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THE NEED FOR WINDSHIP RESEARCH IN EUROPE

by C.J. Satchwell

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C.J. Satchwell Ph.D.

INTRODUCTION

This informal preliminary paper seeks to provide information on an area of European economic activity associated with wind-assisted propulsion for ships. Wind-assist devices are now being produced as prototypes in at least three European countries and are already well-established products in Japan. It is suggested that the CEC consider taking an interest in this field, with a view to improving the position of the European manufacturing and shipping industries.

BACKGROUND

Interest in wind propulsive devices for ships has been rekindled in recent years by the successful introduction of a rigid sail rig design on several Japanese ships. Reported benefits include fuel savings of 25%, reduced rolling, reductions in installed engine power, less propeller roughening and reduced machinery wear.

European efforts in this field have been on a much smaller scale, although they have generally been more technically innovative. In France, the Foundation Cousteau have pioneered the `Turbosail` rig, in Germany the `Indosail` rig has been developed at Hamburg, and in the Uk the `Walker Wingsail` has been produced and fitted to a ship. Smaller European nations such as Denmark and Holland are also very knowledgeable and active in this field, with good proposals for wind-assist devices.

In addition to wind-assist hardware, a number of small companies provide consultancy services to organisations wishing to retrofit sail. These services range from designing small rigs for beach fishing vessels, to arranging complete installations of sail rigs on ships. Europe has a lead in this consultancy field, which is backed up by strong links between the consultancy industry and Universities.

A recent international symposium `Windtech `85` brought most of these European interests together for the first time. It defined the broad categories of wind-assist devices and the level of associated technology. It also revealed a major problem.

In general, ship operators are very conservative and distrust any new technology. European innovations in this field have not been eagerly accepted by operators, who are generally unaware of the full range of benefits offered. Computations of wind-assist benefits tend to be conservative, because deficiencies in data or technology are overcome by conservative assumptions. The situation is that measured benefits tend to exceed predicted benefits, with the result that

wind-assist devices usually look worse at the evaluation stage than they do after they are fitted. Thus, operator`s conservatism, combined with conservative predictions of wind-assist benefits, result in a situation where potentially good devices are not developed.

POSSIBLE SYSTEMS

A number of categories of wind-assist device are under development in Europe, although some are only at an early stage. The main categories are:

Soft Sail

Soft sail implies devices made from cloth and spars, such as traditional sail rigs. Soft sails tend to be high on maintenance and low on reliability, with the result that ship owners worried about manning levels tend to avoid these devices. Good points include low capital costs and simple technology. The German `Indosail` rig is an interesting development in this area.

Mechanical High Lift Devices

These devices use external energy to re-energise a boundary layer and produce very high lift. They are characterised by the French `Turbosail` and German `Flettner Rotor`. Technology is familiar to ship owners and the devices seem well suited to slower vessels with winds predominantly from the beam. Emergency propulsion and roll damping may not be present with these devices.

Flapped Aerofoil Arrays

These devices resemble multiplane aircraft wings with slotted flaps, characterised by the Walker Wingsail. They are suitable for faster vessels, can provide both emergency propulsion and damping, and should be acceptable to ship owners.

Elevated Sails (Kites)

Kites appear to be a good method of providing windship propulsion. They can exploit the higher wind velocities that occur at higher altitudes, can be manoeuvred to increase windspeed and

driving force, and may be stowed away when not in use. Capital costs are low, but roll damping is minimal. Problems include launch, flight control and retrieval. Further development is required.

Wind Turbines

Wind turbines may be coupled to a propeller, to provide a vessel with wind propulsion in any direction relative to the wind. They do not usually provide a vessel with a high speed capability, but do provide high power at low ship speeds whenever wind speeds are high. Trawlers or tugs might beneficially use these devices. Capital costs are high. At present, only small scale installations have been tried.

MARKET OPPORTUNITIES

Market opportunities for wind-assist devices occur when they provide a cost-effective answer to requirements. Unfortunately, their capabilities are not well documented, nor can they easily be predicted, with the result that market opportunities are usually overlooked.

To illustrate this point, an analysis of Japanese publications shows that the installation of a wind-assist device allows a 17-25% reduction in installed engine power, and produces a 30% reduction in rolling. If rolling were to be reduced through the use of stabilising tanks, then the cost of the lost cargo volume and tanks, combined with the cost of additional installed engine power, would roughly amount to the cost of a flapped multiplane array. This means that a multiplane array could be paid for through savings in other items of a ship's specification, and provide fuel saving and emergency propulsion effectively free of charge. Consequently, there would be a very good market opportunity with a new ship where roll stabilisation was required, a weaker opportunity on a new ship where it was not, and an even weaker opportunity in the case of a retrofit to an existing powered vessel.

Arguments for fitting direct wind propulsion devices are strongly dependent on the route and weather pattern, and to a lesser extent on ship speed. This makes market opportunities much harder to identify than for a conventional (engine) fuel saving device which simply saves a percentage of the fuel. A survey of shipping trades, routes and frequencies might be carried out and related to historical weather patterns, so as to identify market opportunities for wind propulsion devices.

Market size might be judged from a 1982 paper, which claimed a total of 82 000 ships exist world-wide, of a size in excess of 100 g.r.t. If 25% of these vessels were fitted with wind-assist devices at a unit cost of 170,000 ECU, a market of around 3 1/2 billion ECU

would exist.

CONCLUSIONS

This preliminary paper has identified an embryo European industry providing products and services in the field of wind-assisted ship propulsion and motion damping. Opportunities for this industry are not clear, although the total estimated market of 3 1/2 billion ECU suggests they should be examined closely. Europe's share of this market will be helped by a realistic plan to identify opportunities, develop appropriate products and encourage demonstration installations so as to gain the confidence of ship owners.

One option for the CEC is to avoid involvement in the field, in which case the Japanese commercial lead will be increased whereas Europe's technological lead will be erroded, and possibly never translated into significant commercial benefit.

If the CEC wishes to consider involvement in the wind-assist field, the questions arise as to what form that involvement might take and what expectations there might be of a suitable program.

It is suggested that any program be preceded by a survey of ship trades and routes, allied to historical weather data, so as to identify the relevant ocean wind energy resource available for exploitation. In parallel with this ocean energy survey, an appraisal needs to be made of the suitability of different wind-assist devices on different ships, with the objective of identifying any constraints or additional opportunities that their installations might present. The result of such a pilot project might be to identify categories of device for short or long term development, markets and deficiencies in technology or data required to evaluate wind-assist benefits.

A program might then be anticipated that could encourage the development of promising wind-assist devices, as well as the associated technology to predict their capabilities. It is

unfortunate that wind-assist devices need to be proven in service before becoming attractive to the general shipping market, as this imposes severe confidence and cash flow problems on their manufacturers.

To alleviate this problem, it is suggested that a program be developed to encourage ship owners to be brave, and try out the new devices. Such a program might involve payments in the event of wind-assist devices failing to reach a minimum level of performance, help with installation costs and grants for sea trials to measure wind assist benefits.

Expectations of such a program would be to provide European manufacturers with a much better appreciation of markets, opportunities to manufacture the best products and the knowledge that those products would have a chance to prove themselves at sea. European ship owners can also be expected to be early customers and their operations should become more efficient. The position of the consultancy sector should be enhanced, through greater market activity, availability of more operating data and the creation of better technology. Secondary benefits might include some additional European ship orders, coming via technological leadership of the wind-assist field.