THEN, AND NOW

Why Roosevelt's Explosive 1933-45 Recovery Worked

Part 3, by Richard Freeman

The following is Part 3 of 3 of an article that appeared in a LaRouche in 2004 special report, Economics: The End of A Delusion. *Part 1 (see* EIR, *April 26, 2002) traced the roots of President Franklin Roosevelt's economic outlook, and showed that his approach was grounded in the American System of political economy, as defined by Alexander Hamilton and by the Constitutional principle of the General Welfare. Part 2 (see* EIR, *May 3, 2002) put to rest the oligarchy's charges that FDR's steps to bring the United States out of the Great Depression was make-work; in fact, tremendous building up of the United States took place.*

C. The Economic Mobilization for the Arsenal of Democracy

The "Arsenal of Democracy" economic mobilization, from 1939, utilized the full achievements of the preceding New Deal, and added a new qualitative dimension, to achieve an economic expansion the scope of which had not been seen before.

In this period, science became the driver of the economy, spinning off new discoveries month after month. The question was: What can be done to change the underlying geometry, and therefore the capability, of the physical economy as a whole? Investment was targetted into those capital goods sectors with the highest civilian or military growth rates. These sectors' superior technologies and higher productivities cascaded over into the economy as a whole. At the same time, the technological skill level of the labor force was upgraded. The creative powers of the population were ignited and directed.

A new principle, of "crash program" mobilization behind a scientific mission, was in operation. From the outside, the World War II buildup of the American economy seems a miracle. It was—but a repeatable miracle. It demonstrated that for most of its history, the U.S. economy, though the world's most advanced industrially since the late 19th Century, has not been living up to half, or even one-tenth, of its potential. *An economy is never functioning until it is tested by being pushed to extremes.* Then industry not merely doubles or triples, but shows a capacity to grow non-linearly, exponentially. The economy discovers new powers and a new perspective.

Roosevelt, assuming the role of wartime commander-in-chief, implemented the principles of the American System of political economy that had guided the New Deal, but with a new characteristic emphasis.

Abundant and cheap credit was injected into the economy, through the Reconstruction Finance Corporation and through the U.S. Federal Reserve Board lending window, but *only for top-priority productive sectors.* These productive sectors were manufacturing, construction, mining, power generation, transportation, and to a more limited degree, agriculture. Other sectors of the economy got limited credit; but speculation, rentier-finance, the secondary real estate market, and the like, were suppressed and cut off from credit.

Teams of the best scientists and engineers were assembled to make planned scientific breakthroughs. The Manhattan

Project is the best known and most breathtaking World War II example. Under this program, within two years, $3 billion was spent, 22,000 scientists and engineers were assembled, including such scientists as Enrico Fermi and Ernest Lawrence, as well as Colonel Leslie Groves and the Army Corps of Engineers, to harness the processes of the atom, discovered by Marie Curie and her heirs, and to produce a controlled reaction from uranium 235. In this way, seminal ideas about the physical universe were forced into existence and fleshed out, permanently altering nature and men's lives.

Electricity was used on a scale not attempted before, including doubling the electric horsepower funneled to manufacturing between 1939 and 1945. Electricity is a pre-World War I technology, vastly more efficient than thermal-heat energy sources for powering machines, turning generators, etc.; but it was only fully exploited during World War II. Projects such as the Tennessee Valley Authority and the Grand Coulee Dam, which were developed by Roosevelt during the 1930s, supplied the massive amounts of electricity necessary to exploit, for the first time, the highly electricity-intensive aluminum industry, without which the United States might not have won the war.

Capital goods and raw material resources were directly allocated where necessary.

The training and retraining of workers was undertaken on a scale unprecedented in American history, including training 3 million civilians between 1941 and 1942 alone.

These elements in their general form are the elements of the American System of political economy, founded by that "American-in-spirit" Gottfried Wilhelm Leibniz in the Seventeenth Century, and formulated in policy and in name by Alexander Hamilton, Benjamin Franklin, and Abraham Lincoln.

The necessity to crush the Nazi forces, and secure civilization, made this economic transformation necessary; but the dynamics of the "science-driver principle" illustrate how it worked, and completed the Roosevelt recovery.

A New Economy

Contrary to the popular myth, the World War II buildup did not represent simply "using unused capacity." The essential process was one of building—on top of the civilian economy—a brand-new war economy, *using the newest technologies and the highest labor productivity,* and therefore radiating a tremendous rate of growth. War goods production, in itself, represents pure overhead or waste to an economy; once produced, war materiel leaves the reproductive cycle forever, as if simply taken and dumped into the Atlantic Ocean. Then how can war goods production generate growth? If it embodies new technologies, the resulting higher productivity in the civilian economy, more than pays for the war expenditure, by means of higher overall productivity and output.

Moreover, there was a very personal method by which the war command economy worked: President Roosevelt constantly and relentlessly drove the production goals higher and higher, outstripping what was thought possible. An internal memo written by Stacey Macy, one of the higher-placed officials of the War Production Board in 1943, illustrates the point. Macy predicted that the United States would meet its war and civilian goals for 1943, but that the next year, the economy would fall apart. In fact, the next year, output grew. In 1944, various memoranda concluded that the U.S. economy could not resolve the strains and make it through to the second half of the year. It did. Each time, the economy would outperform itself.

From the very beginning of the war, FDR would throw out a figure, and most would proclaim that it couldn't be done. When he first proposed 26,000 planes in March 1940, the press denounced his plan as "Buck Rogers." Roosevelt's strength was to ignore the idiots of the press. Every six months, he increased the production quotas—using realistic engineering estimates, but always at the extreme end of their scale. Invariably, the quotas were met.

When he had to be, Roosevelt was ruthless. This has led various of his biographers to label him "duplicitous," and "power-hungry." This is buncombe. While not formally an intellectual, FDR believed fully in the reality of ideas—live and important ideas *such as winning the war.* His passionate pursuit of such an idea, in all its reality, might make him appear to be changing course from day to day. It might make him invade his officials' bailiwicks to get things done. This quality, becoming more forceful in the war years, made him—despite his shortcomings—fill the office of President, and not rattle around in it like most other Presidents of the Twentieth Century.

This will become clearer, after a preliminary review of what the "arsenal of democracy" mobilization achieved, what obstacles the Roosevelt administration had to overcome, how the production goals were achieved, and finally, the capital intensity and productivity of the buildup.

In terms of raw goods output, the outpouring of the U.S. economy from January 1940 through August 1945, totaled more than half of all the Allies' combined military and civilian output, and included:

300,000 war planes
124,000 ships of all types
41 billion rounds of ammunition
100,000 tanks
434 million tons of steel
36 billion yards of cotton textiles.

Compare: The Navy in 2002 is complaining that there may not be sufficient capacity to produce its order of 30 planes for the year.

But there were also profound alterations in the economy and the labor force. **Table 3** shows the industrial production index during the war years. As can be seen, between 1939 and 1944, *the index and thus the real goods output of the economy more than doubled,* increasing by 118%. In 1945, the index fell, reflecting the demobilization from war production in the

TABLE 3
Industrial Output Growth, 1939-45
(Industrial Production)

Year	Index (1967=100)	Per Annum Change
1939	21.7	—
1940	25.0	15.2%
1941	31.6	26.4
1942	36.3	14.9
1943	44.0	21.1
1944	47.4	7.7
1945	40.7	–16.5

TABLE 4
Profits and Wages, 1939-47

Year	Average Annual Wages (dollars)	Corporate Profits (billions of dollars)
1939	$1,363	$ 5.3 billion
1940	1,432	8.6
1941	1,653	14.1
1942	2,022	14.3
1943	2,349	23.5
1944	2,517	23.6
1945	2,517	19.0
1946	2,517	16.6
1947	2,793	22.3

TABLE 5
Employment by Sector, 1939-47
(In Millions)

Year	Armed Forces	Civilian	Manufacturing	Unemployed
1939	0.37	55.75	10.28	9.48
1940	0.54	55.64	10.99	8.12
1941	1.62	55.91	13.19	5.56
1942	3.97	56.41	15.28	2.66
1943	9.02	55.54	17.60	1.07
1944	11.41	54.63	17.33	0.67
1945	11.44	53.86	15.52	1.04
1946	3.45	57.52	14.70	2.27
1947	1.59	60.17	15.55	2.36

TABLE 6
Interest Rates, 1939-47

Year	Discount rate (NY Fed)	Prime Rate
1939	1.00%	1.50%
1940	1.00	1.50
1941	1.00	1.50
1942	1.00	1.50
1943	1.00	1.50
1944	1.00	1.50
1945	1.00	1.50
1946	1.00	1.50
1947	1.00	1.50-1.75

latter part of the year. The average annual compounded growth rate was an astounding 16.9%. **Table 4** shows that average gross wages doubled between 1939 and 1944. (The effects of wage-price controls finally ended wage increases in 1945.) Some of this increase is, of course, due to longer hours worked. Real wages, nonetheless, rose by more than 50% during this period.

At the same time, corporate profits increased 4.5 times, demonstrating that profits can grow spectacularly with enough surplus being generated to greatly increase wages as well—because leaps in productivity vastly increase the size of the surplus.

Table 5 shows the transformation of the labor force. In 1939, the official number of unemployed, at 9.5 million, was almost as large as the total number of the manufacturing workforce, at 10.3 million. By 1944, the unemployment level had fallen to 0.67 million; there was an acute labor shortage throughout all sectors of industry. This represented a reduction in the unemployment level by 8.81 million. Were the United States today able merely to replicate the achievements of 1939-44, unemployment would not exceed 1 million persons.

From 1939 until 1944, the U.S. Armed Forces grew from 370,000 to 11.41 million. The common, but false interpretation of the war period, is that the armed forces simply absorbed the unemployed. But look at what happened to the manufacturing labor force. It grew by 7.3 million, or 70%, during the war years. Even after the war ended, by 1947, the manufacturing labor force was 15.6 million, a 50% increase over the 1939 levels. Blacks and women entered the labor force in large numbers during the war. While many women left, blacks stayed—an upgrading of their status and living conditions. Thus, the labor force had been permanently altered, and along with it the economy. The expansion in manufacturing is what equipped the United States to have stable economic growth in the 1950s.

Credit policy is indicated in **Table 6.** It can be seen that the Federal Reserve's interest rate on funds lent to commercial banks through the discount window was only 1.0% in 1939. By 1942, it had zoomed to . . . 1.0%. Then in 1945, it skyrocketed to . . .1.0%. The prime rate held steady at 1.50% throughout the war.

This refutes the standard argument made by Federal Reserve Board economists, that when there is tremendous credit demand, interest rates must leap upward. During World War II, there was tremendous credit demand. But interest rates remained low, as a result of a dirigistic credit policy. Inflation,

even before wage-price controls were applied in 1943, was relatively low, and a good part of this inflation was created by scarcity of goods.

The Obstacles FDR Had To Overcome

Let us take a step back to the outset of the war, and consider the three major obstacles that the President of the United States faced in building a war economy. They were as much political as economic: 1) an economy not fully functioning up to speed; 2) opposition to U.S. entry into the war against Hitler; and, 3) a non-existent U.S. military.

The first obstacle arose from the fact that Wall Street and Morgenthau had set back the economy in 1937, and it still needed technological improvement.

The second, outright opposition to any buildup, came from a coalition of variously intentioned individuals. There was a widespread fear of war, and a pro-Nazi faction grouped around the Harriman banking house, and such individuals as John Foster Dulles. Fear was manipulated by this faction through a widespread "isolationist" movement. For example, in March 1940, FDR asked Congress for funds to construct 50,000 planes. Congress would only approve funds for 57. Moreover, in November 1941—one month before Pearl Harbor—a majority of businessmen polled by *Fortune* magazine opposed the essential efforts to convert U.S. industry to war production, denouncing the effort as a propaganda trick by FDR to impose more radical phases of the New Deal.

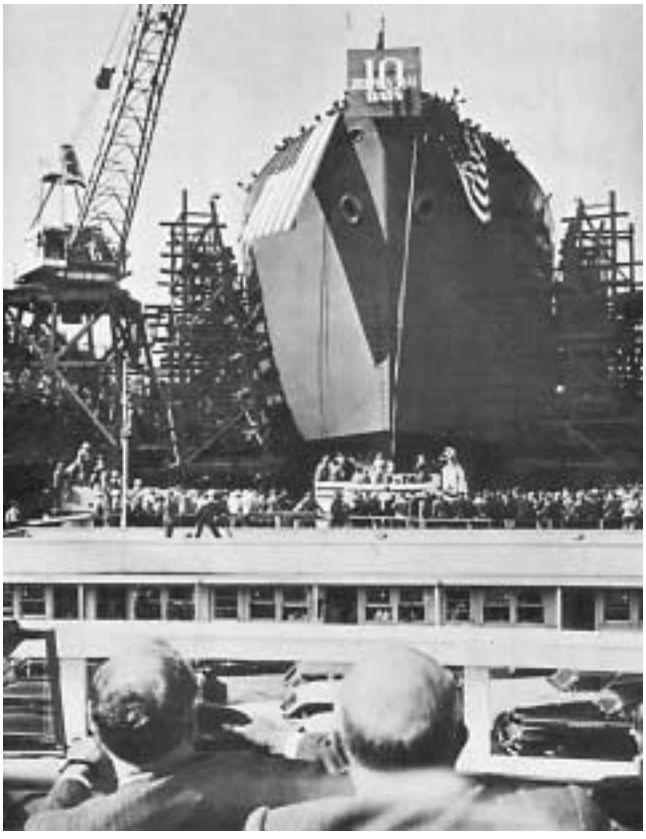
Third, the United States was unprepared to fight. Within the armed forces, there was a widespread belief—until the moment the Japanese bombed Pearl Harbor—that the United States would send planes and munitions to Europe and the Far East, but would never send its own fighting forces. Instead, it would sit back and defend the coastal regions of the United States, if and when Hitler attacked. Douglas MacArthur, George Marshall, and Dwight Eisenhower attacked this belief.

The Nazis had a military air force of approximately 40,000 planes, *eight times that of the United States*, and while the United States could only produce 2,000 planes a year, Goering had the capacity to manufacture 18,000. In 1940, the Nazis had 10,500 tanks, 20 motorized divisions, 135,000 trucks, and 60,000 motorcycles. The United States had 500 tanks. The Nazis had a battle-tested, efficient army of 7 million. The U.S. had 370,000 soldiers in arms, and another 170,000 in reserves.

In 1940, supplies in U.S. arsenals were so low that the newly created "Citizens Army" trained with wooden guns. The soldiers "fired" field pieces which had stovepipes for barrels. Almost anything on four wheels served as a tank in war games. Half of the Army's 100 million pounds of gun powder was World War I surplus.

How the Buildup Was Directed

From the beginning, bold action was taken to get the war effort going. Roosevelt activated a centralized credit policy.



Roosevelt (foreground) in a 1942 visit to the Kaiser Shipyard in Vancouver, Washington, where a merchant ship was launched every 10 days. The time for construction of a battleship in the nation's shipyards in World War II, was cut 90% from World War I, by technological and productivity advances.

In this case, Roosevelt used the Reconstruction Finance Corporation (RFC), which he had reshaped as a Hamiltonian, dirigistic credit-issuing instrument (see above). Between 1940 and 1945, the RFC disbursed almost $23 billion to the economy as a whole, most of it to the war mobilization. During the war, Roosevelt and various of his technical advisers decided where investment was needed, and the RFC was asked to write checks to the chosen area of investment as a loan bearing a 2-4% interest rate. It was that simple.

A Defense Supplies Corporation and Defense Plant Corporation were created within the RFC, their tasks being to funnel the loans. During the war, the Defense Plant Corporation (DFC) made loans which one source placed at $9.2 billion and another placed at above $10 billion. The DFC's investment was allocated approximately as follows:

- $4.5 billion to aviation, including the airframe industry, and even more importantly, those sections of the auto industry that converted to aircraft production.
- $1.5 billion to aluminum and magnesium producers. Both industries (although there was a small amount of aluminum production before the war) are products of World War II.
- $250 million to build 45 plants to produce high-octane

gasoline to fuel airplanes.

- $1.223 billion to build and upgrade 183 steel and pig iron plants, adding 11 million tons of new capacity.
- $715 million to build 51 synthetic rubber plants, which were wholly owned by the government. Before this, the United States had no synthetic rubber industry.
- $2 billion for machine tools.
- Hundreds of millions for building new shipbuilding capacity.
- Many millions more were lent or spent for various infrastructure projects, including the Big Inch and Little Big Inch pipelines to carry petroleum from Texas to the New York-New Jersey metropolitan area; the construction of tugboats and barges for river transportation; new buses and streetcars and feeder railroads to carry war materials and workers to and from their places of employment.

The "arsenal of democracy" mission qualitatively transformed the economy and *the labor force, which acquired millions of newly skilled workers. Here, a woman welder works on the* USS George Washington Carver *in 1943.*

To get U.S. companies to expand capacity, Roosevelt often had to conduct knockdown, drag-out fights. In the steel industry, the Morgan-led U.S. Steel and Bethlehem Steel resisted the government's efforts to expand badly needed steel capacity, because in their view, "once the war is over we will have overcapacity, which will cut earnings." Roosevelt had the RFC's Defense Plant Corporation begin to build the plants itself. The steel companies relented. But the government owned some of the steel plants and sold them back to private industry after the war, as it sold rubber, aluminum, magnesium, and other plants.

At the same time, Roosevelt leaned heavily on the Federal Reserve to keep the discount rate down to 1% in the interest of national security. The prime rate never exceeded 1.5% during this period.

FDR set up a series of administrative boards, each with increasing authority, to direct the war mobilization. In early 1942, he created the agency that was to have the greatest amount of authority until the end of the war: the War Production Board. To head the WPB, Roosevelt appointed Donald Nelson, director of marketing for Sears, Roebuck department store, and part of the faction known as the "all-outers." In his book, *Arsenal of Democracy*, Nelson stated, "There is but one conclusion to be drawn from the examination of any and every phase of our war production effort—whatever this country wants to do it can do. Nothing is impossible for America."

The WPB functioned nothing like the old Soviet Union: it neither owned nor regimented the economy. The economy remained capitalist. What was imposed was an industrial policy: Those activities not conducive to real physical product output were discouraged, or, where possible, stopped. Certain broad guidelines for production, and resource allocation guidelines, were issued. Then industry went out to fill the orders, make the investments, and arrange the work shifts as it thought fit. Industry made use of its normal purchasing channels, continuing on a profit basis.

In 1941, there was some sizeable increase in investment, but the real explosion occurred in 1942, when the United States entered the war. It was realized that the first priority to get an economy to grow, is that one must build up one of the smallest, but most valuable, sectors of the economy, the machine-tool-design sector, which incorporates and transmits the most advanced scientific discoveries. Machine tools build all the other capital goods machines, constructing into them, scientific breakthroughs. Hence, the heavy investment at the start of the war in machine tools.

The machine tool investment took place at the same time that a "war sector" was built virtually from scratch. These were the two priorities, along with investment in certain strategic raw materials in short supply. However, heavy investment in intermediate goods, including metals, was primarily a feature of the second stage.

Investment was slowed down in consumer goods sectors, except where necessary for military buildup (such as apparel for military uniforms). Entire sectors of the civilian economy were converted to war production, often shifting investment to heavier and more sophisticated production than the workers were originally engaged in. For example, the Steinway and Baldwin piano makers produced military gliders; one of the country's largest silverware producers shifted into magnesium production. Starting in 1942, production of cars, and washing machines and dryers, was stopped entirely, while

production of a whole array of other consumer products was sharply curtailed, from bobby pins and nylons, to rubber tires.

Though there was some privation because of the conversion of certain consumer sectors to war production, general health, food consumption, housing, and other living standards were considerably improved by comparison with the Depression years. Though some farmers left the farm to serve as soldiers or work in factories, capital investment in tractor production and the significant increase of farm electrification sent farm productivity shooting up—helped by the efficient use of the parity price system. Food consumption in the United States rose in most categories, especially the consumption of meat.

Finally, the United States took advantage of one of the most fundamental principles in all military history: the strength of a military economy rests on the strength of the civilian economy. A large, industrialized economy gives a nation far better ability to gear up quickly. The President, and other military, industry, and labor leaders of the war effort, knew that the United States had a larger capacity than Germany. In 1940, it produced two and a half times as much steel as Germany—67.0 million versus 28.2 million net tons. In 1939, it produced 2.867 million out of the world's 3.661 million autos. The United States generated 130 billion kilowatt-hours of electricity, the highest level in the world.[5]

Non-Linear Effects

The World War II mobilization put every key sector of the American physical economy through non-linear transformations driven by technological changes, which were in turn prompted by scientific discovery and by cognitive changes among the labor force. This non-linear character of the wartime growth of the economy can be seen in two sectors in particular: the aircraft industry; and the Manhattan Project's crash effort to discover whether a bomb could be developed based on a controlled nuclear reaction. The former was an already established industry, the latter an entirely new one; both powered the war effort.

With these two sectors as the bellwethers, investment policy was geared to bring about the most dramatic change in the map of U.S. industry. A comparative examination of the matrix of the 100 leading industries, before and after the war, would show a sharp change—as great as any change effected in the United States since the second half of the 19th Century. This shift in the matrix of technologies and industrial processes, as well as labor skills, fueled by a cheap credit policy, is the most important characteristic of the World War II economy.

To outline this matrix shift, we examine the aircraft industry; the raw materials and metals industry; the machine tool industry; the military sector; the science and medical sector; the investment and electricity sector; and the labor force.

Aircraft: During World War I, the airplane played almost no role, and traveled at a top speed of 100 miles per hour. During World War II, the airplane played a major role, traveled at top speeds of 250 to 300 miles per hour, and used such revolutionary World War II discoveries as radar. Thus, tremendous wartime advances were made in the theory and practice of aerodynamics.

The changes in the production methods of aircraft were equally startling. The already existing aircraft industry was considerably geared up; above all, the consumer automobile sector was *closed down and converted* to aircraft production. In October 1940, auto executives, accompanied by their top production men, held a meeting in a meat market hall in Detroit. The meeting was chaired by Bill Knudsen, former chairman of General Motors. Displayed throughout the hall were parts of planes: airframes, engine parts, etc. Those present were asked to examine, pick up and handle the various parts, and when they went back home, to draw up blueprints to see what parts could be produced at their plants.

On January 20, 1942, the War Production Board ordered the cessation of all auto production. The last passenger car came off the assembly line on Feb. 10. Because of the advance planning of the previous year, within three months war materiel was rolling off these lines.

The conversion of the auto industry was more than just changing the order of a few assembly lines, or replacing certain machine tools. The conversion meant, in many cases, ripping out all the assembly lines, replacing 70% or 80% of the machine tools, extending the size of the building, replacing the concrete floor, and so on.

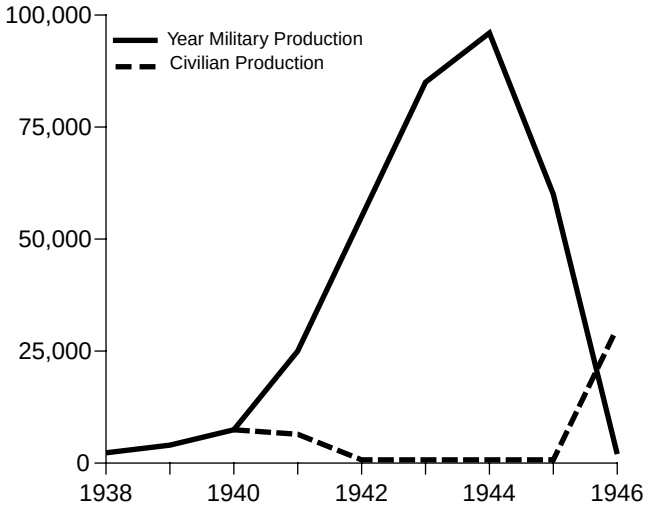
In many respects, the aircraft industry functioned as the leading, or second most important, "science driver" for the economy (depending on how one considers the nuclear industry) during World War II. At its November 1943 peak, the army of aircraft plant employees grew to 2.1 million—12.4% of the total national manufacturing workforce. For a comparable effect, imagine that today, 12.4% of all manufacturing employees could be put into laser beam and other related industries, versus the 0.001% currently so employed.

More was involved than the sheer increase in employment. The production of aircraft had previously been a cottage-industry operation. Assembly lines weren't in widespread use; almost every thing was hand-crafted. For example, the Rolls Royce aircraft engine, which was installed in some of the Spitfire aircraft that the United States produced for Britain, required six months to produce by hand. American

5. Roosevelt planned to use the explosive expansion of the U.S. industrial economy to produce capital goods—such as machine tools, electrical grids, etc.—to industrialize the third world. A body of extremely valuable work is building up in this area, which is recommended to the reader: Lawrence Freeman, "Roosevelt's 'Grand Strategy' To Rid the World of British Colonialism: 1941-45," *New Federalist*, July 14, 1997; Hartmut Cramer, "FDR's New Deal—An Example of American System Economics," *EIR*, June 16, 2000; Jacques Cheminade, "FDR and Jean Monnet: The Battle vs. British Imperial Methods Can Be Won," *EIR*, June 16, 2001; Lonnie Wolfe, "Why the British Hated Franklin Roosevelt: FDR's Fight Against the British Empire and His Vision for the Postwar World," April 22, 1995 (unpublished manuscript).

FIGURE 2

U.S. Airplane Output, Military and Civilian, 1938-47



Source: National Archives of the United States.

engineers took it apart, analyzed every step, and figured out how to mass-produce it in less than half the time. Planes were put on overhead assembly tracks. Fuselages and other parts were standardized to a degree never seen before. New welding techniques were applied, as we shall show below. Methods were devised for stretching the aluminum "skin" over the wing of a plane, to end the tugging and assembling process.

The results were spectacular. In 1941, FDR called for 50,000 planes to be produced over three years. The announcement set off intense debates. Some said it couldn't be done. Others, the "all-outers" said it could be done in 21 months, instead of 36 months. But nobody predicted what a supercharged U.S. economy would actually produce. In 1944, the U.S. produced 96,000 planes in one year. By comparison, in 1939, the United States produced 5,865 planes, of both military and civilian varieties. Thus in 1944, the expanded aircraft industry produced multiples of 1939 production, of Roosevelt's original demand, and even of the "all-outers' " plan (**Figure 2**).

Each individual worker became more productive. One partial measure of this, the "Average Airframe Weight Accepted Per Employee" (the amount of metal, materials, etc. worked on per worker), shot up from 22 pounds in January 1940 to 96 pounds in March 1943, a 4.4-fold increase. Some of this increase simply represents the fact that heavier planes were being built, but a good part of it represents greater productivity. As a result, during the war period, the cost of a four-engine, long-range bomber dropped from $15.18 per pound to $4.82, a saving of more than $500,000 on each plane.

New Materials, Processes, and Discoveries

Aluminum: Aluminum was known as early as 1825, when the Danish scientist Hans Christian Oersted first produced pure aluminum metal. But production of aluminum is very energy-intensive, and American production never exceeded 100 million tons until the war. Aluminum's lightness and toughness made it preferable to steel in World War II aircraft engines and bodies. As a result of the U.S. government's construction of new aluminum plants, aluminum production shot up to 2,782 tons in 1943, a stunning 28-fold increase over 1939 levels.

Magnesium: Humphrey Davy had isolated metallic magnesium in 1808; but although the first commercial production of magnesium started in 1918, magnesium, even more than aluminum, is a World War II discovery. Magnesium has two-thirds the weight of aluminum, is nearly as strong and abundant in nature, and is produced by a similar process. Magnesium production was less than 15 million pounds per year in 1939; by 1944, it was up to 366.5 million pounds, a 24-fold increase.

Synthetic rubber: Synthetic rubber production is entirely a creature of World War II. Without the war, the United States might have continued to rely on the British-Dutch-controlled International Rubber Regulation Committee, based in Malaysia and the then-Dutch East Indies, to supply its raw rubber needs. This cartel controlled 97% of the world's rubber supply. But after the Japanese invasion and occupation of this area, the U.S. government built 51 synthetic rubber plants. It fought Standard Oil of New Jersey, joint holder with I.G. Farben of Germany of patents on synthetic rubber production, which Standard refused to release for the war effort.

In early 1942, the United States announced its synthetic rubber program. Within two years of that announcement, synthetic rubber production had gone from less than 2,000 tons per year to 700,000 tons per year, a 350-fold increase. By the end of the war, synthetic rubber provided 87% of U.S. rubber needs.

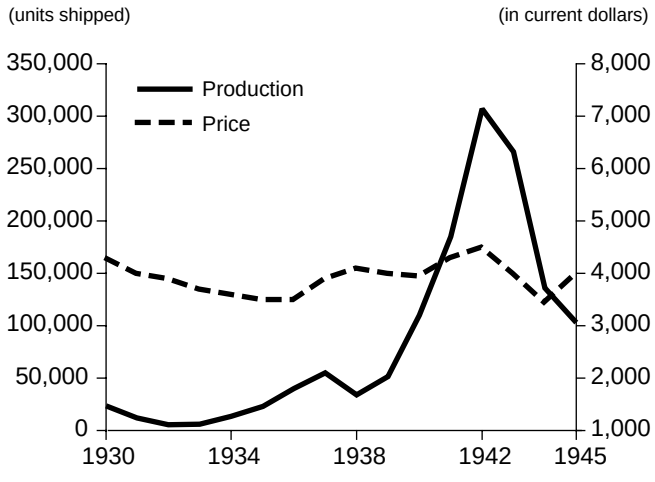
Synthetic resins, plastics, and fibers: The entire industry of such products, including plastics and synthetic fibers, which we take for granted today, was developed during World War II.

Machine tools incorporate and transmit into the economy, the most advanced scientific discoveries. Without them—boring, cutting, polishing, bending machines, etc.—no plant and equipment can be constructed. In 1938, the United States had produced only 34,000 machine tools of all kinds; but during World War II, money, and invention, were poured into machine tool plant capacity, and by 1942, the United States was producing 307,000 machine tools, nearly 10 times the 1938 level and 50 times the level of 1933.

These machine tools were also made far more productive. This was of crucial importance, especially in producing aircraft. For example, the engine for the Wright Cyclone 14 aircraft was composed of 3,500 different parts, totaling 8,500

FIGURE 3

Machine Tools: Shipments and Unit Price, 1930-45



Source: National Archives of the United States

pieces, requiring an estimated 80,000 machining operations. Therefore, new machine tool techniques as well as machines were developed. In the October 1, 1942 issue of *Automotive and Aviation Industries* magazine, George H. Johnson, then president of the National Association of Machine Tool Builders, provided an example:

"One of the most difficult and important assignments given the machine tool industry was the design and building of hundreds of special-purpose machines needed to convert the aircraft engine industry from small-lot to mass production. At the right is [a picture of] a specially designed machine which drills, countersinks, and spotfaces 224 identical 3/8 inch holes in an aluminum airplane engine crank case. It works simultaneously on 32 holes from two different directions. These operations previously took two hours twelve minutes. This one machine now completes the job in 23 minutes."

This increased productivity is reflected in another fact: As **Figure 3** shows, from 1930 through 1945, the average price of a machine tool, at $4,000, remained the same.

Industrial operations: Large productivity gains were made, as well, in a variety of industrial operations, such as welding. From 1939-45, according to "Wartime Technological Developments," a report of the U.S. Senate's Military Affairs Committee Subcommittee on Mobilization in May 1945, industrial welding operations—which can take 10-15% of total work time in the construction of plants or in assembly—were made 15-2,000% more efficient and faster.

Radar: The advance in aircraft included not only better and faster production methods, but, as mentioned above, advances in the aerodynamics and performance of aircraft, which called for better production methods and new technologies. Radar, which had been pioneered since the 1920s, was only fully developed and exploited, on any meaningful scale, during World War II to guide planes on bombing runs, through foul weather, etc.

Vacuum tubes: Vacuum tubes are another World War II discovery, used in radar, but which also revolutionized radio transmission and receiving, and opened the door for the development of the computer.

Shipbuilding: The shipbuilding process, from keel-laying to completion of the ship, was standardized. Pre-assembled parts, as well as new welding techniques, were used. The production time for ships was reduced by 90% from World War I days.

The productivity gains in shipbuilding were so prodigious, that the deadweight tonnage of the United States Navy and Merchant Marine went from 10.5 million tons in 1939, to 53.0 million tons in 1945. By VE day, the United States had turned out the equivalent of two-thirds of the entire ocean-going merchant marine of all the Allied nations.

Penicillin: Identified in the 1930s in Britain, its use was only extended beyond test stages in the treatment of troops beginning 1941. In 1945, penicillin began to reach civilian markets.

Electron microscope: The instrument that has opened man's eyes to the inside of the cell and the atom, was developed during the World War II mobilization.

Completing the Recovery

In 1939, the value of U.S. plant and equipment was placed by the Commerce Department at $39.4 billion. During the five years of the war buildup it increased by $29 billion, or more than 75%. That leap reflected not only high industrial development, but specifically the new application of electricity, in both the construction of new capacity, and the utilization of underutilized capacity. Between 1939 and 1945, the amount of installed electrical capacity increased by 20%. Using both this new capacity, and the electrical capacity which had been established during Roosevelt's New Deal—the Tennessee Valley Authority and the Grand Coulee Dam represented, as of 1939, still largely untapped electricity resources—it was possible nearly to double the amount of electrical kilowatt-hours consumed by manufacturing, from 79.0 billion in 1939 to 144.3 billion in 1945.

This use of electricity represented "free energy" in a higher form, that could enable the economy to suddenly realize its potential.

In building what Franklin Roosevelt called "the Arsenal of Democracy," Americans attempted a kind of economic expansion never before tried, nor thought possible. The characteristic of action of the economy completely changed. It had been demonstrated that a crash mobilization, behind a scientific mission, technologically upgraded everything from the industrial capacity to the productive powers of labor.

When combined with the preceding infrastructural and other achievements of the New Deal, the result was explosive, anti-entropic growth. The full recovery of the U.S. economy was achieved: Production doubled; unemployment was virtually eliminated; the whole economy was imbued with unprecedented scientific potentials. The United States is still living today, for the most part, off the industrial investment and inventions, and the economic infrastructure, of the New Deal and the economic mobilizations for World War II and the Korean War.

Today the world confronts a crisis that is far more severe than the Depression of 1929-33: an ongoing *systemic* financial-economic breakdown that is the worst in 500 years. If not halted, it threatens to plunge mankind into a dark age. Lyndon LaRouche's 2004 Democratic Presidential campaign is the rallying-point for those who choose to fight and defeat this crisis.

Employing the same conceptual principles embedded in the American Intellectual Tradition which Roosevelt drew upon, LaRouche proposes to put the bankrupt world financial system through bankruptcy reorganization and to replace it with a New Bretton Woods monetary-financial system, pivoted around the Eurasian Land-Bridge of rail and associated high-technology infrastructure corridors. This will reconstruct the battered economies of the former industrial world, including the United States, and at long last end the underdevelopment of, and bring explosive growth and human dignity to the so-called developing world, where more than half the human race lives.

The success of Roosevelt's 1933-45 recovery serves as a working precedent: If we are wise enough to adopt this method, we can overcome today's crisis.

The Labor Force's New Mettle: An Example

In 1941, a Training-Within-Industry Branch was set up within the Labor Division of the Office of Production Management (OPM); the training Branch was transferred to the War Production Board when the OPM was superseded in early 1942. The Branch made surveys and recommendations for training in the plants of more than 2,000 war contractors and subcontractors. Along with this, a job-instructor project was devised. By February 1942, the Training-Within-Industry program had provided training to more than 3.3 million workers.

The November 1941 issue of *Automobile Facts* described how this process helped to create skilled aircraft manufacturing workers:

"The training program begins with the introduction of a man to the metal which he must handle. He is first taught to drill it and form it accurately. If he manifests a marked aptitude for welding, his education is turned in that direction. But, since drilling, forming, and riveting constitute the major portion of the operations, the trainees are schooled in these arts through a step-by-step progression from one workbench to another. Each day they are given about ninety minutes of classroom instruction in shop mathematics, blueprint reading, etc.

"After they have mastered metal forming, drilling, and countersinking, they are taught riveting—alone and in teams. Advanced to another subsection, they learn 'blind' riveting in two-man teams. This art is mastered by placing the members of a team on opposite sides of a plywood wall, into an opening in which, is fitted the alloy sheet to be riveted. After men have thus learned to set rivets by signals tapped on the wall, they are moved into a wooden 'dummy' fuselage fitted with similar small alloy sheets. . . . Next, they are introduced to the hundreds of jigs and fixtures being used, to facilitate assembly of planes by semi-skilled men drawn from automobile production jobs. Unlike the supervisory men whose education has been long and thorough, the workmen are taught specific operations only, although opportunities are provided for their voluntary participation in the whole educational course.

"In this complete course, the final lessons are learned by actual construction of a complete bomber section. But, before the trainees build a plane section, they disassemble one previously built by a preceding class.

" 'It's the natural way to learn,' says one instructor.

"Though it was predicted last Spring that workers could not be trained in less than 300 hours, these methods have already proved that good functional workers can be prepared in 80 hours."

This process of learning skills involved not only men. "Rosie the Riveter" was a well-known World War II symbol. In fact, in aircraft production, 20% of all workers were women, and 39.2% of all workers on projects classified as "crucial" were women. Many drill presses and other large machines were specially equipped so that women could operate them more easily, thus benefitting all those who handled them.

The overall labor force participation rate of black workers rose dramatically, as did blacks' entry into industry. Not only did the manufacturing workforce increase by 70% during the war, but the skill levels were also vastly upgraded. This was one of the most important reasons for the higher productivity levels of the American economy during the 1950s and early 1960s.