FOREIGN OPINIONS ON AVIATION, PRESENT AND FUTURE
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Only metals have the vast range of mechanical characteristics which is necessary for materials employed in aeronautical construction. The problems of rigidity, vibration, inderformability and durability are completely solved by metals only. For small and medium planes wood was all right in the past, but the progress attained by modern constructional technics cannot tolerate any longer the use of such material, with which it will never be possible to attain the best ratio between the empty weight and the useful load. Weight is everything in aviation.

In some special constructions the use of wood is quite impossible, that is in the case of small single seaters like fighting and racing planes. Even the change from biplanes to monoplanes (the latter has now nearly conquered the whole field of aeronautical construction) has all the more brought to the fore the necessity of using metal, because monoplane wing problems, particularly when high speed is needed, may only be solved with all-metal wing.

If one looks back at the aeronautical constructions of the past, one can see how wood has been gradually replaced as a consequence of the progress of technics. Several years have been necessary to remove the prejudice in regard to the use of metals. One was the excessive cost. Really this had its origin from the fact that metallic construction was too often realized according to constructive ideas and design derived from the wooden structures. The result was an irrational metallic construction which was too costly. For the same reason metallic constructions were said to be slower than wood construction.

A particularly useful material for aeronautical constructions is duralumin, which alone represents about 90% of the metals employed. In many special cases light aluminum are preferred whilst high resistance steel is useful for stressed structural-welding. Steel is valuable for welded framework, undercarriages and support parts. In the case of civil airplanes, the duralumin is specially useful for the construction of monocoque fuselages, with great advantage over the other types of structures, because it easily allows the interior of the cabin to be lined with thermo-acoustic materials and makes it possible to use the whole volume and lastly is very light.

As regards the wings, the monoplane formula is now indisputed and is applied to the large, medium and small planes as well. The construction of such cantilever wings found its finest solution in the one-piece wing which during 16 years of hard work on the part of technicians all over the world has been more and more perfected. Although today it is nearly perfect, it constitutes for the future one of the largest fields of study which will give more satisfactory results, and emphasize the characteristics of metals.

For all these reasons we can safely say that the aeronautical material of the future is the "duralumin" and that in the always extending and rational use of light aluminum alloys the aeronautical constructions will find the most precious means for progress.

GENERAL ALEXANDER LOHR
Chief of the Austrian Air Force

Experiments of these last years are proving very clearly that fully armed and ammunitioned soldiers can easily be landed by means of parachute. Supplying of advanced patrols with foods and ammunitions has already been accomplished in 1915-1918. During their African campaign in Morocco, the French already practiced it regularly, and it has to be credited to aviation that the Italians succeeded in conquering Abyssinia so quickly owing to the fact that airplanes were able to supply whole arms corps when by no other means this could be done.

It is therefore to be held now as quite possible to send troops to very advanced positions and to supply them by aerial means every time the enemy does not oppose it. In the case of European wars it must be realized, however, that the observation service will generally be able to catch sight in due time of such transports when the objective is far enough and to take the necessary countermeasure. Transport aircrafts, as well as bombers, being often exposed to attacks only during the return trip, it appears necessary that such counter-measures besides the aerial defense with fighter planes have to be helped by anti-aerial artillery.

The landed patrols as soon as down to ground naturally need some time in order to organize themselves and find their way. Should they be caught at this very moment by enemy forces, even small ones, but capable of a quick gathering, the failure of the enterprise is nearly certain. It appears therefore necessary for the future to take defensive measures against aerial infantry such as signal service, lorries ready to start and so on.

More dangerous than aerial infantry seems to be "sabotage" infantry, bold men landed by parachute whose mission is to lay mines, to kindle fires and so on. Results will be greater when plans are drawn up before the war and men fully trained for such particular task.

A matter of outstanding importance will be the landing of troops in the battlefield itself. In some particular spots of it, signal service and other communications may be wrecked or not yet ready and consequently the defence by fighters and anti-aerial artillery out of efficiency. In such case there will be very favorable conditions for a surprise from the sky. If the aggressor is also favored by land's configuration and weather conditions, aerial infantry can easily be successful, by destroying communications in the back-lines and so paralyzing the action of headquarters.

Sometimes the attack could also be struck

from back and sides with better results than can be expected judging only from the sheer number of soldiers involved.

It is consequently my opinion that aerial infantry, although not to be considered as a decisive factor, is nevertheless a quite remarkable novelty in the art of the war.

C. WIESELBERGER
Director, Aerodynamic Institute, Aachen University

Is it possible to reach a stalling to top speed ratio in the order of 1 to 10?

I am firmly convinced that in the next five or ten years, the actual range from stalling to top speed will be increased, but it is also my opinion that better result can only be obtained, at least for some years more, by using the lifting power of horizontal propellers and by further developments of helicopters and autogiros. For the latter particular type of aircraft there are only some particular problems of construction and stability left to solve and the solution is only a matter of a few years.

I do not believe that standard airplanes will reach very low landing speed (let us say 10 to 20 kms. p.h.) owing to the fact that fixed wings will not give at such speed a sufficient and efficient lift.

WOLFANG VON GRONAU
President, Aero Club of Germany

Prototype machines are now being tried which reach the speed of 500 kilometers an hour. The quickest has even done more than 700 kilometers an hour. Why could these results not be obtained with standard equipment aircraft? There are two problems that have to be solved first. First of all there is that of landing. It is difficult to reduce such speeds so as to be able to land slowly in such a little space as that required by some aerodromes, and with safety for the passengers. Military use of damaged airdromes or those of limited space should also be taken into consideration. The present speed of landing should not be increased in any case, even if navigation speed should be increased. Although there are no irremovable difficulties connected with this problem, it does not seem to be very easy to solve. Wind tunnel experiments in which the air current was made visible by smoke have shown that it is still possible to increase the ratio between the highest and lowest speeds.

The second problem, which will undoubtedly be solved gradually, is that of the driving power and of fuel consumption. The prototypes now under test have engines which, on account of their measure and weight, are out of proportion with the size of the body and they do not last long enough owing to their lightness. The foregoing holds good for the fuel quantity required, which is excessive in comparison with the load capacity of the craft. One could nevertheless reach a considerable flying range even with increased power of the engines, provided that their weight and specific consumption of fuel do not increase. In this way the highest speed obtained will not cost more. On the other hand, this is the condition against which the speed of the present prototypes can be utilized practically.

For several reasons I do not think that airplanes with movable wings will come into use in the near future. The lifting propellers and similar constructions are so complicated and in their revolving parts they are exposed to such wear and tear that in the present state of technics it is impossible to build them for trials of some importance. Even the flying windmill has not been able to get a big market for itself on account of the high cost of its too reduced load capacity and a lower speed than that of airplanes with equal power and fixed wings. Since the flying windmill is also extremely sensitive to overloads, it is not even free from danger and many accidents have already happened on account of this fact. On the other hand, with the aid of slot wings, aerodynamic brakes and other devices of that kind, it has been possible to obtain a reduced starting and landing speed for ordinary airplanes, which is sufficient for nearly all cases. This accomplishment together with the marked advantages offered by the airplane make investigations in the field of movable wings seem to be less urgent.

According to my opinion the use of airships for transoceanic services will have further developments, seeing that they can carry a larger number of passengers than airplanes and can offer them more comfort. Passengers will reserve their preference for airships over airplanes on account of the time saved in the voyages with transatlantic craft. On the other hand, I do not think that airships will be used for military purposes as their extreme vulnerability would make them a too easy prey for the airplanes.

ARTURO G. CROCCO
OF THE ITALIAN ACADEMY

The Volta Congress has confirmed the scission of the problems of flying speed in three fields, of which the first reaches about 800 Kms. p.h.; the second range between 800 and 1200 Kms. p.h., and comprises the speed of sound in the atmosphere, and the third goes beyond 1200 Kms. p.h. (Please take notice of the graphic). These three zones can be shown in the graphic by taking as an index the drag-coefficient of a body having a certain form (f. in. an airplane fuselage). The Congress has called them scientifically sub-sonorous, sonorous and ultra sonorous speed. I will use instead more expressive technical terms by naming the first one "aeronautical" and the third one "ballistic." In fact, the aeronautical speeds have in the "Avis" term their natural progenitor, as their technics in the modern airplanes are now following the bird features. This is true not only of their esthetic aspect, but also of the fundamental aerodynamic particular which is that of frontal rounded wings and bodies. It may be foreseen that this particular form will remain the main characteristic of aircraft as far as the drag-coefficient remains constant, that is, up to the highest limit that can be reached, before the problems of speed can be noticed. On the contrary, the "ballistic"

speed, which has already been reached by artillery but not yet by flying men, will compel us to give up this form only to follow the direction of the new theories which were adopted by the Volta Congress, and which require sharp frontal forms, like the ships' prow or like the form of modern bombs.

And ballistic flight's wing have been compared at the Congress to blades. Not only aerodynamical basis but also the principles of propulsion and power will have to change if we want to reach ballistic-flight. New technical principles will have to be realized for propulsive apparatus and for engines. This change will not be a gradual evolution but a revolution.

Where will this ballistic- flight be possible? Of course in rarefied air. The connection between high speed and rarefied air is imposed by the problem of power and by exigencies of take-off and landing which both require low speeds. Perhaps ballistic flight will extend to the ozonesphere, where electrodynamic phenomenons which are characteristic of great rarefaction could help in supporting the airplane. Anyway, since the main obstacle to ballistic speeds is the air, we are justified in thinking of rarefying it as much as possible. This revolutionary characteristic of the probable new human conquest leads to believe that the result of present investigations are only isolated elements of a potential nature. They can be neither reckoned nor measured until a new idea will be born which will associate and value them altogether. Thus at Guidonia, in the stratospharic channel, aerodynamic ballistic is studied. In the General Aerodynamic Laboratory of our Engineer's School of Rome, stratospheric energy is explored. At the flying field of Montecelio, special devices for human respiration in the vacuum are experimented.

Let us leave the field of ballistic speed which is still unexplored. Let us consider the field of aeronautical speed. Practically aeronautical speed reaches a limit a little over 800 kms. p.h. The unbeaten record of Lt. Agello at Desenzano has covered the largest part of such field by surpassing 700 kms. p.h. We have come, therefore, very near the point where drag coefficient abruptly increases and lift coefficient decreases. Within this limit there is still a large margin for common aircrafts, as the question is to double the present speed of civil and military airplanes. The problems here are no more of an aerodynamic but of a constructive nature; such as improving the streamlining, applying more powerful engines and above all, providing for new cooling system. All these problems are now known and it is of little importance to investigate whether the land plane will be in more or less advantageous conditions compared with the seaplane to improve the present speed. Researches will proceed gradually but unceasingly. Therefore, if ballistic-flight is only a future eventuality and Agello's flight is only an anticipation, the continuous improvement of standard airplane speed, together with the capacity of heavy useful load, is now quite tangible.

Unfortunately the race to armaments polarized all aviation development in the military field. While some nations tear themselves to pieces within their borders, while savage man's instinct menaces to destroy civilization and while the instinctive barbarity breaks all bounds of law and religion, the most sane and poised people are forming an alliance between themselves in order to defend their existence and the existence of humanity. During these troubled times the progress of great inventions becomes more rapid, but its characters are deeply modified, especially in the field of scientific ideals. Science becomes positive. Speculative enquiry yields to realism. One does not sow but harvest; one does not look at the future but at the imminent. The daily diffusion of cultural news is veiled with reticence, and all activities are masked with the military secret. * * Progress needs peace in order to materialize. We no more live in the times of Archimede who pursued its theorem within his own brain while Romans were sacking Syracuse. Today, the brain needs laboratories, experimental plants, workshops, raw materials, energy, cooperation. All this cannot exist without a great security within the borders and on the sky, or without a firm discipline among the people or without a leading and strong will power.

UMBERTO SAVOIA AND CELESTINO ROSATELLI
of the "Aeronautica d'Italia Fiat"

Civil and military aviation is now pegged with its series material on a standard near to 300 kilometres an hour. What problems must be solved before the standard of 500 kilometres can be passed on to, which has now been clearly announced by most recent experimental prototypes machines?

There is no difficulty in stating that the speed of 500 kilometres can be reached in the near future as a normal standard for some particular civil airplanes and for some special services. This will not be very easy, however, especially if comfort and safety are not to be sacrificed. Further improvements of the streamlining is required, which can be summed up as follows in regard to the fuselage:

1. Reduction of all harmful spaces and therefore the chief section, and better retractability of the landing gear, the tail wheel, the wireless antennas, etc.

2. Generalization of instrument-flight and further reduction of the present wind screen.

3. Increase of smoothness of the covering surfaces with the use of suitable varnishes and introduction of nails with hidden heads.

The ideas of paragraph 1 are the most important because with them it is possible to obtain an increase of speed which, according to the latest hopes, can reach 25%. With reference to the body, improvements of the aerofoils can be taken into consideration too, and the use of higher wing-loading in connection with the spreading of super-lifting devices. There is no exaggeration in foreseeing that when all means are turned to and without worrying too much about the cost, a fineness in all the airplane can be reached of about 35% more than that which is usually reached now, since as matters stand at present, civil twin-engined air-

planes could exist with 2000 h.p., capable of reaching 430 kilometers at an altitude of 4000 meters, and the saving mentioned above would become an increase of about 10%. The specific power of the engines has not yet been mentioned however. In this regard the greatest obstacle for increase of power is represented by cooling. A reduction of the surface required for the radiators would be obtained if the problem of engines cooled with liquid at 130-135 degrees could be resolved. An increase of power would not, therefore, mean an increase of drag with a result amounting to next to nothing. Five hundred kilometers an hour could then be reached easily and perhaps exceeded.

Do you think that regular air navigation in a near future, within fifteen or twenty years from now for instance, will get near to navigation altitudes close to the world's record?

The problem of flying at stratospheric altitudes with the exception of record flights has difficulties which can now be described as insurmountable. The integral high altitude engine has still to become an accomplished fact, namely, to be capable of giving a constant power for all the altitude on account of technical reasons concerning supercharging and cooling. In spite of the very low temperature and the great speed of the aircraft, cooling of the engines at altitude is almost out of the question on account of the lower density of the air, and if architecture is not to be radically changed. This would mean making it cumbersome and therefore harmful for the purposes of good penetration which is being looked for with altitude. And the supercharger which should establish the same pressure at 10,000 meters as on land, would cause such an enormous heating of the air as to become an obstacle for the engine's working.

Leaving aside the problems of the engines, of the propellers and of the support, there is another with much greater difficulties, namely, if it is possible to live in the aircraft. It is true that like Jules Verne, it is not difficult to think about hermetically closed cabins and supplied with air from suitable compressors, but the problem of flight is first of all a problem of weight, and nobody stops to dwell on the insurmountable difficulties to be met with on this path. The cabin would have to be completely air-tight and be able to hold out against working pressures from the inside to the outside of about 7000 Kg. per square meter. Further, all the problems exist in regard to the passage of the control-cables and not on account of the difficulty in itself, but owing to the enormous burdens of weight they bring about. It is quite out of place, however, to proceed any further with the examination as there is nothing else to be done but to come to the conclusion that flights at very high altitudes will remain for a long time in the field of sport without useful, practical and safe applications.

Ed. Note: This concludes the quotations made of special articles on various aspects of aviation, present and future, which appeared in the first international issue of the Italian aviation journal L'ALA D'ITALIA, published recently. These articles were printed in five different languages, namely, Italian, Englis h, French, Spanish and German. One reading these articles - the contributions of eminent men prominent in aviation affairs - cannot fail but be impressed by the serious thought and deep study which the subject of aviation is receiving in countries beyond our borders.

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