about their own prospects in the coming year; over 75% of NAM survey respondents say they expect their sales to increase over the next year.⁵³ All of these statistics indicate that the manufacturing sector will continue to make direct and indirect contributions to increase the GDP.

Competition: Import penetration by goods from low-wage countries (particularly China) will continue. US industries that employ low-skill, low-wage, and relatively few workers are most at risk. Those most likely to contribute to growth in manufacturing in the US are in high-wage, high technology, and high-skill employment areas.⁵⁴

Companies that can expand their export markets are also likely to do better, and to contribute more to the economy. "Exporters pay 12% higher wages, are 20% more capital intensive, and are 19% more productive."⁵⁵ In 2004, rising fuel prices hurt foreign importers' capacity to purchase US exports somewhat. However, assuming more stable oil prices, this trend should reverse. The decline in the value of the dollar and the improving health of the global economy also should increase demand for US manufactured goods in coming years. Forecasts predict US exports to increase 5.9% in 2005 alone.⁵⁶

Employment: In the future, US manufacturers will draw on a changing pool of available workers. The US population is expected to increase by 24 million from 2002-2012, a slower growth rate than the past two decades. As baby boomers continue to age, those aged 55-64 will increase by 43.6%, or 11.5 million persons.⁵⁷ During the next 30 years, the number of people over 65 will double, from 35.1 million today to 70.3 million. The growth in the prime working age population (age 15-64), by contrast, will only amount to 14.9%, growing from 184 million today to 212 million in 2030.⁵⁸ The male labor force should grow by 10% from 2002 to 2012, compared with 14.3% for females. If future participation rates continue at the same rate as previous generations, the male and female labor-force will converge by 2015.⁵⁹

The implications are clear; America will grow somewhat older, while many other nations will require more jobs for people just entering the work force. Therefore, we expect to see more low-wage, labor-intensive manufacturing jobs move overseas. US manufacturers will need to draw on immigrants and women for their labor pool in the future. The solution may involve innovative responses such as expanding production from the home (1.8 million Americans worked in manufacturing from home in 2001⁶⁰). Part-time labor is also likely to increase; 26.7 million Americans already worked part-time in non-agriculture industries in 2003. Rising productivity, laborsaving technology, and training will also be required to address a projected shortage of 4-6 million workers in the sector by 2012.⁶¹

Education: At 28.3% (for 2001), the US has the highest proportion of college graduates (bachelor's degree or higher) in the world.⁶² However, Americans are earning fewer degrees in areas of importance to manufacturing. Between 1971 and 2002, engineering degrees declined from 6.0% to 5.7% of degrees awarded, physics from 2.5% to 1.4%, and math from 3.0% to less than 1%.⁶³ "One of the most protracted problems that manufacturers face is the lack of new skilled workers to operate their plants."⁶⁴ To remain competitive, US manufacturers will need to hire more of a declining number of US graduates with technical degrees, help increase the number of Americans earning such degrees, and/or hire non-US citizens with such degrees.

R&D: Globalization has increased the transfer of ideas and technologies for US manufacturers. The Manufacturing Seminar saw many examples of this during visits to US companies, which used foreign-made machines to boost productivity. By some accounts, new technologies have led to an additional 5.8% increase in GDP.⁶⁵ As competition from lower cost competitors increases, we expect US firms to expand their efforts to obtain new technologies and maintain their lead in R&D expenditures. US firms realize that a failure to do so may result in a further loss of market share to other nations and potentially to production capability. The Research and Experimentation Tax Credit will expire in 2006. The USG could offer additional incentives to manufacturers by extending these research tax credits or making them permanent.

Investment: Expected US GDP growth is 3.5% for 2005, with predictions for continued growth in the coming years. The trends are encouraging, as orders for non-defense, capital goods rose in 2004 and continue to rise in 2005.⁶⁶ Based on these projections and business plans of various US firms, the Seminar concludes the sector will make incremental investments in its physical plant and higher levels of investment in its personnel in the coming year.

National Security: "The industrial base supporting defense is sufficient to meet current and projected DOD needs."⁶⁷ The manufacturing industry supporting defense is reshaping itself to respond to significant changes in military missions by reducing excess capacity, streamlining processes, and revamping supplier relationships. In spite of the negative consequences of firms exiting the aerospace/defense sector, the industrial base is healthy and capable of meeting US war-fighting needs. Although most of the defense sub-sectors are low-volume industries, the capability exists to expand production rates. (For a thorough review of the industrial base and surge/mobilization capabilities, refer to the essay by Colonel Dave Grohoski.)

RECOMMENDATIONS FOR THE USG, INDUSTRY, AND ACADEMIA

General: Ensuring US competitiveness requires close coordination among the USG, industry, and educational institutions in order to capitalize on technological innovation and emerging markets. A new US manufacturing sector strategy will require the USG to assume the role of partner rather than regulatory agent. At the same time, the growth of multinational corporations, global communications, and interconnectedness will require decision-makers to base their choices in an increasingly global marketplace. Educational institutions (e.g., elementary, college, vocational, technology, etc.) must develop curricula that address workforce skills needed in the future. It is only through a real partnership between the USG, industry and academia that the US will remain as the most productive and innovative country in the world.

National Security: A strong industrial and technological base is one of the cornerstones of our national security and is critical to continued US dominance in the defense industry. An essential ingredient of national security is the availability of production capabilities for critical defense items and technologies. The role of the USG is to develop industrial resource policies and programs that satisfy national security requirements. The USG must safeguard selected areas of the manufacturing sector deemed necessary for national security. The USG should only intervene in the marketplace when necessary to maintain appropriate competition or to preserve industrial and technological capabilities essential to defense.

Contribution to GDP: The USG and its citizens benefit from a thriving economy. While goods production as a share of GDP is increasing, government and industry must set the conditions for continued growth. Foreign competition and US structural costs are the greatest impediments to increasing GDP related to the production of goods. The USG role in this regard is to eliminate barriers to global, free trade; the role of industry is to increase productivity and innovation; and the role of academia is to foster innovation.

Foreign Competition: Free and fair global trade is clearly good for the US and the world economy. Problems occur when governmental actions distort free trade. US policymakers must strive to eliminate imbalances (foreign and domestic) wherever possible and to foster conditions where US manufacturers and foreign competitors compete on equal terms. The following paragraphs identify areas requiring attention by the USG, industry, and/or academia.

Trade Liberalization: The USG should aggressively pursue global, regional and bilateral free trade agreements that reduce barriers to trade and investment. These agreements will eliminate tariffs, subsidies, quotas, and other unfair protectionism measures.

Trade Enforcement: US industries must identify violations of international trade rules (e.g., intellectual property violations), while the USG needs to investigate and prosecute these violations and collaborate with nations to do the same. The USG should demand stronger dispute settlement mechanisms (to include retaliatory options) while insisting on greater transparency. US manufacturers should also enhance their cooperation with foreign partners to combat trade violations. Academia needs to conduct economic analysis on the impact of globalization and trade.

Trade Standardization: The USG and industry should encourage other countries to adopt US manufacturing technical standards.⁶⁸ This would reduce the expense of developing individual production standards and benefit foreign consumers by providing them with the same protections currently available to US consumers. This decision would also make it easier for small companies to export, saving them the expense of meeting domestic and international standards.

Trade Promotion and Offsets: The USG should continue advocacy for US bids on foreign government contracts and accept foreign bids on US contracts. The US should also examine the policy of investment offsets required by some foreign governments, particularly in Asia. Many of the domestic and international companies we visited stated that offsets had become virtually required to support export markets there. The WTO should set rules for offsets, perhaps by providing the investing country with additional trade benefits for a finite time period.

Trade Financing and Profitability: The USG should update the tax code, making it less complicated and costly while eliminating the double taxation provision on income derived by US firms from their foreign investments.⁶⁹ The USG should continue efforts to eliminate currency manipulation (e.g., China).

US Structural Costs: The USG and industry must work together to reduce domestically imposed structural costs, which include healthcare, pensions, insurance, tort reform, regulatory compliance (e.g., environment, health, and safety⁷⁰) and the US tax code. The USG may have to arbitrate agreements between manufacturers and unions to resolve healthcare, pensions, and insurance issues. The USG must conduct tort reform. Academia should develop models that provide choices to reduce structural costs.

Employment: As the US workforce ages, more low-wage, labor-intensive manufacturing jobs will move overseas. As a result, many US jobs will require high technology skills, advanced training, and more education. The US must decide which manufacturing sub-sectors it must retain for national security and devote its efforts to the high-technology areas (e.g., nanotechnology, biotechnology, etc.) where it is most competitive. The US educational system should then train the workforce accordingly.

Education: The US faces an education challenge to fill a growing need for a skilled workforce. Failure to train and educate the US workforce (beginning in elementary school) will result in the loss of competitiveness. The USG must adopt policies that foster growth in the S&T fields (e.g., magnet schools, scholarships, tax credits, etc.), while schools must develop programs that encourage interest in S&T. To remain competitive, US manufacturers will need to hire more US graduates with technical degrees, help increase the number of Americans earning such degrees, and/or hire non-US citizens with such degrees.

R&D and Investment: To maintain a competitive advantage in manufacturing, the USG should increase R&D investment to promote technological innovation and transfer. USG-funded scientific research initiatives, manufacturing technology improvement programs, university partnerships, and tax credits offer long-term benefits for the industry and society. Tax incentives should reward firms who conduct research and expand S&T or other efforts to increase innovation.

The USG needs to maximize support for research programs offered by the DOD, the National Science Foundation (NSF) and the National Institute for Standards and Technology (NIST). NIST's Manufacturing Extension Partnership Program assists small manufacturers through competitive improvements, best business practices and advanced manufacturing technologies.⁷¹ In fiscal year 2003, this program "created or retained 50,135 jobs, increased sales by \$1.4B, realized \$686M in cost savings and invested \$912M in modernization."⁷² The benefits to manufacturers are obvious and the USG should increase funding to \$200M for 2006 – less than 7% of the total economic impact garnered by this initiative in 2003.

CONCLUSION

Geographic isolation and a unique national character compelled the US to develop a degree of self-sufficiency. These historic roots allowed the nation to achieve global dominance in manufacturing. In spite of today's high structural costs and increased foreign competition, the US manufacturing sector is healthy and continues to contribute enormously to the economy and, consequently, the national security of the nation.

A strong industrial and technology base is a cornerstone of our national security and is critical to the continued US dominance across all instruments of national power. The competitive pressure of the marketplace is the best vehicle to shape an industrial environment that supports our overall national strategy. Although foreign firms will be able to compete with US manufacturing firms on certain costs, in a truly free trade environment, US firms can hold their own due to their higher productivity and innovation. The challenge in 2005 is for the USG, industry, and academia to develop a partnership that creates conditions for US manufacturing to flourish. The US must decide which capabilities it must retain for national security and devote its resources to the high technology areas (e.g., nanotechnology, biotechnology) where it is most competitive. Additionally, the US must prepare for the future by investing in education and R&D. These actions will allow the US to retain its position as the world's leader while "providing for the common defense and promoting the general welfare" of all Americans.

ESSAYS ON MAJOR ISSUES

Essay #1: MANUFACTURING R&D

R&D is vital to innovation and continued global competitiveness. It enables the manufacturing sector to deliver new or improved products easier and cheaper. The USG has a strong interest and important role in strengthening the manufacturing industry via supportive policies, laws, and taxes, including stimulating private R&D investment. R&D also creates US jobs in the manufacturing sector, spurring investments in people and equipment, which contributes to the strength of the economy.⁷³ US manufacturers face competition from foreign manufacturers not only for low-cost products, but also increasingly in higher end products. Therefore, US manufacturers face constant pressure to lower prices and increase the value and quality of their products. R&D is critical to coping with foreign competition.

Market forces, combined with existing government policy, have enabled the US to maintain leadership in the manufacturing area, although US dominance has diminished. There are, however, certain imbalances in the allocation of investment for manufacturing R&D. To maintain a competitive advantage in manufacturing and production-related fields, therefore, the USG should marginally increase investment in certain R&D areas, to promote technological innovation and transfer resulting technologies to the US manufacturing sector. Additionally, the USG should adopt policies to stimulate commercial R&D investment that creates new products and innovative advanced manufacturing techniques.

ANALYSIS OF TRENDS

The international competitiveness of a modern economy depends on its ability to innovate technologically and use that knowledge to gain competitive advantage. Most industrial nations accept that economic welfare and competitiveness rely on improving quality and efficiency in production (manufacturing), and in the development of new products. The amount of investment in R&D relative to other nations is an indicator of future growth and productivity.⁷⁴ Based on the absolute and comparative amounts of R&D investment, the US is in relatively good shape: the US outspends the other OECD and non-OECD nations, including China,⁷⁵ and ranks fifth among 30 OECD nations in terms of GDP percentage devoted to R&D. The US also has a good balance of industrially performed R&D across sectors; its spending is among the most diverse among OECD countries.⁷⁶ This diversity and an extensive infrastructure, supported by a large and varied domestic market, has allowed the US to compete in numerous industry sectors and in niche technologies that few other nations can match.⁷⁷

Imbalances in R&D investment in the US economy do exist. One area of concern related to US R&D investment is that much of the funding provided by the federal government is for the DOD and DHS for national security purposes.⁷⁸ Consequently, the nation's overall economic health would improve with more R&D investment devoted to the commercial arena. Increased R&D in broader commercial sectors would have a positive impact on the nation's overall economic wellbeing and could help increase global competitiveness. Investment in engineering and physical sciences produces greater innovation in the manufacturing sector. Innovation in technology accounts for as much as one-third of long-term economic growth and two-thirds of productivity gains.⁷⁹ Another imbalance in US R&D investment is in the area of basic research. The USG contribution to basic research has fallen 37% as a percentage of GDP over the past 30 years, which has contributed to reduced US technological leadership in the global economy.⁸⁰ Basic research is important to keep innovation in manufacturing techniques and new product development at the forefront.

GOVERNMENT'S ROLE IN SUPPORTING MANUFACTURING R&D

The path to commercialization of new technology has three major steps: research, development, and innovation. Research is the mechanism to develop new knowledge. Development is the application of this knowledge into technology that solves practical problems. Innovation is the application and commercialization of developed technology into specific markets, most often by manufacturing industries. Each of these steps involves risk and requires different approaches. The USG has borne the risk of basic and applied research by funding such research in national labs and universities. Entrepreneurs and existing industries have been willing to bear the risk of commercialization of developed technology. However, there are fewer organizations willing to bear the risk of development and even fewer mechanisms designed to encourage it. Traditionally, development projects are the domain of industry, but competitive pressures in the business climate often place a premium on short-term profits. The USG should foster innovation in the manufacturing sector by creating policies that bridge the gap between R&D, implementing programs that share the risk of development with the private sector.⁸¹

RECOMMENDATIONS

The US should maintain robust federal investment in R&D at approximately current levels, but with increased emphasis on the commercial manufacturing sector. USG policies and tax law should provide incentives to industry investment. The USG, partnered with industry, should initiate a major R&D program to develop advanced manufacturing technologies. The USG should increase basic research investment by 15-20% (real dollars) over five years, so as fully develop the new applications. Congress should pass legislation to make the Research and Experimentation Tax Credit permanent.

CONCLUSION

Effective R&D leads to innovation. Innovation is the fuel that drives a strong manufacturing sector. The USG should adopt policies that promote the competitiveness of US manufacturers, while attempting to level the playing field within the international market. Manufacturing contributes to national wealth, creates higher living standards, and enhances national security. The US needs a technologically skilled workforce to support these R&D efforts. A robust, government-and-industry supported R&D capability will ensure that the US manufacturing industry remains strong and competitive globally. *(By Mr. Ken Rackers, Missile Defense Agency)*

Essay #2: REDUCING PRODUCTION COSTS

The manufacturing industry is continuously changing. “Demand for an increased variety of products, reduced product life-cycles and time-to-market, recognition of manufacturing value chains, and rapidly-changing product and process technologies are defining manufacturing environments to a larger and larger extent.”⁸² The environment is also becoming more competitive due to technological change, fragmentation of markets, industry convergence, and advances in telecommunications and computing.⁸³ To thrive in this environment, companies must successfully manage all activities that affect their bottom line—their cost drivers.

In manufacturing, these drivers exist throughout the production process, from the cost of raw materials and energy, to capital equipment and labor, to the cost of regulatory compliance. All of these drivers create competition among producers to optimize their systems and minimize their costs. Those that do it best succeed; those that do not, fold.

Globalization has exacerbated the challenge. US manufacturers no longer face competition from US firms alone, but now compete with foreign manufacturers—many of which do not operate under the same constraints. The uneven playing field has made success difficult for some US manufacturers, resulting in business and job losses. But many companies recognize that global marketplace challenges also represent opportunities to gain a competitive edge. This essay focuses on improvements in production processes and the strategies manufacturing companies use to reduce operating costs.

LEAN MANUFACTURING

Companies that employ lean manufacturing principles adopt a culture that focuses on “the obsessive elimination of waste.”⁸⁴ Waste is “anything that consumes material or labor without adding value to the end product that is received or purchased by the end customer.”⁸⁵ There are three primary means of eliminating waste: (1) quality improvements, (2) production process changes, and (3) facility organization and layout.

Quality Improvements: Product quality is a key indicator of producer success. Quality forms the foundation of a company’s operating culture and is a significant contributor to the cost of production, recognizing that everyone in the process is responsible for quality. Two key approaches are:

Statistical Process Control (SPC): SPC is an approach based primarily on the methods Dr. Edward Deming and Dr. Joseph Juran taught to the Japanese in the 1950s. The essence of the approach is that process quality can and must be measured, charted, and constantly analyzed by the process operator. This facilitates early detection and correction of anomalies.

Six Sigma: This process represents a company’s commitment to quality. Companies apply it in two ways: as a quality control methodology and as a process improvement philosophy. In quality control, Six Sigma literally refers to a quality level close to 3.4 defects per million parts⁸⁶ or 99.9997% perfection.⁸⁷ However, “world-class companies typically operate at a three-to-four sigma or 99% perfection,”⁸⁸ because higher levels of perfection are too expensive to achieve. In a sense, therefore, while full Six Sigma conformity is a producer’s dream, it really represents a company’s commitment to continuous improvement. In this context, Six Sigma is a “philosophy, goal and methodology used to drive out waste and improve the quality, cost, and time performance of any business...to improve profits through defect reduction, yield improvement, consumer satisfaction, and best-in-class product/process performance.”⁸⁹

Production Process Changes: During the “lean” movement, the philosophy of production shifted radically. Instead of large inventories, lean companies keep very little. Batch sizes are smaller; customer options increase; and product is “pulled” through the system to satisfy known orders, not just sit in a warehouse. Three of the more prominent “lean” movements are: (1) Kaizen, (2) Synchronous Manufacturing, and (3) Just-In-Time (JIT) Manufacturing.

Kaizen: Kaizen is a Japanese word that means “gradual, unending improvement, doing little things better; setting and achieving ever-higher standards.”⁹⁰ It is the continual effort at all levels of a company to improve its way of doing business—extending even to areas like labor relations, marketing, and supply.⁹¹

Synchronous Manufacturing: This manufacturing management philosophy includes a set of procedures and techniques “where every action is evaluated in terms of the common goal of the organization.”⁹² Dr. Eliyahu Goldratt designed the most popular system, based on his “Theory of Constraints.” He emphasized the importance of inventory and cycle time reduction, increasing throughput, and removing bottlenecks.⁹³ Manufacturers focus on maximizing system throughput by managing constraint(s),⁹⁴ striving to create a continuous product flow.

JIT Manufacturing: This manufacturing philosophy strives to minimize inventory throughout the manufacturing system. “The JIT process is aimed at organizing manufacturing processes so that the best quality parts, manufactured or purchased, are supplied to the shop floor only when they are needed—not too soon and not too late.”⁹⁵

Facility Organization and Layout: Companies pursuing lean manufacturing must ensure that their process layout minimizes waste and maximizes product flow. Two of the most common approaches are:

Group Technology: This philosophy groups different products according to similar features (e.g., shape, size, holes, and machining operations). By grouping machines into a family of parts, the product efficiently moves through the process.⁹⁶ This approach enables three primary advantages: increased efficiency, standardization, and specialization.

Flexible Manufacturing Cells: This is the most advanced application,⁹⁷ where each manufacturing cell focuses on producing a family of parts. Flexible manufacturing cells will “maximize the layout, resulting in smaller batch quantities that run through the cell with little material handling and small work in process (WIP) inventories.”⁹⁸

AUTOMATION

Improving processes is not the only way companies can reduce production costs. Another approach that became popular in the 1980s was the move toward fully automated plants. Although this incurs large capital investments, automated machines and robots can significantly improve the bottom line. Manufacturing technologies contributed \$200 billion per year to the economy over the past five years and in some cases improved productivity by 500%.⁹⁹

The ultimate objective for integrating automation into any manufacturing environment should be increasing product flow through the plant, improving quality, and increasing responsiveness to the customer.¹⁰⁰ If it makes sense from a business perspective, integrating automated machinery into the production flow can be an effective cost reduction strategy.

SUPPLY CHAIN EXCELLENCE

The ultimate supply chain excellence (SCE) process is a holistic, continuous improvement process to ensure customer satisfaction from the original raw material provider to the ultimate, finished-product consumer.¹⁰¹ A new SCE model, called “dynamic on-demand supply chain”, brings together three principles: world-class supply chain management (SCM), process leadership in lean/Six Sigma disciplines, and what is known as “on-demand” technology - information technology (IT) that is paid for as it is used, not on a per-license basis.

Supply chain programs have originated from many different starting points, with wide-ranging objectives. Some programs were sequential and not in concert with each other. However, many of these initiatives were separate projects, insufficiently linked to the organization’s overarching supply chain strategy or the company’s overall business strategy.¹⁰²

Without enterprise-wide thinking, companies limit their long-term opportunities. The dynamic on-demand supply chain model is beginning to attract substantial interest from supply chain practitioners.¹⁰³ The new model enables companies to focus on reducing redundancy throughout all processes and using advanced technology to convert SCM to SCE.

On-demand IT is an enabler for SCE and promises that organizations can respond dynamically to whatever business challenges arise, while providing products and services “on-demand” in real time. They can adapt their cost structures and processes to reduce risk, drive business performance, cut costs and boost productivity. On-demand IT involves paying only for the IT resources used, as with electricity and water, rather than committing to fixed costs in the form of software licenses and IT employees. With a pay-as-you-go approach to IT, businesses can focus more effectively on their differentiating competencies.¹⁰⁴

Many of the approaches outlined in this essay are compatible with each other, and a mixture of several may yield better results than a single approach. Most successful “lean” companies adopt a variety of process improvements that results in greater productivity, improved quality, increased responsiveness to the customer, and reduced costs. To maximize efficiencies, companies must first transform their cultures by creating new models of SCE that evaluate material and information flow throughout their manufacturing processes. They must align their business goals and apply the SCE principles across the board.

The time is right for consideration of the dynamic on-demand supply chain. Global competition is intense and shareholders are demanding. Research already shows widening performance gaps between supply chain leaders and other manufacturers. The struggles most worth watching will be the industry confrontations for supply chain supremacy. Those quickest to embrace the dynamic on-demand supply chain should excel.¹⁰⁵ (By Lieutenant Colonel Dawson Osland, USAF and Ms. Janet Calahan, L-3 Communications)

Essay #3: SURGE AND MOBILIZATION ISSUES

“Logistics is the bridge between the economy of the nation and the tactical operations of its combat forces. Obviously, then, the logistics system must be in harmony with both the economic system of the nation and the tactical concepts and environment of the combat forces.”

Admiral Henry E. Eccles, USN

The concept of the need to maintain a strong US industrial base emerged from our historical wartime experiences. WWII was a war of mobilization and surge; the Cold War was a race for technological advancement against the Soviet Union. The US is struggling to define the role of the industrial base in the current Global War On Terror because this conflict is not widely viewed as a struggle for national survival.

The US industrial base is becoming increasingly dependent on foreign sources of manufactured goods. In the area of national defense, the US, by law, must maintain the indigenous capability to produce critical components. However, one should ask whether the US still possesses the ability to meet its national defense requirements. The purpose of this essay is

to explore the extent to which the US industrial base is capable of meeting the peacetime, surge, and mobilization requirements of the DOD.

SURGE AND MOBILIZATION ISSUES

General: DOD must ensure the adequacy of production capacity and supply to meet the wartime needs of Combatant Commands (COCOM). This includes the requirement to create, expand, or maintain domestic industrial capacity. Additionally, DOD must ensure the availability of materials and facilities necessary to keep priority defense programs on schedule.¹⁰⁶

Definition of Terms: The term “*Critical Item List (CIL)*” refers to a prioritized list, compiled from a subordinate command's composite critical items list, identifying supply items and weapon systems that assist Service and the Defense Logistics Agency's selection of supply items and systems for production surge planning.¹⁰⁷ “*Mobilization*” refers to the transformation of a society and its industry, from its peacetime level of activity to the industrial program necessary to support national military objectives. It includes the mobilization of materials, labor, capital, production facilities, and contributory items and services essential to the industrial program.¹⁰⁸ “*Surge*” refers to the ability of the industrial base to rapidly meet accelerated production requirements of selected items with existing facilities and equipment.¹⁰⁹

Resourcing National Defense: The US must have an industrial and technological base capable of meeting national defense requirements (as outlined in Executive Order 12919). The Defense Priorities and Allocation System (DPAS) ensures the timely delivery of industrial items in support of national defense objectives in the event of a national emergency. DPAS addresses industrial capacity (e.g., plants and manufacturing equipment) and critical items (e.g., CIL).

SURGE AND MOBILIZATION MATERIALS

The Strategic and Critical Materials Stockpile Act (50 U.S.C. 98 et seq.) requires that a stockpile of strategic and critical materials be maintained to decrease dependence on foreign sources of supply in times of national emergency.¹¹⁰ However, only three materials are required for stockpiling: beryllium, quartz, and mica.¹¹¹ Nevertheless, the US industrial base requires vast quantities of raw materials for use in manufacturing. The US imports many of these materials in order to make many military items. Consequently, the US accepts a degree of risk by not having domestic sources of critical materials.

SURGE AND MOBILIZATION CAPACITY

DOD relies on a combination of private and public sources to support its manufacturing and mobilization requirements. Notable US private companies are General Dynamics, Boeing, Lockheed Martin, Raytheon, and Northrop Grumman. Additionally, many small manufacturers comprise the overall defense industrial base. Globalization makes it more difficult to determine the extent to which DOD contracts are filled with US materials, labor, and equipment – creating a challenge to determine whether or not the US industrial base alone can meet DOD surge and mobilization requirements.

As more manufacturing exits the US, DOD is increasingly reliant upon foreign sources for some of its needs. Foreign contractors collectively represent about 4% of the total DOD contract value and less than 10% of the value of all subcontracts. A DOD study concluded that foreign suppliers provide a limited amount of material for major systems and that using those foreign subcontractors does not affect the long-term readiness of the defense industrial base.¹¹²

ROLE OF GOVERNMENT

General: The role of the USG is to develop defense industrial resource policies and programs to ensure that warfighting needs are met. The competitive pressure of the marketplace is the best vehicle to shape an industrial environment that supports the defense strategy. DOD intervenes in the marketplace only when necessary to maintain appropriate competition or to preserve industrial and technological capabilities essential to defense. There are numerous statutes that address the requirement to “provide for the common defense.” The US Code, Executive Orders, Code of Federal Regulation, Congressional Authorization Bills, etc. all direct, guide, or mandate how DOD will procure items. There is ample debate concerning free trade, national security, intellectual property and proprietary rights, etc. Nevertheless, the USG crafts specific procurement language in order to safeguard the US national security.

Constraints: Health regulations and environmental requirements limit US competitiveness within the global market affecting the US defense industrial base. DODD 6050.51 delineates rules concerning pollution abatement, flood hazards, protection of wetlands, etc. The Occupational Safety and Health Act of 1970 (OSHA), Clean Air Act, Clean Water Act, etc., all well intentioned, further constrain US companies and their global competitiveness.

ASSESSMENT

Defense: DOD conducts assessments when there is an indication that industrial or technological capabilities associated with an industrial sector, sub-sector, or commodity important to DOD could be lost. “Ongoing industrial assessments required to support DOD identified over 1,772 distinct warfighting capabilities where the military must maintain at least a one-generation lead over potential adversaries; and 255 critical technologies supporting those capabilities. For these most important technologies, the study identified over 800 companies with relevant industrial base capabilities.”¹¹³ That said, there could be shortfalls in providing the desired capabilities to warfighters, which arise when actual operational requirements dictate production quantities significantly greater than those required for peacetime acquisitions.

Economic: Although DOD is a relatively small player in the overall US economy (about 3.75% of the GDP), “the overall economic outlook for the US aerospace/defense industry is positive.” Aerospace sales in 2004 totaled \$161 billion dollars; estimates for 2005 sales are \$173 billion dollars with a profit margin of 5.5% (24% higher than in 2004).¹¹⁴

RECOMMENDATIONS

General: There are insufficient resources to ensure compliance and implementation of existing directives. The litany of regulations, directives, laws, etc. is confusing and often contradictory. The first recommendation is to streamline the requirements placed on DOD and industry. Second, DOD and DOC should increase the personnel enforcing compliance with the rules and regulations. These two recommendations, if implemented, would obviate many existing problems (e.g. intellectual property loss) and increase small business participation.

Critical Materials: Consistent with DOD's expectation of short-duration conflicts, the US should continue to sell-off the national stockpile of critical materials (retaining only materials like beryllium and mica). The US minimizes risk by retaining short-term supplies of materials and ensuring the availability of materials from multiple sources on the global market.¹¹⁵

Technology: Congress should permit DOD to create a fund that supports the adoption of innovative technologies.¹¹⁶ The US needs to reinforce efforts to safeguard intellectual property. The US immigration policies should be changed to make it easier for technical brainpower from foreign countries to become American citizens and to obtain security clearances.

Capacity: DOD should continue its current efforts in this area.

Economic: The best approach is for government not to intervene in the marketplace except where countries use unfair business practices (e.g. devalued dollar, counterfeiting, copyright infringements, etc.) or when the situation may involve US vital interests. However, there is an urgent need for tort and regulatory reform because the current situation is decreasing US manufacturers' competitiveness with foreign producers. These actions will help to open markets and level the playing field for US manufacturers.

In conclusion, the US industrial base is sufficiently robust to provide for the domestic manufacture of the CIL used to support COCOMs during periods of surge and mobilization. The manufacturing industry supporting defense is reshaping itself to respond to significant changes in military missions by reducing excess capacity, streamlining processes, and revamping supplier relationships. DOD continues to state that the industrial base is healthy and capable of meeting US warfighting needs. *(By Colonel David C. Grohoski, USA)*

Essay #4: INTERNATIONAL TRADE AND US MANUFACTURING

Following decades of commanding market leadership, the US manufacturing sector now faces unprecedented global competition. The mounting trade deficit and slowdown in the sector's growth compared with other countries are symptoms of this competition. This essay discusses international forces that affect American manufacturing competitiveness, and makes recommendations to prepare US manufacturing to face the future.

INTERNATIONAL TRADE

The history of international trade started long before the first ship or airplane crossed modern borders. Jacob, in the Book of Genesis, traded with Egypt due to a regional famine; trade meant survival. Today we view trade as being beneficial not only when it comes to filling shortages, but also as a means to more efficient global production. Trade barriers have reduced significantly since the end of WWII. The average tariff rate for OECD countries went from 40% at the end of WWII, to 4% at the end of the last century.¹¹⁷ Trade agreements have increased from one regional agreement in 1958 to 161 in 2003.¹¹⁸ The WTO, established in 1995 as the successor to the General Agreement on Tariffs and Trade (GATT), has grown from 18 members in 1948 (under GATT) to nearly 150 members today, with 30 others negotiating memberships. The WTO encompasses 97% of world trade.¹¹⁹ As economists widely agree, the well-established principle of comparative advantage makes trade a good thing.¹²⁰

While US exports grew by 98% during the 1990s, with the US share of total world trade going from 11.4% to 12.2%, exports have fallen to 10.7% (2002).¹²¹ Although the US has led the way in reducing trade barriers, its manufacturers have nonetheless had to cope with significant overseas barriers to their exports. In spite of this, US manufacturing output increased 42% between 1992 and 1999 — years that saw only 29% economic growth overall. In a 2003 report, the WTO claims that the US is the second largest exporter after Germany. The US ranks as the number one importer with 16.8% of total world imports and 9% annual growth.

MANUFACTURING SECTOR CHALLENGES

Despite the increase in global trade, the international trade environment and domestic market characteristics challenges future growth and competitiveness of US manufacturing. An open economy is one that grants people the freedom to purchase what they want at the best available price. While there have been periodic exceptions,¹²² the US clearly leads the way when it comes to open markets. However, many other countries resist opening their markets to foreign goods. The use of subsidies, tariffs, quotas, and other trade barriers are common, particularly in developing countries.¹²³ Consequently, US exporters are often disadvantaged in the same countries whose manufacturers enjoy open access to the US market. Artificial currency conversion rates create another imbalance. The current relative weakness of the dollar compared to the Euro should benefit US manufactured exports. The opposite holds in China, where the government has fixed the value of the Yuan artificially low¹²⁴ giving Chinese exporters an edge.

Additionally, many governments, mainly in developing countries, fail to enforce intellectual property protection for goods developed outside their borders. US manufacturers, whose products often are on the cutting edge, lose their advantage because of massive counterfeiting. This “piracy” also undermines incentives for innovation. Meanwhile, in the developing world, awareness of environmental issues has not reached the level of more developed countries. Therefore, because of regulation, environmental protection costs are higher for US manufacturers than for Asian competitors. The money US companies expend on environmental compliance (7.6% of US manufacturing output¹²⁵) does not add to profits.

THE SPECIAL CASE OF CHINA

The rapid expansion of China's manufacturing sector merits special consideration. China is a principal player in US trade, and its growth should continue through the next decade. The US has a significant trade deficit with China — \$158 billion (as of December 2004) — and more than 25% of all Chinese exports go to the US. At the end of 2003, meanwhile, China was the sixth-largest export market for the US;¹²⁶ US exports to China have grown strongly — 60% since 2000 — even while exports to the rest of the world have stagnated.¹²⁷ The US and China have encountered trade disputes, and both countries recently ratified agreements to resolve a WTO dispute about China's semiconductor exports, intellectual property and other issues.¹²⁸

China's markets are not just in the US: its merchandise export growth in 2003 was two times larger than the world's export growth.¹²⁹ As a result, also China ranked as the fifth largest global exporter with a 5.8% world share and growing at 34% annually. Meanwhile, China consumes 5.3% of world imports, primarily raw materials, growing at 40% annually.¹³⁰ Clearly, as many of the presenters told the Manufacturing Seminar during our travel in Asia, China is becoming “the world's manufacturer.”

CONCLUSION

The US manufacturing sector is sound. However, it is quickly learning that it is easier to become number one than to remain number one. This sector's importance to US global competitiveness demands policy makers' immediate attention. They have two options: either growing imports or restricting imports. Historical experience and economic theory shows that restricting imports likely will produce an adverse economic impact. Therefore, the USG must work towards opening international markets, where a “rising tide can lift many boats.” The challenge requires a multidimensional response, employing all national instruments of power:

Economic Challenges: The USG must advance sound fiscal and monetary policies, closely reexamine regulatory costs that inhibit US manufacturing competitiveness, provide tax advantages for new R&D, and control structural costs, particularly health care and pension costs. The USG also must resist pressures for protectionism or import restrictions.

Diplomatic Challenges: The USG must work to open foreign markets to US goods and promote fair competition worldwide. It must also increase cooperation in multilateral trade organizations, mainly through the WTO. New and expanded bilateral or regional free trade agreements are required when broad multilateral arrangements are not possible.

Military Challenges: The US military must continue to forge partnerships with the manufacturing sector as a crucial element of the defense industrial base.

Information Challenges: The US must support and promote global open markets, while simultaneously improving its own citizens' understanding of the importance of international trade and domestic consumption. (By Colonel Herzi Halevi, Israeli Army)

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The manufacturing SIC division includes establishments engaged in the mechanical or chemical transformation of materials or substances into new products. These establishments are usually described as plants, factories, or mills and characteristically use power driven machines and materials handling equipment. Establishments engaged in assembling component parts of manufactured products are also considered manufacturing if the new product is neither a structure nor other fixed improvement. Also included is the blending of materials, such as lubricating oils, plastics resins, or liquors.

NAICS definition:

The Manufacturing NAICS sector comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. The assembling of component parts of manufactured products is considered manufacturing, except in cases where the activity is appropriately classified in Sector 23, Construction.

Establishments in the Manufacturing sector are often described as plants, factories, or mills and characteristically use power-driven machines and materials-handling equipment. However, establishments that transform materials or substances into new products by hand or in the worker's home and those engaged in selling to the general public products made on the same premises from which they are sold, such as bakeries, candy stores, and custom tailors,

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