

Joining matters

Dr Richard Dolby OBE FREng FIMMM Hon FWeldI will give his Presidential Address at Materials Congress 2006. This article is an edited version of that presentation, which focuses on parallels between welding, his area of expertise, and the Institute.

It is a special honour to be President of this Institute, one that is vividly brought home when you look at the history and recall the many previous organisations, people and mergers that helped create what we have today.

The figure opposite shows our merger history and the 28 prestigious societies and institutes that have helped create our current Institute. When you reflect on the achievements of these founder organisations, and the reputation of the many distinguished individuals associated with them, we can be extremely proud of our inheritance.

Most of my career has been concerned with the joining and engineering performance of materials, particularly steel. Interestingly, the Iron and Steel Institute, this Institute's first founder in 1869, played a major role in the push for nationally coordinated welding research in the 1930s. It organised a symposium on the welding of iron and steel in 1935 at the Institution of Civil Engineers, in conjunction with other bodies. Since that event, the UK and, in particular, TWI (formerly The British Welding Research Association) has attained a world leading position in welding and joining research, and in the engineering assessment of welded joints.

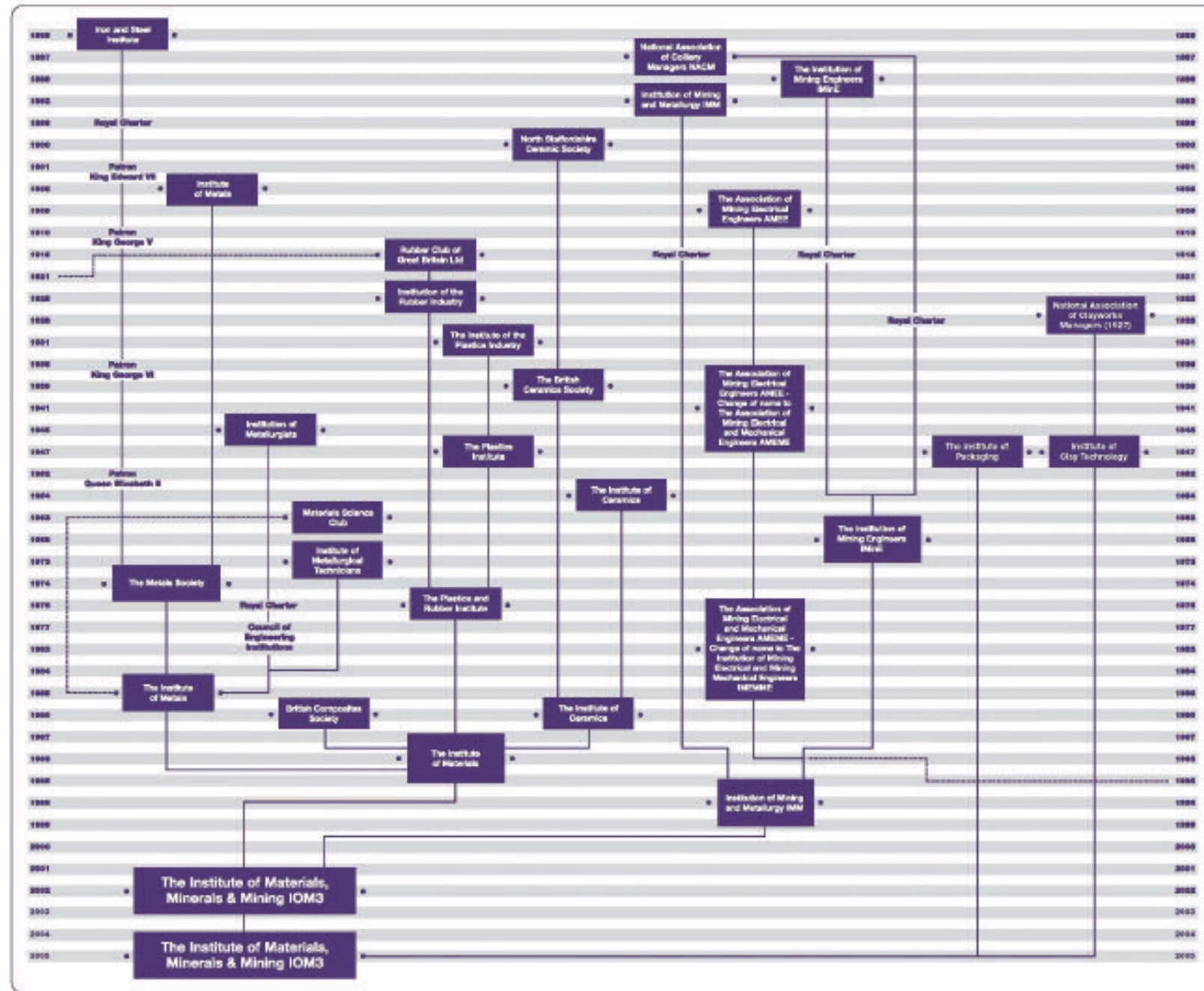
I chose the title of my address to allow several interpretations of the phrase 'joining matters'. The first concerns the safe and reliable operation of engineering structures. In the last 70 years, there have been a significant number of failures in

welded structures, many are well documented and most found to have initiated from weld flaws. Today, there are still hugely expensive problems stemming from flaws in welded joints in power plant and civil structures. For example, fatigue cracking is a big issue in highway bridges in Japan at the moment, and recent earthquakes are causing major changes in joint designs for steel-framed buildings in the USA and elsewhere.

Stress corrosion is an ever present problem in gas pipelines with high CO₂ content. However, overall, the situation is much improved, thanks to worldwide research. This is an area where the UK has led the world, particularly in the development of codes and standards.

Thus, joining 'matters' to safe and reliable operation, whether we are talking about an offshore oil installation, an aero engine, a nuclear reactor, or a 3G mobile phone, which incidentally has over 1,000 joints.

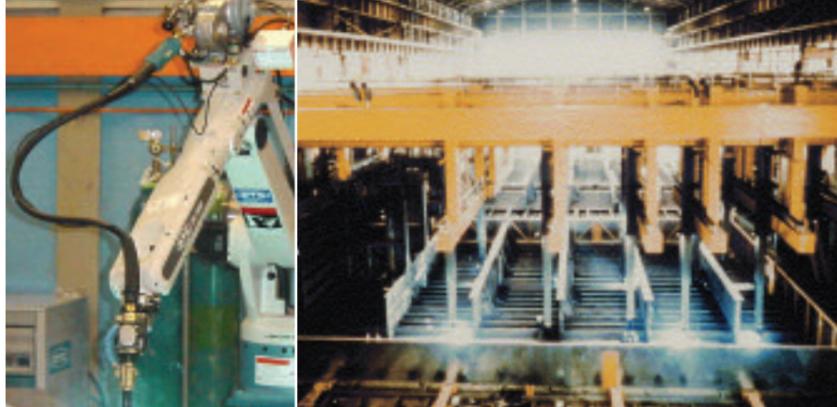
My second interpretation of 'joining matters' relates to professional engineering institutes and institutions. Few have survived without a join or two in their history, and we have already seen that this Institute has been through many joining operations and will probably undergo further ones in the future. Individuals join institutes to further their careers and for personal development, and, in addition, most hope to gain benefits from their membership to help their companies and businesses. So, 'joining matters' are at the heart and well-being of all institutes.



Appendix 10

Factors leading to sound, reliable joints

	Good Welding Engineers provide	Individuals expect from Institutes	Institutes need to provide
Overall plan	o		o
Fast, effective joining processes	o	o	o
Competent, qualified persons	o	o	o
Procedures for quality service, including periodic inspection	o	o	o
Technical/business knowledge	o	o	o



Robots for gas metal arc welding increase productivity and weld quality (left) pedestal type (right) 12 suspended telescope robot arms capable of 3km per day (Courtesy: Odense)

Making sound joints

Complicated welded structures, plant or equipment, such as the pressure hull and internals of a nuclear submarine, a railcar, or a gas pipeline, need experienced project managers and highly competent welding engineers. The project manager would expect the following from the welding engineer –

- n An overall plan. This details the sub-assemblies and gives the sequence of welding for these and the final assembly. Ships provide a good example. There must be access for the welder, distortion must be minimised, and accuracy of fit maximised.
- n Decisions on the most appropriate and cost effective joining processes for each part of the assembly. For example, in shipbuilding, there are around 10 distinct processes that could be chosen. In automotive assembly, where multi-material joining is common, 15 processes are commonly in use. The welding engineer must be familiar with the advantages and disadvantages of each process and select the options which are the most cost effective.

- n Competent, qualified persons for welding, inspection and non-destructive testing (NDT). Individuals need to be trained, examined and certificated every five years for most welding and inspection functions in safety critical fabrications.
- n Procedures and controls during welding to ensure high quality joints enter service. For example, robots are increasingly replacing manual welders in the automotive and ship building sectors because of improved weld quality as well as increased productivity (see images above).



Welded sub-assembly being added to the hull of the passenger ship Seven Seas Navigator (Courtesy: Hydro Aluminium)

n An assembly which facilitates in-service joint inspection/NDT.

n Technical and business knowledge to deliver the points above. Welding engineers need good international networks to exchange knowledge and keep abreast of modern developments. The International Institute of Welding involving 40 countries, and the European Federation for Welding, are good examples of large networks that help welding engineers share good practice.

n The individual's expectations from professional institutes are strikingly similar –

- n Options available and advice on the most appropriate joining route.
- n Fast, trouble free joining procedures.
- n Qualifications/competence assessment and awards.
- n Quality services throughout membership.
- n Technical/business knowledge.

The table on page 50 shows how closely these match the services provided by experienced welding engineers.

Meeting expectations

The needs expressed above will be met provided institutes set out to deliver –

- n Clear guidelines with friendly advice on options and procedures for attaining membership. Fast and efficient procedures in the processing of applications.
- n Clearly presented routes for career enhancement through qualifications, competence assessment, and movement through the various grades of membership.
- n A quality system that includes procedures to examine periodically members' satisfaction with the joining process and other services.
- n Processes which allow members to capture relevant technical/business knowledge from networking, conferences and other events, publishing and other means.

n A financially sound and viable business, that has a clear vision and forward plans.

How does this Institute measure up to these requirements? I believe very well indeed. We have a fine organisation with a substantial membership base of 20,000. This includes 4,000 younger members and 3,500 overseas members in 70 countries. The latest mergers with the Institute of Packaging and Institute of Clay Technology have strengthened our position as the voice of materials, minerals and mining, both nationally and internationally, and these mergers fit well into our plans to extend our coverage of the materials cycle. Further mergers are part of the Institute's current strategy to achieve growth.

It is excellent news that materials, including minerals, is seen as one of Government's seven technology priorities for the UK, impacting on 20% of the UK's GDP and directly employing 1.5 million people. The Institute has been awarded a leading role in a new Government initiative concerned with setting up knowledge transfer networks in the UK to support industry and enterprise, and it is now managing the UK materials network. In another project, it is assisting Government in strengthening the interface between designers and materials. I believe members will derive considerable benefit from the knowledge generated, exchanged and made available from initiatives of this sort.

Our educational reach into schools is ahead of most science and engineering Institutes in the UK, with the education team interacting with over 6,000 school children and 300 teachers in the 12 month period from September 2004.

We have achieved three successful mergers in the last four years, all of which have put a great deal of extra work on the staff. As a result, we are financially more secure and have improved many of our services to the membership.

Time for change

At the beginning of 2005, Council set up Task Groups on various topics, including communication, income generation, and members and mergers, and in the next few months, we will be considering carefully their recommendations for change. However, there are some further 'joining matters' that merit attention in 2006.

A successful business repeatedly asks itself two questions – 'What member needs and problems are we here to solve?', and 'How do we achieve operational

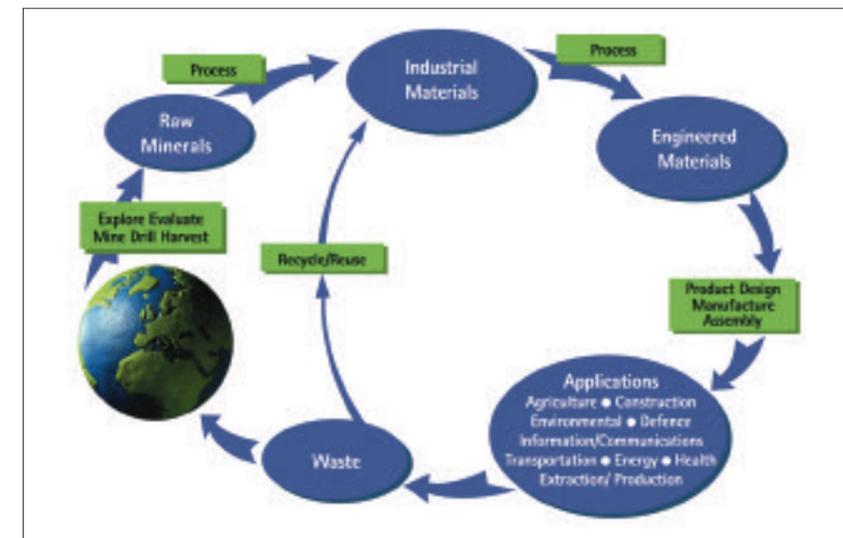
excellence?' There are three areas which follow from these questions and the key factors table. These are – an overall plan, procedures to ensure quality service, and technical and business knowledge.

The first area concerns an improvement to our corporate planning process. We have a clear mission and broad aims in place, but lack a medium term financial and business plan against which we can measure achievement. We have had several years with no financial surprises, which is excellent news. However, we require a rolling plan, updated annually by both staff and Councillors, with challenging, but realistic, targets and testable objectives. I am pleased to say that a good start has been made, and Council discussed the main elements of the plan last month.

The second area concerns quality of service and periodic inspection. I believe we should have external accreditation to ISO 9001, to show members and other customers that we meet internationally recognised standards and take the matter seriously. Going through the process of accreditation is important, but what really matters is instilling a culture of improved service throughout the business and having in place regular systems and procedures to measure the impact and quality of our services on the membership, and taking remedial action if necessary. Some of the required quality elements are already in place, but I believe efficiency will be improved by the process of external accreditation, and members and other customers will see increased benefit.



In-service inspection of insulated pipelines using guided wave ultrasonics (Teletest™) (Courtesy: TWI)



The Institute plans to extend coverage of the materials cycle

For an Institute which has been through a series of recent mergers, inspection of recent merger joints seems a sensible precaution, and I would like to give this 'joining matter' special attention during my term of office.

The third matter is better knowledge provision. The Institute provides a range of services for members to access technical and business knowledge. Conferences and similar events will remain popular, provided topics are closely aligned to members' current and future interests. We run about 20 events of this type a year, and are endeavouring to boost this number by ensuring all Divisions are actively engaged with their communities.

The Divisions are also technical networks and are able to promote their activities using web pages on the Institute's site. But the Institute could do more in terms of knowledge provision to members and other customers. Many members, and particularly younger ones worldwide, will require increasing amounts of technical and business knowledge from us to justify continuing membership, and will expect much of this to be provided through the internet. Continued recruitment overseas could depend crucially on this service being improved.

A stock-take is needed of the Institute's corporate knowledge, such as conference proceedings and key texts, and we need to assess how these and other elements of knowledge can be made accessible over the internet. The Institute already offers

some good e-services, including its wide range of journals, but others are ahead, with substantial virtual libraries.

Making it matter

The welding engineer has a vital role in the materials cycle, turning semi-fabricated products into engineering components and structures. The key engineering factors leading to sound joints seem to closely match those which can create successful institutes, but the analogy can only be taken so far. For example, professional institutes must set out to attract and inspire young people in order to maintain an energetic, vibrant organisation, and we must continually seek ways of doing this. This is not part of the role of a welding engineer. Nevertheless, I hope the comparison has shown that joining 'matters' to materials, individuals and institutes, and always will.

e-Services currently offered by IOM³

- E-newsletter
- Annual Review online
- E-journals
- Magazines (*Materials World*, *Clay Technology*, *Packaging Professional*)
- Training courses advertised
- Training courses online (packaging technology)
- Shop online (books, journals)
- Supplier advertising
- Worldwide and Institute events calendar