

From "The Naval Architect", January 2007 ([www.rina.org.uk/tna](http://www.rina.org.uk/tna))

### **BONDSHIP Project Guidelines**

*Edited by Jan R Weitzenböck and Dag McGeorge.  
Published by Det Norske Veritas, Veritasveien 1,  
N-1322 Høvik, Norway. 216 pages. Hardback.  
ISBN: 82 515 0305 1. Available from the  
BONDSHIP website: [http://www.dnv.com/research/  
BONDSHIP\\_guidelines/index.asp](http://www.dnv.com/research/BONDSHIP_guidelines/index.asp) at a cost of  
Nkr399.00 (Europe) or Nkr449.00 (rest of world).*  
Adhesives are being increasingly used in mainstream shipbuilding; therefore this new book (first published in 2005) will be of great interest to those shipbuilders and designers likely to use such technology. The BONDSHIP project (yet another R&D programme part-financed by taxpayers of the European Community) ran for three years, April 2000 to June 2003, and involved, in typical EC fashion, 13 partners from seven nations. Some of them are household names in the marine industry, eg, Fincantieri, Vosper Thornycroft (VT), CETENA, the University of Southampton, and Meyer Werft.

The aim was to summarise all the steps necessary to design, build, and inspect all types of shipboard bonded joints. There are two parts to the book: the code, and recommended practices. The editors believe – probably correctly – that 'most' designers, builders, and owners are not yet aware of the possibilities – and limitations – of adhesive joints.

The book is mainly aimed – naturally – at high-speed craft and passenger ships, where the benefits will perhaps be most obvious, and at joining lightweight and dissimilar materials and structures. It is recommended that adhesives are first applied in less critical areas of a ship and as service experience

is gained, at more strategic and load-bearing points. Probably the most hesitation over the use of glue in place of welds, rivets, or screws must arise because of the possibility of delamination and subsequent repair or replacement problems, but this book hopes to overcome such fears.

Having said this, the text does acknowledge that the long-term performance of a bonded joint cannot be predicted reliably from the results of accelerated ageing tests, also that numerical analysis cannot reliably predict joint failure without additional large-scale tests.

The editors also point out that adhesive glueing is a complex process with many variables, whose interaction is not yet fully understood. Potential users may, of course, also be put off by the very recent delamination problems of Gaz Transport/Technigaz (GTT) with its new CS1 LNG cargo containment system. Quality control and approved personnel are clearly prerequisite essentials for any bonding project.

*BONDSHIP Project Guidelines* aims to overcome such inhibitions and presents a highly detailed and technical examination of all aspects of adhesives

in a shipboard environment. Naval architects will find the chapter on the design and analysis of bonded joints of special interest. The editors point out that adhesives are especially suitable for joining long or large areas and for transfer of shear or compressive loads for limited times (only with flexible glues) and for shock loading.

Bonding techniques enable relatively uniform stress distribution, and avoid the introduction of pre-stresses in substrates. Adhesives are additionally said to be good for joining dissimilar materials, offer good insulation against sound and vibration, and can compensate for differences in thermal expansion or stiffness.

An important aspect of adhesive-bonded joints is their fire resistance, and a large chapter is devoted to this subject. As a result of practical tests – some are illustrated in the publication – carried out under the BONDSHIP project, it is suggested that adhesives used in fire-sensitive situations should not have heat resistance below 80°C–100°C, while it is possible that necessary insulation thickness might cause problems in certain parts of a ship; however, the small volumes of adhesive generally used do

not present any special flame or smoke problems. Detailed load analyses should however, be carried out, and close contact should be maintained with the relevant class society – especially since experience with glue is not yet great. It is noted that careful joint design can be a considerable aid to fire resistance.

In line with these major attractions, the successful design of a bonded joint additionally requires 'profound knowledge of the behaviour of adhesives under loading and selection of suitable materials and surface preparation.' The key to success is said to lie in detailed dialogue between the product designer, adhesive manufacturer, and a shipyard's production department. The book includes a good selection of technical diagrams, some equations for the mathematically minded, and a small number of colour illustrations showing joints and tests.

Adhesives do offer many attractions to shipbuilders, and anyone interested in considering their use would find the book invaluable. It may even contribute to their greater use.

*Tim Knaggs*

The **BONDSHIP project guidelines** can be ordered here:

- <http://research.dnv.com/bondship/Guidelines.htm>
- [http://www.dnv.com/research/BONDSHIP\\_guidelines/index.asp](http://www.dnv.com/research/BONDSHIP_guidelines/index.asp)