

crisis, but the very act of running hard to make its way had forced the industry into a constant emphasis on research, experiment, and development, and costly as those were, they had led to the latest working knowledges and the designs-in-being that made the country a dynamic factor in a dynamic air age even before war came.

**F**OR a small segment of that minute industry that almost overnight was to become a great arsenal, Pratt & Whitney Aircraft's position in the fall of 1938 was bleak. True, its engineering, except for the diversion of energy into the liquid-cooled projects, was forging steadily ahead. Its new trouble was a dearth of business. At the close of the year its orders had fallen to \$8,700,000, enough to run the small organization through May 1, 1939. There were less than 3,000 people on its payroll. There was the likelihood that the entire plant would have to close unless there was a turn in the procurement tide.

The turn came all right, shortly after 1939 began. But it was not what Pratt & Whitney Aircraft had hoped. Instead, the War Department decided to concentrate entirely on liquid-cooled engines for its fighter aircraft, and gave Allison an order for \$15 million for its V-1710 engines. That engine had just been in a competition with the Pratt & Whitney R-1830. The news of the War Department's decision was all the more stunning since Pratt & Whitney earlier had been informally advised that its engine had won. Pratt & Whitney Aircraft's military business had averaged about 70,000 horsepower each month in 1938 out of a total monthly production of 120,000 horsepower. Shipments to the services now would practically cease by June.

In the fall of 1938, the French had put in their first call for engines. Premier Edouard Daladier had returned from Munich and lamented, "If I had had 4,000 airplanes, there would have been no Munich." Now seeking to rectify its years of indifference, France began its search for air power, to equalize its strength with that of its potential enemies and thus maintain the peace. Sensitive to the weakness of their own aircraft engine industry, the French looked to the United States for help. This fitted in with Pratt & Whitney's plans, for its management many years before had become aware of France's deterioration in air power and its lack of engineering and industrial potential. An intensive campaign had been carried through to persuade France to use its engines. Sales efforts were conducted from a Paris office maintained for that purpose. In 1938 the R-1830 passed a rigid French type test. Its successful completion, in comparison with the failure of French engines under the same test, led France to order \$2 million worth of those

engines, enough for approximately a month's production. The Czech crisis in February, 1939, forced France to examine its critical weaknesses again. That spring France placed a bigger contract, carrying options for further increases, and those were shortly exercised. By fall, France's orders totaled almost \$85 million, and despite the fact that the Arms Embargo Act had not yet been repealed, Pratt & Whitney decided to move fast.

The task of preparing for the oncoming rush fell upon the energetic, tireless Jack Horner. He established a war plans committee, consisting of management, production, and purchasing personnel, which immediately made detailed studies of several possible expansion plans. The estimated production capacity of the plant was 450,000 horsepower a month, and the committee promptly calculated the necessary expansions in floor space, manpower, tooling, and vendor sources that would be required to produce a theoretical 1,700,000 horsepower a month. Training programs were instituted. Pratt & Whitney earlier in the year had taken over 115,000 square feet of space its sister Hamilton Standard division had occupied in the engine facilities. France in October agreed to finance a 280,000-square-foot addition, and ground was broken for its construction. The embargo act was repealed. Almost 3,000 new workers joined Pratt & Whitney's production force. Shipments jumped to over 400,000 horsepower monthly in December, 1939.

Thus, the first of three mammoth war loads had fallen on the little company. Even before Hitler struck at Poland, months before the phony "sitzkrieg," Pratt & Whitney Aircraft had begun summoning its reserves and its plans to meet World War II.

**O**NE of the oldest military axioms says, "No one thing wins wars." In modern warfare, however, no nation wins war without one thing. It must translate the tactics of the battlefields — whether they are fought in jungles, deserts, hedgerows, or the stratosphere — to the tactics of its factory floors. The ablest combat strategy is useless unless it is blended and coordinated with its mines, foundries, and machine shops at home. A tolerance of one ten-thousandths of an inch leading to superior weapon performance can be even more lethal than fanatical fighting zeal.

Tools and machines, tolerances and finishes, side arms and heavy bombers — all of them were determined and redetermined only by planning. In the midst of the gigantic upheaval that turned America's production from peace to war, William Knudsen, who as director of the National Defense Commission (later the War Production Board) saw all the factors that served to make production, thought that eventual success in the building

of war goods could be summarized in five words. "It's the planning that counts," he said soberly.

Pratt & Whitney's planning in part had gone back to 1926 and Rentschler's decision to decentralize the young organization by subcontracting at least half of its fabrication load. He had foreseen the enormous distention that war would bring to a product that primarily, much as its proponents might wish it the other way, would be employed as the deciding weapon of any modern war. The reservoir in supervision that he had insisted upon building was there. The youngsters had matured and broadened, and upon them the great load of planning and carrying through the war production would fall. He was strongly opposed to spreading out his team. The War Department already was considering the likelihood of duplicating Pratt & Whitney's facilities at an inland point, with Pratt & Whitney supplying the management. Commuting management, Rentschler said, might be worse than no management at all. Nor did he want Pratt & Whitney engines to be built by a new team of high-priced executives who were unacquainted with Pratt & Whitney's ways. He saw two courses still open: expand Pratt & Whitney's East Hartford facilities to their workable limits, and license the automotive industry to build Pratt & Whitney engines.

These matters were arising almost simultaneously with the fall of France. England earlier had talked of ordering big quantities of engines, but it was not until Winston Churchill took office as prime minister in May, 1940, that the country acted, and placed a large order for R-2800 Double Wasps to supplement earlier orders for Wasps installed in the Harvard trainer being built by North American. One month later, France collapsed, and the British took over the French orders. Another pavilion, this one called the British wing, comprising a total of 425,000 square feet, was begun in June, 1940, and paid for by the British government. Building that addition, everyone knew, was just the prelude to building still another. President Roosevelt, a few weeks before, had issued his call for 50,000 airplanes, and by fall an American addition, consisting of 375,000 square feet of production space, was begun to supplement the French, British, and original Pratt & Whitney facilities.

One of Knudsen's first acts after accepting the chairmanship of the National Defense Commission was to seek out George Mead whom President Roosevelt had appointed assistant chairman of the National Advisory Committee for Aeronautics, and ask him to establish and administer the aeronautical section of the commission. Mead, who had used his year of freedom to

restore his reservoirs of strength, quickly accepted. After he had spent a few days at the new job, seeking to learn just how the national administration wanted to go about obtaining the fabulous 50,000 airplanes for which it had called, he came to Hartford and called on Rentschler.

**I**T was Rentschler's firm conviction that the automotive industry's best contribution to aircraft production would be to accept the going engines and wherever possible duplicate the manufacturing procedures of the aircraft engine makers. Mead heartily agreed. Neither believed that aircraft engines were uniquely different to build; Detroit's technologies most certainly were abreast those of the rest of the world. They did know, however, that a fluidity of production, far different from the rather inflexible mass manufacture of motor cars, was the keystone of successful aircraft engine building. In combat, a multiplicity of design changes would become apparent; successful fighting would depend upon an instantaneous ability to translate those changes into engines on the factory floor. Both men agreed that there was no time to lose. Under the best of conditions, they estimated that it would require 18 to 24 months for the automotive industry to swing into full production on combat engines such as the R-1830 Twin Wasp or the R-2800 Double Wasp.

Mead returned to Washington. Then, within a matter of days, he laid out a program that in essence covered the entire engine procurement and production field as it would arise and shine for the next five years. It was an astonishingly farsighted and detailed performance, a work that in retrospect was of incalculable importance to the nation. Nor was he content to rest with the merits of the plan's precision and scope. He now was ready to take a major hand in its implementation. First, however, he suggested to Knudsen that they should call Rentschler to Washington and discuss the details with him.

Knudsen was in basic agreement with the policy of licensing the motor car manufacturers. After the three men had talked at length, he inquired of Rentschler which of the motor car companies he would choose as Pratt & Whitney's first licensee.

"Ford," Rentschler replied.

Knudsen said he was doubtful that the Ford people would accept, but if Rentschler wanted to go ahead, Mead could go out to Detroit shortly and talk with them.

He paused for a moment and then said,

"If Ford does decide to do the job, their toolroom will be turning out a