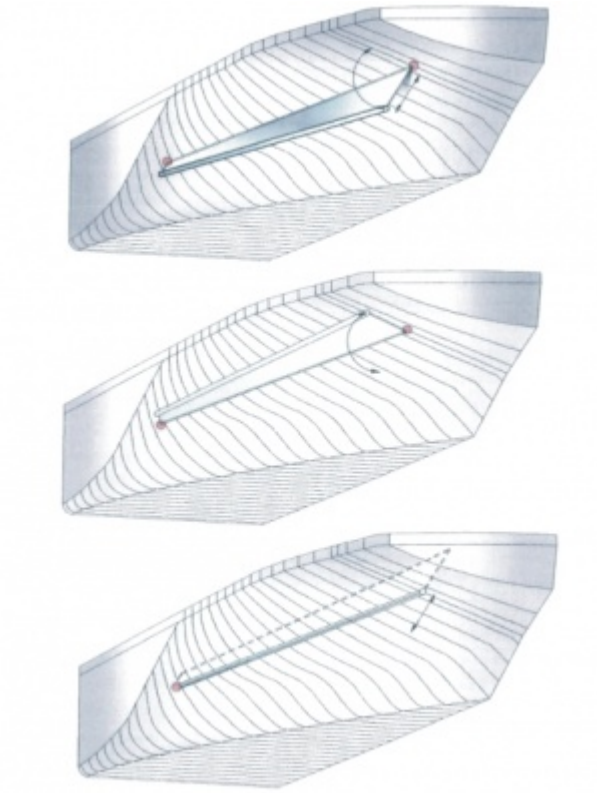
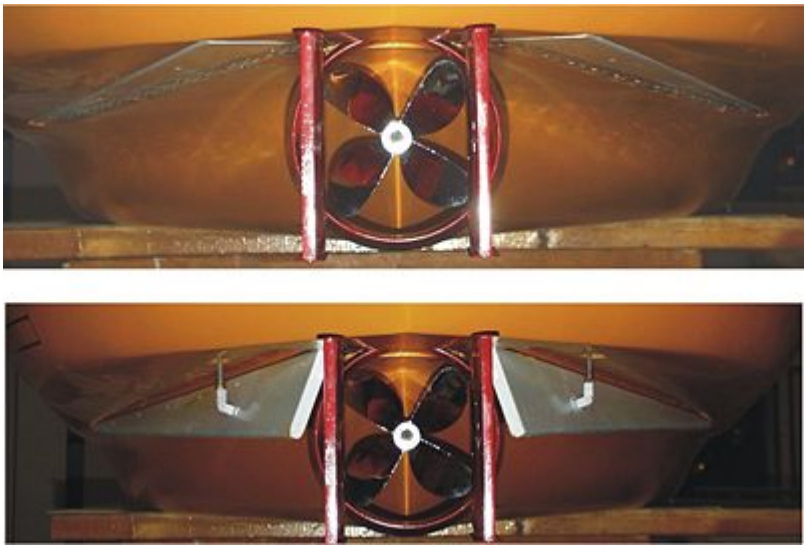
Measures for the reduction of fuel consumption and CO_2 emissions in inland navigation

Example presentation of a potential measure

(from PLATINA Innovation Database)

	Adjustable tunnel
Keywords	Fuel saving, inland vessel, shallow water, propulsion efficiency
Short description	The aftship should be designed in such a way that advantages of navigation in deep water with a relative undisturbed inflow of water to the propeller are used while maintaining possibilities of shallow water operation in partly loaded condition. This can be realized by an adjustable tunnel, which is – dependent on the draught – aligned with the shell or with fins folded downwards to prevent incoming air at low draught. Thus, the propulsion efficiency significantly increases at higher draughts, as no parts, like by fixed tunnel forms, prevent water inflow. In addition, a ship with adjustable tunnel is able to realize by far lower draughts than without it, thereby not jeopardizing safety of operation caused by air intake.  Fig.1: Principle solution for tunnel aprons

	Adjustable tunnel
Objective & target	* Fuel saving of about 10 % for an inland vessel in loaded condition; • when running with retracted tunnel fins, increase of operating range for an inland ship without stern tunnel form up to a draught of 1.20 m.
Key success factors	Not yet implemented in full-scale; but a comparison of power requirements of river-sea ships and inland vessels gives rise to expectations of a saving of about 10 %.
Innovative aspects	flexible adjustment of propeller inflow to draught astern
Benefits for users	Benefits: • vessel is able to operate efficiently and safely within a wide range of water depths, from deep to extremely shallow ones; • safe operation at small draught enables services in shallower water than competitors of the same size can provide.
Geographic area	all inland waterways, where inland navigation takes place
Status	Model tests were carried out at DST, patent granted in 2005
Difficulties met	Difficulties: • In the concrete case the stakeholder operates mostly on the upper Rhine and Neckar, i.e. on waterway stretches with relatively constant and convenient (not extremely shallow) fairway depth. Therefore, there is at the time not an ultimate need for him to have adjustable tunnels on his ships. Other areas of operation with more frequent low water conditions like e.g. the river Elbe are more appropriate for this innovation. • Cost-benefit relation depends on investment costs and on area of operation and respective waterway depth (share of “low water days” compared to “good water conditions”)
Year(s)	2003
Users and stakeholders	Heinz Mertz Co. Schiffahrt GmbH, Stuttgart DST
Contact person	Dipl.-Ing. Joachim Zöllner, DST, Oststr. 77, 47057 Duisburg, Germany, Phone:+402039936940, Fax:+49203361373 email me
Costs & financing	Budget of the innovation and contributing parties
Website / links	The website address of the innovation (if any)
Available data & material	European patent no. 1300330
Added value: possibility for application elsewhere	The use of the adjustable tunnel leads to the realization of a high quasi-propulsive coefficient for a ship without tunnel in partly loaded condition. Moreover, the dynamic tunnel flapped downwards enables the vessel to run in a partly loaded condition, in which the propeller is larger than the draught without any air inlet impeding the trust. This invention might be helpful in all countries with shallow water navigation.

	Adjustable tunnel
Further information	Model tests were done with an inland vessel to display the propulsion properties at different draughts. In doing so the effectiveness of the adjustable tunnel was investigated.  Fig. 2: Adjustable tunnel at inland vessel Propulsion-, resistance- and bollard pull model test were carried out with self propelled inland vessels with and without adjustable tunnel installed at different draughts. When comparing propulsion results for vessels with and without adjustable tunnel, only minor differences in efficiency appeared as consequence of the aft ship hull form and the resulting flow above the tunnel fins. However, the speed-propulsion-behaviour of the tested models was on a better level compared to lots of other inland ships.
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