The use of aerial platforms in aerobiological studies

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Until little less than one hundred years ago, the dynamics of biological particles in the atmosphere were practically unknown. However, the birth of a new technological tool, aviation, offered the opportunity to broaden the scope of aerobiological studies and hence our understanding of the phenomena of deposition and long-distance dispersion of biological particles.

The first sensors, albeit very rudimentary, were soon mounted on aerial platforms by Stakman and Van Overneaau (1932) using airplanes (1924) or by Metha using hot air balloons (1933). Unfortunately, these first devices shared one thing in common: their lack of precision, obtaining results that did not go beyond the merely qualitative. Gradually, these rudimentary instruments were adapted to the special requirements of atmospheric sampling; sometimes in a very peculiar manner such as the system designed by the University of Sienna for the Italia zeppelin used in the expedition headed by Humberto Nobile to the North Pole.

The first serious attempt to bring together both sampling systems and experimental methods was undertaken by Charles Lindbergh with the help of the father of North American aerobiology, Fred Campbell Meier, using the "Skyhook". This aerobiological sampling device was designed to be used during the famous aviator's commercial and scientific flight around the North Atlantic in 1933 and was probably also used by Amelia Earhart in her endeavour to fly around the world.

Later, Proctor and Parker (1938) improved upon the Skyhook's original design for use on a Martin B-10. Nevertheless, it continued to pose some problems in terms of the accuracy of the data obtained, given that the methodological basis of the device did not permit isokinetic sampling and the working conditions were far from neutral or were largely conditioned by the type of platform used. These shortcomings were overcome in part by the work of Polunin, Pady and Kelly who collected numerous samples on board a Boeing B-29 during studies on the polar region concerning the transportation of particles from nuclear tests performed in the atmosphere at that time. Likewise, Proctor himself (1949) designed an isokinetic sampling device that he mounted on board a Boeing B-17 and a North American B-25.

Much progress was made in this field in following years. Indeed, after the 80's, aerial platforms were specifically built or adapted for their use in aerobiological studies. This is the case, for example, of the Lockheed C-130 "Snoopy" of the UK Met Office, the WC-130s of the USA National Oceanic and Atmospheric Administration, the highly specialized Russian Myasischev M-55 "Geophysika" or the Lockheed TSR-2 from the United States, which is able to perform a wide range of atmospheric studies given the modular character of its payload.

In the European Union, as well, there are highly sophisticated aerial platforms such as the Fokker F-27 used by the CSIRO (Commonwealth Scientific & Industrial Research Organization) or the Grob "Strato" 2C, which never quite achieves full operational status.

In the future, however, it seems likely that airplanes will be replaced by a new generation of zeppelins including the Zeppelin ZT or the new unmanned models designed by NASA such as the RPAs of the ERAST program, namely the Perseus and Helios with solar engines that permit them to remain in flight almost indefinitely. Doubtless, the next step should be directed at designing platforms that will permit us to study the presence of biological particles in other worlds. In fact, engineers and biologists are already working on the design of the Mars Airplane.

When the time comes, we will not only know if there is or was life on Mars, but will also be able to deepen our understanding of the laws that govern the dynamics of low-density atmospheric particles such as those existing on Mars.