CHAPTER VII

Aviation Fuel During World War II

United States Capacity for Production of 100 PN Fuel

The declaration of war in Europe in 1939 found the United States with the only significant capacity for production of 100 PN fuel. The British were purchasing 100 PN fuel in the United States and elsewhere. They required this fuel to have a lean PN of 100 and a rich PN of 125. In the United States during 1939 and 1940, 100 PN fuel was made from straight-run gasoline with octanes produced by the hot acid, phosphoric acid, and alkylation processes. Suppliers in the United States of 100 PN fuel to the British were using large quantities of octanes (alkylate, hot acid, and phosphoric acid octanes) in their blends in order to meet the requirement of 125 rich PN since the straight-run gasoline they were using had poor rich mixture properties. One such supplier had cat crackers in operation producing motor gasoline but regarded the product as too expensive for use in aviation fuel and used a poor straight-run gasoline.

Fuel Supplies for United States Air Forces with 50,000 Aircraft

With President Roosevelt's announcement of a plan to build an air force of 50,000 aircraft, intensive studies were made in the middle of 1940 concerning the available and necessary fuel supplies for such an air force. These studies showed that in July, 1940, there was an installed capacity to produce about 650,000 gallons per day of 100 PN fuel in the United States.

Organization for War: Government and Industry

In June, 1940, Roosevelt established the Advisory Commission to the Council for National Defense. The Commission

quickly realized that petroleum supplies were an important essential to defense and appointed Dr. R. E. Wilson as chief of the section dealing with petroleum products. Wilson, a scientist with a distinguished history in petroleum refining and research and currently Chairman of the Board, Standard Oil Company (Indiana), was then President of Pan American Petroleum & Transport Company.

The NACA in 1939 had taken steps to expand greatly and to reorganize its engine research facilities. Expansion and reorganization of the NACA engine activities were largely in the hands of the late George J. Mead, formerly Vice-President of Engineering for United Aircraft Corporation (which includes Pratt & Whitney), and then Vice-Chairman of NACA. Mead undertook to reorganize the NACA Committee for Aircraft Power Plants and its Subcommittee on Aircraft Fuels and Lubricants. These two committees had previously consisted almost entirely of government and university members but Mead, in reorganizing, staffed the committees approximately equally with industry and government personnel. Mead was particularly insistent that the Subcommittee on Fuels and Lubricants should include oil industry personnel who could advise on manufacturing and potential production of fuels and lubricants. Mead considered that improved fuels had resulted in relatively enormous gains in engine performance but that these and further gains would be lost unless development was coordinated with the oil industry which alone knew how to manufacture aviation fuels.

The reorganized Subcommittee on Fuels and Lubricants started activities in June, 1940, under the chairmanship of Professor W. G. Whitman of MIT amid considerable skepticism of regular government bureau members, who, on the grounds of previous experience of the intense competitiveness of the oil industry, doubted that industry representatives could work effectively with the government and each other. At the first meeting of the reorganized subcommittee Dr. Vannevar Bush (then Chairman of NACA) addressed it and told the industry representatives that while working on the subcommittee they were sworn servants of the United States Government and not representatives of their companies. The Bush requirement

that subcommittee members operate as sworn servants of the government was loyally observed and the subcommittee was a very effective advisory agent of the government throughout the war. At the first meeting of the subcommittee, Mead requested it to undertake the problem of investigating fuel supplies. He pointed out that this had not heretofore been a function of the subcommittee but that it was organized and ready to go. He stated that the subcommittee was the only organized agency ready to function in an advisory capacity and must not stand on legal niceties.

The NACA subcommittee arrived at an estimated requirement of 8,000,000 gallons per day of 100 PN fuel for an air force of 50,000 aircraft, this estimate being largely based on data supplied by Army and Navy representatives on the committee. The committee's views on supplies were advisory only and it worked closely with Wilson who had to present recommendations for construction of plant to heads of the Advisory Commission and to the Army and Navy. Wilson's recommendations to the intermediate and highest levels of the Army and Navy air staffs were received almost with derision. The suggestion that 8,000,000 gallons per day of 100 PN would be necessary for an air force of 50,000 aircraft was regarded by intermediate and high level military staffs in Washington as an attempt by the oil industry to feather its nest. Some of the high and intermediate levels of the military staffs and some high-level civilians in Washington were very skeptical of the possibility of an air force of 50,000 aircraft and regarded the proposal as dubious political propaganda on the part of Roosevelt. One industry member of the NACA offered a resolution that capacity for production of alkylate and other octanes should be built up to 5,000,000 gallons per day. A high ranking officer closely concerned with engine development of one of the air services cited this resolution to the industry member who was a friend, as a sample of oil industry axe grinding, without knowing that the industry member had proposed the resolution.

Wilson found that his efforts to convince the high-level staffs of the necessity for building aviation gasoline manufacturing plants were futile. The reasons for the failure of Wilson's efforts were several, of which the most important was: even

elementary knowledge of petroleum products was confined to officers of rank below Colonel or Captain (Navy). The Services in general regarded the oil industry as a monopoly and in particular regarded all Standard Oil Companies as one, rather than as the often rather bitter rivals that they sometimes have been. *The Services had hardly known that manufacturing problems existed in the oil industry since their demands had almost always been met promptly. In this latter respect the views of the Services were in part the fault of the oil industry since the rapidity with which the oil industry (and particularly Shell and Jersey) had met the Army request for 100 PN fuel had served to confirm the previously held opinion. The failure of the military staffs to realize the necessity for capacity to produce aviation fuel is but one of many incidents where civilian and military authorities of the democracies underestimated the production capacities necessary for the conduct of war by armies, navies, and air forces.*

In any case, the net result of Wilson's efforts was that the Army and Navy jointly agreed that priorities should be granted to industry to build up a capacity of about 3,000,000 gallons per day, the capacity to be built at the expense of industry. The ultimate production of 100 PN by the United Nations reached 25,000,000 gallons per day by about the time of the end of the war in Europe. The 25,000,000 gallon capacity was, however, for an air force far larger than 50,000 aircraft.

In the middle of 1941 the Advisory Commission (which developed through various names into the War Production Board) ceased to be responsible for petroleum products and Wilson returned to private industry with a lively sense of defeat. An awakening sense of the importance of petroleum products in the conduct of defense led to transfer of responsibility for supply of petroleum products to the Department of the Interior under Harold L. Ickes. Ickes established the Office of Petroleum Coordinator (hereafter OPC) with himself as Coordinator and Ralph K. Davies (until then Vice President of the Standard Oil Company of California) as Deputy Coordinator. Ickes called a meeting with the oil industry in the middle of 1941 and emphasized the importance of the supply of petroleum products for military purposes with stress on aviation fuel. He obtained the blessing of the Department of Justice in respect to

interchange of technical information between companies as a means of facilitating increase of supplies. The oil industry had previously had reason to fear free interchange of technical information which could be viewed as violation of the Sherman Act. With the vigorous support of Ickes, Davies started to build up a staff by the process of taking expert personnel from the oil industry which at times loaned essential men whom it was loath to lose.

About September, 1941, the Army and Navy reluctantly increased the permissible lead concentration in 100 PN fuel from 3 cc to 4 cc per U.S. gallon. This step at once increased potential production by about 25% as a result of requiring less of the scarce alkylate (or other octanes). In October, 1941, Sun Oil Company, which had built and was building a considerable cat cracking capacity with some alkylation capacity, voluntarily offered to turn this capacity over completely to the production of 100 PN fuel and offered to deliver 400,000 gallons per day of 100 PN fuel at a price to be set by OPC. Sun, by this move, abandoned for the period of the emergency a specialized market in motor gasoline which it had built up for several years. The advent of cat cracked gasoline into the aviation fuel field was of great immediate and future importance since it meant that a given supply of alkylate would make nearly twice as much finished 100 PN fuel with cat cracked gasoline as it would with some of the straight-run gasoline then in use. For manufacture of fuel for the British and with a lean PN of 100 with a rich PN of 125, cat cracked gasoline effected even greater savings than it did with gasoline for the United States which was only required to be of 100 lean PN without a rich requirement.

OPC, headed as it was by a forceful and outspoken member of the Cabinet, was in a position to obtain action in regard to military petroleum supplies which the equally forceful and vigorous Wilson had not been able to achieve since he could not obtain the ear of the highest levels. OPC called a meeting of the oil industry with the Military Services for December 8, 1941, to discuss supplies of 100 PN and other aviation fuels. The disaster at Pearl Harbor the day before lent force to this meeting, and the Division of Refining of OPC promptly coopted

members of the oil industry for service on a committee which met immediately to study the most economical use of existing facilities for the production of 100 PN fuel. The work of this committee in conjunction with the use of 4 cc of lead and of cat cracked gasoline resulted in the available supply being increased to almost 2,000,000 gallons per day (as against only 650,000 gallons in June, 1940). The almost 2,000,000 gallons per day included the Jersey refinery on the island of Aruba in the Dutch West Indies, and this was not included in the 650,000 gallons per day of June, 1940. (The Aruba supplies were henceforth considered as part of the United States manufacturing area.) The increase of supply was obtained by OPC's assuming control of all suitable materials. Thus, for example, a manufacturer of 100 PN who did not have a good straight-run gasoline to mix with his alkylate and was thus using excessive quantities of the latter, ceased the manufacture of 100 PN and supplied his alkylate to another manufacturer who had a better gasoline.

With the coming of war the title of OPC was changed to Petroleum Administration for War (hereafter PAW) and a considerable expansion of the staff began. Staff was built up to take care of all phases of petroleum supply, i.e., production and transportation of crude oil, refining, blending, and transportation of finished products, and design, construction, and development of manufacturing plants. The staff was almost entirely drawn from the petroleum and associated industries, and its competence was in marked contrast to that of the staffs of some of the other war agencies.