

Fulmer UPDATE

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TECHNOLOGICAL CONSULTANCY

Technological consultancy is forming an increasingly important part of Fulmer's business. Its growth is the result of two major factors; first, the demand from industry seeking specialist advice and assistance to manufacture products more competitively and profitably; second, the wider financial support to industry, available through the U.K. Department of Trade and Industry's schemes. Fulmer's integrated multi-disciplinary approach to problem solving and experience in working closely with government agencies places us in a unique position to service this market.

Fulmer's technological base has developed over 40 years to meet changing market demands. From early days, Fulmer offered metallurgical consultancy, trouble shooting and failure analysis. Staff often found themselves catching a train at short notice to a far corner of the U.K. to help industry in the immediate post-war boom. We continue to offer these services, and many of our 4,000 clients have asked for our help on numerous occasions.

With the growth of the plastics industry and Fulmer's acquisition of the Yarsley organisation, the

company branched out in the 1970's into the fields of organic and polymer chemistry and polymer components manufacturing technologies. To meet the market demand, Yarsley Technical Centre developed expertise in polymer component and mould design, and in specialised polymeric materials testing, including smoke emission, flammability and thermal properties.

Throughout the 1970's and 1980's demand has gradually shifted from new materials to new product development services. Fulmer has always maintained the widest possible mix of science and engineering disciplines, and this has proved to be of great importance in responding to the changing market. Technological consultancy on new product development often requires the integration of design optimisation, stress analysis, mathematical modelling, materials selection, prototype manufacture and testing. In the recent past Fulmer has assisted clients in the development of products ranging from automotive water pumps to RF insulators.

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GOVERNMENT-AIDED SCHEMES

Companies seeking specialist technological advice or research and development assistance may qualify for financial support from the U.K. Department of Trade and Industry. The DTI's Business and Technical Advisory Service, aimed at the needs of small to medium size firms, includes schemes to assist manufacturing industry with product design and development, manufacture, automation and quality. Through these schemes the DTI provides up to 75% of the cost of 15 man-days of technological consultancy. For larger R & D projects the DTI's Support For Innovation scheme provides grants of up to 25% of the costs. Additionally, the DTI provides pump-priming financial support to schemes such as the Yarsley Quality Assured Firms System, which Yarsley Technical Centre launched in 1984.

Fulmer is keen to help its clients obtain the best return on investment and one way is by advising on government-aided schemes and in assisting the preparation of submissions. Firms interested in these schemes may obtain further information from Fulmer or the DTI's Support for Business Information Service (01-215-4021).

PRODUCT DESIGN & DEVELOPMENT

MATERIALS SELECTION FOR DESIGN OF RF INSULATORS

A manufacturer of equipment for radio towers and masts identified the need for a novel design in base insulators. The insulators should be capable of withstanding high compressive loads and high tensile loads (from bending) whilst insulating against specified voltages at radio frequencies. A 20 year lifespan with minimum maintenance was required.

A brainstorming approach was used to produce a series of novel design and materials choice possibilities and the customer participated at this stage.

Fulmer evaluated all the possibilities and a novel design, which, in principle, meets all the requirements of the specification was produced. The design involves some changes in materials used but the ceramic insulating block is retained.

FATIGUE FAILURE OF COIN PAYOUT UNIT

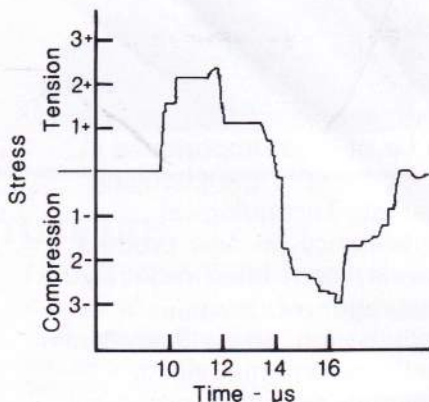
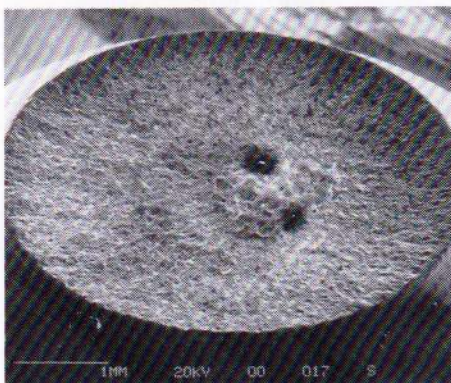
A supplier of a coin payout unit was experiencing premature failures of a solenoid plunger which formed part of the mechanism. The solenoid operated a bell-crank which in turn acted on a spring-loaded slider. Metallurgical investigations and a fracture mechanics analysis indicated a largely tensile fatigue failure mechanism and a stress fracture of $\approx 360\text{MPa}$. Loadings on the plunger were analysed, and it was concluded that the only means by which this stress could occur was by the impact of the solenoid on its stop following energisation. The compressive impact stress wave was reflecting at the section changes in the plunger resulting in a complex stress pattern containing high tensile peaks. Modifications to this plunger geometry, which would reduce these tensile stresses, were suggested, although a more-favoured solution was to reduce the severity of the initial impact by means a compliant element between the plunger and stop.

For further information, please contact Dr. Patrick Finlay, Fulmer Research Laboratories, Stoke Poges.

THERMAL EFFICIENCY OF WINDOW FRAMES

Fulmer was approached by a manufacturer of double glazed window units. His requirement was to optimise the thermal performance of the window frame, particularly in respect of the geometry of the frame sections and the location of the insulating thermal break.

Using a CRAY super-computer, Fulmer carried out a finite element analysis of the heat flow through the manufacturer's current design of frame, giving a map of isotherms for various ambient conditions. The overall 'U' value of the frame was also calculated. A number of modifications to the geometry, location and material of the thermal break were investigated on the computer, and the result was a series of design recommendations for improving the U value substantially, whilst retaining mechanical integrity and architectural styling.



Scanning electron micrograph (top) of a failed plunger and stress analysis at the point of failure, showing fatigue due to reflected tensile stress waves.

DESIGN APPRAISAL SERVICE FOR PLASTICS PRODUCTS AND MOULDS

During recent years, Yarsley has investigated the cause of failure of many hundreds of plastics mouldings. Often, the major cause of failure has been insufficient attention at the design stage to the special requirements of designing for plastics materials.

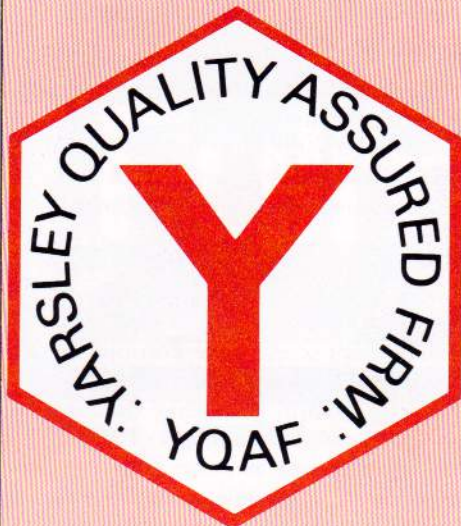
Most of our clients for this service have been companies whose designers are highly skilled in their own product design field, but who have not had the opportunity to develop expertise with the end-use performance and processing of the wide range of plastics materials that may be applicable to their industry.

In these situations, Yarsley is able to complement a company's in-house capability by providing a Design Appraisal Service. The client is asked to submit drawings at an early stage in the development programme, and a team of Yarsley staff comment on possible problem areas, and suggest improvements.

Yarsley has an independent capability for every stage of a complete development project, including: facilities for material selection, stress analysis, procurement of prototype moulds, prototype moulding, testing of prototypes and commissioning of production moulds. The 'in house' expertise essential for every aspect of product and material development, is at the full disposal of the client.

Compared to the cost of correcting mistakes and the associated time delays, using the Design Appraisal Service is particularly cost effective for many component and product manufacturers. Yarsley has assisted customers in industries ranging from medical to aerospace, and automotive to electronics, to achieve the optimum use of plastics, in both established and novel applications.

To make use of the Design Appraisal Service, please contact Bob Trubshaw, Yarsley Technical Centre, Redhill.



Yarsley Quality Assured Firms Limited (YQAF) is a third party certification body, financially supported by the Department of Trade and Industry, for the certification and subsequent registration of firms with proven capability in maintaining a consistent quality level. These are firms whose quality management systems conform to the relevant part of BS 5750: Quality Systems. Such registration is an authoritative and independent accreditation that the supplier's systems are geared to maintain the required quality level of their product or service. At present there are YQAF schemes operating within the building, plastics, sealants and adhesives industries. Applications to become a Yarsley Quality Assured Firm are accepted from both single firms or sector groups which have the capability, willingness and commitment to offer a product or service of assured quality. Trade Associations can also participate in the setting-up of sector schemes relevant to the industry which they represent.

Many companies interested in Quality Assurance are faced with two important considerations: the costs of implementing and maintaining a Quality Assurance system and the difficulties in implementing the system, especially for those with no prior knowledge of Quality Assurance.

By achieving YQAF registration, the initial commitment and resource allocation necessary is an investment rewarded by efficient use of resources, increased business and reputation. Furthermore, the Department of Trade and Industry offers financial assistance towards costs for those companies applying for YQAF registration.

Companies applying for assessment and YQAF registration before the end of 1985 will qualify for a reduction in initial assessment costs and may be eligible for inclusion in the 1986 Department of Trade and Industry Register of Quality Assessed UK Companies.

For further information please contact Reg Easy, Yarsley Technical Centre, Redhill.

FIRE CONSULTANCY:

FLAMMABILITY OF AIRCRAFT SEAT CUSHIONS

Consultancy on the suitability of materials or equipment in critical environments is an important feature of the fire technology service at Yarsley Technical Centre. Yarsley has assessed products ranging from fire doors to ship bulkheads, fire blankets to furniture and fittings. Also, we go one stage further to aid in the evaluation or formulation of the technical standards themselves.

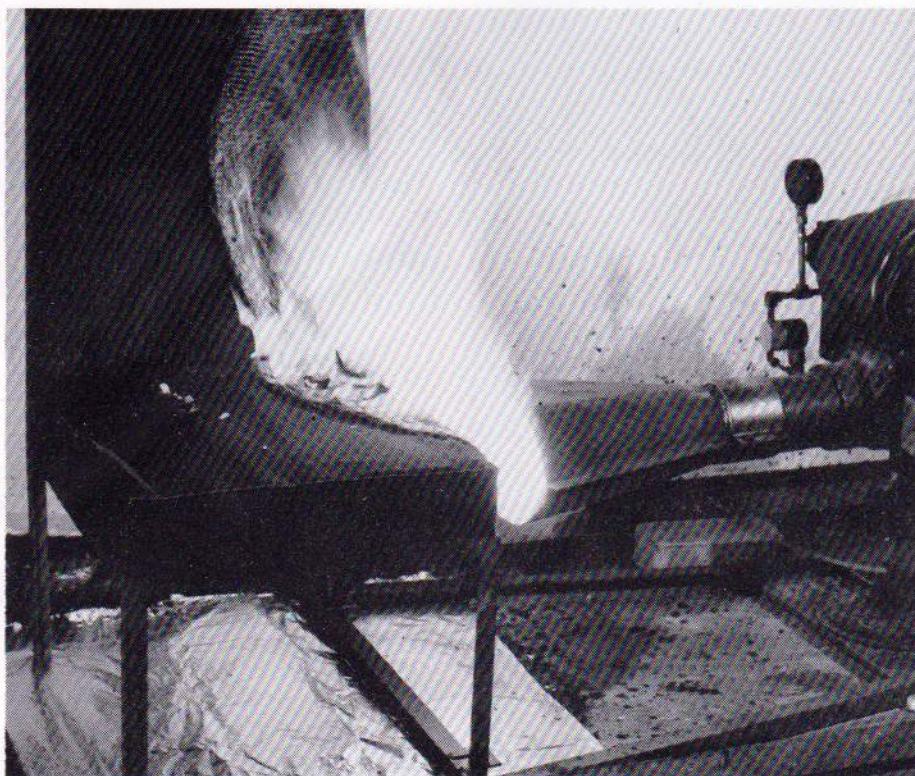
A recent example is Yarsley's work for the British Civil Aviation Authority (CAA). The American Federal Aviation Authority (FAA) had issued notice of a proposed rule on the 'Flammability Requirements for Aircraft Seat Cushions.' To enable comment on these proposed rules the CAA placed a contract with Yarsley to carry out a programme of testing at the Fire Research Station using the apparatus and test method specified in the proposed FAA rules.

Yarsley commissioned the apparatus and carried out a series of 45 tests. This culminated in a CAA

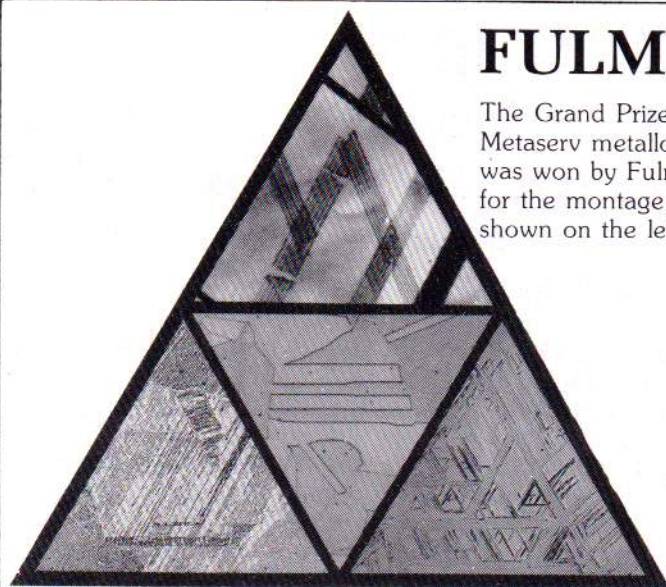
seminar on the proposed test, held with the aircraft industry and its suppliers. As a result of the test programme the CAA were able to provide a series of comments on the proposed regulations to the FAA. The FAA has issued the finalised rule, requiring that all seating in large civilian aircraft in the U.S.A. must comply with the new regulations by November 1987. It is understood that similar requirements will be made by the CAA in the near future.

Since the original flammability tests on the seat cushions, Yarsley has carried out minor modifications to the test rig to allow for slight changes in the final regulation. The apparatus has been recommissioned at Redhill, and many seat material systems have already been tested.

For further information please contact Bob Bishop, Yarsley Technical Centre, Redhill.



Aircraft seating—resistance to fire test in progress.



FULMER PRIZE WINNER

The Grand Prize in the 1984 Metaserv metallography competition was won by Fulmer's Dr Ursula Lenel for the montage of micrographs shown on the left.

This eye-catching entry combined high quality optical metallography and high magnification electron metallography (top), to emphasise the important features of a range of unstable austenite steels developed at Fulmer.

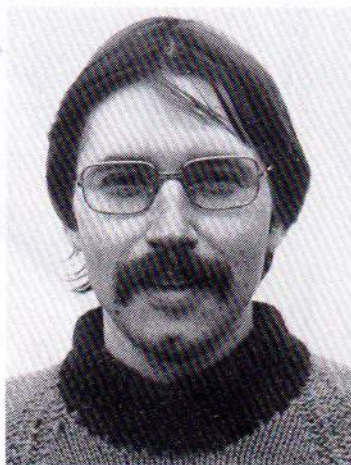
Dr Lenel's essay "The Use of Wear Theory in Designing Engineering Materials", based on the same development work, also won her the prestigious 1984 I.Mech.E./Esso Tribology Award. The essay describes the successful development of steels to combat severe abrasion and corrosion in aggressive environments such as hard rock mines.

NEW FACES



Margarita Lam
Margarita has recently joined our mathematics and computing unit as a member of our mathematical modelling team. She came to this country from Hong Kong to undertake higher education and now has an honours degree in mathematics from Newcastle Polytechnic. She not only strengthens our mathematics and computing staff but also helps us to understand our Chinese clients better.

Dr. Nick Goodchild
Dr. Nick Goodchild joined the Yarsley Organic Chemistry section at Ashted in March 1985. His doctorate was undertaken at Birmingham University on the reactions of tetrafluoro-ethylene pentamer and its derivatives. He subsequently spent a year at the University of Iowa (USA) undertaking post doctorate studies in organometallic chemistry followed by 12 months at University College, London, where he undertook studies into electron spin resonance. His work at Yarsley covers the production of a range of organo-fluorine compounds, usually supplied for use in the initial research stages for new pharmaceuticals and pesticides.



Nick Glover
Nick Glover joined Fulmer Singapore in April as a Metallurgist. After qualifying from Nottingham University with a degree in metallurgy, he worked within the APV Group for 10 years. His activities ranged from conducting material investigations for most of the APV Group to the study and development of new materials, such as high performance alloy steels and nickel-based alloys. He will be applying his experience in material selection, evaluation and failure analysis to the further development of Fulmer's metallurgical activities in Singapore.

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