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## Mobile laser beam applications in shipbuilding – From hand-guided cutting to hybrid welding with a welding tractor

### Results of the DOCKLASER project

Within the framework of the “DOCKLASER” European research project, application possibilities with the solid-state laser were opened up in the rough conditions of shipbuilding.

The processing of the plate thicknesses typical of ships has been made possible by the rapidly advancing development of the solid-state lasers in the high-power range. An additional factor is that, in the meantime, the flexible beam transmission by means of optical fibres also in the processing of large structures permits the utilisation of the laser beam in fabrication on site. In the project, it was possible to prove this in practical investigations in two European dockyards.

On the one hand, the utilisation of the laser beam in the field of ship assembly was intended to allow an increase in the effectiveness of the production and a higher quality due to reduced deformations and surface damage. On the other hand, one

objective related to more comfortable working conditions for the operators by reducing the emission of fumes, gases, heat and UV radiation.

The work was carried out by a consortium of end users, appliance manufacturers and developers with the following composition:

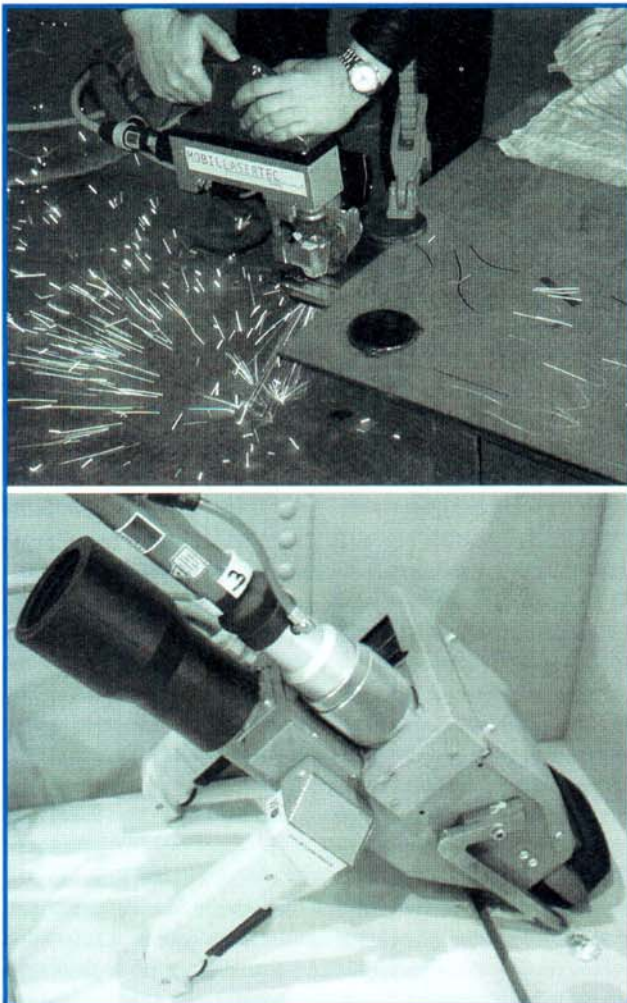
- Meyer Werft, Germany,
- NAVANTIA dockyard, Spain,
- FRONIUS International, Austria,
- Intelligent Welding Automation, Denmark,
- Mobil Laser Tec, Germany,
- SLV Halle, Germany,
- SLV Mecklenburg-Vorpommern, Germany,
- Vyskumny Ustav Zvaracski, Slovakia,
- FORCE Technology, Denmark,
- Det Norske Veritas, Norway,
- Center of Maritime Technologies, Germany, and

- BALance Technology Consulting, Germany.

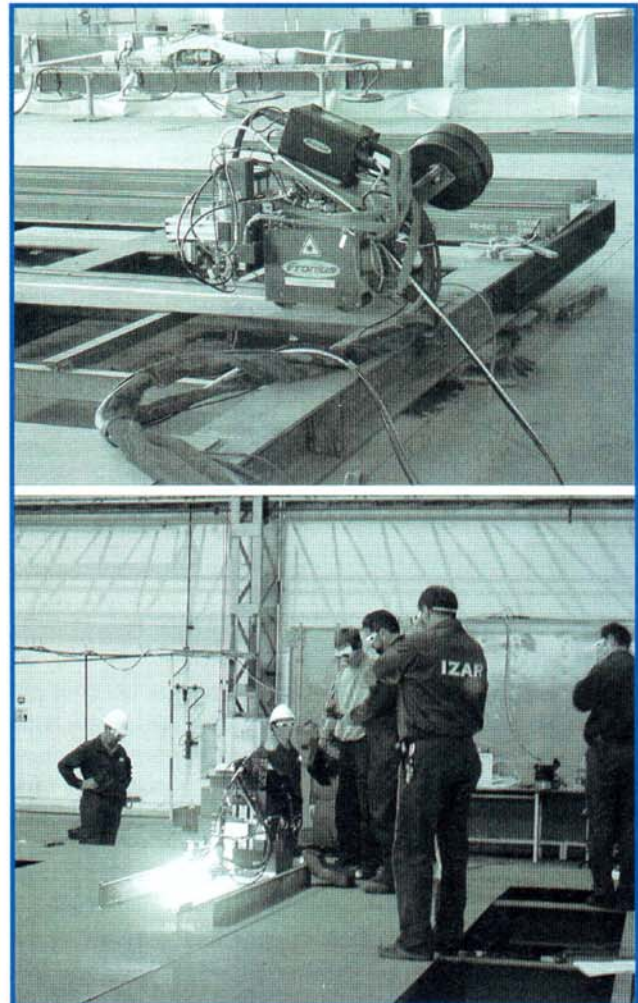
In this respect, those applications for the utilisation of solid-state lasers which are being investigated in the project vary from manually guided laser welding and cutting for the ship equipment via the fully mechanical laser tack welding to be positioned manually for butt joints and T-joints in preassembly to the utilisation of a welding tractor for the laser/gas metal-arc hybrid welding of long straight welded seams.

In the first phase of the project, the processes to be implemented in each case and their boundary conditions were formulated by the dockyards. This resulted in the following applications for manually guided cutting and welding:

- cutting of openings in walls and decks for ducts,
- cutting-out of damaged areas in sandwich panels,



**Fig. 1.** Manual laser cutting (top) and tack welder for the hand-positioned laser tack welding of components (bottom).



**Fig. 2.** Tractor for the hybrid welding of butt joints and T-joints during the testing in Spain.

- welding in lap joints in the equipment,
- welding of already preserved components in the equipment and
- repair welding on damaged sandwich panels.

Provision was made for a hand-positionable laser welding appliance mainly for the fixing (tack welding) of the components before the laser/gas metal-arc hybrid welding. The end users specified three applications for the tractor-guided laser/gas metal-arc hybrid welding of long seams:

- welding of T-joints on deck stiffeners and for the production of T-beams,
- welding of conventional butt joints in ship panel fabrication and
- welding of butt joints on sandwich structures.

The manually guided welding and cutting,

the fixing of parts by means of laser tack welding and the hybrid welding with the welding tractor were successfully tested and qualified during the project period with two different solid-state lasers (one lamp-pumped 4 kW Nd:YAG laser and one 10 kW fibre laser) not only in a test field of SLV Mecklenburg-Vorpommern in Rostock/Germany but also in the Meyer dockyard in Papenburg/Germany and in the NAVANTIA dockyard in Puerto Real/Spain.

The results of the comprehensive tests for the qualification of procedures and appliances (particularly the fatigue limit investigations conducted on hybrid-welded seams and the investigations into the laser safety in mobile applications) will be presented in February 2006 in a workshop concluding the project. This workshop will

take place at SLV Mecklenburg-Vorpommern in Rostock and will provide not only the results of the project but also the prospects of further planned work on the complex of subjects.

Any parties which may be interested in the complex of subjects are invited to take part in additional projects relating to the utilisation of mobile laser technology. Frank Roland from CMT in Hamburg/Germany is available as the contact for the project and the workshop. Interested parties can make a reservation for participation and will receive an invitation in good time: CMT - Center of Maritime Technologies e. V., Bramfelder Straße 164, D-22305 Hamburg, telephone +49(0)40 6919947, fax +49(0)40 6919973, cmt.roland@t-online.de, www.cmt-net.org.

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