

EVALUATION OF JAPAN AIRCRAFT MAINTAINANCE CO. LTD.
DIGITAL FUEL CONSUMPTION METER

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Emission Control Technology Division
Environmental Protection Agency

Background

The Japan Aircraft Maintenance Co. Ltd. approached EPA relative to the potential purchase of one of their digital fuel consumption meters. EPA being involved in measuring fuel economy in its laboratory obtained loan of one of these instruments for evaluation. The Test and Evaluation Branch of the Emission Control Technology Division conducted an evaluation on one of these meters.

Device Description

The fuel meter tested was a Japan Aircraft Maintenance Co. Ltd. (JAM) model CM-1. The device uses a positive displacement transducing element, which is tied into a digital counter and display. Included in the instrument plumbing is a hydro-meter for measuring the fuel density, a thermometer for fuel temperature and a pressure gauge to measure pressure into the fuel meter.

Test Program

The fuel meter was used to test fuel consumption of several vehicles. Various driving modes were used. They included portions of the LA4 driving cycle, steady state, and the highway driving cycle. The carbon balance technique and/or a fuel weigh technique was used to compare the fuel meter results.

Test Results

The attached Figure 1 gives the calibration obtained for the fuel meter. A calibration was obtained by comparing a weigh scale reading with the JAM fuel meter reading. The weighed fuel was corrected to volume by measuring the fuel specific gravity and correcting to volume. The calibration is very linear as shown in Figure 1. The meter calibration was measured at 0.9717 cc/meter unit.

The attached Tables I, II and III give the individual test results. All data were corrected to a fuel density of 0.7389 kilogram/liter.

The mean ratio of JAM meter fuel consumption to carbon balance fuel consumption was 1.030. This gives a mean JAM meter fuel consumption that is 3% higher than the carbon balance value. The higher consumption given by the JAM meter may reflect evaporative fuel losses which the carbon balance technique does not take into account. The data had a range varying from plus 7% to minus 8% of this mean.

The mean ratio of JAM meter fuel consumption to weigh technique fuel consumption was 0.956. The data had a range of plus 10% to minus 6% from this mean. The large spread of data and the poor comparison of data seen with the weigh data raises suspicion as to possible anomalies in the weigh data.

Conclusions

The Japan Aircraft Maintenance Co. Ltd. model CM-1 fuel consumption meter obtained a mean fuel consumption value 3% higher than when compared with the carbon balance technique. The higher average may be associated with evaporative fuel losses which are not measured in the carbon balance technique. The difference in measurement methods ranged from plus 7% to minus 8%.

FIGURE 1
JAM MODEL CM-1 FUEL
CONSUMPTION METER CALIBRATION

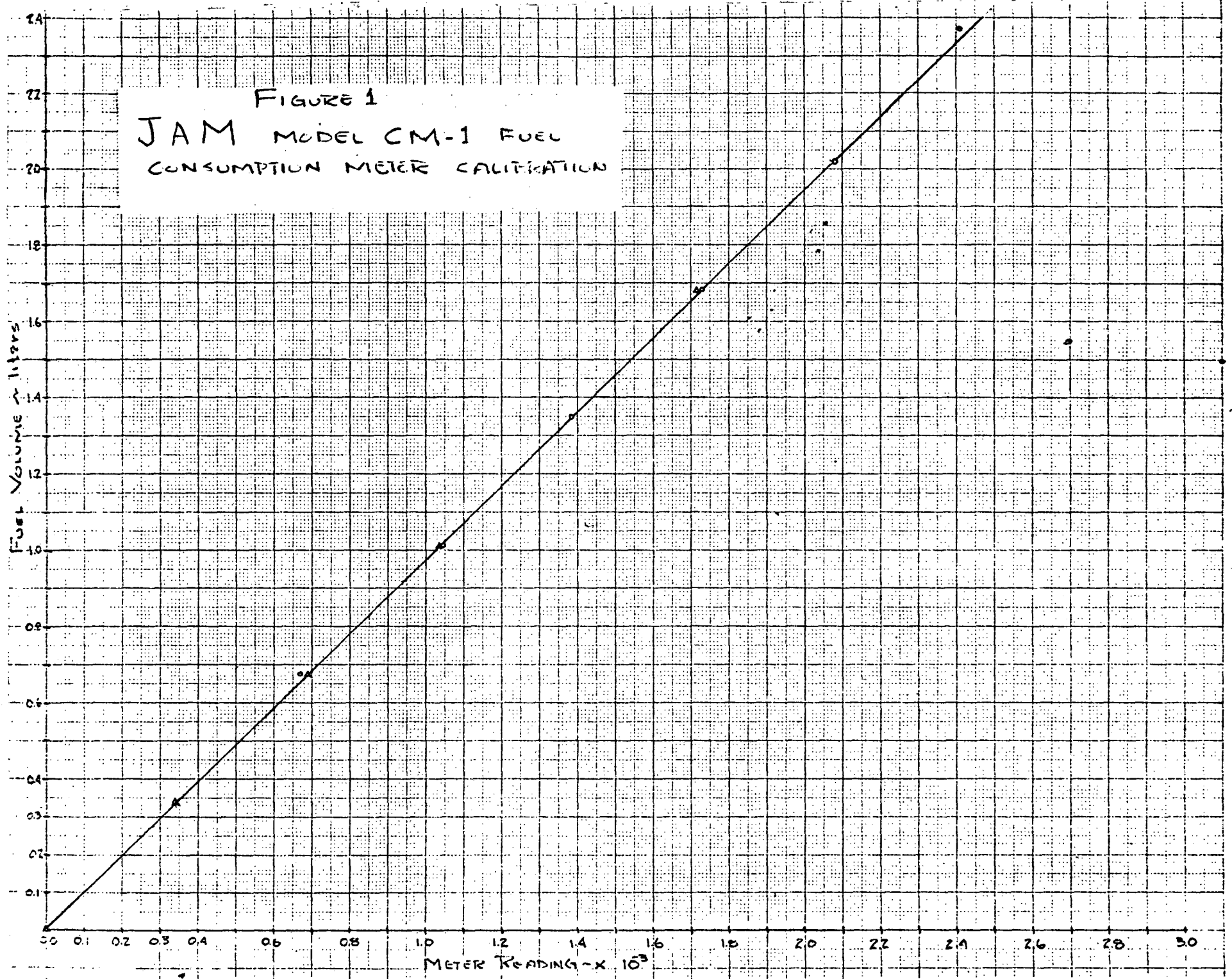


TABLE I
1963 Chevrolet Biscayne

	1975 FTP			Steady State			
	<u>Bags 1&2</u> <u>l/100 km</u>	<u>Bag 3</u> <u>l/100 km</u>	<u>Idle</u> <u>l/hr</u>	<u>15 mph</u> <u>l/100 km</u>	<u>30 mph</u> <u>l/100 km</u>	<u>45 mph</u> <u>l/100 km</u>	<u>60 mph</u> <u>l/100 km</u>
JAM meter	14.81	13.56	1.332	12.48	8.484	10.080	11.30
carb. bal.	14.48	12.83	1.302	12.40	8.932	9.603	NA
weighed	16.37	15.11	1.461	12.78	NA	9.530	11.42
Ratio:							
JAM/carb. bal.	1.023	1.057	1.023	1.006	0.950	1.050	NA
JAM/weighed	0.905	0.897	0.912	0.977	NA	1.058	0.989

TABLE II
1968 Chevrolet Impala

	Hot '72 FTP <u>l/100 km</u>	Highway Cycle <u>l/100 km</u>	Highway Cycle <u>l/100 km</u>
JAM meter	14.25	10.84	10.64
carb. bal.	13.92	10.50	10.64
Ratio:			
JAM/carb. bal.	1.024	1.032	1.000

TABLE III
1971 Chevrolet Vega

	<u>'75 FTP</u> <u>l/100 km</u>	<u>'75 FTP</u> <u>l/100 km</u>	<u>'75 FTP</u> <u>l/100 km</u>	<u>'75 FTP</u> <u>l/100 km</u>	<u>Hwy.</u> <u>l/100 km</u>	<u>Hwy.</u> <u>l/100 km</u>	<u>Hwy.</u> <u>l/100 km</u>	<u>Hwy.</u> <u>l/100 km</u>	<u>Hwy.</u> <u>l/100 km</u>
JAM meter	11.02	9.647	10.32	8.779	6.652	6.377	6.651	6.408	6.766
carb. bal.	11.09	9.151	10.03	8.490	6.426	6.305	6.339	5.969	6.157
Ratio:									
JAM/carb.bal.	0.994	1.054	1.029	1.034	1.011	1.011	1.049	1.074	1.099