Iron ore export project

Introduction

The President wants to revitalize river transport : https://www.grandslacsnews.com/posts/felix-tshisekedi-veut-redynamiser-le-transport-maritime-congolais-et-relancer-le-transport-fluvial-4723

It's exact : "...*Reminding the Government that river transport has the double advantage of being the least expensive in terms of cost per tonne-kilometre transported compared to other modes of transport, and the less expensive investment, the President of the République has also instructed the latter to invest in the revival of this mode of transport* ».

It is worth pointing out that the iron ore that supplies the steel industry in Austria is transported by river up the Danube over a distance of the same order of magnitude as that from Kisangani to Kinshasa. The difference is that in this case the barges go up the Danube and in our case we go down the Congo.

Navigation on the Congo River is difficult because it is not marked and the sandbanks move.
Traditional river transport requires intermediate reloading which reduces its economic efficiency

We are developing innovative river transport that meets the specificities of the Congo River, which we want to be as economical as possible through the use of new technologies and

Navigation in a regularly dredged narrow corridor and without intermediate reloading

A convoy of barges loads a convoy of hopper wagon in such a way as to avoid intermediate reloading.

Each wagon is carried by a barge. Each barge is attached to the neighbor by an axis of rotation which imposes the horizontal continuity of the two barges and their horizontal rotation. This rotation is controlled by electric jacks on either side of the two adjacent barges.

The axis of rotation between two barges corresponds to the coupling between the wagons which therefore remain coupled to each other.

The electric actuator which impose the relative positions of the adjacent barges are controlled by on-board software which is itself controlled by satellite. In this way, each barge is forced to follow the defined course which is dredged regularly.

The width of the barges is such that the draft does not exceed 2m, This width is 4.5m in the example considered in this memo. The barge convoys are symmetrical in order to move in both directions of the outward and inward direction.

The river is very wide, the curves are slight, the barges deviate very little from each other. A curve in the river with a radius of 3km, the spacing of the side ends of two adjacent barges is only 2cm.

In this way, we can guarantee perfect sealing of the caissons between the barges where the cylinders and the coupling are housed. This sealing is ensured by a flexible material (such as latex)

Drag reduction to optimize speed and reduce energy

The wave resistance depends on the Froude number and is inversely proportional to the length of the convoy. The induced resistance is zero since the lateral forces are negligible.
There remain the friction forces which depend on the submerged surface and the great turbulence which would be generated by the roughness of the submerged surface.

These frictional forces are a function of the square of the speed of movement and the coefficient of friction between the contact surface with the water.

The largest submerged surface is the bottom of the convoy.

We propose a continuous air cushion over the length and width of the convoy. The sealing between boxes containing the air cushion is provided by a flexible material in the same way as the spaces between barges.

The generated problems are solved

- perfect horizontality of the convoy is necessary to stabilize the air cushion; this is imposed by dynamic actuators controlled by the embedded software.
- a constant level of the convoy during the loading/unloading of loaded wagons and empty wagons, thanks to the use of side floats controlled by electric actuators
- tipping safety since the center of gravity is well above the center of thrust provided by the side floats which are above the water in normal operation

A fan installed at the ends of the convoy imposes a displacement of the air of the air cushion at the speed of movement of the convoy so that the relative speed of the air and the water is zero.

When the convoy arrives at its destination, the jacks are actuated to sink the safety floats and rest them on the bottom of the river to allow the convoy to get to the level of the landing quay and landing stage. The electric jacks which position the barges between them block them against each other to impose a constant horizontal level allowing the wagon convoy to roll on a flat level.

With the air cushion, it is legitimate to consider that the convoy will move at a speed greater than 25km/h with a specific power identical to that of the Chanic pushers.

The number of wagons in the river convoy will be the same as the number of wagons in the rail convoys between the mine and Kisangani and between Kinshasa and the port of Banana. For example 210 wagons like the ore trains in Mauritania.

The wagons will be the subject of a study in order to lighten them as much as possible. A call for tenders will then be launched for their manufacture in Congo.

It is therefore legitimate to consider a river transport cost of less than $10/tonne transported.

Other convoys will come in and move at the same speed, taking advantage of transport management by central software that will benefit other transport companies.

This ore export project will therefore revolutionize river transport and boost development all along the river. It is therefore a dimension of the project that must be taken into account.

This deserves a serious study by a very competent design office, both in the river and digital modeling field and in the computer field to produce the on-board software and the central software.

The project as a whole

This global project with the energy of 2000MW will create a parallel industrial activity which will boost the economic and social development of the Republic.

The distance by road between Kisangani and the 3 polygons is around 225 km (cf page 4 of http://thaurfin.com/Memo.pdf)

For an export of 50Mt/year of ore, a double track seems necessary to me.

A single track between Mombasa and Nairobi with a length of 480km cost $3.6b or $7.5M/km. (PS)
A double track does not cost twice as much as a single track, say 50% more, or $11.25M/km over a length of 240km. It takes a budget of $2.7b.

If depreciation is done over 15 years, the cost of depreciation per ton of ore would be $3.6/tonne.
The cost of rail transport is around $0.2/TKM, given the height difference of approximately 100m laden and the return empty, we consider $0.1/TKM, or approximately $5/ton transported.

These costs must be considered within the framework of the overall project that we are presenting.
The project presented is associated with the development of a steel industry by DRI/H2, the construction of a 2000MW dam and a 500km gas pipeline which brings methane gas from Lake Kivu.
This means that the energy cost (which is the most important part of the cost of transport) will, in the long term, be reduced by the use of these installations (methane gas and H2)

In short, if the cost of rail transport is around $8.6/ton between the mine and the river for a distance of 240 km, we can consider the same order of magnitude between Kin and Banana over a distance of l order of 400km.

The cost of the infrastructure will not be borne solely by the project. We can reasonably count on a transport cost of around $17/tonne before taking advantage of the energy from the 2000MW dam and methane gas.

The profitability is therefore excellent, which will make it possible to finance the steel project in Kisangani and the hydroelectric dam. In addition, this project will bring a significant volume of transport which justifies the construction of the deep water port of Banana.

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PS As usual, the costs are expressed in USD. It would be wise to convert them into Yuan given the events.