DRAPER PRIZE FOR JET ENGINE GOES TO WORLD WAR II FOES

The second biennial Draper Prize for Engineering, like the first, awarded in 1989, went to two men who worked on the same invention but were completely unaware of each other's effort. This time, however, the two were wartime enemies: Frank Whittle, an engineer in Britain's Royal Air Force, and Hans J. P. von Ohain, a physicist working for a German aircraft manufacturer, Ernst Heinkel. The first winners, Jack S. Kilby, who did his prize-winning work at Texas Instruments, and Robert N. Noyce, cofounder of both Fairchild Semiconductor and Intel Corp, had been adversaries in protracted litigation over patent rights to the creation of the monolithic integrated circuit, better known now as the semiconductor microchip (PHYSICS TODAY, November 1989, page 52). Though Whittle and von Ohain invented the turbojet aircraft engine virtually simultaneously in the early months of World War II, it was ignored by their respective governments and never even considered as a technology that would revolutionize the character and significance of aerial combat and public transport.

On 2 October, the birth date of the late Charles Stark Draper, inventor of modern inertial guidance systems, Whittle and von Ohain were presented with the Draper award at the annual meeting of the National Academy of Engineering. They shared the prize of $375 000, provided by the Draper Laboratory in Cambridge, Massachusetts. The academy's 12-member selection committee, headed by Solomon J. Buchsbaum, senior vice president of AT&T Bell Laboratories, cited Whittle and von Ohain "for engineering innovation and individual tenacity in the development and reduction to practice of the turbojet engine, thereby revolutionizing the world's transportation system, improving the world's economy and transforming the relationship between nations and their peoples."

Whittle, who spent 25 years in the Royal Air Force, became obsessed by the idea of jet propulsion while at the RAF College in Cranwell, England. His 1928 graduate thesis, "Future Developments in Aircraft Design," dealt with gas turbines and jet propulsion for flight. Whittle applied for his first patent on the turbojet engine in January 1930, but his concept failed to impress either the British Air Ministry or the commercial aircraft companies, which remained skeptical because gas turbines had such a long history of flops. It was not until 1939 that Whittle, using funds raised from bankers and businessmen, was able to show off his engine on an experimental airplane, the E28/39, built by Gloster Aircraft Co.

Whittle and von Ohain: Sharing a prize for their solitary creativity.

Von Ohain's achievements were received more enthusiastically. Struck by the possibilities of jet propulsion while working for his doctoral degree in physics at the University of Göttingen in 1935, von Ohain was prodded to continue his studies of jet engines by one of his physics professors. Von Ohain showed a design model to Heinkel, who immediately hired the young man. With Heinkel's backing, von Ohain's engine progressed rapidly. By 1937 von Ohain had successfully tested it in a laboratory. The following year the German Air Ministry directed all aviation companies to begin developing jet engines. But in 1939, just as Nazi Germany marched off to war, the order went out to shift back to propeller-driven aircraft. At 6 am on 27 August 1939, only days before Nazi troops invaded Poland, a Heinkel 178 equipped with von Ohain's first turbojet engine took off and landed without mishap after a seven-minute flight at Marienhe Airfield on the Baltic Sea. Excited by the event, Heinkel telephoned Luftwaffe General Ernst Udet with the news. "Fine," said Udet. "Now let me get back to bed."

At 7:30 pm on 15 May 1941, during the Battle of Britain, Whittle's engine powered the Gloster plane on a 17-minute flight. "Frank, it flies," shouted an observer. "That was bloody well what it was designed to do, wasn't it?" said Whittle angrily. In the next 12 days, the plane made 17 test flights, completing 10 hours in

the air, as required for certification by the Air Ministry.

In Germany, Hitler, kept abreast of von Ohain's test runs with the engine, objected to producing jet-powered fighters, believing the war would be won with heavy bombers and with his "ultimate weapon," the V-1 and V-2 rockets. In Britain, jet engines were considered too unreliable and unsafe for fighters and bombers, though after observing several flights of Whittle's engine, US General H. A. P. Arnold sent Whittle's plans to General Electric for further development. By April 1942 the engine was part of the twin-jet P-59A Bell Aircomet.

Progress in Germany and Britain was slowed by wartime shortages of materials and bureaucratic opposition to new aircraft developments. Even so, by 1944 Messerschmitt 262 twin-jet fighter planes were in action, and soon afterward Gloster twin-jet Meteors became operational.

After the war Whittle became an RAF technical adviser to the Ministry of Supply. In 1948, on his retirement from the RAF with the rank of air commodore, he was knighted by King George VI. He emigrated to the US in 1976, and the next year he joined the faculty of the US Naval Academy in Annapolis, where he is currently an adjunct research professor. Von Ohain came to the US in 1947 and worked at the Wright–Patterson Air Force Base in Ohio, where he became chief scientist, responsible for maintaining the quality of all Air Force R&D on turbojets. In 1979 he retired from the Air Force and joined the University of Dayton Research Institute, where he is a senior researcher.

At a news conference at the academy after the award was announced, Whittle said that throughout World War II he knew nothing of von Ohain's efforts, "though it was often rumored that a German four-engine jet-powered bomber would pummel New York City one day soon." He thought the most practical application of jet aircraft would be to fly mail from Europe to the US the same day.

Asked how the US could stimulate the development of more creative talent like theirs, both jet-age pioneers stressed the need for simplicity. "Things are getting so complicated that individuals don't have the chance to do big things," Whittle observed. Von Ohain added that while improvements in existing inventions require complex technology and teamwork, "breakthrough ideas are not from teams. . . . Radical innovations are usually created by solitary figures." —IRWIN GOODWIN

WASHINGTON INS & OUTS

MUSICAL CHAIRS AT OSTP, DOE AND PENTAGON LEAVE TECHNOLOGY POLICY A TRIVIAL PURSUIT

Some call it musical chairs. To the more cynical it's something like the Mad Tea Party in *Alice in Wonderland*, at which the participants changed seats at the direction of the Hatter. In *Alice*, the shuffling of seats had little effect on individuals or on events. By contrast, the moves in Washington over the past few months are intended to make a difference at the White House Office of Science and Technology Policy and the Departments of Energy and Defense.

At OSTP the changes were set off on 25 September when **William D. Phillips**, the agency's very first associate director for industrial technology, unexpectedly announced that he was resigning. Phillips said he was leaving for personal health reasons. He had been coaxed to Washington early in 1989 from St. Louis, where he was a professor of chemistry at Washington University. In addition, as president of the Missouri Advanced Technology Institute and as science adviser to Missouri's Republican Governor John Ashcroft, he was active in strengthening regional government–industry collaboration on commercially promising technologies. It wasn't surprising, then, that he was brought to OSTP to lead the charge to coordinate government–industrial technologies in Federal policy-making circles.

Announcing the departure, D. Allan Bromley, the President's science adviser and director of OSTP, declared that Phillips had "built new bridges between the Administration and the private sector." In fact, after introducing OSTP's only major policy statements to Congress—the first on US technology policy (PHYSICS TODAY, December 1990, page 54) and the second on national critical technologies—Phillips decided there was little more he could do in Washington to promote the policies enunciated in the two papers. Sources in Congress say the purpose of both papers clashed with the Bush Administration's abhorrence of "industrial policy." Representative George E. Brown Jr, a California Democrat and chairman of the House Committee on Science, Space and Technology, claims there are obvious distinctions between technology policy, which deals with R&D in the precompetitive stage, before products are designed and perfected, and industrial policy, which usually involves the market stage. The White House argues that government backing of advanced commercial technologies means choosing "winners" and "losers" and that the business of government is to stand aside and allow the "invisible hand" of the market to make those decisions.

For a time at OSTP, Phillips was responsible for setting up the Critical Technologies Institute. The institute was conceived by Senator Jeff Bingaman, a New Mexico Democrat, to reinvigorate America's declining technological fortunes. Bingaman, chairman of the Senate Armed Services subcommittee on defense industry and technology, claims that the Reagan and Bush Administrations have shown "a vacuum of leadership" in advancing joint government–industrial research on technologies that are likely to yield high payoffs in military and civilian products. Persuaded by Bingaman's fervor for increasing the government push behind dual-use R&D, his colleagues in Congress gave OSTP $5 million (to be spent over two years, if necessary) from the 1991 Defense Appropriations Act to set up the institute. The act designated the director of OSTP to head the new institute's board, which would number 10 senior government officials plus 10 members from industry and other sectors of society. Lawmakers say they voted for the institute as a way of improving US competitiveness in the international marketplace. If American companies are to succeed in outperforming the government–industrial juggernauts in other countries, they need to have, among other things, access to the R&D their tax dollars make possible.

A 55-page report issued on 12 September by the august Carnegie Commission on Science, Technology and Government concludes that the Energy, Commerce and Defense De-