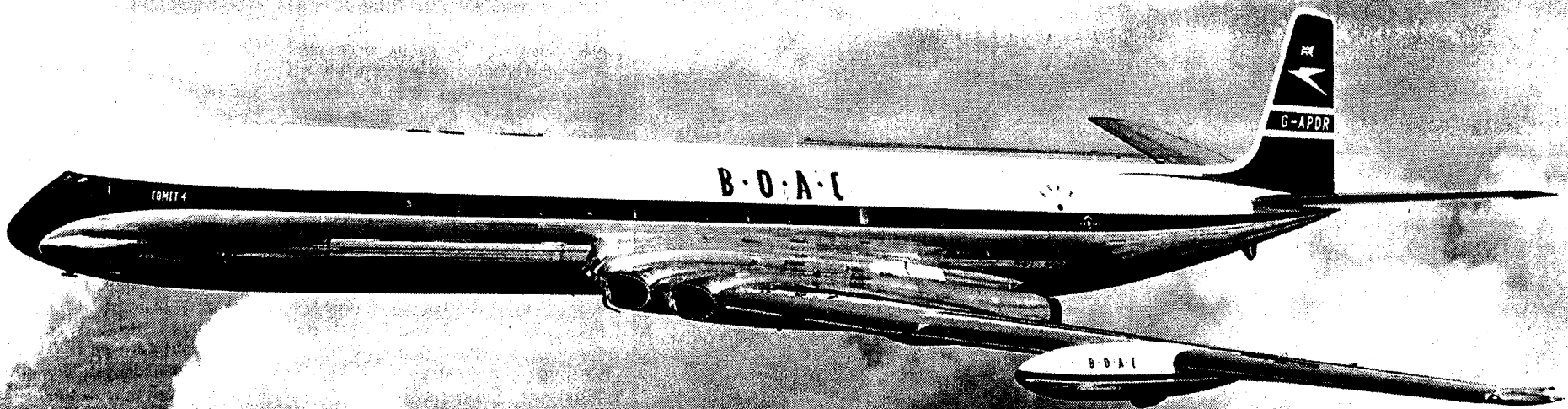




A Comet 4 in 1962: The highly successful jet airliner was a modified version of the Comet 1, which suffered a series of crashes in the early 1950s that baffled conventional experts.

ARNOLD HALL

## Solved mystery of early jet-airliner crashes

*Brilliant engineer helped produce the first working jet engine and later headed Hawker Siddeley Group*

ANTHONY TUCKER  
*The Guardian*

Sir Arnold Hall, who became famous in the 1950s for his investigation into the mysterious and catastrophic crashes of de Havilland Comet 1 jet airliners, has died at 84.

The brilliant aeronautical engineer, scientist and industrialist designed the compressor for the world's first jet engine, shaped the gyroscopic gun sights in D-Day fighter aircraft, defended Britain's aerospace industry against nationalization and built the giant Hawker Siddeley Group.

Sir Arnold's Comet investigation brought new technical profundity to complex failure analysis and is still seen as the model for major aviation inquiries. It revealed the scale of his reach as a scientist and administrator and his calmness in crisis.

When the first passenger-service Comet took off from London's Heathrow Airport on May 2, 1952, Britain's aviation industry and its major operator, British Overseas Airways Corp., led the world into the era of high-altitude, high-speed civil jet flight. After de Havilland's costly and seemingly exhaustive test programs, the world's most advanced and elegant passenger aircraft appeared to be as safe and sound as prudent engineering could make it. Orders flooded in.

In those grey postwar years, the Comet 1 was a symbol of British confidence and national recovery. But after only two years in commercial service, three Comets failed catastrophically in flight — the last one only a few days after a very costly investigation into the second accident had given the aircraft a clean bill of health. There was despair in industry and near panic in

government.

All Comets were grounded, all contracts were put on hold. At this crucial time, Sir Arnold, then the youngest director of the Royal Aircraft Establishment at Farnborough, was approached by the government for advice.

Experts in industry and conventional investigations could produce no explanation: There were suggestions of terrorist bombs and unknown high-altitude atmospheric phenomena. Neither Lennox Boyd, minister of transport and civil aviation, nor Duncan Sandys, minister of supply, knew what to do or how to save British aviation prestige.

Sir Arnold's response was decisive. The industry could not be left floundering in the face of huge investigation costs, nor could the mystery be left unsolved. However unpalatable the idea was to government, teams from Farnborough had to be brought in to carry out an independent investigation of all possible causes — a huge open-ended task. Within a couple of days, Mr. Sandys gave the go-ahead and, within weeks, Sir Arnold had decided that some crucial stress calculations were of such complexity that mathematical theory alone could not provide the answers.

He promptly built Farnborough's famous "whole pressurized aircraft" test rig, in which the stresses of flight cycles could be simulated rapidly many thousands of times on a complete aircraft. The outcome, clinched by early and massive failure of the test aircraft's pressurized cabin, explained the catastrophes, provided new knowledge of aluminum alloys under repeated stress, gave new meaning to the concept of metal fatigue and revealed the unexpected inadequacy of conventional and hitherto highly



Arnold Hall in 1968.

trusted methods of stress testing and analysis.

Within two years, Sir Arnold's findings led to the modified and very successful de Havilland Comet 4. But, by then, the United States, and to a lesser extent France, had caught up with the British aircraft industry and the world market slipped away.

For Sir Arnold, this period at Farnborough, during which he had expanded its activities, forged strong links with research establishments in Europe and the United States, and received a knighthood (at 39), was a major turning point. He was by choice an academic; now the government wanted him to stay in Farnborough. Instead, when his contract came to an end in 1955, he moved into industry, first as technical director of the Hawker Siddeley Group, then as managing director of the new group member Bristol

Siddeley Engines and, later still, as vice-chairman and chairman of the entire group.

In 1962, he chaired an Anglo-French Concorde design group. Then, in the costly wake of cancellation of three of Hawker's military aircraft projects and under growing political pressure for nationalization of the aircraft industry, Sir Arnold broadened the base of the group so that aircraft and engines were no longer dominant.

"I felt a great responsibility to the companies we had taken over and to the people we employed," he recalled. "I did what I could to protect them."

By the mid-1970s, when the Hawker Siddeley Group employed about 85,000 people, 50,000 were engaged in electrical and other forms of civil engineering.

Sir Arnold's decision to keep Hawker Siddeley in the eventually highly successful European Airbus project after the British government had pulled out emphasized his gifts and made the government look very slow-witted.

Sir Arnold, driven by the spirit of private enterprise and professional responsibility that he saw as essential to the creation of an effective industrial base, was vigorously and openly hostile to the government's nationalization proposals.

When named Businessman of the Year in 1975 for his "vision, courage and commercial discipline" in turning Hawker Siddeley into one of the world's most efficient industries, he said flatly that he wanted no part of any nationalization program.

When the axe fell in 1977 (by a single vote in the the House of Commons), Sir Arnold left the aircraft industry for good.

He later spoke of being "deeply saddened" by the enforced take-

over of a third of his industrial group. He was perhaps making the understatement of the century.

Born in Liverpool to parents who had left school at 12, Arnold Hall grew up during the Depression. Many of his older relatives were involved in maritime activities, but his father was an upholsterer and his mother a brilliant self-taught pianist.

"My mother tried to teach me, but I'm afraid I was something of a disappointment to her. My interests were always in engineering and science. I was too busy making steam engines and other gadgets."

His mathematical gifts and his potential in science and engineering emerged clearly at school. Sheer brilliance took him to Cambridge, where he won prizes in engineering, aeronautics and thermodynamics.

On a postgraduate fellowship, he worked with Frank Whittle and carried out the compressor-stress calculations for Mr. Whittle's jet engine, the first in the world to run (in April of 1937). It is now in the Science Museum in London.

In 1938, Sir Arnold joined the Royal Aircraft Establishment where, during the Second World War, he led teams that produced both an advanced bomb sight and the gyro gun sight that, from D-Day onward, more than doubled the kill rate of Allied fighter aircraft.

In 1945, he was appointed professor of aviation at the University of London and head of the department of aeronautics at Imperial College. In 1951, when his postwar academic research program was just getting into its stride, the death of the Farnborough director and fears over escalation of the Korean War prompted the government to ask him to take over.