



Measures for the reduction of fuel consumption and CO₂ emissions in inland navigation

		Reduction of CO ₂ emissions through optimisation of the hull by using CFD.
1.	Keywords	ReFRESKO, PROCAL, hull optimisation, drag, shallow water, computational fluid dynamics (CFD), prototype measurements, drag reduction, benchmark, retrofit, propeller hull interaction, fuel savings, energy efficient
2.	Short description	<p>The MARIN's CFD code ReFRESKO can be used to calculate the flow around the vessel of detailed hull forms. In addition, ReFRESKO can be linked to the propeller analysis programme PROCAL. This allows for analysis of vessel and vessel-propeller interaction. We are going to apply these programmes to improve the fuel consumption of existing inland shipping vessels.</p> <p>We start with on-board measurements of existing vessels to record their performance. Next, to analyse the performance of the vessels, ReFRESKO calculations of all measured vessels are carried out. Based on these calculations, improvements to the hull are recommended and the pay-back time is calculated.</p>
3.	Objective & target	For each vessel, a report is prepared containing recommendations for improving the vessel and the pay-back time of these improvements. The skipper or shipping company can use this report to make a well-considered choice to invest in making his vessel energy efficient and therefore reduce CO ₂ emissions.
4.	Key success factors	The MARIN is highly experienced in optimising vessels with CFD, but primarily for marine navigation and less so for inland shipping. Optimisation with CFD has turned out to be a success in marine navigation, and will also be the case for inland shipping.
5.	Innovative aspects	The CFD code ReFRESKO developed by MARIN and the link with PROCAL will be applied to optimise inland shipping vessels for the first time.
6.	Benefits for users	This method is used to investigate how a vessel can be improved as well as what the pay-back time is. This is practical information, which a skipper or shipping company can use to decide whether or not to invest.
7.	Geographic area	When optimising a vessel it is very important for the design condition to be properly determined. Thus, it is important to determine the average water depth of the route the vessel is going to sail. The geographic area is not limited: it applies to all inland shipping vessels in all situations.
8.	Status	MARIN's code ReFRESKO is already being used in marine navigation and offshore shipping. This year we would like to use ReFRESKO on a large scale for inland shipping.
9.	Difficulties met	A ReFRESKO calculation is time-consuming.
10.	Year(s)	the next 3 years
11.	Users, stakeholders	Skipper owners, inland shipping companies
12.	Contact person	Karola van der Meij or Henk Blaauw

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13.	Costs & financing	Research funds from the MARIN, JIP SAVE (Group of 15 Dutch inland shipping companies, and FP7 MoVeIT!
14.	Website / links	http://www.marin.nl/web/Ships-Structures/Inland-ship-1.htm
15.	Available data, publications	http://www.marin.nl/web/Facilities-Tools/Software/CFD/ReFRESCO/ReFRESCO-publications.htm
16.	Added value: possibility for application elsewhere	In the coming years, this method will be used for existing vessels from the Netherlands and Europe. ReFRESCO can also be used for new inland shipping vessels to be built.
17.	Further information	
18.	Filled in by	Karola van der Meij
19.	Date	29-03-2011