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# UAQ4 magnetic levitating train

## Introduction

The UAQ4 magnetic levitating train is the most advanced and ecological train in the world: it is the only transportation system with 100% resistance free motion, except aerodynamic drag. The system in theory allows to connect high distance points without energy consumption and consequently starts a new era in the economics of transportation. The UAQ4:

- Compared with similar traditional high speed trains, allows an annual fuel savings of 7,000 tonn/year per train travelling at an average speed of 500 km/hr;
- Compared with planes, provides higher or comparable commercial speed for short and medium distances, with much lower energy consumption.

## Technology

UAQ4 uses supermagnets on the track and high temperature (liquid nitrogen: 77K = -196°C = -321°F) superconductors on the vehicle for lifting and guiding. It can operate both at low speed to transport goods, or passengers in urban environments, and at high speed (up to 600 km/hr in air, and even higher in a depressurized tube) to transport passengers on long distance trips.

The levitating system is simple, passive and reliable:

- The train floats on a magnetic field that creates a gap of 6 cm between track and vehicle in all phases of motion, zero speed included;
- At low speed the energy consumption is almost zero: the UAQ4 is the only magnetic levitating vehicle with 100% resistance free motion, except aerodynamic drag;
- The propulsion is provided by an innovative direct current linear stepper motor, capable of recovering almost 95% of the train kinetic energy when reducing speed;
- The system significantly minimizes environmental impact as it does not have any vibrations, noise or pollution.

The UAQ4 technologies are patented and the main system components are comprehensively and successfully tested in the laboratory.

## Differentiation

The UAQ4 technology, materials and working principles are closer to aeronautical systems than to "traditional" high speed trains. Its main advantages are:

- Lower energy consumption;
- 35-40% lower train mass;
- Capability of climbing over 10% grade slopes (vs. traditional 2.5% grade), thereby possibly simplifying the track layout;
- (Vs. planes) capability of starting from / arriving at the city center;
- Superior comfort due to large cabin size and vibration-free motion;
- Comparable investment costs;
- Lower maintenance costs for both track and vehicles.

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## Business outlook

The UAQ4 technology is economically sound for carrying:

- Goods at low speed;
- Passengers at low speed in urban areas and/or at high speed on long distance trips.

In the former case, the higher investment must be compared with the higher returns, due to minimized resistance to motion, reduced energy consumption and maximized energy recovery.
In the latter case, investments are just comparable: for both a "traditional" 300 km/hr high-speed train and a brand new 600+ km/hr UAQ4, the largest share of the investment is technology-unrelated, just due to the physical building of the track layout (moreover, the possibility of climbing 10% grade slopes may even allow "easier / cheaper" layouts).

As regards a comparison with plane technology *(yet to be performed on a quantitative basis)*, the UAQ4 should provide better performances in terms of commercial speed (since it could reach town centers) for short and medium distances, with much lower energy consumption: planes exhibit excess aerodynamic drag on front sections – many planes are needed to carry the same number of passengers of a train with the same front section – large resistance to motion by wings (for the indicated many planes), as well as direct and indirect costs for secondary logistics between airports and towns. The larger initial investment for the track layout should be evaluated in terms of payback time.

Overall, for a high speed network, the UAQ4 exhibits:

- Equal to lower investments than traditional high speed trains;
- Lower operating cost than traditional high speed trains, much lower than planes;
- Better performances than planes on short to medium distances, much better than traditional high speed trains.

## Next steps

The implementation roadmap, after a limited investment in technology industrialization, is heavily linked to politics:

- A consortium of interested industrial partners should be gathered, with close political links, to realize a full scale system prototype;
- From the very beginning, a "sponsoring (political) client" is needed, capable of investing first in a test bed development and then in a deployment plan.