

# WELDING IS FUN, EXCITING AND REWARDING!



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**How do you get young people interested in and enthused about welding?**

**Simple, a good dose of inspiration, a measure of excitement, a lot of fun, and some treats!**

**The Welding Institute, one of the smaller Professional Engineering Institutions, delivered a novel and highly popular attraction at the Big Bang UK Young Scientists' and Engineers' Fairs in Manchester in March 2010, and again in London from 10 to 12 March this year.**

With the 'Welding with Chocolate' experiment, designed by TWI Ltd structural integrity engineer Dr Philippa Moore, as the cornerstone of our welding engineering outreach programme, how could we fail to delight?

A Cambridge University Materials Science and Metallurgy graduate, Philippa's PhD

investigated the microstructures and properties of laser and laser/arc hybrid welds in pipeline steels, and her work has been published through a number of conferences and journals. In addition to her role in the Fracture Integrity Management section at TWI in Cambridge, which involves her in fracture toughness testing and fitness-for-service assessments

of welded structures, mostly in support of the oil and gas industry, Philippa is always generating new ideas to create hands-on, inspirational, interactive engineering activities that can be used to promote engineering, technology and science to young people. Philippa has participated in numerous educational outreach activities, the most recent of



Dr Philippa Moore receives her Leslie Lidstone Medal from Steve Yianni of Network Rail, and Chairman of Council of The Welding Institute

which is her Welding with Chocolate experiment.

Having developed the Welding with Chocolate experiment in her own time, Philippa has taken it from a school-based experiment trialled at Science Week at the University of Cambridge in 2009, to the Big Bang Science Fairs in Manchester and London, SkillsLondon at the Excel Centre, and SkillsCymru in Cardiff, reaching out to over 100,000 young people in 2010 and approximately 29,000 so far this year.

For her client-focused project work as well as her exceptional engineering outreach contributions, The Welding Institute awarded Philippa its 2010 Leslie Lidstone Medal, sponsored by ESAB Group UK, which is awarded annually to the person under 40 years of age who is deemed to have made the most significant contribution (not associated with the manufacture and supply of welding consumables and equipment) to the advancement of welding technology during the period of five years preceding the year of the award. Philippa was the first female recipient of this award in its 30-year history.

Whilst superficially 'fun with food', Welding with Chocolate is a brilliantly simple engineering experiment that communicates the principles of fusion welding and the benefits of welded fabrication in structural engineering, all in a safe and highly enjoyable hands-on activity. Using beams of low melting point engineering material (chocolate), hot plate welding is used to create fillet welds between four beams to fabricate a box girder structure. The heat source is from bottles filled with hot water and no safety equipment is required by the welder, although sticky

hands often need a good wash once they have been licked clean of chocolate!

The experiment encourages participants to load a single plain beam with weights until failure. The load bearing capacity of the beam is noted and the failure mode and appearance of the fracture face can be discussed to develop understanding of overload and brittle failure, or ductile failure in the case of those girder-like composite confectioneries. In speculating over the potential load carrying capacity of four beams welded into a box girder, participants often forecast four, five or six times the weight to failure compared to the plain beam; although one visitor to our stand confidently stated that it would be much more than four times, otherwise we wouldn't be doing the experiment, which was more of a comment from experience of life than experience of GCSE Physics!

Surprisingly for most is that the box girder is often able to support twenty to forty times the load that caused the plain beam to fail, providing an impressive visual confirmation of the performance benefit of welded fabrications. When the box girder eventually fails there is much chocolate to be eaten but not before some discussion on the location of the fracture and the effects of fit up, distortion and weld quality, of course.

As deliverable on the domestic kitchen table as it is in the science laboratory, the Welding with Chocolate experiment is an exceptional hands-on experience that brings real engineering practices and principles within the sticky (often literally) grasp of learners from age 7 to 17.

With significant reliance on manufacturing to generate UK economic growth, there is much



You're only as good as your last weld, and they look pretty pleased with this welded chocolate box-girder bridge!

concern amongst employers that the image of welding dissuades potential new entrants from joining the industry but it is not so much that welding has a poor image, more that it is rarely seen at all. Anglo-Saxon and Viking pattern-welded swords were the superior technology of their ages, and their blades were etched to highlight the "serpents" in the steel. Having gained the status to own one of these outstanding pieces of craftsmanship, the owners wanted the welding to be seen and, unfortunately for their opponents, most likely the last thing to be seen. Today's materials joining and welding is hidden in the finished product, painted, clad or covered, and is rarely seen or appreciated by the end-user. More commonly it

is the scale of the structure, or the light it permits into or through a space that observers find impressive without any concern for how the construction was fabricated.

Many visitors to The Welding Institute's exhibition stands and engineering outreach events have little knowledge of welding or how welding has made their world and the products within it; through the Welding with Chocolate experiment they have learned about the process and application of welding and it has sparked their enthusiasm for engineering and technology. Above all, Welding with Chocolate has shown that engineering, and specifically welding engineering, is fun!