Why America beat Iraq
but Loses to Japan

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America won the military war against Iraq for the same reason the Japanese are winning the high-technology trade war against us: the application of a fast-cycle, time-based competitive strategy. In the Gulf War, America used a dynamic, maneuver-based strategy to defeat the entrenched Iraqi forces who expected a head-on attack. The primary reason so many commentators overestimated the number of American casualties was that the Pentagon abandoned its traditional attrition-based strategy for a time-based strategy. Similarly, the Japanese use fast-innovation, flexible manufacturing to out-compete traditional mass production techniques widely used in this country. Unless American business abandons its traditional methods and adopts these techniques to a far greater degree, and unless the federal government supports the rapid research, development, and manufacturing necessary to sustain such a transition, then not only will American economic security suffer; ultimately, so will our military security, as our high-tech weapons will increasingly have to rely on foreign-made parts that may not be available fast enough in a future crisis. On the other hand, nurturing advanced manufacturing can bring high-paying jobs back to America and help revitalize our economy.

THE ADVANTAGES OF TIME-BASED COMPETITION IN WARFARE AND BUSINESS

The idea that time is an essential component of military strategy is hardly new. Almost 200 years ago, Napoleon said: “Strategy is the art of making use of time and space. I am less chary of the latter than the former. Space we can recover, never time.... I may lose a battle, but I shall never lose a minute. The whole art of war consists in a well-reasoned and circumspect defensive, followed by rapid and audacious attack.” The World War II German General Gunther Blumentritt described the success of the German Blitzkrieg this way: “The entire operational and tactical leadership method hinged upon ... **rapid**, concise assessment of situations ... **quick** decisions and **quick** execution on the principle: ‘each minute ahead of the enemy is an advantage.’ ”[1]

The man who developed the theoretical framework for a time-based military strategy, the man whose theory was so successfully implemented in Operation Desert Storm, is Colonel John Boyd. Colonel Boyd was a renowned Air Force pilot in the Korean War, flying the F-86 Sabre against the Soviet built MiG-15. His strategic thinking began as he attempted to determine why the F-86 consistently beat the MiG in aerial dog-fights even though the MiG was a "superior" plane by traditional standards, since it could accelerate more rapidly, climb faster, and hold a tighter turn than the F-86.[2] It turned out the F-86 had two crucial advantages. First, its glass-domed bubble canopy enabled the

pilot to see out of the plane and observe enemy activity much easier than did the more restricted view from the MiG cockpit. Second, the F-86 could change from one maneuver to another much more quickly—decelerating and diving while turning or switching directions. This meant that as each plane danced around the other in a classic dog-fight, the F-86 would accumulate a larger and larger positional advantage, rapidly turning from potential victim to predator. At Nellis Air Force base after the war, Boyd acquired the nickname “40-second Boyd” for his open challenge—which he never lost—to pay a fighter pilot $40 if he could not outmaneuver the pilot in 40 seconds.

Over the next two decades, Boyd studied engineering and military history to learn how to generalize his Korean War experience into a coherent theory of warfare. This theory evolved into a series of briefings, totaling 9 hours, with names like “A Discourse on Winning and Losing,” and “The Strategic Game of Interaction and Isolation.” The key to winning, Boyd preached, is to operate at a faster tempo or rhythm than an adversary, to get inside their O-O-D-A time-cycle loop.

The loop consists of (O) Observing the competition's actions, (O) Orienting oneself to the unfolding situation, (D) Deciding what to do, and then (A) Acting. The action (and any response it evokes) then alters the situation, necessitating new observations and a repetition of the cycle. When one side's OODA loop is faster, shorter or more efficient than its opponent's, the first will run circles around the second; the slower side will be constantly reacting to its adversary's previous moves, unable to take the initiative.

This is exactly how the Japanese use flexible manufacturing to out-maneuver our industry. They can cycle through the entire production systems—research, development, production, marketing, and sales—much faster than nearly all their American competitors.

Time has never meant more to business than it does today. For example, in the international battle for next-generation memory chips, IBM's estimated lead of three to six months in producing the 16-megabit chip is considered a competitive advantage.[3] A current television advertisement has Chrysler chairman, Lee Iacocca, showing off the new Dodge *Viper*, which, he boasts, was conceived in 1989 and will reach showrooms next January. “For those of us who forgot,” Iacocca says, “it's called being competitive.” Although Honda's *Acura* division and G.M.'s Saturn were announced at roughly the same time, Saturn is only arriving now, while Honda has completed three major model changes. Moreover, in the time it took General Motors to bring Saturn to market, Honda has been able to incorporate into its *Civic CRX*, “almost all of the innovative aspects of the Saturn design that have been made public so far.”[4]

The flexible manufacturing strategy that makes such competitive advantage possible was originally developed for Toyota Motor Company by Taiichi Ohno,[5] but by the early 1980s had spread to a variety of Japanese manufacturing companies (and some American ones). In such industries as automobiles, air conditioners, and projection televisions, the Japanese can develop and manufacture new products in one half to one third the time of any other nation, usually with a comparable reduction in cost and personnel. The rapid manufacturing capability in turn makes possible Ohno's just-in-time supply system, which is based on the notion that new parts should be produced only to meet an immediate need. This system has allowed Toyota assembly lines to stock only about two hours' worth of parts inventory compared to two weeks' worth of inventory for a typical General Motors plant.

At double or triple speed, Japanese companies can achieve an enormous advantage in time-based innovation and product through a process of steady, incremental improvements. A typical example comes from the 1990 book *Competing Against Time*, by George Stalk, Jr, and Thomas Hout. Every year between 1979 and 1988, the Melco (Mitsubishi Electric Company) added a new feature or made a major design change in its three-horsepower heat pump, including the introduction of integrated circuits to control the pump cycle (1980), microprocessors (1981), an inverter for better control of the electric motor's speed (1984), and "learning circuity," which allow the unit to learn when to defrost itself and how to best respond to each consumer's unique temperature environment (1988).[6] It was not until the middle 1980s that the American company that led the industry was considering the use of integrated circuits in its residential heat pump. The four to five year time required for new product development, manufacture, and marketing would have given the company a new product in 1990 comparable to the 1980 Melco heat pump. The American company decided instead to purchase their advanced air conditioners, heat pumps, and components from the Japanese competition.

The clearest sign of success of fast cycle time strategy in business is when your competitor raises the white flag and sources their products or components from you. Similar, the clearest sign of success of fast cycle time in warfare is when the enemy surrenders. Prisoner count, not body count, is the goal.

How can an organization achieve a fast response or time compression? Any organizational system, to be most effective, to run as efficiently as possible, must minimize the "friction" in its four loop phases. Friction is usually thought of in mechanical terms, as the lack of smooth operation of equipment, which generates waste heat. It was the great 19th Century military strategist Carl von Clausewitz who first made the analogy to warfighting.[7] "Friction is the only concept that more or less corresponds to the factors that distinguish real war from war on paper." This friction could be equipment that fails, bad weather, mistaken intelligence, orders that are never received, the so-called "fog of war," as Clausewitz also called it. "Friction, as we choose to call it, is the force that makes the apparently easy so difficult." Friction in business is parts that are not available, defects that have to be repaired after production, inventory pile-up—whatever occurs in a product cycle that delays the adding of value.

Applying Clausewitz's reasoning, Boyd concluded that since we want to compress our own cycle time, we must eliminate friction wherever we can in the cycle. To get the best observations, we must be as directly connected to our environment as possible. In Operation Desert Storm we not only had satellite images, but also reconnaissance planes that could be used to assess the effectiveness of operations because of our rapidly achieved air superiority. The central idea is to gather and disperse the information as quickly as possible.[8]

Superior observation and communication are crucial in many businesses. The Cable News Network, CNN, was able to keep its Baghdad correspondents, Peter Arnett and Bernard Shaw, on the air during the first night of Allied bombing in large part because of an expensive dedicated voice circuit. All of the other networks had regular phone lines. The coverage of the Gulf War attracted the largest audience in CNN history. Although only 11 years old, CNN has surpassed the networks in providing instantaneous global coverage of fast-breaking new stories. It has become a

fast-cycle company, as Tom Peters has explained in his 1991 PBS special, “Speed is Life.” Perhaps it is not surprising that the best coverage of a fast-cycle war was done by a fast-cycle news organization.

In manufacturing, the observations are made most directly by the retail sales people, who learn day by day what sells and what does not. Speed requires constant upgrading of customer information, instant transmission to the home office, and tabulation on computer. During the design phase of its new cars, Toyota assigns sales personnel to development teams to provide them, directly, with the latest information on ever-changing customer needs, desires, and attitudes.

To be able to decide and act quickly requires having as few layers of management and bureaucracy as possible. Decision-making should be delegated to field officers, wherever possible, for in warfare, as in business, there is usually no time to refer decisions all the way up the chain of command. This delegation—local responsibility, decentralized scheduling—together with the elimination of the many layers of indirect laborers who add no value, is the essence of flexible manufacturing—producing the same goods with fewer people in less time. The biggest U.S. manufacturer of automobile suspension components uses 107 direct laborers and 135 indirect ones to produce 10 million units per year (at $100 per unit). A Japanese competitor that produces one third as many units—3.5 million per year (at $49 per unit)—uses 50 direct laborers, but only 7 indirect ones.[9]

What is the opposite of delegation? America carried the notion of a centralized chain of command to its extreme in Vietnam, a war in which the selection of bombing targets was often made by President Johnson and his advisors inside the White House. In the Gulf War, President Bush fully delegated the conduct of the war to General H. Norman Schwarzkopf, based in Saudi Arabia, the theater of operations.

Unfortunately most American companies remain mired in bureaucracy, with a stunningly top-heavy management system. Here is the how many major companies tip the scales:[10] At General Motors, the quintessential American manufacturer, 77.5% of the work force is white collar and salaried, 22.5% are hourly blue-collar workers; Mobil Oil is 61.5% white collar; General Electric 60%; Dupont, 57.1%; Chrysler, 44.4%, Exxon, 43%; A.T.&T, 42%; Ford, 37%. At IBM, which does much of its manufacturing overseas, a stunning 91.5% of the staff is white collar. As UCLA professor Richard Rosecrance has written, “More than half of the modem American corporation consists of workers uninvolved in operations or production work, an astounding fact.... The ratio in typical corporations in Japan is about one-sixth of the American figure.”

The ability of various elements of the armed forces to think and move quickly and independently requires special training. As realized in the blitzkrieg, this necessitated, in the words of General Blumentritt, “an officers training institution which allows subordinates a very great measure of freedom of action and freedom in the matter of executing orders and which primarily call for independent daring, initiative, and sense of responsibility.”[11]

THE NEED FOR A COMMON ORIENTATION

A fast tempo by independent sub-groups of the same organization requires that all sub-group leaders are headed in the same direction. For Blumentritt, this is a “body of officers to whom all tactical conceptions are fully

clear." For Boyd, their common outlook will "simultaneously encourage subordinate initiative yet realize superior intent." This is the "Orientation" of the time-cycle loop. The orientation determines one's ability to accurately interpret information. It is the lens through which one views the world. Orientation is crucial because no matter how efficiently an organization Observes, Decides, and Acts,—no matter how fast its cycle time—it is doomed to fail if it is headed in the wrong direction—building cars no one wants or attacking in the wrong place. What is needed in each organization is a coherent paradigm that can shape and adapt to unfolding circumstances. Since the world is constantly changing, successful response and adaptation requires constant re-education, followed by re-orientation.

This concept is the essential element of flexible manufacturing—a highly educated work-force, highly trained, yet continually being retrained. As a *Harvard Business Review* article put it, "fast cycle time is a management paradigm, a way of thinking about how to organize and lead a company."[12] The common orientation can be promoted by such techniques as life-time employment guarantees, a company-wide commitment to quality, and the like. The common orientation helps achieve internal harmony, which is necessary to respond coherently to changing circumstances. Without it, different sub-groups of an organization will necessarily respond differently, and new external threats will lead to confusion and disorder, even internal paralysis. After introducing a new car design, American auto companies typically require 11 months to return to their previous level of quality, while Japanese lean production auto plants require under one and a half months, even though they started with a higher level of quality.[13] The solution is to avoid compartmentalization, rigidity, and disconnection from the environment. Surviving external competition requires achieving internal cooperation.

In the Gulf War, internal cohesion was in large part achieved because most of Schwarzkopf's key planning officers were graduates of the School of Advanced Military Studies (SAMS) at Fort Leavenworth Kansas. The school was established in 1983 by Brig. Gen. Huba Wass de Czege to teach top Army officers the operational art of war. Each year 150 students take intensive seminars in military history and war theory. The strategy taught focuses on maneuverability, agility, and speed, rather than the Army's traditional tactics of frontal assaults and superior firepower. Colonel Boyd regularly gave his briefing on how the history of warfare from the battles of Alexander the Great, Hannibal, Genghis Khan, Frederick the Great, and Napoleon, to the blitzkrieg and the Vietnam War, demonstrated the importance of fast-cycle time, maneuver-based warfare.

The school tried to foster a "bond of common knowledge and common interest" among the students, according to Col. Richard Sinnreich, SAMS director between 1985 and 1987. "Huba's view, and mine, was that common orientation was not only valuable, but essential." This bonding "facilitated within the Army an ability to communicate tactical and operation constructs concisely and clearly, which is very beneficial," according to Lt. Col. Hal Winton, a former deputy director. In the Gulf War, every level, from division and corps command up to U.S. Central Command in Riyadh had a planning group of three to five officers; most of who were SAMS graduates.

Unfortunately, internal coherence has not been the norm in most recent U.S. military operations. More typical is the failed 1980 "Desert One" hostage rescue mission.[14] Desert One should have been a small, tightly knit operation; daring commando raids require split second timing and a high degree of cohesion. Instead, all four

services—Army, Navy, Air Force, and Marines—were involved in the operation. Confusion between Marine helicopter pilots and Air Force refueling tankers apparently caused a collision in which eight died, helping to doom the mission.

Similarly in U.S. manufacturing, too often there is competition between labor and management, between the financial division and the design engineers, and so on throughout the organization. In the 1960s and 1970s, this competition slowed innovation and the adoption of the latest technology in many of our major manufacturing companies; it helped delay the introduction of front-wheel drive cars at Ford Motor Company for more than a decade. To reverse the trend, Ford abandoned the rigidly hierarchical pyramid in its organizational chart for developing the *Taurus* and chose a hub-rim design, with the overall car program management in the center connected to all elements of the team, from manufacturing to service; such a management design increases flexibility and adaptability and decreases internal friction. More generally, the Japanese, and some American companies, have established a close, cooperative relation, not just between management and labor, and the various internal divisions of a company, but also between major companies and their component suppliers, and, most importantly, between the company and the customer. Once a strong bond is formed between a company and a customer, achieved by stressing quality products and customer service, it can be difficult to break, even as changing currency values make a competitor's products competitive in cost. It was to a great extent the quality of Japanese manufactured goods (coupled with initially lower costs) that broke the weak bonds of customer loyalty between American consumers and manufacturers that had developed as a result of inattention to both quality and customer service.

Destroying a competitor's interconnections became a key element of Boyd's military theory. He went beyond Clausewitz's idea of minimizing one's own friction to the notion of maximizing the enemy's friction at the same time. One could do it by clouding an adversary's Observations with deceptive or ambiguous pictures of reality, and ultimately by destroying his world-view by disorienting him. This idea came from Sun Tzu, the brilliant Chinese military strategist of the Fifth Century B.C. Sun Tzu's teachings, *The Art of War*, have been widely used for more than 2000 years by military commanders, including Mao Tse-Tung; the book is also a favorite among Japanese businessmen (See “The Wisdom of Sun Tzu”).[15]

SIDEBAR: THE WISDOM OF SUN TZU

“All warfare is based on deception.”

“Offer the enemy a bait to lure him; feign disorder and strike him.”

“In war, numbers alone confer no advantage. Do not advance relying on sheer military power.”

“The enemy must not know where I intend to give battle. For if he does not know where I intend to give battle he must prepare in a great many places. And when he prepares in a great many places, those I have to fight in any one place will be few.”

“For to win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill.”

“Thus, what is of supreme importance in war is to attack the enemy's strategy....”

In the fast-cycle framework, what is of supreme importance is to attack the enemy's orientation, the enemy's world-view. Saddam Hussein's strategy was to withstand our blows and force us to fight the kind of war he fought with the Iranians—direct frontal assault against fortified positions. Schwarzkopf attacked and destroyed Hussein's strategy, by creating a false impression of U.S. intentions and then rapidly bypassing the fortified positions. The very name, Desert Storm, implied that the aim of the U.S. attack was to multiply enemy confusion and friction, to maximize Iraq's "fog of war."

In manufacturing, America's strategy has been mass production. The Japanese attacked this strategy using flexible manufacturing. As one manufacturing analyst wrote of traditional, slow-cycle production, "What distorts the system is time: lengthy delays inevitably create an inaccurate view of the market."[16] By exploiting time-based competition to accelerate the pace of innovation and production, by developing product cycle times two to three times faster than that possible under mass production, the Japanese made their competitors' distorted view of the market an even greater liability.

According to a Peter Drucker op-ed, "The Big Three Miss Japan's Crucial Lesson,"[17] "Detroit still operates on the assumption that the U.S. car market is segregated into four or five 'socioeconomic' groups. But this theory became obsolete 15 years ago." The Japanese, on the other hand, not only understand the far greater "life-style" segmentation of the American market, but the flexible manufacturing system allows more different models to be generated, and at a faster pace, which in turn allows the Japanese to more rapidly adjust their cars to changes in consumer tastes. Nissan in particular has developed an advanced flexible manufacturing factory that can be retooled simply by changing its computer software, rather than by changing the machine tools themselves. This "intelligent" assembly line may be able to reduce new-model changeover times from over 9 months to under three months, which would give it a tremendous advantage in the growing niche markets of cars and trucks that sell under 200,000 units a year.[18]

An analogy can be drawn between the fossilization that took place in American industry during the 1960s and 1970s and what happened to the American military. Here is how Boyd describes the old way of thinking, as epitomized by World War I trench warfare: "The aristocratic tradition, the top-down command and control system, the slavish addiction to the 'Principle of Concentration,' and the drill regulation mind-set, all taken together, reveal an 'Obsession for control' by high-level superiors over low-level subordinates that restricts any imagination, initiative, and adaptability needed by a system to evolve the indistinct- irregular-mobile tactics that could counter the increase in weapons lethality." Substitute "foreign competition" for "weapons lethality" and this is an uncanny indictment of many large U.S. companies.

The rigid, head-on, attrition-based strategy was a common one for America in most wars. It is how the Marines fought the Japanese in Iwo Jima. It was the basis for the "body count" mentality of the Vietnam War. General David Jones, former Chairman of the Joint Chiefs of Staff candidly acknowledged:[19] "Although most history books glorify our military accomplishments, a closer examination reveals a disconcerting pattern: unpreparedness at the start

of a war; initial failures; reorganizing while fighting; cranking up our industrial base; and ultimately prevailing by wearing down the enemy—by being bigger, not smarter." Before it was rewritten by Brig. Gen. Wass de Czege in the 1980s to reflect more maneuver-oriented warfare, the Army's field manual instructed the commanders at battle front that

> "The chief mission of these forces must be to fight with sufficient strength and tenacity to force the enemy to disclose the size and direction of his main attack, and to buy time while defending forces concentrated **in front of the main thrust**.... In mounted warfare, armored and mechanized elements must be set in motion toward the battle positions **in the path of** the enemy thrust."[20]

Taking the enemy head on requires large forces and insures high casualties. Expecting the military to fight the traditional way, virtually all of the nation's military experts significantly overestimated the American casualty rate in the Gulf War.

WINNING THE GULF WAR THE FAST-CYCLE WAY

The first clue that the Gulf War might be different came with news reports in early January that the commandant of the Marine Corps, General Alfred Gray, had sat through, and paid attention to, the briefings of a Colonel John Boyd, an officer not known to the general public. When Gray took command of the Marines in late 1980s, he had had their basic fighting manual rewritten to reflect a more mobile, maneuver-oriented warfare, using the principles developed by Colonel Boyd. He mailed Sun Tzu's book to every officer and in 1990 designated it the "Book of the Year"—required reading for all Marines.[21]

Sun Tzu's axioms—such as "In war, numbers alone confer no advantage. Do not advance relying on sheer military power"—are the antithesis of attrition warfare. Discussing how to deal with the entrenched Iraqi forces shortly before the air war began, Brig. Gen Russel Sutton, head of Marine Corp planning said, "The last thing we want to do is try to meet him [Hussein] head on. This is pure Sun Tzu."

The next, and clearest, evidence that this was a fast-cycle-time war came from a mid-February briefing by Marine Brig. Gen. Richard Neal, U.S. Central Command's deputy director of operations: "We're inside his decision-making cycle.... We're kind of outthinking him.... We can see what he's been doing, we can kind of anticipate what his next move is going to do, and we can adapt our tactics accordingly."[22]

Compare this with Boyd's central message: "Mentally we can isolate our adversaries by presenting them with ambiguous, deceptive, or novel situations, as well as by operating at a tempo they can neither make out nor keep up with. Operating inside their OODA loops will accomplish this by disorienting or twisting their mental images so that they can neither appreciate nor cope with what's really going on."

Isolating the Iraqis was a primary goal. We used the U.N. to isolate them politically and economically. Then, our military plan for the Iraqi Army was, in the words of Chairman of the Joint Chiefs of Staff Colin Powell: "First we're going to cut it off, then we're going to kill it."

The final indication that the Gulf War was a John Boyd war came from the February 27 news conference in which Schwarzkopf spelled out the U.S. war strategy. First, we destroyed the Iraqi ability to observe our actions. In

Schwarzkopf's words: “We know that he had very, very limited reconnaissance means. And therefore, when we took out his air force, for all intents and purposes, we took out his ability to see what we were doing down here in Saudi Arabia.... We had taken out his eyes.” At the same time, we destroyed Iraqi communication facilities, command and control bunkers, and bridges, degrading the army's ability to decide and act quickly. In a sense, these attacks, coupled with the initial allied build-up along the Kuwaiti-Saudi border, froze Iraq's strategic plans and guaranteed that any response to a changing allied strategy would be very slow.

Once the Iraqis’ eyes and ears were taken out, troops and supply bases were rapidly shifted west, in one of the most sophisticated, high-speed logistical operations in history. About 300,000 troops, together with thousands of tons of fuel, ammunition, spare parts, and food—a 60-day supply—were moved in a few weeks. When the ground war began, the Marines and the Saudis launched two thrusts directly across the Kuwaiti border so as to convince the Iraqis we were going to “take them head-on into their most heavily defended area.” At the same time, amphibious feints were launched to freeze those Iraqi forces situated along the coast.

A sweeping indirect attack was then launched in the west, to cut off and encircle the Iraqi Army. As many of the smaller head-on assaults penetrated the Iraqi lines, the Iraqis became completely surrounded and disoriented, making the ultimate annihilation of their once-feared Republican guard surprisingly simple. This is Boyd's strategy: “Present many (fast-breaking) simultaneous and sequential happenings to generate confusion and disorder—thereby stretch out time for adversary to respond in a directed fashion.”

As noted earlier, the object of the fast-cycle strategy is to disorient the enemy, and so the clearest sign of success, particularly evident in the ground war, was the tremendous number of prisoners.

Remarkably, a 1988 *Harvard Business Review* article on the impact of flexible manufacturing foretold the U.S. military strategy against the large, entrenched Iraqi army: “Indirect attack requires surprise. Competitors either do not understand the strategies being used against them or they do understand but cannot respond sometimes because of the speed of the attack, sometimes because of their inability to mount a response.... Time-based strategy offers a powerful new approach for successful indirect attacks against larger, established competitors.”[23]

Success through surprise requires variety, rapidity, and novelty. Possessing a variety of responses that can be applied rapidly has two advantages. First, it increases adaptability, by allowing an organization to try quickly many approaches for responding to changing circumstances. Second, it allows the organization to maintain the initiative, while any competitor can do little more than react to the multiple attacks. Novelty further slows an adversary down by confronting him with unfamiliar events and ideas, ones that have not been experienced before. The Iraqis were familiar with the head-on, human wave attacks of the Iranians, not the rapid, flanking maneuvers of the Allies.

Similarly, a key advantage of flexible manufacturing is that it can quickly generate a large variety of novel products to overwhelm a competitor. The Stalk article described the Honda-Yamaha “variety war.” The two companies both started with 60 models of motorcycles. In 18 months, Honda replaced 113 models, turning over its production line twice. Yamaha managed only 37 changes. Honda introduced novelty—four-valve engines, composites—which the customer began to expect. But Yamaha could not deliver and it was crushed. At one point it had more than 12 months

of inventories in its dealers showrooms. Its time had been stretched out; its friction (those inventories) had been maximized. Honda had been able to “turn manufacturing into a marketing weapon.”[24]

The Allies had a variety of options—continuing the air campaign to starve out the Iraqi Army, a frontal blitzkrieg assault using multiple pincer attacks, an amphibious assault, or, the one they chose, a sweeping attack around the Iraqi right flank. Yet the specific ground war plan the Allies used to achieve their Gulf War victory was far less important than their ability to achieve a much faster cycle time than the Iraqis. After all, the Iraqis might have guessed what we would do and changed their tactics, but even if they had, we would have seen the Iraqi movements, and changed our tactics, perhaps by destroying the moving forces from the air, or by driving through whatever hole was opened up by the Iraqi movement. Since we had more options and a faster response time, we could be assured of ultimately outmaneuvering them. In this sense, a fast cycle time strategy reduces the risk of being caught off guard by enemy actions

Similarly, a fast-cycle business strategy reduces risk. For instance, the danger posed to Honda's market share by G.M.'s Saturn has been reduced by Honda's ability to incorporate Saturn designs into its *Civic CRX* before Saturn was even introduced. Risk reduction can be even more dramatic in volatile businesses such as women's fashion. New clothing orders from the Far East Asia can require 9 months lead times, but demand can be as much as 40 percent above or below such long-range forecasts.[25]

In recent years, domestic manufacturers have reduced the lead time to weeks, which reduces the inaccuracy of forecasts to plus or minus 10%. The American textile manufacturer Milliken & Company can deliver fabric to customers in a week or less, and has been working with American apparel manufacturers to reduce their production cycle times and to put in place “just in time” inventory controls.

According to Bud Konheim, president of Nicole Miller, a maker of women's clothing, “Everybody contracting in Hong Kong is projecting three and four months ahead of time, which means they're almost always doomed to overbuying.”[26] The company started moving manufacturing back to the U.S. in 1986 and almost all of their dresses and suits are now made here. Since 1989, Euro-American Textile Corporation has increased its volume of American-made fabric from $3 million to $25 million, while European manufacturing dropped to 78%. Fast-cycle time manufacturing is a way to bring jobs home.

BEING FLANKED IN THE TRADE WAR WITH JAPAN

The United States is losing a “manufacturing war” with Japan that threatens to leave us with a reduced standard of living relative to other nations,[27] and also threatens to leave us critically dependent on them for key technologies crucial in civilian and military production. It is not merely in the “micro” level of flexible manufacturing in which individual Japanese companies beat individual U.S. companies. The Japanese have also, in some sense, used multiple indirect attacks in their "macro" trade war with America.[28]

The U.S. federal government's strategy on the trade deficit has been to focus on one number—the overall deficit. To lower this number while increasing their own economic vitality, the Japanese have taken a variety of

approaches. They have moved some assembly plants to the United States, lowering the deficit by the value added by U.S. workers to what remain largely Japanese goods; what is particularly startling is that in the first five months of 1991, Japanese car companies shipped more autos **back** to Japan from their American manufacturing plants than American auto makers sold in Japan.[29] The Japanese have similarly moved plants to countries other than the U.S., like Thailand, while keeping the highest value-added jobs in Japan. Direct overseas investment by Japanese manufacturers has risen from the $2 to $3 billion range of 1982-1985 to more than $15 billion in 1989. Finally, while the Japanese have increased their trade surplus with the U.S. in computers, office machinery, and electrical and power-generating machinery, they have more than offset this by increased purchases in American cork, breakfast cereals, meats, fish, scrap metal, tobacco, fruits and vegetables, coal, and paper.

In 1990, Japan's trade surplus with the United States in just three areas—computers and telecommunications equipment, cars and trucks, and industrial equipment—totaled more than $50 billion. Nevertheless, Japan's rapid and novel “flanking maneuver” helped to lower their overall trade surplus with the United States by more than $10 billion between 1987 and 1990, apparently satisfying U.S. trade negotiators who believe that exporting raw materials and importing high technology goods can maintain U.S. economic security. In this sense, the Japanese have followed Sun Tzu and successfully attacked our trade strategy.

America's strategy, which allows the continued erosion of our manufacturing base in key technologies, is dangerously mistaken on both military and economic security grounds. In the Gulf War, more than 20 weapons systems, including the F-15, F-16 and F-18 fighters, relied on foreign components such as transistors and micro-chips. Many, such as the M-1 tank, could not be manufactured without Japanese machine tools. Allied officers had to go to Japan for urgently needed battery packs used in command and control computers, for video display terminals needed to analyze real-time data from reconnaissance planes, and for semiconductors and other key components. In all, the Bush administration made nearly 30 requests to foreign governments during the course of the war for key parts.[30] Moreover, most of the weapons we used in the Gulf war were based on U.S. technology developed in the 1970s. Increasingly, weapons systems are relying on advanced technologies that America does not control, which is at odds with a fast-cycle time-based military strategy. America had the luxury in the Gulf of more than five months to prepare our weapons, test them in the desert, and see what spare parts were needed and what components needed fixing. In a future war, we may not be so lucky, and we might not have such cooperative allies, as President Bush was able to assemble for the coalition.

In his new book, “The Japan That Can Say *Really* Say No,” Shintaro Ishihara writes, “what made [the Americans] pinpoint bombing so effective was PTV, a high-quality semiconductor used in the brain part of the computers that control most modem weapons. There were 93 foreign-made semiconductors in the weapons used by the United States. Among them, 92 were made in Japan.”[31] America “should wake up from this illusion” of superpower status because it “had to ask other countries to contribute money so it could fight, and it depended on foreign technology to carry out its war strategy.”

A healthy industrial base is vital for more than purely military security considerations. Economic security, or competitiveness, is the degree to which a nation produces goods and services that meet the test of international markets while simultaneously maintaining and expanding the real income of its citizens in an equitable fashion.[32] The U.S. no longer provides economic security for the majority of its citizens, as recent Census Bureau reports have revealed. In 1990, the median American family income dropped below its 1973 level. Only the top 20% of American households have had a significant increase in their mean incomes in the past 18 years.[33] Americans are losing their struggle to maintain their standard of living: Only the richest 20% of American families added to their median net worth between 1984 and 1988, while the remaining 80% suffered declining net worth.[34] In 1990, for the first time in thirty years, the total net worth of American households declined.

While manufacturing productivity rebounded in the 1980s, and manufacturing exports began to increase, the manufacturing sector no longer served as the source of good jobs at good wages. According to the Bureau of Labor Statistics,[35] the manufacturing sector has lost 2,500,000 jobs since 1979—2,000,000 of those in durable goods manufacturing. In the late 1960s, manufacturing workers made up more than 25% of the labor force; today it comprises roughly 15%. Worse still, **the United States was the only major industrialized nation whose manufacturing production workers experienced a drop in hourly compensation between 1978 and 1988.[36]**

A recent study[37] found that the U.S. was behind or falling behind in the areas of flexible manufacturing; design for manufacturing; design of manufacturing; integration of research, design, and manufacturing; high-speed machining; precision machining and forming; and total quality management. In the area of robotics and automated equipment, the U.S. is no longer a player.

REVITALIZING AMERICAN MANUFACTURING

The reason America is standing tall again militarily is because we had heavily invested in a highly trained force and advanced technology, and we applied John Boyd's systems approach to our Gulf strategy. The reason America is having trouble competing economically is that we do none of these things: we neither invest in a highly trained work force, nor devote adequate resources to advanced civilian technology, nor take a systematic approach to our economic strategy, such as having a fast-cycle production system or a manufacturing industrial policy.

The nation would benefit greatly if flexible manufacturing were widely used by U.S. companies. Lean manufacturing achieves highest efficiency, quality, and flexibility the closer each element of the system is to one another, from design to assembly to marketing and sales. As competition between foreign and domestic lean producers intensifies, the advantage would go toward the company that did most of its manufacturing in the United States. Therefore, the more U.S. companies adopt flexible manufacturing, the more high paying jobs will be created, both by the U.S. companies and by competitors increasingly forced to manufacture components as well as final products in America.

The environment needed to support flexible manufacturing is well known—a great deal of R&D into advanced manufacturing technology, rapid diffusion of that technology to American companies, and heavy investment in the worker training and infrastructure needed to sustain sophisticated manufacturing.

A variety of federal policies are required. The government cannot afford to keep spending more than 300 times as much federal money on defense R&D as on industrial development. In April, the White House released a list of more than 20 areas of technological development that should be supported as "critical to the national prosperity and to national security"—including flexible computer integrated manufacturing, intelligent processing equipment, micro- and nanofabrication, and systems management technologies.[38] In a letter accompanying the list, William Phillips, chairman of the National Critical Technologies Panel states: "We most recently have been reminded, by the spectacular performance of U.S. coalition forces in the Persian Gulf, of the crucial role that technology plays in military competitiveness. It is equally clear that technology plays a similar role in the economic competitiveness among nations." So far it is has given only lip service, not money, to these new technologies. Worse, in fiscal year 1991, the Defense Department spent more than $300 million in its manufacturing technology program, to help support technologies from automatic machinery to machine tools. The 1992 Bush budget proposes slashing that to under $100 million.

One study found that by the late 1980s, probably 40% of the Japanese stock of machine tools was computer-controlled (or programmable), compared to 11 percent for the United States.[39] As of 1987, more than half of the 1,000 manufacturing plants surveyed in the metalworking sector did not have even one computerized machine! Those suppliers with out-moded equipment account for about one million manufacturing jobs.

The Omnibus Trade and Competitiveness Act of 1988 gave the National Institute of Standards (NIST) the job of creating and supporting Manufacturing Technology Centers, non-profit regional centers for the transfer of manufacturing technology to small and medium-sized companies. These Centers are intended to "transfer technologies developed at NIST to manufacturing companies; make new manufacturing technologies usable to smaller firms, actively provide technical and management information to these firms; demonstrate production technologies; and make short-term loans of advanced manufacturing equipment to firms with fewer than 100 employees."[40] In 1991, about $12 million went to fund 5 centers,[41] and the present NIST plan envisions increasing the number to 12 by 1995. In 1985, the Japanese had 185 comparable testing and research centers providing technology extension services to smaller manufacturers. America has a proven model: the U.S. Agricultural Extension Service has funding of more than $1.2 billion (31% Federal), offices in almost every county in every state, 9,650 county agents and a staff of 4,650 scientists and technical experts; studies have found high rates of return on investment in agricultural research, extension, and farmers' schooling.[42] Yet agriculture contributes 2% to the GNP and manufacturing 20%. The OTA estimates that 120 Manufacturing Technology Centers with a total staff of 3,120 would be needed just to serve 7% of the nation's small and medium-sized manufacturing firms.[43] This is far too low even as a minimum goal for the program.

Flexible manufacturing puts more responsibility in the line worker, and necessitates higher training. New production workers receive 380 hours of training in Japanese automobile plants (370 if those plants are North

American), but only 46 hours in American plants. Public funding for worker training and retraining dropped in the U.S. more than 50% during the 1980s, from $13.2 billion to $5.6 billion, and current Labor Department budgets propose further cuts.[44] Overall public spending on workers—employment services, labor market training, special youth programs, direct job creation, employment subsidies, and programs for the disabled—comes to only 0.25% in the United States.[45] The German government spends more than 1% of its GDP on its workers. If spending on worker training does not increase, neither will high paying jobs. We cannot continue to ignore the 75% of Americans who do not graduate college. The United States must consider an apprenticeship program such as the Germans have, and such as Oregon is now putting in place for non-college bound youth.

Finally, state-of-the-art infrastructure is crucial for creating an environment that sustains high-paying jobs. Unfortunately, our record on infrastructure has been dismal—spending on new infrastructure has fallen from 2.3% of GNP in 1963 to only 1 percent in 1989.[46] At the same time, the U.S. share of major construction contracts world-wide dropped from 50% in 1980 to 25% in 1988. This decline can be expected to continue as the U.S. loses technological superiority in construction to Japan companies, which spend 40 times as much on research into new construction technologies as American contractors. The Japanese government said in 1990 it would spend $3 trillion in the next decade on roads, rail transport, advanced communications technology, and the like.

Since the labor force is expected to increase only 1% a year in this decade, and we are doing nothing to increase productivity beyond its current dismal growth rate of 1% a year, America's economic growth in the 1990s and beyond may not exceed its 1930s average of 2.1%! If Japan is able to maintain a 4% annual growth rate, then its economy will surpass ours in 20 years.[47]

We can pretend we do not know how the Japanese succeed, we can pretend that federal spending in the research, development, and diffusion of manufacturing technology, worker training, and infrastructure will not reverse our declining competitiveness, and we can continue to allow high-paying jobs to disappear and suffer declining wages. If we do, however, then, as Samuel Huntington, Director of Harvard's Institute for Strategic Studies, has written, "at some future time, the United States could find itself in a position relative to Japan that is comparable to the position the Soviet Union is now in relative to the United States."[48] Avoiding this dismal fate will be a challenge, but one that we ought to be able to meet. The Gulf War showed that we know how to implement a winning strategy, that we know how to operate on a fast cycle, that we know how to use technology to our advantage.

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[1] Gunther Blumentritt, "Experience Gained from the History of War on the Subject of Command Technique," January 27, 1947, as cited in Colonel John Boyd, "A Discourse on Winning and Losing," August 1987, p. 79. The emphasis is from the original.
[2] James Fallows, *National Defense*, New York: Random House, 1981, p. 28.
[3] "Two U.S. Firms Outpace Japan Rivals," *Wall Street Journal*, June 14,1991, p. Bl..
[4] Womack, Jones, and Roos, *The Machine That Changed the World*, MacMillan, 1990, p. 109.
[5] See George Stalk and Thomas Hout, *Competing Against Time*, New York: The Free Press, 1990, and Womack, Jones, and Roos, op.cit.
[6] Stalk and Hout, op.cit., pp. 113-114.
[7] Carl von Clausewitz, *On War*, Howard and Paret (eds. and transl.), Princeton University Press, 1976, pp. 119-121
[8] A key breakthrough that made the blitzkrieg possible was General Heinz Guderian's simple decision to put a

radio and radio operator in every tank, an innovation that was a major reason the Germans, with fewer tanks, were able to defeat the French and British at the start of World War II. See James Fallows, op.cit., p. 28.
[9] George Stalk, 'Time--The Next Source of Competitive Advantage," *Harvard Business Review,* July-August 1988, p. 45. Unit costs figures are only for comparison.
[10] Richard Rosecrance, "Too Many Bosses, Too Few Workers," *New York Times,* July 15, 1990, p. F11.
[11] As cited in Colonel John Boyd, "A Discourse on Winning and Losing," August 1987, p. 74.
[12] Joseph Bower and Thomas Hout, "Fast-Cycle Capability for Competitive Power," *Harvard Business Review,* November-December 1988, p. 111.
[13] Womack, Jones, and Roos, op.cit., pp. 118-119.
[14] Edward Luttwak, *Pentagon and the* Art *of* War, New York: Simon and Schuster, 1984, pp 44-45.
[15] Sun Tzu, *The* Art *of War,* translated by Samuel B. Griffith, London: Oxford University Press, 1971.
[16] George Stalk (1988), op.cit., p. 47.
[17] Peter Drucker, "The Big Three Miss Japan's Crucial Lesson," Wall *Street Journal,* June 18, 1991.
[18]"Nissan's Flexible, "Thinking' Line for Auto Body Assembly," *New York Times,* August 25, 1991, p. Fl1.
[19] Cited in Luttwak, op.cit. p. 266.
[20] Fallows, op.cit. p. 32.
[21] *Wall Street Journal,* "A Very Old General May Hit the Beach With the Marines," January 9, 1991.
[22] *Boston Globe, "*The Force was with them: Army's Jedi Knights forged Gulf War strategy," March 17, 1991, A23.
[23] George Stalk (1988), op.cit., p. 50.
[24] The phrase is borrowed from Tom Peters, *Thriving on Chaos,* Alfred A. Knopf, 1987, p. 195.
[25] Stalk and Hout, op.cit., p. 31.
[26] "U.S. Garment Makers Come Home," *New York Times National Edition,* October 8, 1991, pp. C1, C17.
[27] See, for instance, Michael Dertouzos, as quoted on *60 Minutes,* April 21, 1991 and Michael Porter, *The Competitive Advantage of Nations,* New York: The Free Press, 1990, pp. 723-724.
[28] Kevin Kearns, "Japan's Sleight of Hand in Trade," *New York Times,* April 7, 1991. See also, "U.S. Is Asked To Review Japan Trade," *New York Times,* March 25, 1991, and "The Rising Sun Tries to Ration its Rays," *The Washington Post National Weekly Edition,* April 8-14,1991.
[29] *New York Times,* June 14, 1991, p. D2.
[30]The U.S. Achilles' Heel in Desert Storm," *The Washington Post National Weekly Edition,* April 1-7, 1991 and *60 Minutes,* April 21, 1991.
[31] As. cited in "A Japan That Can Take Credit," *Newsweek,* July 15, 1991, p. 27.
[32]Adapted from the definition of competitiveness used by the Presidents Commission on Industrial Competitiveness, cited in John Young, "Technology and Competitiveness," *Science,* July 15, 1988. 1 have added the notion of equity, which has, historically, been an element of economic security.
[33] "Money Income of Households, Families, and Persons in the United States 1990," Bureau of the Census, August 1991.
[34] "Household Wealth and Asset Ownership: 1988," Bureau of the Census, December 1990.
[35]"Industry Analytical Ratios for Manufacturing," Bureau of Labor Statistics, September 1991.
[36] Lawrence Mishel and David M. Frankel, *The State of Working America 1990-91,* Armonk, New York: M. E. Sharpe, Inc., 1991, pp. 258-259.
[37] *Gaining New Ground: Technology Priorities for America's Future,* Council on Competitiveness, Washington, D.C., 1991.
[38] "White House Lists 22 Critical Technologies," *New York Times,* April 26, 1991.
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[40] U.S. Congress, Office of Technology Assessment, *Making Things Better, Competing in Manufacturing,* OTA-ITE-443, Washington, DC: U.S. Government Printing Office, February 1990, p. 54.
[41] "An Industrial Policy, Piece by Piece," *New York Times,* July 30, 1991, pp. D1, D2.
[42] *Making Things Better, p. 55.*
[43] Ibid, pp. 55-56.
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[45] "Why we should invest in human capital," *Business Week,* December 17,1990, pp. 88-89.
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[48] Samuel Huntington, "America's changing strategic interests," *Survival,* January/February 1991, p. 16.