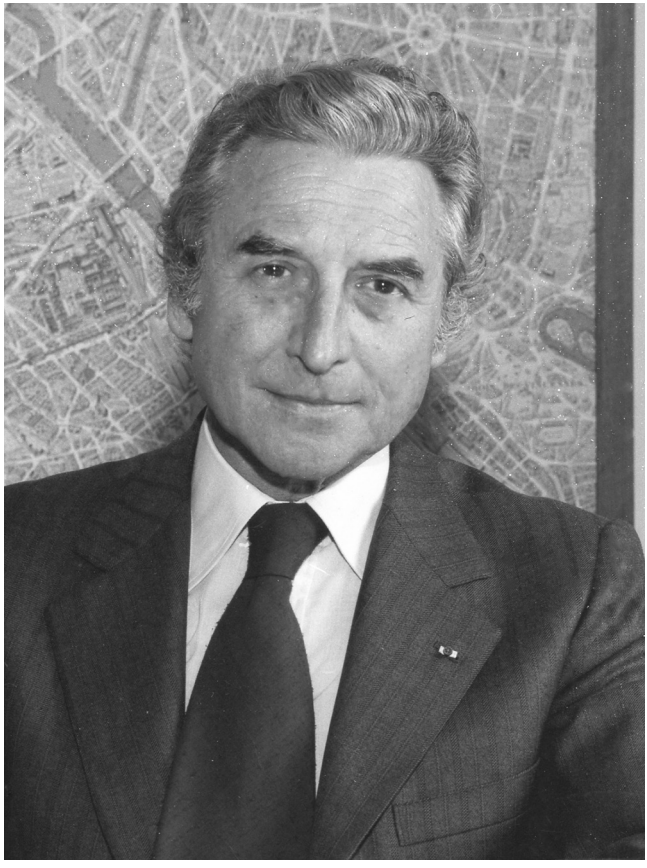

LUCIEN C. MALAVARD

1910–1990

Elected in 1980

"For contributions to the field of aerodynamics and, in particular, original work in flow visualization and in French research and development."

BY PIERRE C. PERRIER

LUCIEN MALAVARD, an international aeronautical engineer known simply as Malavard, died in Paris on March 2, 1990, at the age of 80.

Malavard was born in Marseille, France, on October 7, 1910. He received a master in sciences degree from the University of Marseille in 1930 and then started a PhD under the supervision of Joseph Pérès, a renowned professor of theoretical mechanical engineering sciences at the University of Marseille. Malavard became his assistant when Pérès received funding to open a laboratory for research in aerodynamics at the request of the French Defense Ministry. The ministry wanted to increase research in aeronautics by creating a network of institutes for fluid mechanics, the first in Paris and the second in Marseille. In addition to experimental work on propeller blades in the new low-turbulence wind tunnel facility, Pérès hoped to extend to three dimensions the analog voltage and current equivalent measurements that are analogous to speed voltages in incompressible fluids surrounding subsonic aircraft in motion.

Pérès set out to build lift load distribution tables (cord and wing-tip) to provide data for structural calculations for new aircraft and thereby optimize their performance. This was achieved in the late 1930s, not in Marseille but in Paris: when Pérès was appointed director of the Institute of Fluid

Mechanics at the Sorbonne, Malavard accompanied him as his assistant.

While working with Dr. Pérès, Malavard continued his studies and in 1934 was awarded a diploma in aeronautical engineering. He then "upgraded" his doctorate to a state doctorate, qualifying him to teach at the university. During this time he also contributed to the final work on the main wind tunnel in southeastern France (near Modane), initiated in Austria at the end of World War II. He was appointed to chair the Aviation Science Faculty of Science, Paris, and also accepted a position as scientific director at the Aeronautical Institute in Saint-Cyr (near Versailles). In 1960 he assumed the directorship of his own laboratory and became professor at both the Von Kármán Institute and the Free University of Brussels, Belgium. The following years were intensively devoted to research for the validation and use of his centers for analog computation in both research and industry. He acquired an international reputation.

This was a time of renaissance in French aeronautics as well as the beginning of various international actions. Malavard became a major actor in the European success of a proposal by Theodore von Kármán that was well received in the United States: to achieve military coordination of the Western world, in the framework of the NATO treaty, through multinational cooperation in aeronautical research and development (R&D). von Kármán, a refugee in the United States, needed collaborators in France (Malavard) and Great Britain (Alec Young) with whom he could cooperate directly to give weight and substance to the project. Naturally, it was important to succeed with the working party on fluid mechanics, von Kármán's primary field. Malavard and Young brilliantly explored several paths opened by the famous Hungarian professor. Such coordination of R&D was the first of its kind, and was duplicated in other aeronautical disciplines through the famous Advisory Group for Aerospace Research and Development (AGARD), where Malavard from the outset was an active collaborator with von Kármán in the Fluid Dynamics Working Group.

When von Kármán died in 1963, Malavard was invited to work with his successor, Courtland D. Perkins, who at the time chaired the Aeronautics Department at Princeton University (he was later elected president of the National Academy of Engineering); their collaboration led to numerous useful exchanges for both European and US R&D policies.

In addition to his tenure as professor of aerodynamics and aviation at Sorbonne University, Malavard worked in the field of analog simulation of fluids for aeronautics with extensions from incompressible flows to sonic and supersonic linearized equations. He also turned to other applications as soon as it appeared that numerical computers would play a major role in future computations of compressible flows around aircraft and other vehicles.

Thanks to his time spent sailing boats on his holidays in the Mediterranean Sea, Malavard soon directed his research toward reducing losses of energy, particularly in the field of transportation, in the newly created laboratory for the sciences and engineering at Orsay University, which he headed continuously from its creation in 1971. He proposed mixed propulsion systems with motors coupled to standard propellers and sails; the latter were rigid to avoid the need for sailors to handle the sails and complete a maneuver under sail. This led to the application of new digital codes of airflows to the TGV (France's high-speed train) and the reuse of wind energy for propulsion of boats.

Malavard nourished a great love for the sea, with sailing forays out of Marseille. He followed with interest the ecological work of Jacques Cousteau, world-famous for his research on submarine fauna in particular in the southern seas. Malavard invented a silent sailing ship with a patented "turbo-sail": a rigid cylinder replaces both mast and sail, with a slot to catch the winds and supply drive that is far easier to control than a suite of sails, since there is only one that can be reset by simple rotation and a control for the air slot. A boat built according to this design crossed the Atlantic, with Cousteau at the wheel, in a remarkably short time. But Malavard's work on auxiliary propulsion systems for boats to reduce energy consumption

did not come to fruition (other than for sea-based research programs) because of the very low cost of oil at that time.

In contrast, he and his laboratory colleagues, back at the University of Orsay, were reorienting their research to a new form of computation, digital algorithms. He was the first scientist in the world to define the regular links needed for the so-called difference method (or singularity method for sources and drains), calling on the definition of surfaces developed by Pierre Bézier for automobile manufacturing and assembly. This led to software for computer-aided design (CAD) and an early version compatible with digital computation, used to compute designs for the first TGVs (particularly in the case of tunnel penetration at speed). This CAD was also used for ship building. Even as Malavard reduced his time in the laboratory to sporadic brief (but always very congenial) visits, his lab became a pioneer in artificial intelligence.

Former NAE president Perkins said at the time of Malavard's death:

> During my tenure as chairman of AGARD, I had the good fortune to become a friend and close associate of Malavard. We achieved this in spite of the fact that he spoke very poor English and I spoke very poor French. I soon recognized Lucien as a man of many talents, an able scientist and innovator, a strong leader of men, a fine manager of major enterprises, and a man of wit and great charm. He has held many important positions in academia and in government, and his work is well recognized outside of France. This was demonstrated when he was elected a foreign associate of the National Academy of Engineering of the United States, one of the first scientists and engineers so honored. Lucien Malavard, then, was a great teacher-scholar, a powerful contributor to the NATO alliance, and an innovative and creative person who brought great credit to France in many ways…. France and the international scene of aeronautics have lost a strong leader and I feel that I have lost an able and close friend.

Lucien Malavard was a pacifist at heart and also displayed great courtesy *à la française* without ever conceding or compromising his positions. When discussions were on

scientific grounds, he would aptly and quietly recall the sound bases for the reasoning, never needing to raise his voice to be heard. This ability alleviated numerous difficulties in the missions he led and when his role was to defend forward-looking projects. His attendance was therefore most sought in project phases where protagonists were debating the "foundation steps" or deep disagreement had to be overcome. If as a PhD student he famously contributed to the success of the building of the big transonic wind tunnel, as a professor at the Sorbonne he played an even greater role in the establishment of an integrated administration for research and test centers (DRME) in France's Ministry of Defense, where there was a manifest lack of connections between the academic and institutional world. He also participated in several working groups linked to government departments.

Lucien Malavard was greatly appreciated as a true coordinator among people and organizations in science and engineering, both in France and elsewhere in the world.