

SASMEE Locomotive Efficiency Trials Day 2007

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On 23/6/2007 we ran the fourth SASMEE steam locomotive efficiency trial. Engines haul a train of the driver's choosing for about 30 minutes. A computerised dynamometer car records the work done at the drawbar and the coal consumed is carefully measured. The overall thermal efficiency is the proportion of useful work done at the drawbar, relative to the energy released by the coal.

The dynamometer car, built with John Lyas, is a close 5" gauge replica of the prototype in its early livery. Internally, it is very modern. The front drawbar is linked to an electronic load cell, and the wheels drive a DC tachometer and an optical revolution counter. A box of electronics conditions the signals, converts them to digital format, and transmits them to a laptop computer carried on a conventional passenger truck behind the car.

The laptop computer displays a scrolling "paper" chart, like the original instrument table, but it reads data every second and stores the information on disk for subsequent display or printing.

A full technical description of the dynamometer car, and the detailed results from the last few years of trials, can be downloaded from my website, at www.avocetconsulting.com.au/modeleng.

Figure 1 is a typical display, showing the charts for Speed, Force and Power over the duration of a test run.

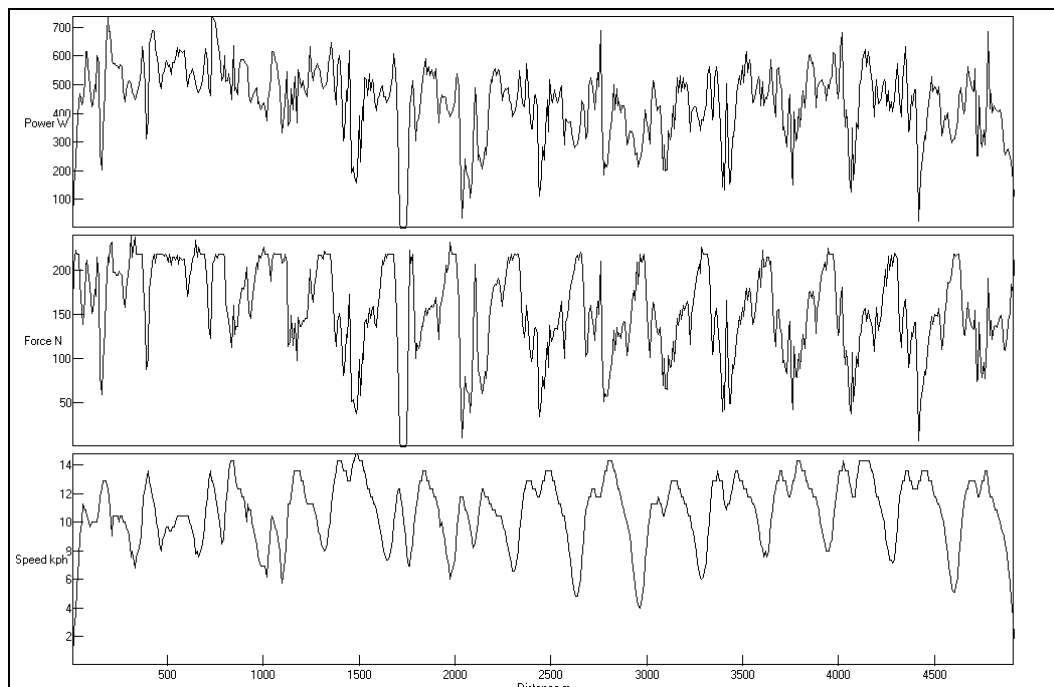


Figure 1 Chart from 7.25" g 4-6-2 no 8443 (Ian Thomas)

We had two 7.25" g entrants, three 5" g, and for the first time a tiny 3.5" g tank engine. Andrew Mottram did a magnificent job as timekeeper for the day, and this year we handed the

responsibility for the initial and final firebox fill to the timekeeper, for improved consistency and independent coal measurement.

The day was not without its incidents. Ten minutes of data was lost when the computer shut down – sorry Graeme. The Kitson Meyer results were scaled back to the full time on the basis that the 20 minutes was a good representation of the whole run. Now the need to set up the laptop system correctly is firmly on the checklist. Ian's large Pacific did its best to stretch the dynamometer set with a long and heavy train. The run was restarted with the car's internal loadcell after a derailment put an electrical offset into the external load cell. After that the Pacific could not be fully "opened up" because of the reduced load cell range. The chart in figure 1 shows how the load cell was just clipping the peak force. No such problem presented for the little "Juliet" however, and with the help of a rather unflattering bean tin strapped to the tank for refilling on-the-run the engine performed solidly for the 30 minutes.

Figure 2 shows the relative thermal efficiencies in rank order.

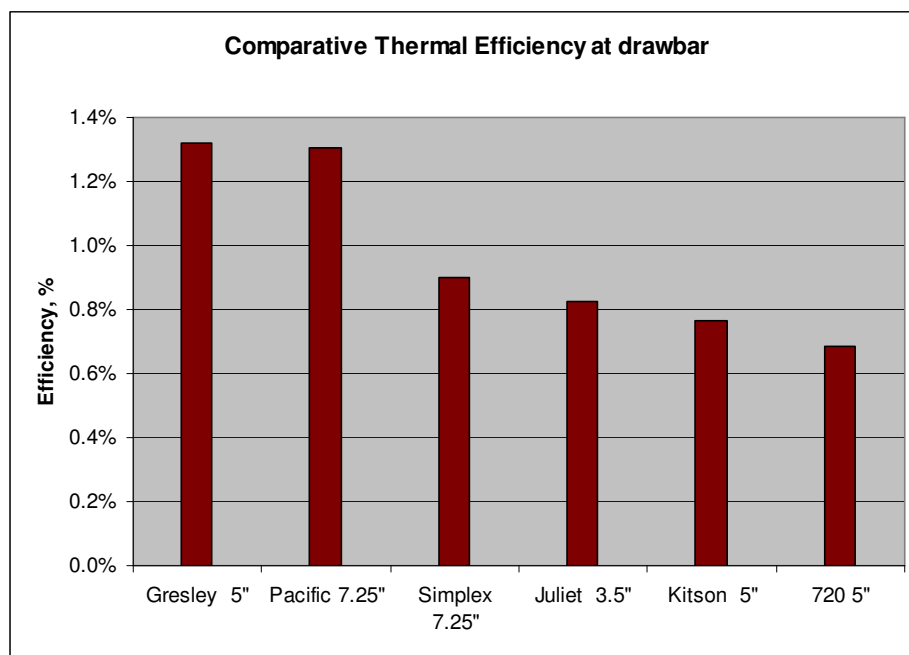


Figure 2 Efficiencies

Figure 3 breaks the efficiency into its two components for each engine, where drawbar power is the Output, and coal rate is a measure of Input.

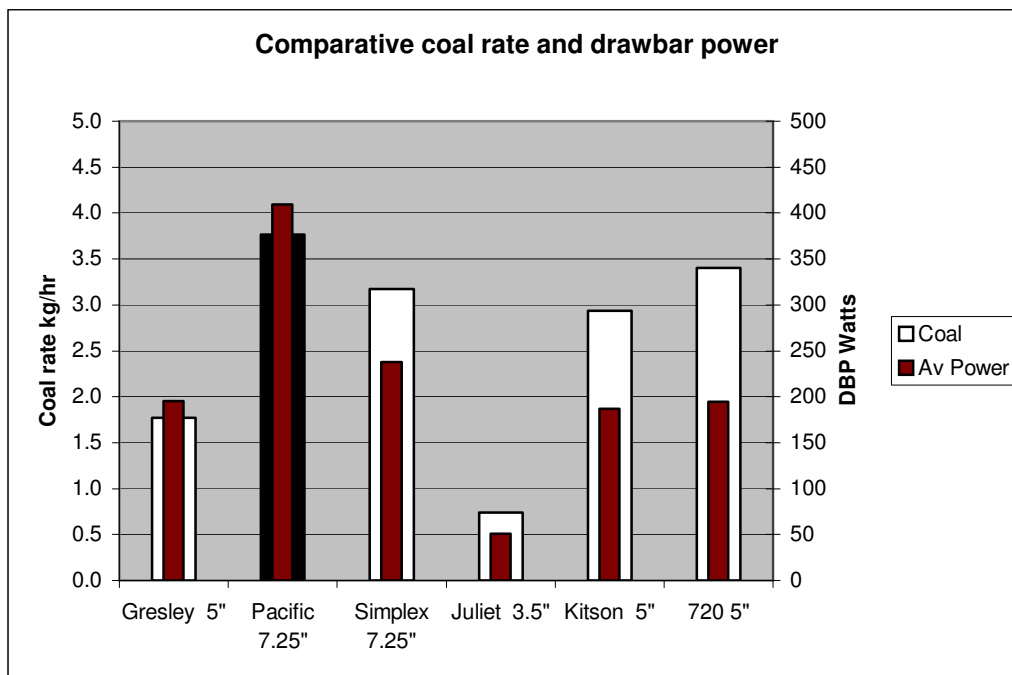


Figure 3 Coal rate and average drawbar power

Figure 4 provides tabular data for the day.

Owner/Driver	Loco.	Wheels	Time	Distance	Av Speed	Coal Rate	Av DB Power	Efficiency
			Min	metres	kph	kg/hr	Watts	
Simon Lindsay	Gresley 5"	2-8-0	30.4	4268	8.4	1.8	195	1.3%
Ian Thomas	Pacific 7.25"	4-6-2	31	4916	9.5	3.8	410	1.3%
John Lewis	Simplex 7.25"	0-6-0	29.2	5579	11.5	3.2	238	0.9%
Allan Wallace	Juliet 3.5"	0-4-0	31.2	3695	7.1	0.7	51	0.8%
Graeme Driscoll	Kitson 5"	0-6-0 0-6-0	30	5424	10.8	2.9	187	0.8%
John Mere	720 5"	4-8-4	29.7	4562	9.2	3.4	195	0.7%

Figure 4 Results table

While the Gresley was a whisker ahead of the Pacific in the third decimal place, it would be inappropriate to distinguish between the two results considering the resolution of the measurement, so to be fair the first place should be shared by Simon Lindsay and Ian Thomas.

Simon deserves a special mention since it is his first ever efficiency run, and he has only recently acquired the engine. The engine was built by Frank Lee to the popular Martin Evans design. It has Walschaert's valve gear and slide valves, plain axleboxes, a copper boiler with a narrow firebox and two radiant superheaters. The grate has 50% open area and boiler feed was mainly by the donkey pump.

Ian's Pacific was built in 1984 by Ivan Levanec and it weighs about 450 kg (that's 30 Juliets). It has a copper boiler with a wide firebox, 37% open area in the grate and no superheat. It has slide valves and Walschaert's valve gear. Boiler feed is from two axle pumps.



Figure 5 John Mere's magnificent SAR 720 hauling the dynamometer set and freight cars

Thanks to the committee, the helpers and the drivers for helping make this an enjoyable and instructive day.