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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

TECHNICAL MEMORANDUM 113

AVIATION IN THE BELGIAN CONGO.

By Col. A. van Crombrugge,
Director of the Belgian Air Service.

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By royal decree of June 26, 1919, on the initiative of the King of Belgium, there was created a "Comité d'Etudes" (research committee) for aerial navigation in the Congo. This committee, afterwards designated by the initials C.E.N.A.C., consists of three members, including a delegate of the Colonial Department, a technical specialist and a director of the civil and military air service. The decree established a well-defined program for the C.E.N.A.C.

1. To establish, by way of experiment and according to the financial resources (3,000,000 francs) placed at its disposal, an air line for passengers and mail between Stanley Pool and Stanleyville;

2. To consider the possibility of making a map of the river by aerial photography and to do preliminary work in this direction, within the same financial limits.

The second part of the program has not been begun. The C.E.N.A.C. has thought best, before undertaking photographic work, to establish transportation for the whole distance, this being of prime importance.

The conditions of exploitation imposed on the C.E.N.A.C. necessitated recourse to a contractor. The choice fell on the

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S.N.E.T.A. (Syndicat National pour l'Etude des Transports Aeriens) which was entrusted with the work within the limits of the instructions of the C.E.N.A.C. and under the direction of the latter.

A preliminary organization of the line was made in Brussels, by placing at the disposal of the contractor a dozen Levy-Lepen seaplanes, with spares. These seaplanes could carry about 400 kg. (880 lbs.) at a speed of 145 km. (90 miles) per hour for four hours without stop. It was agreed that, at least for the first trips, a mechanic should accompany the pilot. The C.E.N.A.C. also turned over to the S.N.E.T.A. a dozen Bessonneau canvas hangars, 20 x 28, with spare parts. Furthermore, the military air service authorized its pilots and workmen to enter into contracts for employment in the colony. Lastly, the colonial department gratuitously put its marine workshops at Leopoldville at the disposal of the exploitation company.

This preliminary project divided the line, about 1725 km. (1000 miles) long, into three sections of as nearly equal lengths as possible. The operation of these sections was to be autonomous and their various stations were to resort to the main shops at Leopoldville only for important repairs. In this way the pilots would be able to concentrate their attention on a relatively short distance and acquire a thorough knowledge of their own section. Furthermore, each pilot would always use the same airplane, which would furnish an incentive for him to keep it in the best

running condition possible. This organization has stood the test of experience and is still giving entire satisfaction to the exploiting company.

In August, 1919, after the project had been all mapped out, a portion of the personnel left Europe, arrived at Kinshasa (Stanley Pool) toward the end of September and immediately began the installation of the terminal station of the line and of the secondary stations. It is not possible to enumerate all the difficulties encountered during this preliminary work. The most serious were of two kinds. Difficulties of an administrative order were manifested, especially in the impossibility of acquiring fields in the vicinity of the principal posts where all the suitable locations on the banks of the river were already occupied; and also in the difficulty of obtaining laborers and construction materials.

The installation mission was greatly assisted by the local authorities who realized the importance of the undertaking and lent their influence to the work. In most cases, fields were ceded gratuitously by the colonial government and, in other cases, its intervention enabled us to obtain land belonging to private individuals. The local government put at our disposal native soldiers of the engineering division, who rapidly built the dwelling houses and offices from the materials of the country: wood, earth, grass, etc.

The technical difficulties were very many and varied. Four times a year the rises in the river reach 5 to 6 meters. This necessitates the installation of very long "slips", in order to avoid too steep slopes, which might cause accidents in putting the seaplanes in the water. These slips were made of timbers which had to be shaped on the spot, no easy matter on account of the lack of machine tools.

The mounting of the hangars also gave much trouble, due to the fact that in colonial expeditions, which necessitate the transportation of materials long distances, with numerous transfers, many parts disappear. With us, it was principally bolts and cordage which were missing. Our principal difficulty was to moor the hangars suitably. Nearly all the colonials told us that such light structures could not withstand the tornadoes. On three occasions these hangars have already survived the tornado season, thus demonstrating that the method of mooring adopted perfectly remedies the danger.

But, though the canvas hangars withstood the violence of the tempests, the awnings, which covered them, were rapidly destroyed by the action of the sun and had to be replaced. We decided on a sufficiently light roofing material consisting of boards 2 cm. (3/4 in.) thick, imported from Europe and covered with tarred paper. Under this roof there was put a ceiling of grass for the purpose of protecting the hangars from the heat.

The considerable losses of gasoline reported by other Congo expeditions also gave us some fears. These losses being generally attributed to evaporation, we dug underground store-rooms for the fuel. In these caves the average temperature was 25°C (77°F). No appreciable losses were observed, however, at any rate, in tight and hermetrically sealed cans. It may therefore be concluded that the losses reported were due to other causes than evaporation.

Thus, in spite of all these difficulties, a line of 1725 km. was established and provided with secondary stations according to the following list:

1st section	Kinshasa (Stanley Pool)	0 km.
	Bololeo	314 "
2nd "	N'Gombe	570 "
	Coquilhatville	690 "
	Mobeka	997 "
3rd "	Lisala	1211 "
	Basoka	1513 "
	Stanleyville	1724 "

As may be noted, the terminals of the sections are large towns the only exception being N'Gombe, which was chosen instead of Coquilhatville (further from Stanley Pool) for the terminal of the first section. N'Gombe has the advantage of its geographic position at the confluence of the Congo and the Oubanghi, the latter being a broad river which drains a large portion of the French Congo.

The entire distance from Kinshasa to Stanleyville is navigable and is traversed by small river boats which require 15-17 days for

the ascent and 12 for the descent. By airplane the distance is covered in three days. Thus there is a great saving in time for correspondence with the commercial establishments scattered along the river and even in the interior.

On the 2nd of February, 1920, the first seaplane with the Belgian colors flew over Stanley Pool and 20 days later, two seaplanes made the trip from Kinshasa to N'Gombe and return without incident.

Reasons of an administrative nature prevented the immediate beginning of traffic. The first section began operations in July; the second in December, and the third in June, 1921.

The accompanying diagram gives an idea of the regularly increasing activity manifested on this line. The diagram ends with the month of July and the European public did not know until that time that the whole of the line was in operation. The results were still better in the following months.

After beginning operation, the difficulties did not disappear and the personnel continued to suffer from the lack of adaptation of the seaplane type to local conditions. The plywood hulls immediately caused trouble. The water, absorbed by the wood, moistens the glue which ferments and produces blisters which separate the thin layers of wood and often even tear them, necessitating continual repairs. It is estimated that the water thus absorbed even by new hulls caused a loss of 100 kg. in the carrying capacity of the seaplane. The alternating sojourn in the hot air and in the

water subjected the hulls and their coverings to consecutive contractions and expansions which distorted them. Since the center of gravity is already relatively low, this disadjustment can greatly diminish the longitudinal stability at the moment the engine stops either for alighting or as the result of a breakdown.

Cells with wooden spars and ribs, although not subjected to such influences nor to so great stresses, suffer nevertheless and often reveal sufficient distortions to reduce the speed from 145 km/h to 110 km/h and reduce the commercial carrying capacity to about 200 kg.

The engines (300 HP Renault) worked well. Since their initiation into the services, there have been only about ten breakdowns which (it is interesting to note) were not at all due to their utilization in the colonies.

The radiator alone, although of the colonial type, appeared to be too small and was only able to keep the water at 80°C (176°F), a temperature which has caused us no trouble but which nevertheless we consider a little too high.

The installation of an engine gives rise however to very serious difficulties. It is extremely difficult of access and the least repair (replacing exhaust manifold or grinding a valve) necessitates complete dismantling.

Manual labor, especially of the skilled sort, is infinitely more expensive in the Congo than in Europe. This increases disproportionately the expense of operating aerial transportation lines in the colonies.

Furthermore, starting the engine is almost impossible, without some special starting device, which occasions much trouble and may even cause a catastrophy in case of a forced alighting. Starting by hand has already caused two accidents of which members of the personnel have been victims.

Cloth-covered propellers give better results, from the endurance point of view, than simply varnished propellers, which unglue very quickly.

It should be remarked that, in spite of the great extent of the river system of the Congo, only 3000 km. of the rivers (of which 1735 km. are already being exploited) are capable of utilization by seaplanes. These 3000 km. comprise the present "King Albert" line, a branch of the Oubanghi and several hundred kilometers on the Kasaï. It is manifest that terrestial airplane lines must be established in the future.

This brief recital suffices to give an idea, on the one hand, of the difficulties to be overcome and the errors to be avoided and, on the other hand, of the services which aerial transportation is capable of rendering the colonies and of the need of extending and improving the air lines. From now on, it may be considered certain that no serious local difficulty will interfere with the employment of aerial conveyances in the Congo. This has been demonstrated by 500 hours of flight and 60000 km. traversed by the pilots of the "L.A.R.A." (Ligne Aerienne Roi Albert).

The seaplanes now in use, however, show defects or, more prop-

erly speaking, an evident lack of adaptation to the work required of them. First of all, their hulls, which are suitable only for seaplanes designed to fly over the ocean, are a source of serious trouble. They have increased the difficulties of operation to such an extent that their use should be unconditionally condemned. Metal hulls might be used, if absolutely necessary.

If it is desired to adopt a seaplane of small capacity, as many predict, since it is a question of aerial navigation along a river, it would be infinitely better to adopt one with floats which could be easily removed and replaced. They could therefore be conveniently repaired and could be made good. Another advantage of this type is its longitudinal stability which, better than in a boat seaplane, can withstand the influence of the distortion of the parts in contact with the water.

Such a seaplane could be of much simpler construction and facility of transportation, assembling and upkeep. It could be be made almost entirely of metal, at least as to its fuselage and wing spars. It could be equipped with an engine cooled by fins, more conveniently operated and more easily taken apart and cared for.

Lastly, it would be less expensive, would have a carrying capacity sufficient for some time to come and could be piloted by young pilots of less experience than is required for pilots of 300 HP seaplanes.

The removal of such seaplanes from the hangars is much easier

and they are more easily started without loss of time and without danger. They are more easily managed on the river and when forced to alight in a storm, their wings can be removed in a few minutes. After the wings have been removed, the seaplane has nothing to fear from the storm and its relatively small weight enables it to be pulled to the bank and put in a sheltered place with the aid of only a few natives.

Small seaplanes tire the pilot less and are easier to maneuver in disturbed air, so that pilots can make more frequent trips without excessive fatigue.

It is easily demonstrated that the cost of upkeep and operation is not simply proportional to the number of HP developed, but that it increases at least as the square of this number.

In conclusion, I wish to call attention to the fact that since the armistice, thanks to His Majesty, King Albert, we have succeeded, in spite of difficulties, in establishing in the Congo, by way of experiment, an air line, the results of which speak favorably for the future of air navigation in the colonies.

This activity, in such a domain, can only be compared with that displayed in the same domain by our friends and allies, the French, as demonstrated by the results obtained on the banks of the Maroni by the "Societe des Transports Aeriens Guyannais" (Guiana Aerial Transportation Co.).

Incontestably we owe this success to the activity of those who have labored for this enterprise and especially to the sacrifice of

those who have paid with their health or their lives for their devotion to so great a work, namely:

The pilot Mestdagh, who died at the hospital in Coquilhatville; Commander Michaux (director); the pilot Bastin and the mechanic Mengal, all fatally injured in a fall at Stanley Pool, in May, 1921.

Translated by the National Advisory Committee for Aeronautics.