Options for Financing Faster Rail

Dear Members of the Committee,

I completed a Ph.D. in Physics at The University of Melbourne, and then worked in the computer industry for most of my life, completing an M.B.A. whilst employed as the Deputy Director of the Computer Centre at the University of Melbourne. I have always had a keen interest in other problems, including nuclear waste, drought, climate change, and telecommuting and have contributed to the ABC Radio Show Ockham's Razor many times. I invented binary microfiche and a touch screen bedside clock which wakes the owner up with bird calls. I have recently taken an interest in high speed rail, preparing documents including patent applications.

You will be acutely aware that the cost of laying rails suitable for high speed trains is high, commonly reported as around A$30M per kilometre or higher. My study of this has led me to believe that the major factor for this cost is the issue of alignment. The rails need to be reliably and accurately straight and level in sections without turns, and reliably and accurately curved and slightly tilted in turns. The forces induced on conventional trains by bumps and wiggles rise with the square of the velocity, if not the cube or higher orders. This has led to a wide spread belief that high speed trains need totally new tracks – they cannot share tracks with other trains which might generate these bumps and wiggles.

The high cost of high speed rail lines established overseas is often borne by Government, but in countries with short rail lines and high populations, the fares can make a major contribution. Sadly the latter effect does not apply in Australia, with the possible exception of a Melbourne to Sydney link which is serviced by more than 50,000 aircraft flights each year. More than most other countries, Australia needs a way to get trains to go at high speed on our existing tracks. I have recently written a contribution to a web site which is viewable at http://blackjay.net/?p=692 which asserts this claim and supports it in a limited way.

This idea is not new. The British Advanced Passenger Train (APT)[1] project was begun to create vehicles which ran at high speed on existing tracks. This project was eventually abandoned, but the patents were sold to Italian train developers who subsequently sold trains back to England. Many technologies including the Steadicam, SOLIDWORKS, mobile telephones and the Internet have been developed and adopted since then. My submission to your committee is that it would be negligent of it to exclude re-examination of the challenge of devising a vehicle to run at high speeds, say 250 km/hr, on existing tracks. The original cost of development of the APT, £50M, would be about £750M or A$1,500M in today's money, the price of 50 kilometres of track. Modern design technology and component offerings will make the design cost much less than that. I submit that this alternative ought not to be discarded without some measure of the likely costs.

I would not expect the high speed to be able to be sustained at all points in the track, and some track changes, especially in signalling could scarcely be avoided. The key problem to solve is misalignment of the track. I assert that this can be managed by making a suspension system whose compliance can be changed from being very soft on straight track well away for other objects like

[1] See http://www.rail.co.uk/rail-news/2016/inside-story-of-british-rail-250mph-train-of-future-apt/ and https://www.youtube.com/watch?v=nDN7PPW4AE8

tunnels or stations, to being as hard as existing trains when the train needs to be accurately located. When the suspension is soft, the bogies will be free to dance about while carriage glides smoothly above, so high speeds would be possible. But the suspension would need to have a compliance close to those of existing trains when entering stations, tunnels or passing other trains, so these sections of travel would need to be at lower speed.

There are a range of other issues, such as level crossings, animals on the track, signalling, passing other trains, and especially curves which need to be addressed. Some of these problems may require new sections of track, but not a complete new track if the track quality issue described above can be managed.

Very few Australians have been involved in the design of any radically new rolling stock. Most of our designs come from overseas where the Shinkansen mantra of having a quite separate track for high speed trains is well established. This will make it difficult to avoid criticism of any plans to explore trains which travel at high speed on our existing tracks.

However, the potential gains are enormous. Reducing the cost per kilometre from A$30M for full high speed electrified track to A$2M for the signalling over more than half the track can save billions of dollars. I submit that spending the cost for one kilometre, A$30M, on a test of such a vehicle would be eminently defensible. It would be even more defensible to issue a Request for Proposal (RFP) for development of a vehicle similar to a single carriage of a train, but with suspension and other advances to accommodate high speed on the open track. I would be delighted to contribute towards the development of such an RFP.

There are many technologies used elsewhere which may assist with this challenge. Electric trucks with ranges exceeding 1000 km is one example. The automatic navigation of self-drive vehicles is another. Modern digital communication over microwaves, light, and the frequencies used by mobile phone towers will almost certainly be helpful. The “Steadicam” mount for a movie camera on a person was invented in 1975 and illustrates the potential of a soft suspension system.

However turns with short radii cannot generally be managed at high speed. At 160 km/hour, the centripetal force required for a turn whose radius is 400 m is half the weight of the train. A train would need to be tilted at 30 degrees to eliminate lateral force on the passengers. Many aircraft bank at 30 degrees without significant passenger discomfort – passengers are known to sleep through these turns – so a solution is possible. NSW tried the X2000 Swedish tilt train but found “Consistent high speeds for a local Tilt Train would appear to require considerable track upgrading for success”[2]. Australia should be embarrassed that it needs to import trains from a country with 1/3rd its population and 1/3rd its length of rail (13,000 km vs 36,000 km). Mercifully there are many stretches of rail line with only occasional turns. For the others, the train must slow down and then speed up for each turn, unless the track is relayed with curves of greater radii. This means that high power deceleration and acceleration will be required to hold transit times down, and that makes battery or supercapacitor storage of electricity on the train attractive.

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[2] See the report by David Foldi in www.railknowlegdebank.com/Presto/Content and https://www.railpage.com.au/f-t1836.htm

If anyone on the committee wishes to explore this alternative, please let me know and I will attend and present a draft Request for Proposal.