



L. B. McGuire

## HENRI GASTON BUSIGNIES

*1905-1981*

BY LOUIS T. RADER

**HENRI** GASTON BUSIGNIES, an outstanding scientist, inventor, and engineer, died on June 20, 1981, in Antibes on the French Riviera at the age of seventy-six. In 1975 he retired from International Telephone and Telegraph Company (ITT) where he had been Senior Vice-President and Chief Scientist. His career, all with ITT, spanned a half century of major contributions to the field of telecommunications. He was responsible for more than 140 patented inventions, many of which were of major significance to commercial and military aerial navigation.

Dr. Busignies was born in 1905 at Sceaux near Paris, France, the son of a mechanical engineer. He showed a very early interest in radio and became a "ham" at age fourteen. Even as a teenager he soon discovered that he was more interested in experimenting with radio circuits to improve them than in receiving far-off stations, which was a prime interest in the early days of radio. He studied at the Jules Ferry College in Versailles, and in 1926, at the age of twenty-one, obtained a degree in electrical engineering from the Institute Normal Electro Technique in Paris. In 1926, before getting his degree, he obtained his first patent on a radio compass, a device that electronically pointed to the direction of the radio transmitter from which waves were being received. In that same year he received the first of his many awards, the Lakhovsky Award by the Radio Club of France.

In 1928 Dr. Busignies became an engineer with the ITT Paris

Laboratories. For the next twelve years he developed radio direction finders, airplane radio navigation systems, and early radars. In the first demonstration of an aircraft guidance system in 1936, his automatic direction finder dramatically guided a plane from Paris, France, to the Isle of Reunion off Madagascar. The equipment was demonstrated in the United States in 1937, and he continued to perfect it until World War II.

Dr. Busignies invented the world's first automatic direction finder, for which he received the Pioneer Award of the Aeronautical and Navigational Electronics Group of the Institute of Radio Engineers in 1958. The award also covered development programs including TACAN (tactical air navigation), the standard air navigation system used by U.S. and NATO military aircraft, and part of VORTAC (very high frequency omnidirectional range) in the Nation's common system for air navigation and traffic control on federal airways.

A model of the automatic radio direction finder resides in the Smithsonian Institution, where it was presented by the inventor and accepted in 1975.

One of Dr. Busignies' inventions was destined to make a vital contribution to the Allied war effort in the Battle of the Atlantic. At the time of the fall of Paris in World War II, much secret electronic work was being done in the ITT Paris Laboratory for the French military. One project, initiated by information supplied to the French by the British secret service, involved a method by which German U-boats could be located. The U-boats required periodic radio communications with each other and with Germany. To avoid being discovered by means of their radio transmitters, the Germans developed a technique of "burst" transmission, consisting of very short time intervals on the air, usually less than a second. During the years 1934 through 1945, Dr. Busignies received four patents on a high-frequency direction finder, later known as Huff-Duff, which was able to show instantaneously the direction from which the radio signals of the enemy submarines were coming and to indicate it on a cathode ray tube in a compass setting.

During the German occupation of Paris, Dr. and Mrs. Busignies along with two of their associates and their families (a party of ten) were able to escape from Paris with their working drawings and

models under the eyes of the Gestapo and make their way first to Lyons, in unoccupied France, then by ship to North Africa, Portugal, and finally the United States. The invention was demonstrated to top U.S. military men, who immediately ordered that prototypes be built. Production followed rapidly.

A network of Huff-Duff stations was quickly established, first along the East Coast and later along both coasts. One thousand equipment stations were installed on destroyers and aircraft carriers, and 1,500 mobile ground stations were made for the U.S. Signal Corps. Another 30 to 40 stations were installed throughout the world.

German submarines were immediately located, as many as 150 in a single day during the peak period of the Battle of the Atlantic in 1943. This translated into raising Hitler's submarine losses to as high as forty in one month and decreasing Allied convoy ship losses to one-fiftieth of their worst figures. Hitler admitted that this was the "one single technical invention" that caused the German U-boats to lose the Battle of the Atlantic.

In recognition of these contributions, Dr. Busignies was awarded the U.S. Navy Certificate of Commendation for Outstanding Service to the Navy and the Presidential Certificate of Merit for his activities with the National Defense Research Council.

Another early wartime Busignies invention was the moving-target indicator (MTI) radar. This ingenious circuit scrubs off the radar screen every echo from objects that are stationary and displays only echoes from targets that are moving. In addition to military applications, the MTI radar is used in all airports of the world to eliminate the confusing echoes from cities and other stationary objects surrounding airports.

After the war Dr. Busignies elected to remain in the United States rather than to return to France, and he became a naturalized citizen in 1953. Since 1941, when he participated in the founding of ITT Laboratories, he played a major role in the growth of the corporation's U.S. activities. He became Technical Director of its laboratories (1949), Vice-President (1953), Executive Vice-President (1954), and President from 1956 until 1960, when he was advanced to Vice-President and General Technical Director of ITT. He later became

Senior Vice-President and Chief Scientist of the worldwide corporation.

After the war Dr. Busignies concentrated on the development of aids to navigation as well as on radio navigation. In addition to the two fields, noted above, of the radio compass and Huff-Duff, he made significant contributions in several areas. Inventions in the radar field in addition to the MTI were the IFF (Identification Friend or Foe), conical scanning radar, shell trajectory control, gun-fire control, three-dimension radar, and a system to deceive and induce errors in enemy radar observations. The importance of the inventions to national defense is indicated by the fact that many of them were kept secret for periods ranging from seven years for gun control radar to twenty-six years for the IFF. Some of his inventions are still in the secret category.

His inventions in the field of navigation systems included parts of ILS (instrument landing systems), TACAN, and VORTAC.

His inventions in the communications field cover the first use of Doppler effect in transmission and reception, the principle of phased-array antenna, and the use of metallic needles and ionized gases in orbit for communication when used as reflectors of radio waves.

Under his direction, some of the first pulse time modulation and pulse code modulation systems were developed, as well as the first commercial over-the-horizon link for television and telephone between Florida and Cuba in 1957-1958. He was also responsible for developing one of the first satellite antenna, 40 feet in diameter, in Nutley, New Jersey, in 1958.

In March 1959 Dr. Busignies presented to the Committee of Science and Astronautics of the U.S. Congress a project for international communication by synchronous satellites. This testimony contributed to legislation establishing the Communication Satellite Corporation.

Fortunately, Dr. Busignies' genius was well recognized during his lifetime. In addition to the recognitions noted earlier-the Pioneer Award, the U.S. Navy Certificate of Commendation, and the Presidential Certificate of Merit-he was elected a Fellow of the Institute

of Electrical and Electronics Engineers (IEEE) in 1945, and in 1964 received the Institute's David Sarnoff Award for outstanding achievements in the field of electronics. In 1969 he received the IEEE Award in International Communications and in 1977 the Edison Award. In 1974 he was elected a Fellow of the Radio Club of America and in 1975 received their Armstrong Medal. He was awarded an honorary Doctor of Science degree in 1958 by Newark College of Engineering and an honorary Doctor of Engineering degree in 1970 by the Polytechnic Institute of Brooklyn. He received the Industrial Research Institute Medal in 1971 for his "outstanding leadership management ability, vision and wise counsel."

Dr. Busignies was the author of many technical publications, published both in the United States and in Europe. He was also invited to give many addresses, such as "Intercontinental Telecommunications by Artificial Satellites," which he presented at the Thirteenth International Congress of Communications in Genoa; "Industry Can Meet the Challenge of National Goals," presented at the National Security Industrial Association Symposium; "Science and Technological Changes: How to Survive Them," presented at the Governors' Conference on Science and Technology; and "Competing Internationally," the keynote address before the Thirteenth Annual Joint Engineering Management Conference—all presented in 1965.

Dr. Busignies was elected to the National Academy of Engineering (NAE) in 1966 and immediately began a long and distinguished service to the Academy. He was a member of the NAE Council from 1968 to 1971; Chairman of the NAE Project Committee from 1970 to 1973; a member of the Division of Engineering's Executive Committee from 1971 to 1973 and of its Committee on Space Applications. He served as Chairman of the NAE Committee on Telecommunications from 1973 until July 1974 when this committee was reorganized as the National Research Council's Committee on Telecommunication-Computer Applications. He continued to serve as Chairman until 1976 and also served as a member of a number of this committee's support panels.

Noted for his technical preeminence, Dr. Busignies was also an

extremely courteous person who gave freely of his time to help others-from student to practitioner-and as a result he inspired very strong loyalties in all who came in contact with him. He was in truth one of "nature's gentlemen."

Dr. Busignies is survived by his wife, a daughter, and two grandchildren.

