Economic and Financial Strategies for Tourist Railways in the 21st century

By Sergio Rodriguez Zubieta, Southern Fueguean Railway, Ocotber 2003

The purpose of this paper is to explain the operations of a railway located in an unprovided region of the world, and the improvements achieved in relevant costs savings applying Eng. Livio Dante Porta´s know-how.

The Company

At the very end of South America, 55° South, you can find Tierra del Fuego and our city, Ushuaia. The area is very similar in climate and landscape to Alaska. Mountains that melt into the sea with glaciers flowing into fiords, peat bogs, otters, whales and the Andean sub-Antarctic forest. All this beauties and wilderness makes the place to have an expanding tourist industry, and the Southem Fuegean Railway is an important part of this development.

Ushuaia was founded on 12th October 1884, settlement being encouraged from 1896 by the development of a "Prison for Relapsed Felons". This establishment required large amounts of timber for construction and fuel purposes, and as tree felling progressed further from the jail, improved transport became necessary. Various wooden tramways soon became insufficient and a 60cm Decauville line was built. This line expanded over the years, and at its peak owned 5 locomotives and a main line extending some 15 krn west from the prison into the basin of the Rio Pipo. The prison closed in 1947, and the line rapidly fell into disuse, an earthquake and flooding taking their toll.

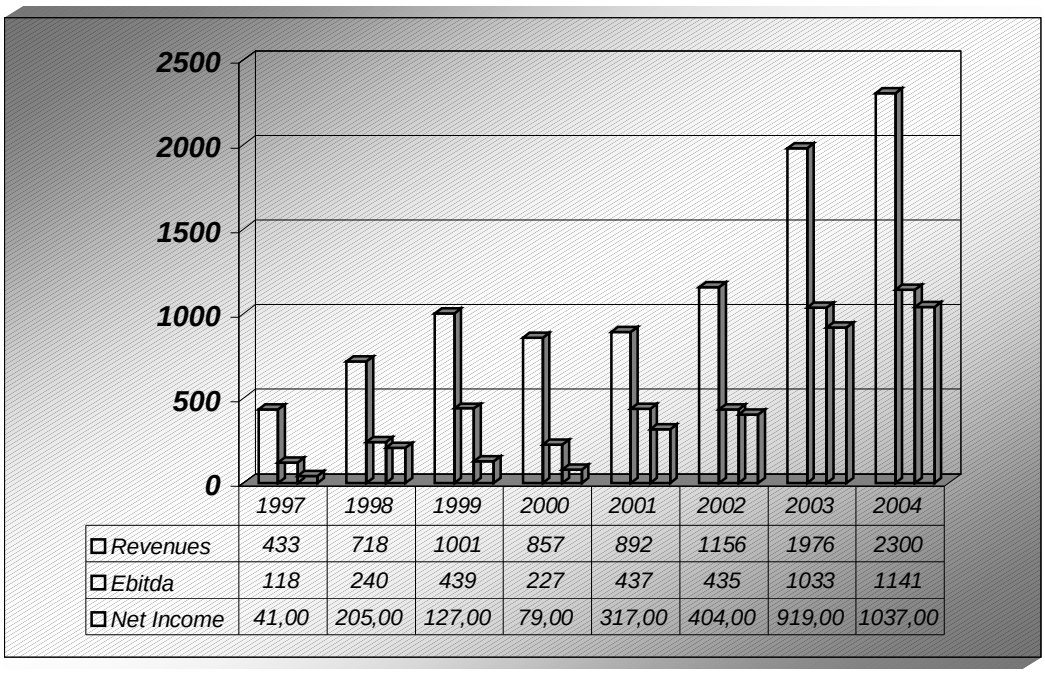
The present (20") 50 cm-gauge railway opened on 11th October 1994 as an environmentally friendly means of permitting tourists to visit and view an otherwise inaccessible part of the Tierra del Fuego National Park. The 5 ¼ km section of line currently being operated follows the upper reaches of the old system, starting and ending alongside National Road 3.

The locomotive fleet currently consists of three diesel and two steam locomotives. A small Ruston built in 1937 was used in the construction of the line. No. 1 is a 1938 Orenstein & Koppel 72 HP 0-6-0 diesel. Known as *Rodrigo* it was regauged in 1994 to suit the 50cm line. No. 2, is the 0-4-0+0-4-0 Garrett locomotive originally built as *Nora,* was a sealed down version of the KI type designed in 1907. It was modified and repowered during 2001 and renamed as *Eng. Livio D. Porta.* No. 3, *Camila,* a 2-6-2T, of 90 HP was delivered by Winson Engineering of Daventry in March 1995, along with three coaches and a generator van. No. 4 is a 0-6-0-diesel *Tierra del Fuego,* constructed by Phil Girdlstone at Port Shepstone (South Africa) and delivered to the railway in October 1999. This Caterpillar engined machine of 140 HP is capable of hauling the entire passenger stock of the railway in a single train.

The coaching stock consists of 14 passenger vehicles. There are three tourist class vehicles which each accommodates 21 passengers and a tour guide. A further seven tourist class vehicles seat 24 passengers each. The

three first class coaches each seat 16 at individual tables, and a Presidential coach, with kitchen and toilet.

Ushuaia is mainly a tourist city with 130.000 visitors a year. It is also an important harbor for cruise ships sailing to Antarctica, Cape Horn and the southern seas. There are several tourist attractions at the area, and our train catches 30 % of the visitors to the city. We transport 50.000 passengers, 60 % of them are foreigner from Europe, Asia and the USA. the rest are nationals. Our one way ticket at regular class is 16 US$. Our revenues are close to 800.000 US$ and our profits are 35% of the revenues. The following graph shows the figures in our currency. Until 2001 our Arg. Peso was peg 1 to 1 to the US dollar, but today the ratio is 3 to 1.



	1997	1998	1999	2000	2001	2002	2003	2004
Revenues	433	718	1001	857	892	1156	1976	2300
Ebitda	118	240	439	227	437	435	1033	1141
Net Income	41,00	205,00	127,00	79,00	317,00	404,00	919,00	1037,00

Figure 1 : Sales evolution in Arg. Pesos $

It can be seen from the graph that during the period 1999 / 2000 the company was dropping dramatically the profits and unless corrective measurements were taken the doom would be close. A short and a long term plan was defined. Changes in the historical operations of the trains were introduced. Strict control on the cash flow and a change of mentality from a family business towards a professional managed corporation.

It was crucial to work out an annual budget and start with close follow up of the figures. After a deep understanding of the business, the target structure of the budget was defined as follows:

Operational Margin = Revenues – operational costs = 79%
EBITDA = 39%
Net Profits = 29%

The operational cost structure was simplified to identify the basic figures which must be improved:

Labor costs = 50% of total costs
Fuel consumption = 8 % of total costs (23% of operational costs)
Locomotive maintenance = 4 % of total costs

The technical changes towards "second generation" locomotives

Our two steam locomotives were engines of very simple design. They carried several mistakes from the original construction. The trustful nature of steam engines was veiled by their poor output power, low thermal efficiency (around 5%) and heavy man hour consumers.

With the support of Eng. Porta and lead by our engineer Shaun Mc Mahon a large overhauling program was settle down to increase the efficiency of the two locomotives on both ways. Power output increase and reduction of fuel and water consumption.

The idea was to introduce a series of modifications recommended by Porta to the original design. The investment was quite low related to the price of the locomotives and all the changes together would bring an increase of the bottom line net margins of around 10%.

The changes were several, and the following table resumes the major concepts:

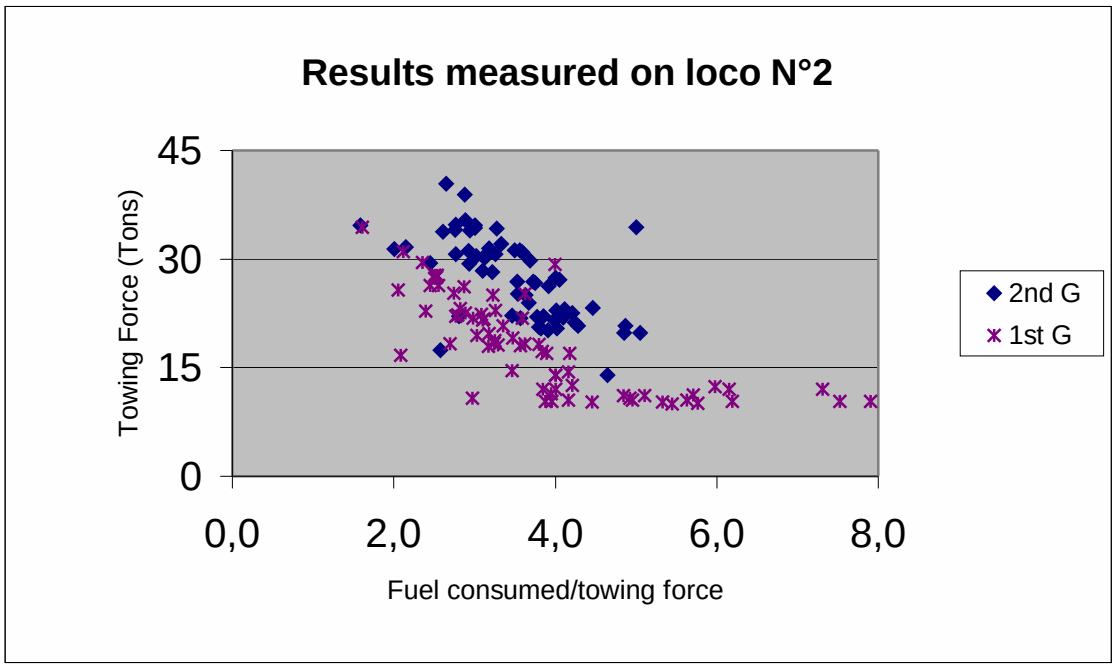
1. Re-design the combustion chamber. relocation of rotary burner, modification of crown and side stays, improvements on gases flow.
2. Introduce a LemPort exhaust manifold, to improve the backup pressure.
3. Changes in the steam low pressure line to improve efficiency and reduce pressure drop at the cylinders. New exhaust steam pipes and Kordina.
4. Increase of isolation on boiler and steam lines to reduce heat losses.
5. Ergonometric design of the driving cabin to allow an easy and safe one-man operation.
6. New design of mechanical parts, counterweights, for the increase of power.
7. Increase in the air pump capacity for brakes.
8. Enlargement of the chimney to improve exhaust gases flow .
9. Increase on water and diesel tank capacities.

The works have been carried out at our workshops with our own personnel guided by Shaun. Locomotive N°3 was transformed during year 2000 and the Garret type, Locomotive N° 2, was transformed during 2001 and 2002. Detailed explanation of the works carried out on the locos can be found in the paper "Avances Técnicos en Locomotoras a Vapor y sus Resultados en Impacto Ambiental y Eficiencia", Shaun McMahon. It can also be found on our web site http://www.trendelfindelmundo.com.ar

The investment faced by the company was quite low (around 15% of the value of the locomotive) and the improvements achieved are self explanatory :

1. Increase of towing capacity from 5 to 9 coaches (increase of 80%)
2. Fuel oil consumption reduction from 80 to 50 liters (40% improvement)
3. Reduction in water losses and water consumption (30% improvement)
4. Reduction of heat loss on boiler water, therefore less need of man hour to start –up operation early in the morning. (20% improvement)
5. Easy maneuvering and cabin operation, reducing accident risk.
6. Easy access to smoke box and fire place, easy maintenance of boiler.

The following figure shows clearly the improvements in drawbar output achieved with the overhaul of locomotive N°2. It can also be seen the reduction on fuel consumption per load transported. These figures are just "on the field" measurements and by no means are the result of a serious research done on the locomotive. We show them here just as a visual explanation of the benefits that we see in our pockets. 2nd Generation measurements corresponds to the period Jan / Mar 2003. and 1st Generation measurements were carried out by Chris Parrot during Jan / Mar 2001.



Base on a detailed study of our costs, we were able to assert the following improvements of the operational costs after locomotive N° 3 modification:

Daily Operational costs	At the same Power Capacity (winter)		Increased capacity (summer)	
	Before	Now	Before	Now
Gas Oil	68,12	39,13	295,07	220,32
Water cost	3,03	1,63	13,11	9,18
Lubrication	1,77	1,36	7,65	7,65
Locomotive maintenance	10,60	8,15	45,90	45,90
Coach maintenance	3,53	2,72	15,30	15,30
Personnel	137,28	137,28	261,32	261,32
Extra hours of personnel	43,7		65	
TOTAL	**268**	**190,26**	**704**	**559,67**
Daily Income per locomotive	1.300	1.300,00	5.660,00	7.367,00
Operational Margin	1.1032	1.109,74	4.955	6.807,33
	79%	85%	88%	92%
Margin improvement	**8%**		**6%**	

A similar study on locomotive N°2 showed that the improvement on the net margin was 11%.

The water treatment

"Second generation" steam locomotives cannot be conceived without perfect water treatment. Fortunately, and not as was thought in the past (and still is think in many circles), the stage has been reached in which that idea can be approached.

The various problems associated to water treatment can be described as follows:

1. scaling of firebox plates leads to high metal temperatures, causing heavy overheating of the plates (plate cracks, leaks, uneven expansions, etc)
2. corrosion on plates and tubes reducing reliability. To prevent that builders increase the thickness
3. Contamination of the steam with scale deposits build up inside superheater elements, provoking additional wear on pistons and valves.
4. caustic embrittlement produces cracks in a variety of appliances, bolts, plates, flanges.

Unknown amount of money on today's tourist trains is lost do to the repairs on boilers, and boilers wash out loss hours. The concept was "clean water" and a

“clean boiler” was the only way to prevent major problems. It was resumed in a regulation that prescribed monthly boiler washouts.

Eng. Porta developed a corrective boiler water treatment regime during 1950´s which was recovered from the shelf and put into practice in our locomotives.

The system is designed to work by maintaining a high level of alkalinity within the boiler. At the beginning we recorded a pH number of 9,5, this was raised relatively quickly in order to give a pH number of 11 and the problem ceased. We achieved a concentrated, fully mobile, brown sludge in the boiler of the locomotive. Foaming[1] occurred after only 14 days into the steaming cycle. As concentration levels in the boiler rose additional (and very powerful) polyamide antifoam was added to the treatment applications. If for any reason antifoam was unavailable for a certain period of time, cylinder oil was added to the boiler water to act as an antifoam. To control the foam height, it was installed in both locomotives a “three lights monitor” designed by Porta.

Thanks to this innovative process we have increased the boiler washout periods from 3 to 6 months. In the case of N° 2 , it was wash out under the presence of Mr. David Morgan on January 3rd and it worked continuously without stop 33 km a day for 6 months until it was wash-out again last June. It was found the pipes were complete clean with a uniform dark brown mud covering the surface.

The details of what I briefly explain regarding the water treatment and foam monitor were detailed explain by our engineer Shaun Mc Mahon at his paper “THE PRACTICAL APPLICATION OF 'PORTA TREATMENT' - AN ADVANCED INTERNAL BOILER WATER TREATMENT SYSTEM - ON STEAM LOCOMOTIVES OF THE FERROCARRIL AUSTRAL FUEGUINO, REP. ARGENTINA.” presented at Fedecrail Spring meeting in Wales 2003.

The result of this treatment are easy to see.

1. Washouts are suppressed and blowing down is eliminated.
2. Boiler water specifications lie within very wide limits.
3. Very high alkalinity levels are aimed at in the boiler water.
4. The treatment chemicals are designed for rough handling by running shed and footplate staff. One member of staff can control the boiler water of up to 30 locomotives in one running shed.
5. The whole system is based on a revised physiochemistry relating to scale formation phenomena.
6. Chemists carry out their work at central laboratory level, remote to the railway.
7. Foam height control monitor permit a very high loading of the available steam space.

The boiler, once considered the heaviest maintenance part of a locomotive, has ceased to be the main conditioner of the repair program. There are no more heavy repairs in which the boiler is taken off the frame, and spare boilers are no longer necessary.

The final words

We are proud of the work we have done, it help us to recover the figures of our company and to be innovative in the sector. That is something sometimes hard to do when you talk about steam locomotives.

Several tourist railways do not understand this concepts. They prefer to preserve everything unchanged. Like frozen in time. That approach is all right in a museum technology, but some people is afraid of globalization and don't want to change just to keep their traditions.

Well, since I came from South America I would like to express some few thoughts. The man started to grow on earth more or less at the same time, 3000 years before Christ, in several spread places. Important cultures developed in Asia, Africa, Mediterranean and America. 2000 years later those cultures developed individually at the same speed. But then, for some reason, the Mediterranean became very active and by the year 1492, the Europeans discovered a virgin world. It is fascinating to see how the invasions, wars, the movement of cultures and the trade, in few words globalization, developed a society ready to face trouble and solve it. Meanwhile the isolation of the American cultures developed a naive society, with large spiritual values different to the Europeans but without skills to face the change. It doesn't matter who would have discovered it, America would have never been ready to survive the encounter, because it was never connected with the rest of the world. Isolation was its problem and to keep it like that is today's poison.

That is why we support the idea of working more together with other trains, and share experiences from everywhere, because acting unitedly the tourist trains will be a growing sector, with a huge potential to became a recognized business. In that form we could be financed by market instruments, like syndicated loans, bonds, Initial Public Offering, or just bank loans. We could find support from authorities to understand our constrains under certain technical regulations. We could be understood by insurance agents to reduce our risk, liabilities and fees. Finally we could be a chapter within the World Tourism Organization and governmental bodies.

That is why we strongly support the idea of an International Association and we wish that by the end of this congress it can be work out .