Project PACSCAT

Development of a partial air cushion support catamaran for freight transportation on inland waterways

Funding: European (5th RTD Framework Programme)
Duration: Nov 2002 - Jul 2005
Status: Complete with results

Background & policy context:

A safe and environmentally acceptable maritime transport system is important for the entire European Community. The volume of maritime transport in European waters is increasing and many European short sea shipping initiatives aim to move freight from the roads to the water, with subsequent environmental improvements. This increased traffic indicates the need to enhance the economic attractiveness of waterborne transport modes, whilst also improving their environmental acceptability. PACSCAT is moving towards these needs, focusing specifically on inland waterways.

Objectives:

- Development of detailed vessel designs for two applications of PACSCAT for freight transportation on inland waterways, and assessment of these designs against environmental, safety and cost criteria;
- Generate detailed design data for PACSCAT vessels which meet logistical operator requirements for use along the Rhine and Danube waterways;
- Ensure acceptability against safety and environmental criteria for such a vessel in the context of regulatory and societal requirements;
- Generate detailed economic data governing the capital and operating costs of such vessels, against relevant market-based scenarios;
- Project likely penetration of PACSCAT vessels into the river freight market and estimate the resulting environmental benefits;
- Establish and maintain dialogue involving all stakeholders in the logistics chain to maximise awareness of the PACSCAT initiative and its implications.

In a technical sense, the project contains three major innovative aspects:

- Engineering of novel, full-scale hull-form and related propulsion/lift systems. The PACSCAT hull-form is novel with a number of patentable features, and incorporates a high length-beam ratio cushion operating at relatively high pressure between specially shaped slender side-hulls. Although high speed catamaran type craft have been designed as ferries and are currently in service around EU coasts, none operate on the PACSCAT principle;
- Development of a numerical tool for predicting the performance of PACSCAT type vessels. Numerical modelling of a PACSCAT type craft poses significant scientific challenges, due to the need to model the moving air pressure region between the hulls. A new model is being developed, based on established modelling approaches, and is being validated against experimental data. This new capability will potentially be applicable to a variety of PACSCAT configurations;
- Analysis of how a high-speed freighter concept could be integrated within freight logistics infrastructures and safety/environmental regulatory frameworks, including simulator studies. Whilst a great number of logistics and multi-modal studies have been performed, PACSCAT opens up new possibilities due to its unique operating flexibility. This in turn permits the evaluation of how such developments could offer substantial benefits in terms of environment and reduced congestion.

Methodology:
The collaborative RTD project will perform a detailed design and performance assessment for a vessel suitable for deployment in the Rhine and Danube freight logistics market. It will be implemented by a trans-national consortium spanning the complete value chain from vessel designer to operator, and including interfaces with key regulatory authorities.

**Related Projects:**
- CRAFT

**Parent Programmes:**
FP5-GROWTH KA3 - Land transport and marine technologies

**Institute type:** Public institution

**Institute name:** European Commission, Directorate-General for Research (DG Research)

**Funding type:** Public (EU)

**Partners:**

**United Kingdom:**
- University of Southampton (Financial/Administrative Co-Ordinator);
- Independent Maritime Assessment Associates Ltd, IMAA (Scientific/Technical Co-Ordinator);
- CheckmateUK LTD (Avon);
- MDS Transmodal Ltd;
- Marinetech South Ltd;
- Shipbuilders & Shiprepairers Association;
- White Young Green Consultancy Ltd;

**Germany:**
- Institut für Seeverkehrswirtschaft und Logistik;
- Germanischer Lloyd AG;
- Sovtransavto Deutschland GmbH;
- Witt & Sohn AG;
- Europaeisches Entwicklungszentrum Für Binnen und Küstenschiffahrt VBD;

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- Wärtsilä Propulsion Netherlands BV;
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**Key Results:**

**Technical Feasibility**
- The project has validated a novel vessel concept that is feasible with respect to its engineering and operational requirements. It can carry 2000 tons of freight at speeds up to 37 km/h (equivalent to around 200 TEU in a LoLo version, or 43 trucks in a RoRo version);
- An environmental impact assessment, including consideration of specific sensitivities on the target routes, has indicated that operation of the vessel is unlikely to cause any significant environmental impact which would call its operation into question. Areas of possible risk (which would need to be reviewed when a demonstrator vessel is available) are the height of wake wash and the level of noise emission.
- Considerable effort has been devoted to understanding the hydrodynamic performance of vessel. A variable geometry research model was initially constructed and tested in a shallow water towing tank. This provided research information and enabled the influence of the main hull parameters of PACSCAT to be identified. These functions were then transcribed into a computer program which can predict the performance of specific designs of PACSCAT vessels, including the generation of wake wash profiles. Predicted performance of the finalised design of a River Freighter was subsequently confirmed by
further tank tests on a large (6.8m) long model.

- Safety issues were also considered in detail, to ensure that introduction of a fast PACSCAT vessel on a waterway would not pose significant risks to other users and would comply with navigational requirements. A full simulator configuration for PACSCAT vessels was created on a commercial simulator, to explore the feasibility of specific manoeuvres (stopping, berthing etc) and vulnerability to natural hazards (tight ends, fog etc). The large model was operated with propulsors in a freely manoeuvring mode to generate the key manoeuvrability data needed by the simulator. The resulting simulation was piloted by two experience pilots, who were unable to encounter any situations which caused concern.

Based on required specifications, designs for two types of PACSCAT River Freighters were prepared with accompanying general arrangement drawings. The 135m long design for the Danube was designed to carry 43 trucks in a RoRo configuration. A similar LoLo vessel was designed to carry about 200 TEU for operation on the lower Rhine. Both could transport a deadweight of up to 2000t at up to 37km/hr (20kt), and could operate in shallow

**Policy implications**

Development of a PACSCAT fleet operating on the Danube could make a significant contribution to expansion of high-value trade within Eastern Europe and across its Eastern border. This would be achieved without causing further congestion of road networks, and without the major investment in additional rail capacity. Successful operation of a Danube fleet would provide a foundation for deployment on other routes. As operational experience develops, niche markets are likely to be identified on the Rhine and possibly Rhine-Sea routes. Such expanded deployment would help substantially to meet the policy objective of modal shift from road to water.

**STRIA Roadmaps:** Network and traffic management systems
- Water transport (sea & inland)

**Transport sectors:** Freight transport

**Geo-spatial type:** Network corridors