American Challenge, European Response

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The idea that Sloanism, like Fordism, would become dysfunctional when carried to its illogical conclusion was inconceivable in the pre–World War II era of American dominance in world automobile manufacturing. In 1928 North American manufacturers produced some 84 percent of world motor vehicle exports and had captured some 35 percent of the world automobile market outside the United States. About 10 percent of American automobile production was being exported. Additionally, both Ford and GM had become multinational enterprises. By 1928 Ford was assembling cars in twenty-one countries, GM in sixteen. James Foreman-Peck observes, "By 1928 American multinational production abroad exceeded the total output of both the French and German motor industries. A survey of the mid-1930s concluded that there were very few major markets of the world in which assembly plants had not been established by Ford or General Motors." [1]

The establishment of Ford and GM factories in Europe was particularly notable, for it marked recognition of a newly developing mass market there for cars. While the North American market stagnated during the Great Depression, there was a gradual but steady increase in middle-class motoring in Europe, where economic recovery occurred earlier than in the United States. British registrations increased from 1.4 million in 1929 to 2.59 million in 1938; French registrations increased from 1.3 million in 1929 to 2.27 million in 1938. In Hitler's Germany registrations jumped phenomenally, from only 654,400 when he assumed power in 1932 to 1.67 million in 1938.

With the expansion overseas of Ford and GM, and the emergence of a European-owned industry producing for a mass market, the relative position of the Canadian industry deteriorated. From its inception the

Canadian industry had been essentially the export branch of the American industry. As overseas markets came more to rely on local production, from 1930 to 1939 Canada produced only 1.34 million units, falling to fifth place in world production after the United Kingdom with 3.56 million, France with 1.94 million, and Germany with 1.82 million.

The Multinationalization of Ford and GM

Ford overseas expansion began in 1911 with the formation of the Ford Motor Company, Ltd.—a wholly owned subsidiary of Ford-U.S., capitalized initially at only £1,000 and financed entirely out of profits earned in the United Kingdom. Although Percival Perry ostensibly was in charge of Ford-England, its operations were closely supervised from Dearborn. Product was identical, to the point that the Model T steering wheel remained on the left side of the car in defiance of the British custom of driving on the left-hand side of the road. At first Model Ts were assembled at the Trafford Park plant on the edge of Manchester from cars shipped "completely knocked down" (ckd) from Dearborn. But the proportion of local content was gradually increased to 92 percent by mid-1924 as a policy was implemented of buying Birtish-made components whenever they were of comparable quality and cheaper than components shipped from the United States.

American work rules and methods, however, were uncompromisingly adopted. In 1923 even the customary British Christmas raffle and the foremen's social club were abolished by mandate from Dearborn. The imposition in 1919 of the American exclusive franchise system on the Ford U.K. dealer organization was considered "particularly outrageous." Volume in the British market was simply too small to justify a dealer's handling only one make of car, even if that make was the Model T. So Ford lost or canceled out scores of dealers while he reaped a whirlwind of ill-will in the British automobile trade press. Although he remained the leading U.K. auto producer from 1911 through 1923, Henry Ford was, according to Kenneth Richardson, "very unpopular at the time, and these arbitrary actions, for so they were made to appear, seemed to confirm the view that he was both ruthless and anti-British."[2]

The policies initiated at Trafford Park characterized Ford's overseas operations throughout the Model T era. Wholly owned subsidiaries financed out of local profits produced an identical product. Barrages of directives from Dearborn were filed at branch agencies and plants across the globe in thick loose-leaf operations manuals called Ford Bibles. This rigid imposition of Ford-U.S. policies where local conditions made them

inappropriate resulted in significant Ford losses of market shares worldwide after 1925 both to GM and to European producers.

GM followed the opposite strategy of overseas expansion through acquiring interests in strong foreign firms that produced cars designed for local markets. Negotiations to acquire Citroën in 1919 and Austin in 1924–1925 were dropped when it became apparent that both firms had physical plants in poor condition and weak management. Instead GM bought Vauxhall Motors in 1925 and Adam Opel AG in 1929.

At the time of purchase, Vauxhall made a relatively high-priced car and had an annual volume of only about 1,500 units. It did not begin to make money for GM until 1933, when it introduced the Light Six, a small car designed for European conditions. Opel was by far the more important GM wedge in the European market. Its purchase made GM the largest automobile manufacturer in Germany. Opel accounted for 26 percent of the German market and 44 percent of the sales of German-made cars. After 1933 Opel and Vauxhall sales combined exceeded GM's American exports.

The other significant GM acquisition was Holden's Motor Body Builders of Australia, from whom GM had purchased bodies since 1923. In 1931 GM purchased Holden's and merged it with General Motors of Australia, formed in 1926. This solidified the great gains over Ford that GM had made during the 1920s through its Holden's association in the developing Australian market.

The multinationalization of Ford and GM was necessitated by the emergence in the interwar period of strong tariff barriers against further U.S. penetration of European automobile markets. A dramatic reversal of the pre–World War I world tariff structure on automobiles had occurred. The 1913 U.S. tariff of 45 percent on passenger cars valued over $2,000 and 30 percent on cars valued under that was reduced in 1922 to 25 percent or a duty equal to that imposed by the exporting country, but not to exceed 50 percent. In 1930 the U.S. tariff on automobiles was further reduced to 10 percent. In contrast, the U.K. moved away from a policy of free trade in 1915 to the 33⅓-percent McKenna duties, which were retained into the post–World War II period, except for a brief removal in 1924–1925. On the Continent automobile tariffs soared: in France from 9–14 percent in 1913 to a minimum of 45 percent and as high as 180 percent with reciprocity by 1924; in Germany from a mere 3 percent in 1913 to 13 percent by 1924, 25 percent by 1932, and 40 percent by 1937; in Italy from only 4–6 percent in 1913 to an exorbitant 101–111 percent by 1937. Manufacture abroad with a high proportion of local content to avoid these prohibitive tariffs thus became essential if Ford and GM were

to retain niches in the most important developing overseas markets for cars.

Adapting to the European Market

"Both indigenous manufacturers and American multinationals, if they wanted to increase their European market shares, had ... to adapt American technological experience." writes Foreman-Peck. "The Americans eventually had to develop a different product for sale in the European market, and both groups had to adapt American process technology to the smaller production runs." Underlying realities were lower per capita European incomes, far higher raw material costs and gasoline prices than in the United States, and discriminatory horsepower taxes. Foreman-Peck estimates, for example, that in 1927 significantly higher French coal prices made sheet metal for body work 134 percent more expensive in France than in the United States, and that steel prices for Ford-England were 50 to 70 percent higher than those for Ford-U.S. "A Dodge analysis of 1927 concluded that the four-cylinder Dodge met few if any of the European requirements," he further observes. "In Germany the cost of fuel was 28–30 cents a gallon, equal to the hourly wage of the highest paid worker, yet the Dodge could only achieve 12–14 miles per gallon. Taxation [based on horsepower formulas] on the 'Four' was $161 per year in Germany, $116.50 in England, and $89 in France." [3]

European horsepower taxes were intended to discriminate against American cars, whether produced in the United States or locally. The horsepower ratings were based on formulas, not brake mean horsepower (bhp) at a given number of revolutions per minute (rpm), and the formulas were discriminatory against the American large-bore, short-stroke engine. The 1906 Royal Automobile Club (RAC) formula used in the U.K., for example, was $ND^2/2.5$, where N is the number of cylinders and D the cylinder diameter. Because length of stroke was not incorporated, the RAC formula was not a measure of cylinder capacity/engine displacement. By this formula the 20-horsepower Model T was rated as a 23-horsepower car, and the purchaser of a Model T in 1923 paid £23 (about $73) more in taxes than the purchaser of an Austin Seven.

Although horsepower taxes based on the RAC formula helped U.K. manufacturers in the home market, the resulting British high-performance, small-bore, long-stroke engine with high piston speeds, and the small cars it powered, were ill suited for export to Commonwealth and other countries where driving conditions approximated those in the United States. "British roads were slow and congested," notes Peter J. S.

Dunnett. "Cars suitable for these conditions were ones which would trundle along easily in top gear at twenty miles per hour with sufficient engine torque to accelerate to forty or fifty miles an hour when the opportunity to pass slow traffic arose. Demand for such high-revving, low-geared cars was, quite simply, incompatible with much overseas demand.... British cars tended to emphasize maneuverability, light steering and good engine torque and to de-emphasize high-speed cruising ability." [4]

Conversely, American-type cars were not well suited to European driving conditions. The Model T and other low-priced American-type cars faced even stiffer competition in the interwar period from more fuel-efficient European light cars. The first European car to compete directly with the Model T was the four-cylinder, 8.5-horsepower (by RAC formula) Morris Oxford, assembled from jobbed-out components and introduced in 1913 at the moderate price of £175. The first popularly priced, mass-produced European car was the 1919 four-cylinder, 10-horsepower, four-door Citroën Type A Torpedo. The Type A sold for only 7,500 francs, about a quarter of what a comparable pre–World War I car had cost. By the end of 1920 Citroën had sold nearly 23,000 Type A's, inducing Mathis, Peugeot, and Renault to bring out competitive economy models by 1922.

The best and most successful of the 1920s European light cars was the 1922 Austin Seven, a 7-horsepower car by RAC formula that actually developed 13 horsepower. The Seven's high horsepower-to-weight ratio made it a spectacular performer in hill-climbing contests and in racing competitions. It won the Shelsey Walsh Hill Climb in 1922. Then in 1923 it won the Brooklands Small Car Handicap and went on to take first place in the 750-cc class of the Italian Grand Prix at Monza, becoming the first British car to win a race on the Continent since 1914. In 1924 the Seven established some twenty-two International Class H records. The production car gave a fuel economy of 50 mpg and had a top speed of 52 mph. It sold in 1922 for only £225, in 1924 for a mere £125.

The Seven was rivaled after 1929 by the Morris Minor. The redesigned 1931 two-seat, side-valve Minor became the first British car to sell for as low as £100; and with sales of over 200,000 units within four years, it became the largest-selling pre–World War II British car as well. A special model fitted with a supercharger did over 100 mph at Brooklands; then, under RAC supervision, without the supercharger, the car was driven 107.4 miles at 15 mph on a single gallon of benzole. Advertising coupled the 100-mph speed and 100-mpg fuel economy with the £100 price. Morris Garages, organized as a separate company from Morris Motors, from 1924 also pioneered in the development of the classic light sports car with its MG models.

To meet the new competition, Ford Motor Company policies underwent drastic revision. In August 1928 Sir Percival Perry, fired during the 1919 Ford purge of executives, was rehired, and by November Ford's European operations had been completely reorganized. A new English corporation was created; called Ford Motor Company, Ltd., it acquired all of the assets of the Ford Motor Company (England), Ltd., Henry Ford and Son, Ltd., of Ireland, and the shares of the nine Ford operations on the Continent. Ford-U.S. would continue to hold 60 percent of the new company's stock and thus continue to exercise control. The other 40 percent would be sold in small lots to the British public. The new Ford-England in turn would control 60 percent of the shares of the Continental subsidiaries, with 40 percent being offered to the public in each country. The authorized capitalization of Ford-England was increased from £200,000 to £7 million, and it was made the center of Ford's European operations. To avoid the problem of double taxation by the host countries on the Continent and England, a holding company was formed in 1930—first headquartered in Lichtenstein, then in Luxembourg—that acquired Ford-England's stock in six of the Continental subsidiaries.

The goal here was to encourage the idea in the host countries that Ford was not a foreign corporation. This idea was reinforced by the appointment of directors for the various European subsidiaries who were distinguished citizens of the host countries. Consequently, by 1933 only two of Ford's European and North African branches had American managers. Mira Wilkins and Frank Hill report that by 1936 Ford-England had come to be considered a British company and that "its executives took counsel with Dearborn specialists on production and purchasing, but they rarely requested or received advice as to sales, finance, or labor relations. In these areas they were on their own." [5]

On May 6, 1929, construction was begun on a new plant at Dagenham, near London. With an annual capacity of 120,000 units, the Dagenham plant was planned as Ford's European manufacturing center and as the largest automobile factory outside the United States. In 1930 a small-bore Model A was introduced, but sales proved disappointing. So in the spring of 1932 Ford introduced its first car designed specifically for the European market—the Model Y. Eight-horsepower by RAC formula, the Model Y actually developed 22.5 horsepower. It was manufactured exclusively in Britain. A 10-horsepower (by RAC formula) Model C was added in 1934. "These two vehicles—the Popular and the De Luxe as they came to be called—transformed the British company from a deficit to a profitable enterprise," relate Wilkins and Hill. "With them, Ford in England was again in a position to challenge the leaders of the British automotive industry, the Morris and the Austin." [6] The four-seat Popular

undersold the two-seat Austin by £2 10*s*. and the two-seat Morris by £18. In 1935 Dagenham began producing as well the American-type V-8. By 1937, with 22.3 percent of the British market, Ford ranked third after Morris and Austin.

On the Continent Ford did not do nearly as well. Ford-SAF (Société Anonyme Français) never challenged Citroën, Renault, and Peugeot. After 1935, in addition to the V-8 with a French-designed body, Ford-SAF produced a smaller V-8. Both were named Alsace. A 1934 manufacturing arrangement with Mathis to produce a light four-cylinder car did not work out, and plans for Ford to produce it alone were shattered by Hitler's invasion of Poland on September 1, 1939, just as the machinery for its production was being assembled for shipment from Dearborn.

With a four-cylinder car called the Eifel, made entirely of German content, and the V-8, Ford-AG (the German branch) in 1936 captured 8 percent of the German market for fifth place in passenger car production. In truck production, however, Ford-AG ranked second, producing the four-cylinder Model BB and the eight-cylinder Model 51. The outbreak of the war squelched plans to bring out the Taunus, an attractively styled car that used an Eifel motor on a longer wheelbase.

In Fascist Italy no Ford assembly plant could be built without government permission, and Mussolini's policy was to foster the development of a 100-percent Italian-owned automobile industry. Consequently, with Il Duce's support Fiat monopolized the Italian market while Ford's share was infinitesimal.

Automobile production in the rest of 1930s Europe combined was insignificant, ranging from only 31,326 units in 1931 to 236,727 in 1938.

Adopting Fordist Methods

Fordist production methods were, appropriately, first introduced in Europe by Ford-England at its Trafford Park plant. Some 1,500 workers there assembled 12,500 cars in 1914—a phenomenal productivity rate by European standards. In 1915 Trafford Park began to employ, on a much smaller scale, the special-purpose machine tools, moving assembly lines, and other techniques developed at Highland Park.

European automobile factories remained heavily dependent on American-made machine tools. "Citroën in 1925 used 3,100 machine tools at the main 50-acre works at Javel, selected from the best in the United States," Foreman-Peck points out. "Opel's plant was reported by a visiting delegation from Dodge in 1927 to look almost entirely American. At his Coventry engine factory Morris used a large number of American

specialized machines in the same year, and the British industry imported large quantities of American stamping and pressing machinery and lathes." So too were American-made machine tools predominant at Fiat and in the emerging Russian motor vehicle industry. Yet Foreman-Peck concludes significantly that "the use of such advanced machinery did not necessarily guarantee high productivity.... [O]utput per worker was less [in the U.S.S.R.] than in Britain, where in turn American management was sometimes disturbed at the poor productivity."[7]

Europeans were slow to adapt Fordist methods to the production of small, fuel-efficient cars. Primitive attempts at continuous-flow assembly were made in 1913 at both the Fiat works at Turin, Italy, and the Sunbeam factory at Wolverhampton, England, where chassis were moved mechanically from one group of specialized workers to another during assembly. However, progressing beyond this was militated against by Sunbeam's annual sales of less than 2,000 units and by Fiat's wide range of products, variety of automobile models, and failure to standardize. Fordist production methods were not inplemented fully at Fiat until 1936, when it opened its huge new plant at Mirafiori to produce the tiny 13-horsepower, 9,750-lire (£711) Topolino (little mouse). The Mirafiori factory boosted Fiat production some 50 percent in one year, giving the firm 84.9 percent of the total 1937 Italian production of 77,700 units. Citroën in 1919 became the first French manufacturer to adopt the moving assembly line; Renault waited until 1922 to install one.

Ford-England's British competitors lagged still farther behind. Austin began to move toward continuous-flow production after Herbert Austin visited American automobile factories in 1922 to learn firsthand about "the means by which U.S. manufacturers were able to deliver a car from their works for about the same price that our company had to pay for materials and accessories for building a similar-sized car." Yet, as Roy Church reports, "not until the beginning of 1928 had output expanded sufficiently to justify the wholesale mechanization of chassis erection, though in ... 1924–1927 moving lines, electric hand operated [*sic*] hoists, pulleys, and conveyors had been installed." Following the installation of the moving assembly line at Austin's Longbridge plant, it was quickly adopted by Singer, Standard, and Hillman. Nevertheless, labor productivity in British plants remained significantly lower than in American factories. Notably, in response to the introduction of continuous-flow techniques and the consequent reclassification of job skills, the Longbridge workers walked out on March 25, 1929, in "the most serious strike ever" in Austin's history.[8]

As early as 1914, William Morris too had visited the United States, in an unsuccessful effort to place orders for components for his Cowley. He

returned to England with drawings for an American engine that cost £25, as against the £50 he was paying for a similar engine supplied by the British firm of White and Poppe. He again visited the United States in 1925 and returned home this time to form the Pressed Steel Company of Great Britain in association with the Budd Manufacturing Company of Philadelphia, the pioneer in the development of the all-steel body. Budd dies and designs were used to manufacture all-steel bodies for the 1927 and 1928 Morris Oxford.

Although Morris was the largest British producer, he did not install a moving final assembly line until 1934, apparently because demand for cars seemed too low in the U.K. to justify the investment. Continuous-flow production was introduced in 1934 at the new Morris Cowley factory, giving it the capacity to produce 100,000 units a year—greater than the total 1933 German production of 95,700 units and better than half of the total 1933 French production of 189,000 units.

Although theoretically the Morris Cowley plant could produce 20,000 fewer cars a year than the Ford Dagenham plant, in fact it produced far more. Actual production at Dagenham ranged from a mere 24,152 units in 1931 to a high of 94,165 in 1937, then declined to 65,387 in 1939. In contrast, the Morris Cowley plant truned out 96,512 units in 1935; and although precise statistics are not available, production at Cowley is estimated at 90,000 units or more annually for the rest of the 1930s. Moreover, production at Cowley was even more integrated and mechanized than at Dagenham. A car was turned out every two minutes, and Morris claimed to have surpassed mass production with "progressive production." R. J. Overy makes the well-documented claim that after 1934 Morris "controlled the largest and most technically advanced factory of its kind not only in Britain but in Europe as a whole.... The main assembly shop at Cowley was the largest and most progressive in Europe, despite Ford's massive investment of 1932/1933 at Dagenham"[9] Still, Morris's total production of 58,248 units in 1934 and 96,512 units in 1935 was dwarfed by Ford's recorded 1934 factory sales of 757,931 units for the United States and 872,849 worldwide.

Underlying problems were the failure of European automobile manufacturers to standardize and the craft tradition entrenched in European automobile factories. The British industry provides striking examples. In the first place, it was fragmented among too many small producers producing too many models. A plan put forward in May 1924 by Herbert Austin to merge his company with Morris Motors and Wolseley Motors was quickly and firmly rejected by William Morris, although the proposed merger of these leading firms had the potential to rationalize and consequently to improve greatly the competitive position of the British

industry. Morris sold two basic body types with a dozen body styles in 1927, nine basic body types with twenty-six body styles in 1933. Daimler, the leading British producer of luxury cars, in 1927 offered twenty-three models, exclusive of body styles, with a choice of five different engines and twelve wheelbase lengths. As late as 1934, Austin offered fifty-two models and Hillman thirty-four.

British manufacturers of motors and chassis for higher-priced cars still expected in the late 1920s that the purchaser would order a custom-made body from a specialized body maker. "Their workshops were virtually divided into a number of independent republics of craftsmen, each specializing in a particular production process," writes Richardson. "Blacksmiths, coachbuilders, painters and trimmers, they usually belonged to one of those small unions such as the United Kingdom Coachmakers, which amalgamated into the National Union of Vehicle Builders in 1918.... Most of them had been apprenticed and knew their own jobs to perfection, loving the feel of good wood and the gloss upon finished panels." Twenty-one coats of primer, paint, and varnish—each taking twenty-four hours to dry naturally—were applied by brush, for example, at the Grosvenor Carriage Company, which made bodies for Vauxhall in the early 1920s; when flow painting and drying chambers were belatedly introduced, the time of the painting operations was cut to only two hours.[10]

Production methods were not nearly so antiquated in the Austin and Morris plants. There too, however, in contrast with Ford-England, a strong class tradition separating manual from white-collar work militated against management's intervening to rationalize production on the shop floor. Too many skilled workers with too many prerogatives were divided into too many job-skill classifications. The workers were organized into too many small craft unions, each of which had to be negotiated with separately, and none of which could discipline even its own members. Remuneration was based on an antiquated, individualistic piecework system that was antithetical to the coordination of production and to quality control. Church provides a particularly striking example of this retrogressive pattern of labor relations at Longbridge: "The men demonstrated a preference for independent action, and in 1924 the skilled body makers successfully resisted the introduction of semi-skilled workers to cope with tasks customarily regarded by the men as skilled. They struck in direct contravention of the trade union agreement, and achieved a settlement through direct negotiation with the Austin managers.... The dispute lasted for only two days and was resolved before the union officials had time to become involved."[11]

This concession to wildcat worker demands occurred in a factory

where few of the workers were unionized, a factory whose owner, Herbert Austin, was as hard-nosed and outspoken an opponent of labor organization and worker democracy as Henry Ford. As late as 1939 the automobile industry was "the most weakly organized section of British trade unionism. It has been estimated that at the outbreak of the war 'seldom more than a fifth and often only a fiftieth of mass production operatives [in U.K. automobile plants] were union members.'" Not until 1944—three years after the unionization of Ford's American plants—did the workers at Dagenham gain Ford's recognition of their right to join a union, and it took a sit-down strike that disrupted essential war production to extract that recognition. As opposed to the exclusive representation of Ford-U.S. workers by the UAW-CIO, negotiations had to be conducted with twenty trade unions by Ford-England. However, in contrast with the negotiating patterns that had become customary in the U.K. automobile industry, "the Ford Motor Company would recognize unions, but it would deal only with the national officers of those unions. It wanted no bargaining on the shop floor. Like Ford in America it wanted to preserve its right to manage, to control the work rate." [12]

There was, then, something illusory about the large-scale conversions of British and other European automobile plants to American-made specialized machinery and continuous-flow production that took place between the world wars. In industrial organization, in product rationalization, and in labor-management relations, a chasm as wide and deep as the Atlantic still separated the European and American automobile industries.

Remaking Germany: The Volkswagen

During his 1923–1924 imprisonment in Landsberg for riotous behavior, Adolf Hitler read Henry Ford's autobiography, *My Life and Work*, and wrote *Mein Kampf*. Although the Führer never learned to drive, he was a lover of cars, especially fast Mercedes sedans. Jacob Werlin, the salesman who sold him his first Mercedes in 1923, became Hitler's chief adviser on automotive affairs. Werlin was made a member of the Mercedes-Benz board of directors when Hitler became chancellor of Germany, and pouring money into building up the Mercedes racing team became one of Hitler's pet projects. He undoubtedly was unaware that his favorite car had been named for the granddaughter of a Hungarian rabbi.

Hitler's first major public speech after becoming chancellor was given on February 11, 1933, at the Berlin Motor Show. In that speech he announced plans to abolish the registration tax on purchases of new auto-

mobiles and motorcycles, to make driving licenses easier to obtain and traffic laws less stringent, to build a network of superhighways across Germany, and to develop a small car for the masses. He declared, "A nation is no longer judged by the length of its railways but by the length of its highways." The theme of remaking Germany into a mass automobile culture was reiterated in Hitler's speeches at subsequent annual Berlin Motor Shows through 1939.

R. J. Overy argues that until 1935 mass motorization was more important than rearmament to Germany's recovery from the Great Depression. "The military expansion before 1935," he writes, "did not involve large increases in personnel, and was largely carried out in secret. The motor sector on the other hand had the advantage that it could rapidly absorb a large number of unemployed with the maximum of publicity. Thus the strength and rapidity of the recovery can be explained with reference to cars and roads rather than tanks and aircraft." [13]

There were six million unemployed in Germany when the Nazis came to power. Hitler estimated in 1935 that his motorization program had produced one million jobs. By 1938 it was providing one and a half million jobs, one out of every twelve, and the structure of the German economy had been altered by the key role that motorization had come to play in only five years. By 1939 some 17,000 kilometers of road had been improved, 3,000 kilometers of new road had been completed, and over 3,000 bridges built. Production of motor vehicles increased from only 52,088 units in 1932 to 342,169 units in 1938, the last peacetime year. Between 1925 and 1930 only 89,000 commercial vehicles had been produced, versus 265,000 between 1933 and 1938. Tractors in use increased from 25,000 in 1929 to 82,000 in 1939. "The transport load as a whole was shifted onto the motor vehicle for private travel while the number of passengers on public transport increased as bus services spread over the German countryside," Overy observes. *Motorisierung Politik* tremendously increased the demand for concrete, steel, machinery and tools, electrical equipment, textiles, tires, and petroleum products. It also encouraged the rise of many small retail businesses, particularly garages and repair shops. All in all, rapid motorization in 1933–1938 under the Nazis wrought a revolution in the German economy and society, and its importance as a "'leading sector' . . . would have increased had the Nazi motor plans not been interrupted by the war." [14]

German leadership in automotive technology became increasingly evident in the 1930s. The *Reichsautobahnen* feverishly built to link Germany from border to border were the first integrated network of express highways in the world and became a model for all future highway construction. Germany led in the development of diesel-powered trucks and

passenger cars. And German reentry into grand prix competition under heavy government subsidy led to impressive victories by Mercedes Silver Arrows and Porsche-designed Auto Union P-Wagens.

Legally a citizen of Czechoslovakia, Austrian-born Ferdinand Porsche was made a naturalized German by his fellow Austrian Hitler, who considered the Czechs to be subhuman. Porsche received honorary doctorates from the technical universities of Vienna and Stuttgart for his contributions to automotive technology. He shared his Führer's great admiration for Henry Ford and the desire to build a cheap small car for the German masses.

While managing director of Austro-Daimler, shortly after World War I Porsche became interested in building a *Volksauto*—a generic term for any "people's car." His vision was not shared by the Austro-Daimler board of directors. He did, however, build a tiny racing car, the Sacha, for the movie mogul Count Sacha Kolowat that was capable of 106 mph and that won both first and second prizes at the 1922 Targa Florio race in Sicily. Shortly afterward Porsche became technical director of German Daimler, which in 1926 merged with the Benz firm to form Mercedes-Benz. There he was chiefly responsible for designing a number of the great supercharged Mercedes racing cars of the 1920s. Fired in the course of depression-induced cutbacks, he returned to Vienna as technical director of the Steyr Works, which had shifted from arms to automobile production after World War I. Then in January 1931 Porsche established his own independent design and engineering consulting firm in Stuttgart, Germany, where Mercedes-Benz was located.

Porsche designed the P-Wagen racing car for Auto Union, formed in 1932 from Audi, DKW, Horsch, and Wanderer. Grand prix racing cars were limited to a weight of less than 1,653.8 pounds (750 kg). Yet although the ultra-lightweight P-Wagen weighed less than the later VW Beetle, it was powered by a 295-horsepower, V-16, rear-mounted engine. The P-Wagen won three grand prix events in 1934 and set a new flying-mile record of 199 mph in 1935. Robin Fry notes that it "looked more like an aircraft fuselage on wheels than a racing car.... In its later development Porsche's wonder car, driven by Bernd Rosemeyer, notched up a formidable number of victories, with speeds of up to 250 mph (402 kph), equal to racing cars even today, bringing much prestige to German motor racing."[15]

The rear-mounted engine and aerodynamic streamlining were design features of the P-Wagen that Porsche wanted to adapt to his Volksauto. And in 1932 he patented torsion-bar suspension, another radical feature intended for his people's car. Porsche developed Volksauto prototypes for

Zundapp in 1932 and for NSU in 1933 that bear striking resemblances to his later VW Beetle.

During a series of meetings with Porsche on the P-Wagen, Hitler discussed his ideas for a people's car, which he referred to as a *Volkswagen.* Porsche responded on January 17, 1934, with an outline of the basic requirements for such a vehicle. The idea of building a cheap, scaled-down bantam was never entertained by Porsche or Hitler. The Volkswagen was to be a closed-body car capable of carrying four persons, with a cruising speed of 60 mph (100 kph) and fuel consumption of 33 mpg (6 liters per 100 km). It was to have an air-cooled engine, in order to eliminate frozen radiators and starting difficulties in winter. It was to be durable and cheap to maintain and repair. It was to be safe and comfortable, and to have a high resale value. Porsche believed that "in the case of the future people's car, there must be no question of a compromise solution. In fact a new basic design solution must be sought which will enable the price to remain acceptable for a wide section of the population and will also be in step with technical progress for many years to come." Porsche thought that such a car could be built to sell for 1,500 reichsmarks (RMK) (about $600). Hitler demanded that its price be below 1,000 RMK. In his speech at the 1934 Berlin Motor Show, the Führer explained, "As long as the car is a vehicle for the rich, it is with bitter feelings on my part that millions of good, hard-working, and industrious people will be excluded from the use of a motor vehicle, which would be particularly beneficial to the less well off, and which would not only prove useful to their way of life, but would also enhance their Sundays and holidays, giving them a great deal of future happiness." [16]

Porsche signed a contract with the Nazi government on June 22, 1934, to build three prototypes of his people's car, for which he was allocated a small budget of 200,000 RMK. Production of its components was to be undertaken by the members of the RDA (Reichsverband der Deutschen Automobilindustrie, or Society of German Automobile Manufacturers), who were forbidden to develop their own Volksautos and therefore resented the unfair competition from the government-subsidized Volkswagen project. Consequently, they gave Porsche only minimal cooperation. The contract stipulated that the purchase price of the car was to be 900 RMK on an output of 50,000 vehicles, about half the price of the cheapest German car on the market. Interest in the car's military potential was evidenced by the stipulation that the Volkswagen be capable of carrying three soldiers plus a machine gun and ammunition. The prototypes were handed over to the RDA for testing on October 12, 1936. Only minor defects were found.

In late May 1937 the Gesellschaft zur Vorbereitung des Volkswagens

(the Volkswagen Development Company) was formed, with a capitalization of 480,000 RMK. The capital was supplied by the state-controlled DAF (Deutsch Arbeitsfront, or German Labor Front). The company became Volkswagenwerk GmbH (the acronym GmbH is the equivalent of "Ltd.") in 1938, and its capitalization was increased to 150 million RMK in 1939.

In August 1938 Robert Ley, head of the DAF, announced that the Volkswagen project would be sponsored by the KdF (Kraft durch Freude, or Strength Through Joy). This was the DAF branch charged with organizing recreation and travel for workers. A plan was announced by which a worker could purchase a Volkswagen on a 5-mark-weekly layaway plan for 990 RMK ($396), including insurance, garage, and maintenance costs. However, the actual cost under the plan came to 1190 RMK, and the KdF contract did not in fact obligate the state even to deliver a car once the final payment had been made. Walter Henry Nelson reports that under the KdF plan 336,668 Germans furnished 280 million RMK ($67 million) in capital to build cars that they never received. Hitler officially named the car that would become the Volkswagen the KdF-Wagen; in May 1938 he had dedicated a new plant and surrounding city, near Fallersleben in Lower Saxony, constructed for production of the KdF-Wagen. Plans to begin production with 150,000 units in 1940, to be boosted to an annual 1.5 million units within a decade, were canceled with the invasion of Poland and the outbreak of World War II. Yet layaway payments continued to be collected by the KdF until the war's end in 1945.

The KdF-Wagen purchase plan has been called "the world's biggest installment swindle." During the war the KdF-Wagen plant at Fallersleben, built from KdF "savings," used slave labor to turn out war materials for the Nazis. After the war the remaining funds accumulated in the KdF layaway accounts were confiscated by the Soviet occupation forces. In 1954 the West German supreme court absolved Volkswagenwerk from all responsibility for the KdF contracts. Nevertheless, litigation from disgruntled savers continued. In 1961 a settlement was reached whereby savers who had completed their payments would receive either 600 greatly devalued deutsche marks (DMK) in credit toward a new VW or 100 DMK in cash. About 87,000 claims were settled on these terms by mid-1964, half of the claimants choosing to purchase the car.[17]

Porsche's final KdF prototype, the VW38, was a 1,600-pound, 94.6-inch-wheelbase car with a central-tube frame. It was powered by a flat four-cylinder, 25-horsepower, large-bore/short-stroke, air-cooled, rear-mounted engine, and it featured both fully independent and torsion-bar

suspension. Its aerodynamic styling gave it a drag coefficient of only .49. Forty-four VW38 cars were rigorously tested on back roads by SS men sworn to secrecy before it was introduced.

Hitler designated Porsche *Reichs Autokonstrukteur* (State Auto Designer); and in 1938, Nelson records, "Nazi Germany honored its leading designer ... with its own equivalent of the Nobel Prize.... Other 1938 winners were Ernst Heinkel, for his bombers; Willy Messerschmidt, for his fighters; and Dr. Fritz Todt for his Autobahnen. Dr. Goebbels announced the prizes and Adolf Hitler delivered an anti-Semitic harangue."[18]

The extent to which the KdF-Wagen was intended to be a military vehicle rather than a universal car for the German masses remains moot. Hitler undoubtedly was serious about developing a mass automobile culture in Germany, and the KdF-Wagen undoubtedly was conceived by both Hitler and Porsche primarily as a people's car. As noted, however, the earliest specifications mandated that the car be suitable for military use. Jerry Sloniger argues that "a military version ... had really been a prime concern since the first and would be the only one after May 1938. After a showing to German generals all facilities were devoted to it as of June 1940." He further observes that the KdF-Wagen plant at Fallersleben was built with no wood floors, "in anticipation of incendiary attacks. Porsche soon asked if it was a car factory or a war plant. Hitler replied, 'A VW factory and nothing else.' But his aides stipulated no flat or angled windows which might reflect moonlight at hostile airplanes. Officially, German industry had gone on a 'wartime footing' four years before the German army marched into Poland."[19]

During the war a number of versons of the KdF-Wagen were used by the German military as general-purpose vehicles. The most important were the Kommandereur (command car), the Kübelwagen (literally, "bucket car"—the counterpart to the American jeep), and the amphibious Schwimmwagen. Unlike the heavy German trucks, these light, air-cooled military KdF-Wagen models were particularly well suited to desert warfare. Field Marshal Erwin Rommel wrote to Porsche: "Your jeep, which I used in North Africa, saved my life. It didn't pack up when crossing a minefield, when the heavy Horsch trucks traveling behind with the supplies were blown sky high."[20] Yet here too German inferiority in mass production was evident. Only 50,435 Kübelwagens were turned out during the war, versus Allied war production of some 660,000 jeeps.

The chief legacy of the Nazi motorization program, the Volkswagen was also the mainstay of German economic recovery in the post–World War II period. Hitler's car remade Germany into one of the world's foremost automobile cultures. Predicated on the product philosophy of

the Model T, the VW Beetle would surpass the Model T to become the best-selling car of all time and to set a new standard of excellence in performance and durability for a low-priced, family car. It would also change significantly the competitive structure of the worldwide automobile industry.

Freedom's Arsenal

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Ferdinand Porsche visited the United States to study American mass-production techniques in both 1936 and 1937. His entourage on the second trip included Bodo Laffrentz, chief aide to DAF head Robert Ley, and Jacob Werlin, the Führer's adviser on automotive affairs. Porsche met with Henry Ford and discussed the KdF-Wagen. Ford declined an invitation to visit Germany. The envoys mounted a campaign to recruit American-trained German nationals working in the United States and American citizens of German descent to return to Germany to work in the KdF-Wagen plant. The campaign was carried out through 1938 by German consuls in American cities. About twenty technicians were signed up.

When war was declared between Germany and the United States, Porsche wondered how Germany could possibly expect to win, given the great American superiority in mass production that he had witnessed. As late as the outbreak of World War II, the German automobile industry was hopelessly fragmented among some seventeen small firms. Although Hitler's panzer divisions wrote a new chapter in the history of mechanized warfare, the German automobile industry—including the American-owned subsidiaries Opel AG and Ford-Werke AG—produced only 32,994 commercial motor vehicles and a total of only 289,271 motor vehicles of all types during the first six months of 1939. The totalitarian Nazi regime never succeeded in rationalizing the German automobile industry. Even military truck production was not fully standardized until the last year of the war. The superiority of Ford trucks produced in Canada and at Dagenham early became evident to the Germans. On December 15, 1941, for example, Rommel wrote an order to his Afrika Korps commanders: "For desert reconnaissance only captured English