Maglev

The principal of a Magnet train is that floats on a magnetic field and is propelled by a linear induction motor. They follow guidance tracks with magnets. These trains are often refered to as *Magnetically Levitated* trains which is abbreviated to *MagLev*. Although maglevs don't use steel wheel on steel rail usually associated with trains, the dictionary definition of a train is a long line of vehicles travelling in the same direction - it is a train.

How it works

A maglev train floats about 10mm above the guidway on a magnetic field. It is propelled by the guidway itself rather than an onboard engine by changing magnetic fields (see right). Once the train is pulled into the next section the magnetism switches so that the train is pulled on again. The Electro-magnets run the length of the guideway.

What is the advantage of Maglev?

Well it sounds high-tech, a floating train, they do offer certain benefits over conventional steel rail on steel wheel railways. The primary advantage is maintanance. Because the train floats along there is no contact with the ground and therefore no need for any moving parts. As a result there are no components that would wear out. This means *in theory* trains and track would need no maintanence at all. The second advantage is that because maglev trains float, there is no friction. Note that there will still be air resistance. A third advantage is less noise, because there are no wheels running along there is no wheel noise. However noise due to air disturbance still occurs. The final advantage is speed, as a result of the three previous listed it is more viable for maglev trains to travel extremely fast, ie 500km/h or 300mph. Although this is possible with conventional rail it is not economically viable. Another advantage is that the guidway can be made a lot thicker in places, eg after stations and going uphill, which would mean a maglev could get up to 300km/h (186mph) in only 5km where currently takes 18km. Also greater gradients would be applicable.

What is the disadvantages with Maglev

There are several disadvantages with maglev trains. Maglev guide paths are bound to be more costly than conventional steel railways. The other main disadvantage is lack with existing infrastructure. For example if a high speed line between two cities it built, then high speed trains can serve both cities but more importantly they can serve other nearby cities by running on normal railways that branch off the high speed line. The high speed trains could go for a fast run on the high speed line, then come off it for the rest of the journey. Maglev trains wouldn't be able to do that, they would be limited to where maglev lines run. This would mean it would be very difficult to make construction of maglev lines commercially viable unless there were two very large destinations being connected. Of the 5000km that TGV trains serve in France, only about 1200km is high speed line, meaning 75% of TGV services run on existing track. The fact that a maglev train will not be able to continue beyond its track may seriously hinder its usefulness.

A possible solution

Although I haven't seen anywhere a solution could be to put normal steel wheels onto the bottom of a maglev train, which would allow it to run on normal railway once it was off the floating guideway.

Are maglevs really more enviromentally friendly?

In terms of energy consumption maglev trains are slightly better off than conventional trains. This is because there is no wheel-on-rail friction. That said the vast majority of resistive force at high speed is air resistance (often amounting to several tons), which means the energy efficiency of a maglev is only slightly better than a conventional train.

German engineers claim also that a maglev guideway takes up less room and because greater gradients are acceptable there is not so much cuttings and embankments meaning a new guideway would be less disruptive to the countryside than a new high speed conventional railway.

Will Maglevs replace conventional trains?

Provided maglev can be proved to be commerciably viable (which has not yet been done) it should be a success. Most people have their eyes on Germany, where the first maglevs will run in commercial service. This may decide whether or not maglevs will be used across the world. Maglev may become the preferred path for new high speed railway lines although it would depend whether or not services were needed to stretch beyond a high speed line. For example, if you have 300km of conventional track between two cities cleared for over 200km/h but there was a 60km long section only cleared for 80km/h then it would make sense to build a new high speed (300km/h) line for the 60km distance. If a maglev train were to be used a track 300km long would have to be built. However if there is no existing rail network (only the case in the USA) then it makes sense to build a maglev line. Whether or not new railway lines stopped being built in favour of maglevs, one thing is certain, there is 31932km of track in the UK, 34449km in France and 40726km Germany, no one is going to convert all of this into maglev track, conventional trains are here to stay for a long time.

Maglevs in commercial service.

In the mid 1980s, Britain was the first country to introduce a maglev service. It was to link two terminals at Birmingham airport, about 400meters long and a top speed of about 10mph (16km/h). However it was recently replaced with a bus service due to the difficulty of getting spare parts.

Germany is the only country with solid plans for a maglev railway which will link Berlin with Hamburg in 2005. This will be high speed called the transrapid project.

There are no other examples of maglev in use, even thought the technology has been around since the 1960s. This has meant most have lost interest in the idea, especially now when very high speeds are achievable with conventional steel rail technology.

Maglevs under test

Above: The Japanese Test Track

Countries who tested maglev trains are the USA, Japan and Germany. However nowerdays the USA is less interested in maglev. Japan has built two maglev lines, the first in the 1960s and the second in 1996. The first was to test the basic theory of maglev the second is going for more advanced things such as high speed tests with the MLX01, and set a speed record of 550km/h (344mph) in early 1998.