

SUMMARY OF SRF RESEARCH OUTCOMES 2013 - 2016

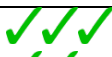



Key SRF research outcomes to-date are summarized in this quick reference document. Details of project outputs and results are provided along with potential fuel savings, estimates of the costs of implementation and recommendations for the best implementation strategy are outlined. The aim is to summarize and clarify how the research can bring direct commercial and social benefits to member companies.

INTERPRETATION OF RESULTS

For each research project, a table is provided containing: the potential fuel savings; implementation costs; and implementation timetable. These are presented on approximate numerical scales so that the effectiveness of the various outputs can be compared.

It is important to note that the % fuel savings refer to the benefits for an individual vehicle in comparison with a suitable reference vehicle (typically the same vehicle in unmodified form). The overall benefits to an operator, or indeed the UK as a whole, will depend on the level of take-up of the result across the vehicle fleet.

SCALE KEY:

Dimension	Symbol	Value
% Fuel Saving:	1 x ★	5 % reduction in fuel consumption
Cost of implementation:	1 x £	An implementation cost in the order of £5000.
Implementation strategy:	✓, ⊘	 Ready for Implementation now  Implement over the next 5 years  10 years to implementation  Do not implement at this time

SUMMARY OF RESULTS:

Project Output	% Fuel Saving	Cost of implementation	Implementation strategy
Trailer Aerodynamics	★★★	£	✓✓✓
Dual-Fuel Engines	⊘	££££	⊘
Logistical Measures	★★★★★	££££	✓✓
SRF Logger	★★★	£	✓✓✓
Urban Delivery Vehicle	★★★★★	£££	✓
SRF Optimiser	★★★★★	FREE	✓✓✓
Trailer Lightweighting	★★★	£	✓✓

TRAILER AERODYNAMICS

PROJECT OUTPUT

A package of measures for improving the aerodynamics of refrigerated semi-trailers, including optimised rear end taper and side skirts.

RESULTS

Results showed a 14% reduction in aerodynamic drag coefficient in modified vehicles.



% Fuel Saving:



7% reduction in fuel consumption at highway speeds, measured in highway tests by Waitrose

Cost of implementation:



Trailers cost £4,500 more than the standard vehicles to produce, with an estimated payback period of 2 years and a lifetime of 10 years.

Implementation strategy:



- Implement now.
- Designs are available from the research team.
- First 50 or so trailers have been built by Gray and Adams

DUAL-FUEL ENGINES

PROJECT OUTPUT

Testing of dual fuel tractor units before and after conversion to dual fuel to analyse engine emissions.



RESULTS

Dual fuel CO2 emissions are 4%, 9% and 12% lower than diesel over urban, rural and motorway phases of the drive cycle.

Total GHG (CO2e) emissions for dual fuel are 17% 13% and 24% higher than diesel over the urban, rural and motorway phases of the drive cycle respectively, as a result of methane slip.

Exhaust after-treatment using an effective methane oxidation catalyst can lead to approximately 5-8% reduction in total GHG

% Fuel Saving:



Although dual fuel operation has the benefit of reduced fuel costs, total GHG emissions for Euro V retrofitted dual-fuel systems are higher than diesel over urban, rural and motorway drive cycles.

Cost of implementation:



Approx. £18,000

Implementation strategy:



Do not implement at this time

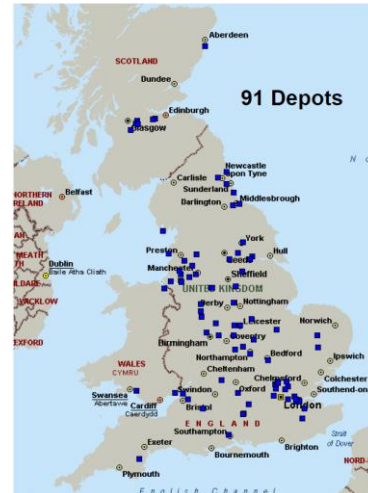
LOGISTICAL MEASURES

PROJECT OUTPUTS

- 1 Optimise distribution centre (DC) locations
- 2 Optimise the allocation of customers to DCs
- 3 Create new collaborative networks

RESULTS

- 1 Quantified estimates of the potential reduction in truck-km, energy and carbon emissions, for the various logistics measures.
- 2 Collaboration opportunities identified between participating FMCG companies



<p>% Fuel Saving:</p> <p>★★★★★</p>	<p>Identified carbon savings from logistics strategies:</p> <ul style="list-style-type: none"> • Backhaul: 10.4% • Regional consolidation centres: 18.6% • Use of rail and alternate vehicles in conjunction with regional consolidation centres: 23%, • Logistics clusters: 5.1% • Co-loading: 5.2% • Urban consolidation centres: 28% • Urban consolidation centres with night time deliveries: 29.9%
<p>Cost of implementation:</p> <p>££££</p>	<p>Barriers to implementation are largely organisational.</p>
<p>Implementation strategy:</p> <p>✓✓</p>	<p>STARFISH III project aims to operationalise some promising avenues for co-loading and collaboration. Contact: a.palmer@hw.ac.uk</p>

SRF LOGGER

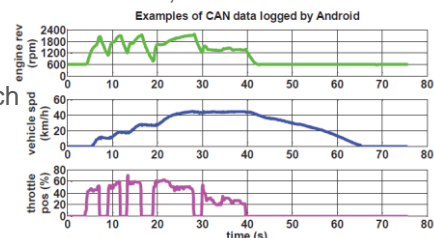
PROJECT OUTPUT

An Android based solution for heavy vehicle monitoring.

- Measures and reports fuel use & engine parameters; vehicle position, motion and dynamics.
- Customisable to measure other data
- Wireless data logging.
- Data streams back to server and database.

RESULTS

Once analysed, data collected via the app can be used for improving logistics, measuring drive cycles, identifying engine maps and parameters for vehicle simulation models, driver behaviour measurement and many other research applications



<p>% Fuel Saving:</p> <p>★★</p>	<p>Data measured by SRF Logger for real operations is the key to the SRF vehicle simulation tools. These will unlock substantial fuel consumption and emissions reduction opportunities for operators.</p>
<p>Cost of implementation:</p> <p>£</p>	<p>Free to members apart from hardware cost (apx. £300 per vehicle)</p>
<p>Implementation strategy:</p> <p>✓✓✓</p>	<p>The testing programme with members is currently ramping-up. Contact Xiaoxiang Na <xnhn2@cam.ac.uk></p>

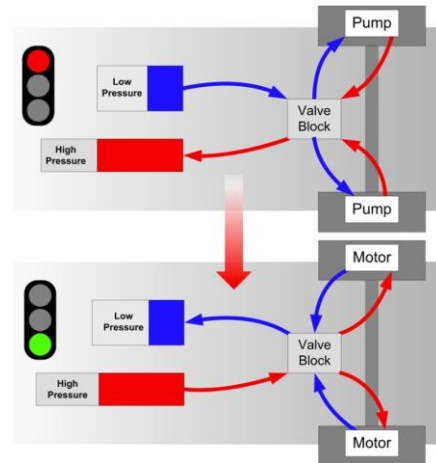
URBAN DELIVERY VEHICLE

PROJECT OUTPUT

Development and testing of a prototype urban trailer with path-following steering system and hydraulic regenerative braking system.

RESULTS

1. The best way to improve fuel consumption in urban delivery is to increase vehicle capacity, whenever the logistics operation allows.
2. Regenerative braking can give substantial further benefits, but the costs are significant.



% Fuel Saving:



1. The payload increase enabled by the trailer steering provides up to 33% saving in fuel per unit of freight task.
2. The regenerative braking system provides a further 9 - 18% reduction in fuel, for urban conditions, depending on the drive cycle.
3. The overall fuel reduction is 35 - 42%

Cost of implementation:

£££

The business case for regenerative braking is yet to be made. Costs of commercial systems need to be determined.

Implementation strategy:



1. Consider all ways to increase payload, while maintaining fill
2. Trailer steering can be implemented now, for niche operations. Ask David Cebon for details <dc@eng.cam.ac.uk>
3. Regenerative braking needs further development and may not give the necessary payback at current fuel price levels.

SRF OPTIMISER

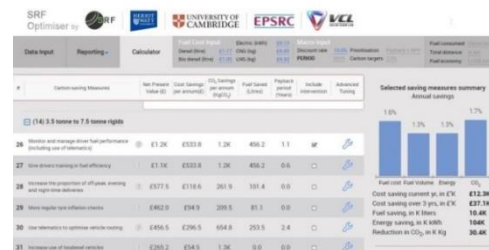
PROJECT OUTPUT

An online software tool that:

- Analyses fleet fuel consumption and CO2 emissions
- Provides a list of possible fuel-saving interventions and likely payback periods
- Generates ESOS reports
- Could be used in future to provide input for to FTA's LCRS scheme.

RESULTS

The benefits depend on individual operations. Try the tool to quantify the decarbonisation options for your fleet.



% Fuel Saving:



Provides best fuel-saving interventions for a company's fleet and fuel savings associated with each interventions based on fleet input

Cost of implementation:

FREE

Implementation cost of each fuel-saving intervention is provided in the tool

Implementation strategy:

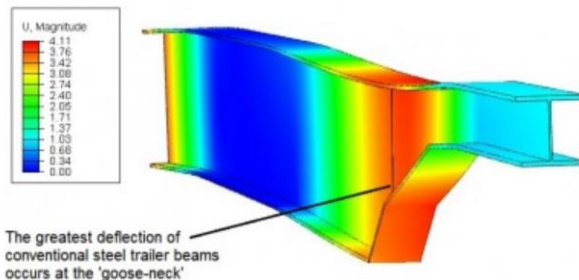


Implement now. Visit the SRF Optimiser website: <http://srf-optimiser.valuechainlab.com/profile/sign-in>

TRAILER LIGHTWEIGHTING

PROJECT OUTPUT

1. Demonstrated a new lightweight deck and various component modifications which allow for increased payload for weight limited operations.
2. Identified which operations could benefit from lightweighting.



RESULTS

1. Double deck trailers in grocery haulage and 'walking-floor' trailers in bulk haulage are two operations that can benefit significantly from lightweighting.
2. A weight saving of 1,000 – 2,000 kg can be achieved on a 13.6 m single deck box trailer through a combination of lightweighting measures:

Component	Weight Saving (kg)
Optimised chassis beams	200 - 900
Lightweight sandwich sidewalls	300 - 500
Lightweight sandwich deck	100 - 200
Glass fibre running gear	250
Carbon fibre wheels	150
TOTAL	1,000 - 2,000

% Fuel Saving:



A weight saving of 1,000 – 2,000 kg would allow an additional 3 – 6 roll cages to be carried. Each additional roll cage corresponds to a 1.5% improvement in fuel consumption for a 13.6 m single deck trailer. So between 4.5% and 9% fuel reduction is possible.

Cost of implementation:



Raw material cost of a lightweight deck is approx. two times greater than for standard hardwood deck.

Implementation strategy:



- Applying lightweight composite materials to trailer subcomponents such as decking and side walls can be implemented in short time frames for a small increase in cost.
- Holistic lightweight composite trailers will become increasingly viable in the long term as fuel price increases.