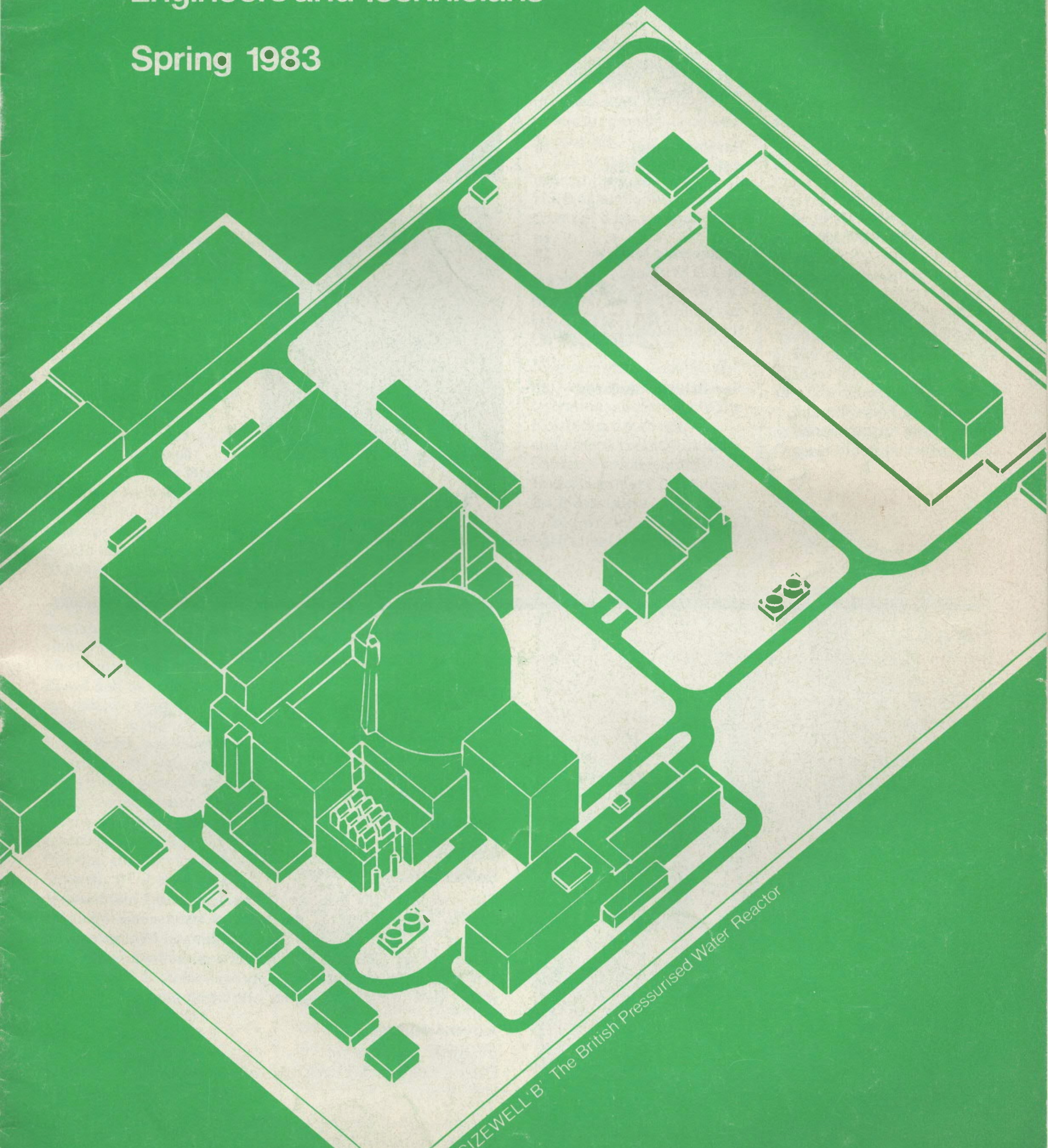
JOURNAL

The Institute of
Engineers and Technicians

Spring 1983



THE INSTITUTE OF ENGINEERS AND TECHNICIANS, 100 Grove Vale, London SE22 8DR, England. Tel: 01-693 1255

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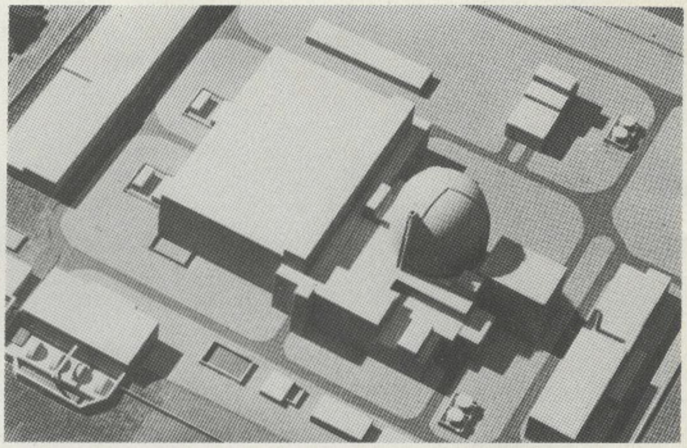

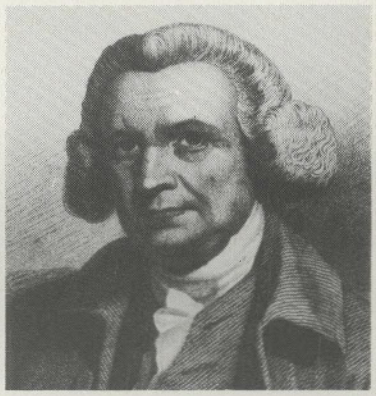

Subscriptions
The Journal of the Institute of Engineers and Technicians is sent to all members of the Institute (and certain known leaders in the profession) free of charge. Copies can be purchased for 50p each or £1.75 for four consecutive issues. It is hoped that members will approach their own companies with a view to their taking out subscriptions.

Advertisements
Enquiries and copy to:
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ENGINEERIUM

A GOOD YEAR FOR ENGINEERS

It comes around very quickly. Yet another new year is upon us and here is the first issue of the *Journal* in 1983. It contains a variety of subjects ranging from Atrium type buildings (in architectural terms these are essentially light-weight glazed structures), to Sizewell 'B' ————the British Pressurised Water Reactor. If anyone feels that we are not covering sufficient topics perhaps they would care to drop a line to 'Postbag'.

In recent issues we have given considerable space to the subject of PWR's as viewed by the Central Electricity Generating Board and in order to keep the balance right one of the Institute's members, Mr Frank Bean, has submitted an article assessing the UK's power generation and energy requirements. It makes interesting reading, especially in the light of the fact that the inquiry into Sizewell 'B' opened on 11 January this year.

In addition readers may be interested to learn that Mr Patrick Jenkin, Secretary of State for Industry, has announced a new scheme to enable young, well qualified engineers from British Industry to work in Japan.

It looks as though 1983 will be a good year for up and coming engineers.

EDITOR.

BETTER USE OF CONSTRUCTION INDUSTRY RESEARCH

Minster for Housing and Construction, John Stanley, has launched a drive to secure better use of construction industry research.

It is planned that a consultant will be employed to carry out a six month review of the present system of making practical use of research findings. Tenders up to £50 000 will be considered.

The consultant will be expected to recommend steps which will lead to the best application of research results in the quickest time. The starting point will be an investigation of current information systems in terms of speed of production, content and type.

The decision to use a consultant follows a recommendation from the Economic Development Committee for Building whose advice was sought by Michael Heseltine, (then Secretary of State). The EDC considers the paramount priority is to develop information systems which can lead to the maximum application of research results as soon as possible.

The Department's present programme of building and construction research costs around £10m pa.

CIRCUIT-BREAKER FOR 170 kV SYSTEMS

Swedish-based worldwide manufacturer of electrical equipment, ASEA, has introduced a new generation of high-voltage circuit-breakers for the voltage range 123-550 kV, for rated currents up to 4 000 A and with a maximum breaking capacity of 50 kA.

Each circuit-breaker is a hermetically sealed unit, filled with SF_6 at a pressure which ensures full breaking capacity at temperatures down to −40°C. The breaker is of the live-tank, puffer type. This means that, when current interruption is initiated, SF_6 gas is forced very quickly past the break and extinguishes the arc.

The ASEA SF_6 circuit-breaker for 170 kV systems.

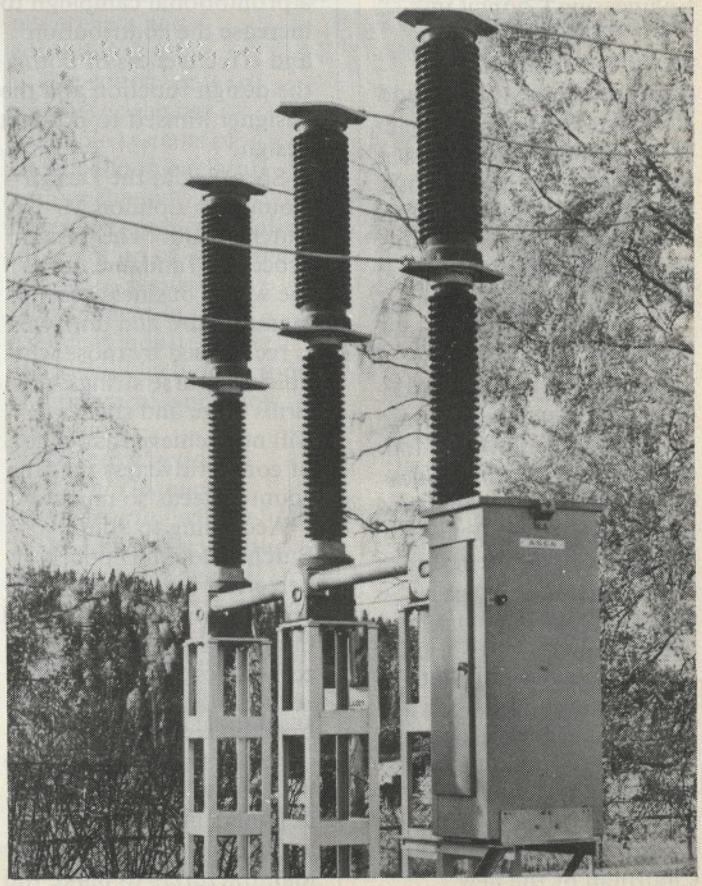
NEW SAFETY MEASURES FOR HELICOPTER OPERATIONS

New measures to improve the safety of helicopter operations, especially in the North Sea area, were announced recently by Iain Sproat, Parliamentary Under Secretary of State at the Department of Trade.

In a written answer to a Parliamentary Question from Albert McQuarrie MP (Aberdeenshire E), Mr Sproat said:

'I have recently had constructive discussion on this important subject with the Chairman of the Civil Aviation Authority, Mr John Dent. The CAA will shortly publish a Helicopter Performance Code of Practice, and it is their intention to seek the incorporation of weight and performance rules for helicopters into legislation when their Code has been proved and refined in actual operation'.

Mr Sproat added that the Authority will shortly be opening an Airworthiness Office at Aberdeen with a resident airworthiness surveyor and there is to be increased supervision of operators by the Flight Operations Inspectorate.



'ENGINEERING MUST BECOME A PASSPORT TO THE BOARDROOM'

Speaking at the recent award presentation ceremony of the Young Engineer for Britain 82 competition, Mr Patrick Jenkin MP, Secretary of State for Industry stressed the significance of the Engineering Council for the engineering, industrial and educational community.

'Young engineers have the world at their feet. We owe it to them to make sure that their education and training allows them to make the maximum contribution to the process of wealth creation', he said. He added that engineering should be every bit as valid a passport to the boardroom as say, law or accountancy and in particular he stressed the need for more design engineers at the top of British industry.

He said, 'These are some of the reasons why the Government set up the Engineering Council in 1982. This Council provides a forum for engineers, industrialists and educationalists. It allows them to work out together how to enhance the contribution of engineers to our economic performance and national life'.

'The Council will inevitably have more influence on the standards of engineering than the traditional professional engineering institutions can ever have alone, good as they are', said Mr Jenkin, 'and the Government is determined that the Council will work on a wider canvas'.

'The Secretary of State for Education, Sir Keith Joseph, and I have already met the Chairman of the Engineering Council, the Chairman of the University Grants Committee and the Chairman of the new National Advisory Body for Polytechnics. The purpose was to discuss how the Engineering Council can work with the UGC and National Advisory Board in determining the content and priorities in the higher education of engineers.'

Mr Jenkin said that the tragedy of Britain's past has been its insistence on drawing artificial distinctions between the value of one profession and another, when none existed.

'Without the wealth which engineering creates, there would be fewer stocks to broke or students to teach'.

DESIGN FOR PROFIT

A new Government initiative, 'Design for Profit', was launched recently by John Butcher, Parliamentary Under Secretary of State for Industry.

The new scheme is aimed at raising the competitiveness of manufacturing industry by a promotional campaign to increase the contribution and effectiveness of both the design function and the designer himself to product design.

Speaking at the Design Council in London Mr Butcher said: 'The design process is fundamental to the whole business of manufacture and until this is recognised by those who hold the purse strings in firms large and small we will not achieve that edge of competitiveness that the country needs so much'.

According to John Butcher design is poorly perceived by up to 60 per cent of British industry and infact a large number of companies have actually reduced their design effort over the last two years.

As Mr Butcher said, 'We have many talented designers in this country and we must encourage our manufacturers to make full use of them. Their worth has been recognised abroad and they are being used by our competitors in the battle for the world's markets for manufactured goods'.

During the coming nine months the Government will, with the Design Council, be taking this message to senior management throughout the UK. The campaign will consist of a nationwide advertising campaign followed by a series of 12 seminars around the country, most of which will be hosted by Brian Redhead, of the BBC radio programme 'Today'.

Small travelling exhibitions will be associated with the seminars and the campaign will end with an eye-catching exhibit and a 'Design for Profit' conference at the Design Engineering Show in Birmingham on 4 October which will be opened by Patrick Jenkin MP, Secretary of State for Industry.

MINISTER STRESSES KEY ROLE OF THE CONSTRUCTION INDUSTRY

Writing in the *Building* magazine's Information Technology supplement published recently, John Stanley, Minister for Housing and Construction, says that the British Construction Industry needs to seize the full range of opportunities presented by information technology.

In his article John Stanley highlights the following seven areas of construction where he has been particularly impressed by the developments and opportunities in information technology:

Computer Aided Structural Analysis and Design;
Computer Aided Drafting;
Financial Evaluation and Controls;
Construction Site Management;
Building Management and Maintenance;
Automated Production Processes;
Communications.

On the Government's involvement in the application of information technology, John Stanley says that Government 'has a role in providing the right economic climate and for promoting the application of new technology through the use of the purchasing power of the public sector. The Department of Industry has been charged with taking the lead in promoting new developments and new applications for IT hardware and software. In total £130m has been made available over the next four years; it is up to the construction industry to ensure that it obtains its share of these resources'.

John Stanley concludes: 'Information technology represents a major challenge to the construction industry. The potential benefits are considerable. Achieving these benefits will mean a determined new approach by the industry. The Government can help through research, publicity, and the sensible and timely application of the new technology in the public sector. But only the industry can seize the full range of new opportunities. It must do so if it is to remain competitive and prosperous in the 1980s and beyond'.

HAS R & D STOOD UP TO THE RECESSION?

What has happened to R & D in this recession? With official R & D statistics only available up to 1978, it has been virtually impossible to tell. So the Confederation of British Industry carried out its own survey.

Two key sectors of British industry have increased their spending on research and development, despite the recession, says the CBI survey. They are electronics (up 14 per cent), and chemicals (up four per cent). But these figures -for the period 1978-81 -show spending has actually slowed down. Over the two previous three-year periods, 1972-75 and 1975-78, electronics research and development spending grew by 25 per cent and chemicals by 11 per cent.

Spending on research and development in the rest of British industry between 1978-81 rose about four per cent for the first year but subsequently remained broadly flat.

The CBI confirms that all this masks divergent movements in different sectors and companies, reflecting sharp cut-backs in research and development in some and growth of expenditure in others.

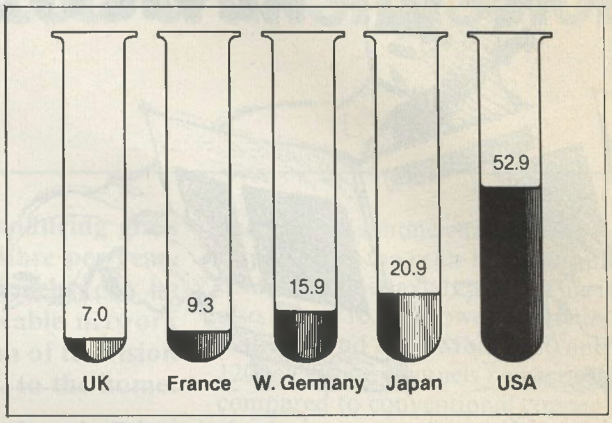
Some sector research and development figures, says the CBI, may not reflect accurately the efforts of firms to modernise products and enhance competitiveness.

For instance, the increasing sophistication of performance monitoring equipment in motor cars, using 'computer in car' electronic dashboards and so on, is likely to result in higher expenditure by the motor manufacturers on bought-out components and parts. The associated research and development spending is likely to be included in the figures for the electronics sector rather than the vehicles sector.

The CBI survey, which covered 64 firms in manufacturing and construction, also suggests a decline in research and development employment during the survey period of about one per cent a year since 1979.

International comparisons for research and development

R & D SPENDING $ BILLION 1978/79

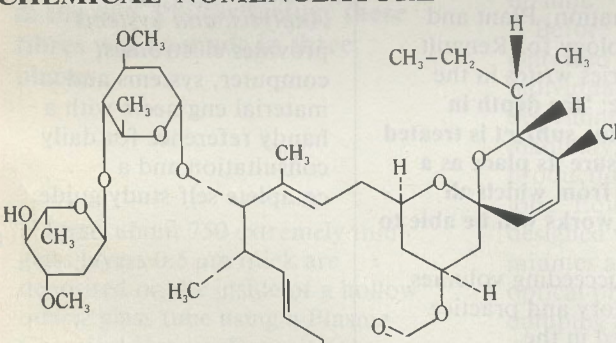


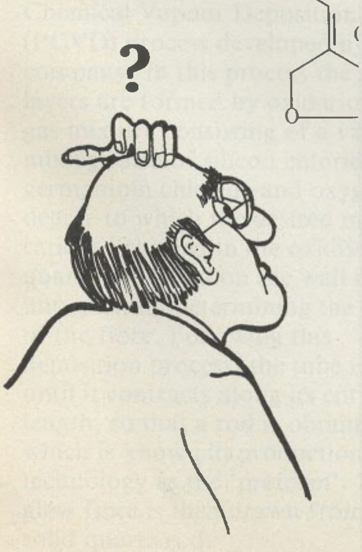
Source: OECD Science Resources Newsletter Summer 1981.

expenditure in 1978-79 showed the United Kingdom in fifth position, behind its major competitors, the USA, Japan, West Germany and France. There is nothing in the CBI survey - progress of which has been followed closely by the Government's Business Statistics Office - to suggest any change since 1978-79 in the United Kingdom's poor relative position vis-a-vis competing countries.

Fresh survey data for 1981 is due to be published in 1983 by both the OECD and the United Kingdom Business Statistics Office.

INTRODUCTORY COURSE TO CHEMICAL NOMENCLATURE





A two-day course on chemical nomenclature is being held in March as part of the Laboratory of the Government Chemist (LGC) effort to promote the use of a logical and unambiguous system of chemical nomenclature based on the rules of the International Union of Pure and Applied Chemistry. The lack of such a system causes problems for world trade, difficulties in interpreting legislation, confusion in purchasing and misunderstandings amongst researchers and educationalists.

The course aims to encourage the use of available systems of chemical nomenclature among chemists of all disciplines, educationalists, information officers and middle to senior management in the chemical industry. The course will include lectures and practical workshop sessions.

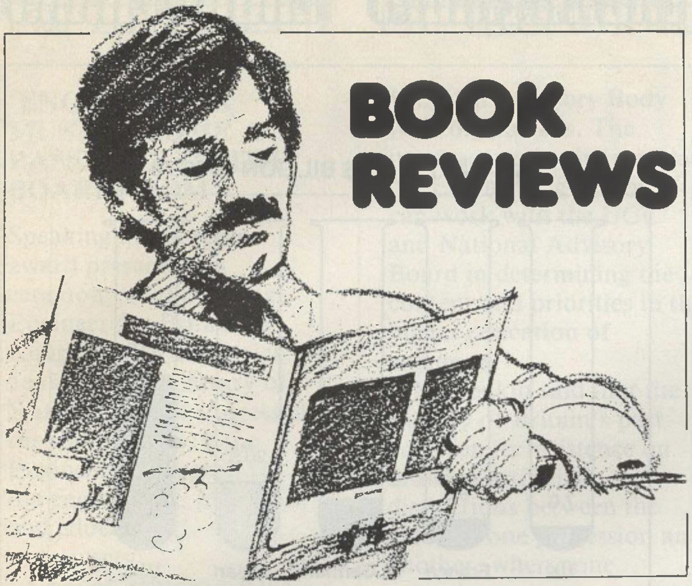
An introduction to Practical Chemical Nomenclature will be held at the Laboratory of the Government Chemist, Cornwall House, London on 23-24 March 1983. The cost of the course is £105 plus VAT and full details and application forms may be obtained from: **The Course Organiser, LGC, Cornwall House, Stamford Street, London SE1 9NQ. Tel: 01-982 7900 ext 588.**

BLISWORTH TUNNEL CONTRACT AWARD

The main contract to repair the lining in the centre section of Blisworth Tunnel, on the Grand Union Canal in Northamptonshire, has been awarded by British Waterways Board to John Mowlem & Company.

Approximately 1 000 yards of brick lining, the centre third of the 1¾ mile tunnel, will be replaced with precast segmental concrete units.

Blisworth Tunnel, on the principal waterway route between London and the Midlands, has been closed to traffic since the Autumn of 1980 and is expected to be re-opened in about two years time.



Register of Computer Programs (in six volumes)
Published by: Central Electricity Generating Board.

This publication from the Central Electricity Generating Board (CEGB) provides summaries of computer programs. Part 1: information and management control systems; Part 2: power system planning and operation; Part 3: plant design and simulation; Part 4: stress analysis; Part 5: nuclear physics and health physics; Part 6: statistical analysis, mathematics and science.

The Safety of the AGR
Edited by: G C Dale and compiled by J M Bowerman
Published by: Central Electricity Generating Board
Price: £10

The Safety of the AGR provides information on the basic principles of safety applied to an Advanced Gas-cooled Reactor power station, including statutory requirements, administrative procedures and technical features. Most of the technical information is based on the design of two AGR stations under construction: Heysham II for the CEGB and Torness for the SSEB.

Analysis and Design of Integrated Electronic Circuits Volumes 1, 2 and 3.
by: Paul M Chirlian
Published by: Harper & Row

The three volumes of *Analysis and Design of Integrated Electronic Circuits* form a concise, up-to-date undergraduate textbook, covering the core topics in electronics. It will provide students with a thorough understanding of most electronic circuits and the procedures used.

The text concentrates on integrated circuits and their applications, although the use of discrete devices such as junction transistors and FETs is also considered. Many numerical examples of both analysis and design are included, and it is intended that these will help students develop a general design philosophy which can be applied to all electronic circuit designs.

Modelling and Control
by: Philippe Coiffet
Published by: Kogan Page
Price: £22.50. Hardback

The majority of robots in use at present are essentially simple machines which, although of great practical use, are limited in application. Their future development will be dependent on the design and production of the 'advanced robot' - a machine possessing a computer 'brain' and capable of sensing and reacting to its environment. Eventually, using artificial intelligence methods, these will form the next generation of robots. Such adaptive robots are the subject of the new 'Robot Technology' series.

Comprising seven volumes plus an index/bibliography, the first volume *MODELLING AND CONTROL* by Philippe Coiffet was published in January. It establishes the basic definitions of concepts used in robotics. Structural and operational models of articulated mechanical systems possessing many degrees of freedom are described in detail. In developing mathematical models, *MODELLING AND CONTROL* provides the basis required both for the successful design of the articulated mechanical system, and for its computer control.

As Jean-François Le Maître, Director of Automation, Plant and Technology for Renault Industries writes in the preface: **'the depth in which the subject is treated will ensure its place as a source from which all future works will be able to draw'.**

In succeeding volumes the theory and practice involved in the development of the advanced robot are covered.

Restricted and General Dimensional Analysis
by: Dr Constantin I Staicu
Published by: Abacus Press
Price: £20.95

This book covers both the conventional dimensional analysis — called by the author 'restricted dimensional analysis' — and the author's new research in this field which leads to 'general dimensional analysis'; this analysis gives the answer to the question whether it is possible to derive values of all quantity exponents from typical monomial physical relation by using only dimensional analysis calculations.

Electronics: Models, Analysis and Systems
by: James G Gottling
Published by: Marcel Dekker Inc.
Price: SFr 170.00

Effective utilisation of models enables engineers to comprehend and predict the performance of electronic circuits. This new volume details both large-signal and small-signal models, placing their applications into perspective. This complete coverage, will enable students to quickly understand the functional behaviour of existing electronic devices and to adapt this skill to future developments in the field.

Electronics: Models, Analysis, and Systems provides electronics, computer, systems and material engineers with a handy reference for daily consultation and a complete self-study guide. □

GLASS FIBRE NETWORK - suitable for integrated transmission of services

At the start of 1983 Philips completed a new factory for producing glass fibres, enabling them to produce about 30 000 km of glass fibre per year. They claim that if the demand increases the production capacity can be doubled without any trouble. As Philips say, a glass fibre cable network opens up attractive possibilities for integrating the transmission of television and radio broadcasts, possibly combined with other services, to the home. Below is a report from Philips on these latest developments.

In recent years optical technology has come to play an important part in communication systems. The reliability and life of the solid-state lasers and glass fibre cables required for these systems have increased as a result of intensive research. Experimental projects have been set up in various countries to test the new systems technology in practice and preparations are being made for the large-scale production of glass fibres. This particularly concerns fibres made of quartz glass for telecommunication purposes and in the new Philips factory these fibres will be made in three phases.

First, about 750 extremely thin glass layers 0.5 μm thick are deposited on the inside of a hollow quartz glass tube using a Plasma Chemical Vapour Deposition (PCVD) process developed by the company. In this process the glass layers are formed by oxidation of a gas mixture consisting of a varying mixing ratio of silicon chloride and germanium chloride and oxygen. The degree to which the desired mixing ratio is achieved in the oxidised quartz deposited on the wall is very important in determining the quality of the fibre. Following this deposition process, the tube is heated until it contracts along its entire length, so that a rod is obtained which is known in production technology as the 'preform'. The glass fibre is then drawn from this solid quartz rod.

Improvement of production process

Radical improvements have now been made to this production process, which takes place in dust-free rooms. Preforms can now be produced from which approximately 7 km of fibre can be drawn. Until recently this was only around 1200 m and the speed of production has also been increased considerably. The larger preforms are made in about the same time as the small preforms used to be.

The drawing speed of the glass fibre used to be about 30 m/min, this has now been increased to 60 m/min.

Before the glass fibres are delivered the optical properties of the individual fibres must be accurately determined which can be done manually, but with the increased production this would take far too long. Equipment has therefore been designed which can determine in six minutes a number of the fibre's optical properties such as the damping and the bandwidth at different wavelengths, the numeric aperture and the length.

Wide-ranging uses for glass fibre

In many countries glass fibres are already being used for linking telephone exchanges and the use of optical systems which work with a longer wavelength such as 1300 nm instead of 850 nm means that the damping of the transmitted light is so low that distances of 20 to 25km can be covered without any intermediate amplifier. There are also advantages from the economic point of view. For larger traffic capacities with the standard bit speeds of 34 and 140 Mbit/s (480 and 1920 telephone channels respectively) the price is favourable compared to coaxial cables. This is also found for the lower capacities with two and eight Mbit/s (30 and 120 telephone channels respectively) compared to conventional copper systems. It is expected that particularly the connections between telephone exchanges will in future be made by glass fibres.

Linked up to the telephone exchanges is a large subscriber network which uses copper cable. There are two important considerations which point to the use of glass fibres in this case as well. Firstly, investments in cables for the telephone network are primarily for the subscriber network. If glass fibre cable becomes cheaper than copper cable then considerable savings can be made in the long term. It seems likely that this reduction in price will come about, along with a sharp increase in consumption. However, there is little point in using glass fibre cable for telephony alone. Its capacity is so large that other services such as broadcasting could also use it.

A subscription on the basis of glass fibre cable could create the possibility for integrated transmission of telephony, broadcasting and other services. Some of this transmission will be in only one direction: examples are a video library, TV education or shopping by TV. As well as this there will also be two-way connections for television meetings or videophony. Using coaxial cables, this kind of network would probably require several cables per subscriber and many amplifiers. Glass makes it much simpler. In the long term it is even probable that one glass fibre per subscriber will be sufficient, as digital technology provides the best facilities for integrating the transmission of the various signals and for integrating the circuits, but it does require a relatively higher capacity in the connections. Glass fibre supplies this higher capacity.

Developments in glass fibre technology

There are currently several developments in glass fibre technology being investigated, which could make an integrated network economically viable. One important development, as already mentioned, is transmission on longer wavelengths such as 1300 nm: this is interesting because of the extremely low fibre damping and hence the very long amplifier distances. 1300 nm provides the subscriber network with additional options in conjunction with another completely new technology: wavelength stacking.

In wavelength or colour stacking, different source signals at different wavelengths are optically combined and transmitted via the same fibre. At the reception end the wavelengths are split and the different information signals become available individually. This can easily be done using one wavelength in the 850 nm range and a second one in the 1300 nm range. These same optical techniques can also be used for duplex traffic (ie traffic in two directions) through the same fibre.

Control of the wavelengths of the optical sources used (semi-conductor lasers) has recently been improved to such an extent that even wavelengths which are close together can be used in the same wavelength range for wavelength stacking. In other words, two accurately determined wavelengths in the 850 nm range (eg 820 and 845 nm) and/or two accurately determined wavelengths in the 1300nm range (eg 1200 and 1300 nm). It is expected that in a few years' time it will be possible to have three or even four wavelengths in each range, bringing the total to six or eight.

Costs of integrated glass fibre suscriber network

In the future, wavelength multiplexing will mean that a single fibre will be sufficient to make up to eight independent channels available between individual subscribers and the exchange. From the point of view of cable costs such a network will be economically feasible. At the moment the subscriber is served by two different networks for telephone and cable television. The amount saved by the installation or replacement of one network, together with the drop in the price of the fibre, will ensure that the cable costs per average subscriber connection will remain comparable to the costs of the present local telephone network.

As far as the equipment costs are concerned, these obviously depend on the facilities which the subscribers may wish to have at their disposal. The maximum amount of equipment will not be installed everywhere. Where the maximum *is* installed, it is estimated that the equipment cost will be the same as the cable costs. This still amounts to a tidy sum altogether, but on the other hand the glass fibre network does provide a lot of extra facilities.

Test machine setup for rapidly determining a number of optical properties of a glass fibre.

INSTITUTE NEWS

BURMAH CASTROL AWARD 1983

The Burmah-Castrol Award presented for the most original and constructive short paper on a set subject, is to be repeated in 1983. The subject this year will be: 'The future use of plastics and ceramics in engineering'.

The prize is now £250 and this will be awarded either in total to a single entrant, or divided in proportions deemed appropriate by the judging panel between two, or a maximum of three, entrants.

In additon, a commemorative silver medal will be presented to the overall winner and certificates of merit to the runners up.

Introduced in 1975, this award is sponsored by the Burmah-Castrol company and administered by the Institute.

The awards will be presented to the winners at the Institute's Annual Dinner in London in November 1983. Full details are available on application, by no later than 1 April 1983, to: The Institute of Engineers and Technicians, Burmah-Castrol Award, Competition Registrar, 100 Grove Vale, London SE22 8DR. The closing date for registrations will be 30 April and completed papers must reach the Institute by 15 July 1983.

BARONESS PLATT AND EQUAL OPPORTUNITIES

The Institute's Vice-President Baroness Platt of Writtle is to be the new Chairman of the Equal Opportunities Commission.

Baroness Platt succeeds the Commission's first chairwoman, Baroness Lockwood. She takes up this job on 1 May.

Baroness Platt's new job will involve a considerable change of life-style as she will have to commute from her home to the Commission's Manchester office two days a week.

Since 1959 she has been involved in local government; is Conservative Vice-Chairman of Essex County Council; and was created a life Peer in 1981. Her career has been both varied and interesting.

After leaving school, Baroness Platt chose Mechanical Sciences rather than maths at Girton College, Cambridge, because it would be more useful in the war effort. She specialized in Aeronautics and in 1943 her first job was a lone woman technical assistant at Hawker Aircraft. There followed a period with British European Airways before she married in 1949.

Crown Agents Appointment

Mr David Wilkinson, a member of the Institute, has been appointed senior training adviser at the Crown Agents.

Previously, Mr Wilkinson was a vocational training consultant with the International Labour Organisation in Thailand, Indonesia and the Solomon Islands.

PRESIDENT MEETS THE SECRETARY

The Institute's President recently had the pleasure of meeting Barry Barber MBE, MA, FCIS, Secretary of the Institute of Chartered Secretaries and Administrators at Burmah House, Swindon.

Our photograph shows Derek C Guy presenting Mr Barber with a silver paper knife given as a reminder of the visit. Mounted on the top of the knife is a 'Chinthe' fashioned in silver gilt.

The 'Chinthe', which is the emblem of The Burmah Oil Company, is the mythical leogryph of Burma. A guardian of the temples, it goes back into Buddhist and Burmese mythology.

'Chindit', the name given to General Wingate's Special Force in Burma in 1943/44, is a vernacular corruption of 'Chinthe'.

Degree presented by John Morgan

Mr Simon Lopez MIE a Graduate of the Amalgamated Technical School, Singapore, is seen here receiving his BSc degree in Civil Engineering of the International University Missouri USA, from John Morgan General Secretary of the Institute of Engineers and Technicians.

Mr Lopez is now working in a New Zealand engineering firm building hospitals for the Singapore Government.

SUBSCRIPTIONS AND NOMINATIONS

Subscriptions for 1983/84 are now due and your co-operation in this matter will be appreciated by all the staff at headquarters.

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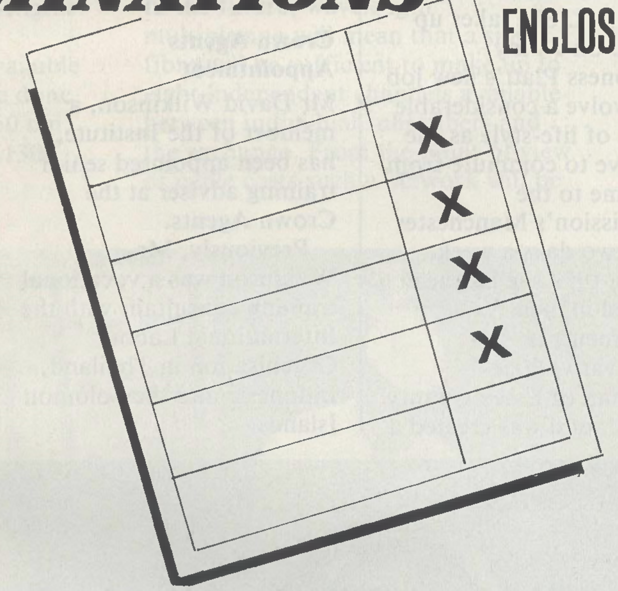
Also, enclosed with this *Journal* you will find a Ballot Sheet to elect the new Council. It is to be used by all Corporate Members. The progress of the Institute relies on the voluntary and dedicated service of the Council and now is therefore the time to show your support and complete the Ballot Paper.

BALLOT SHEET ENCLOSED



BOOKS ARE NEEDED IN KARACHI

Dr S Lloyd, of the Karachi (Pakistan) Section is keen to hear from UK members of the Institute who may wish to donate any number of books to a proposed new library. The Karachi Section is anxious to establish a library for students and full members but simply cannot afford to pay the high price for engineering books. We are sure you will wish to help Dr Lloyd and his colleagues, so why not send him any spare manuals/books you may have.

INTERESTED IN AFFILIATION?

Any Section or member interested in establishing a technical college to teach and prepare students to qualify for Institute Membership Examinations should contact Dr S Lloyd in Karachi. Also any college in any country interested in being affiliated to the Educational Programme of the Institute, may seek advice from the Principal of the Institute's Training College at Karachi.

Contact: Dr S LLOYD PhD MSc(Eng) MIEE FIE College of Engineers and Technicians, C-378, Block '6', Federal 'B' Area, Karachi, Pakistan.

25 year celebration in New Zealand

In April The New Zealand Institue of Mechanical Engineers is 25 years old and in May it is celebrating the occasion. The President of the NZI Mech E has written to extend an invitation to any of our members who may be in New Zealand in early May and wish to join in the fun.

The address is: The New Zealand Institute of Mechanical Engineers, PO Box 1769, Auckland.

Situation Wanted

Associate member seeks a position in Australia. Siow Kim Soon, AMIE, has six years experience in the aircraft industry. He is involved in first line supervision, second line maintenance and servicing and third line overhauling. Knowledge of missiles, jet trainers and transport aircrafts.

Contact: Siow Kim Soon, AMIE; 58 Brockhampton Drive, Singapore 1955, Republic of Singapore.

CONDOLENCES

It is with deep regret that the Institute passes on the news of the recent deaths of three of its members: David Brown of Denny, Stirlingshire; Gordon Maynard of Horsley, Derby; and James Hancock of Westow, Northampton. The Institute extends its condolences to their respective families and friends.

Chelmsford Dinner and Dance

It was a cold night on Saturday 5 February but this in no way spoilt the evening for guests who attended the Chelmsford Section's Dinner Dance held at the Old Chelmsfordians Hall, Chelmsford.

Toastmaster for the evening was the Institute's own General Secretary, John Morgan, and he performed an excellent service through the evening keeping order. Music was provided by "Love Train", a disco organised and run by Phil Libby. Our thanks to him.

Before the dancing got underway there was a toast to the Queen. The toast to the Institute was proposed by Jane Sword, editor of the *Journal*. The reply was given by the President, Derek Guy. The Mayor of Chelmsford proposed the toast to the ladies and the reply was given by Baroness Platt of Writtle.

Everyone agreed it was a marvellous evening.

At the Dinner and Dance were (left to right); Mr Stuart Platt; Mrs McCoy; Derek Guy; Mrs Guy; the Mayor of Chelmsford; the Lady Mayoress; Eric McCoy and Baroness Platt of Writtle

Modern technology gives history a lift

This article first appeared in Offshore Research Focus and is reproduced here with the kind permission of the Department of Energy.

The on-board monitoring and simulation (OMS) system, which was developed by Atkins Research and Development with support from the Department of Energy was recently installed on the Howard Doris floating barge *Tog Mor* (Gaelic for Big Lifter), which successfully raised the Tudor warship *Mary Rose* earlier this year.

Using forecasts of expected wave conditions together with information on ballasting, crane outreach and hook load, the system is able to determine the optimum barge heading and crane configuration for lifting operations.

The system's computer software, originally designed to help reduce downtime of crane barges during lifting operations, has now been further developed to allow for basic static stability and mooring analysis of semi-submersible platforms. Atkins Franlab Marine Ltd, who market the system, has recently joined forces with a Norwegian instrumentation company, Syminex Norge, to provide the Norwegian offshore industry with quick and accurate mooring stability analysis on board vessels, in accordance with requirements laid down by the Norwegian certifying authorities.

The stability of semi-submersible platforms can be seriously affected during operations by changes in ballasting, or by damage to the pontoons or columns. The OMS system allows personnel on board the vessel to obtain predictions of how certain ballast changes will affect static stability and thus the vessel's safety. Alternatively, given information on the stability, draft, heel and trim required by the operator, the system will determine the optimum ballast distribution. Post-damage stability can also be assessed by simulating controlled or free flooding of compartments.

The computer software developed for this analysis uses finite-element techniques to model the vessel in great detail (bulkheads, watertight compartments, thruster tunnels and other structural details can all be modelled to a high degree of accuracy). The full six degrees-of-freedom (surge, sway, heave, roll, pitch and yaw) can be modelled and they are completely coupled so that any change in buoyancy or stability will be accurately reflected on the display: eg a transfer of ballast, or flooding of compartments will be reflected in roll and pitch simultaneously. The effects of mooring lines may also be included.

When designing the OMS system, Atkins felt it was important that it could be operated by personnel on board the vessel who, in the main, are unlikely to be computer experts. The special, simplified console and colour display unit are small enough to be installed on the bridge or in the control room of the vessel. The small computer which drives the system can be left to run unattended in a remote part of the vessel.

In addition to its original application on crane barges and the stability analysis for semi-submersible platforms, the OMS system has applications on pipelaying barges, drilling rigs, support vessels and in deep ocean mining. Both software and hardware can be tailored specifically for each vessel and its operation. Simulation software for pre-planning of offshore operations has recently been sold to Exxon Production Research for use in an installation and hook-up cost forecast model.

Specific enquiries about this project to: Mr D B Mathews, MaTSU, AERE Harwell, Oxon OX11 0RA. Tel: Abingdon 24141 ext 3008.

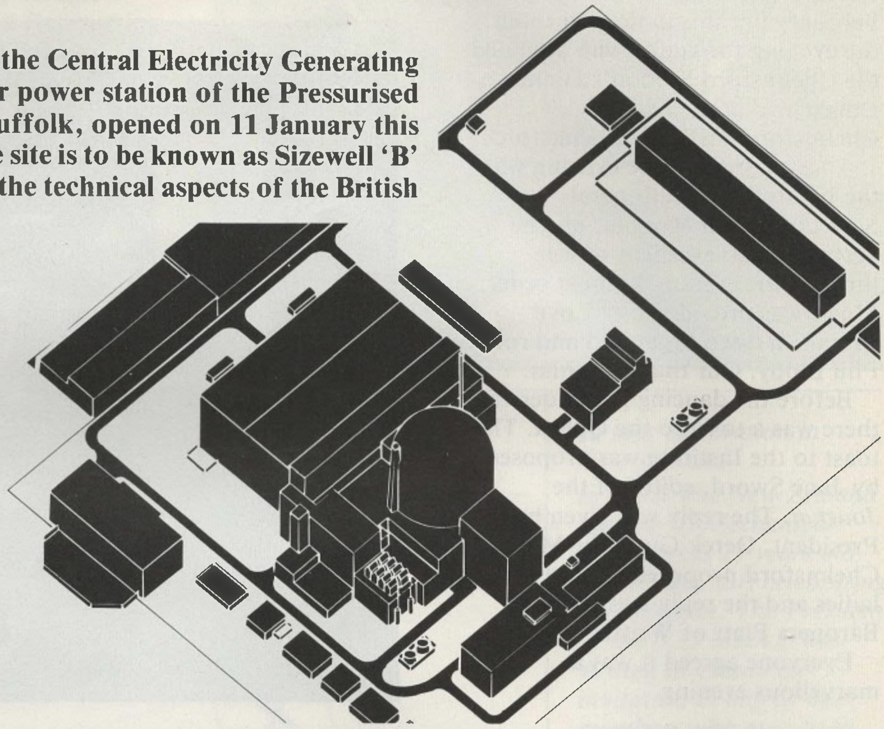
A technical outline of

SIZEWELL 'B'

— the British Pressurised Water Reactor

The main hearing of a public inquiry into the Central Electricity Generating Board's application to construct a nuclear power station of the Pressurised Water Reactor (PWR) type at Sizewell, Suffolk, opened on 11 January this year at The Maltings, Snape, Suffolk. The site is to be known as Sizewell 'B' and below is an outline, by the CEGB, of the technical aspects of the British PWR.

The Central Electricity Generating Board has to build new power stations to replace worn-out plant and to secure electricity supplies for the future. As oil and gas reserves dwindle, the only fuels available for large-scale electricity generation will be coal and nuclear fuel. It is therefore important to continue the development of nuclear energy, which has proved to be a safe, reliable and economic means of generating electricity in Britain for over 25 years.



Until now, Britain has pursued a nuclear energy programme based on Magnox and Advanced Gas-cooled Reactors (AGR) whilst most other industrialised nations have used various designs of water reactors of which the Pressurised Water Reactor (PWR) is predominant.

In order to have the best possible choice open for future power station ordering, the CEGB proposes to build a PWR power station in Britain. This involves the development of a suitable design for a British PWR, the production of a safety case and the holding of a full public inquiry on the project. Having achieved these objectives, they will only then be in a position to evaluate fully the options of coal, AGR or PWR powered stations for future ordering.

The Pressurised Water Reactor system was first developed over a quarter of a century ago in the United States of America as a compact power source for marine propulsion - a role in which it has proved extremely successful, both in the USA and in Britain. The merits of the system were quickly recognised in the USA and adapted to the design of a land-based electricity generating plant.

This resulted in the world's first prototype PWR power station being brought into service at Shippingport in the United States in 1957. The plant was designed by Westinghouse and produced 75 megawatts (MW) of electricity. The first generation of commercial PWRs commenced with the building of Yankee Rowe power station in the USA in 1961. This was a two-loop* plant of 175 MW output and was built by Westinghouse. Since then Westinghouse have developed three and four-looped plants up to 1300 MW in size. The first four-loop plant, Zion, has been operating succesfully since 1973.

Over this period Combustion Engineering and Babcock and Wilcox developed their own designs of PWR in the USA whilst Westinghouse sold licences outside the USA for others to build their designs. These included Kraftwerkunion (Germany), Framatome (France) and Mitsubishi Heavy Industries (Japan).

In addition the USSR has developed its own PWR and has at least five currently operating.

There are more than 100 PWRs now operating throughout the world with many more under construction.

**A 'loop' refers to a combination of steam generator and circulating pump through which the primary coolant water circulates, taking heat from the reactor.*

In the United Kingdom almost all electricity today is generated by thermal power plants where water is turned into steam - in much the same way as boiling water in a kettle - to drive a turbine-generator. The heat needed to create the steam at these plants is produced in one of two ways; either by burning fossil fuel -coal, oil or gas - or by using nuclear fuel, which involves nuclear fission -the splitting of particles of matter, known as atoms - in a nuclear reactor.

In the PWR, nuclear fission of enriched uranium* dioxide fuel is used to produce the heat to generate steam.

In the core of the PWR reactor, the fuel is surrounded by a water 'moderator'. One of the purposes of this water is to slow down or 'moderate' the 'free' neutrons produced in the fission process so that they may be used to promote further fissions to enable a controlled 'chain reaction' to be maintained. Graphite is used for this purpose in Magnox and Advanced Gas-cooled Reactors but in the PWR the water that removes heat from the fuel also acts as the moderator.

The reactor core and its coolant are contained within a very strong steel boundary known as the primary pressure circuit. This comprises a reactor vessel, steam generators, primary coolant pumps and the pipework connecting these items into closed circuits or loops. One of these loops contains the pressuriser.

Despite the heat generated in the core, the water in the primary circuit is always kept from boiling and is therefore maintained in the liquid phase. This is achieved by means of a pressuriser which is a cylindrical tank partly filled with water and connected directly to one of the cooling loops. The water in this tank is heated locally to a temperature higher than that in the reactor vessel, thereby maintaining a pressure in the circuits adequate to prevent the water from boiling. This is why it is called a pressurised water reactor.

The operation of the reactor is controlled by the insertion and withdrawal of special metal control rods which absorb neutrons from the core. These rods are split into two groups: The first is used to control the rate of energy release from the fuel, so that it can be balanced by the energy demand of the turbine-generator, whilst the second, along with the first, is used to shut down the reactor quickly when required by allowing them to fall into the reactor core under gravity.

The heat produced in the reactor is removed by the primary coolant water and transferred to the steam generators where it is used to generate steam in a second completely separate water circuit. The steam produced in this secondary circuit is used to drive the turbines which are coupled to the generators, which in turn produce the electricity. After the turbine has extracted all the available energy from the steam it is condensed and returned to the steam generators.

**Enriched uranium - uranium which has been treated to increase the proportion of uranium atoms which are able to undergo nuclear fission -thus increasing its effectiveness as a fuel.*

The British PWR

There are, worldwide, a number of different reactor designs based on the PWR principle and a larger number of power station designs incorporating these reactors.

Following careful consideration of the alternatives it was decided that the British PWR should be based on the Westinghouse Electric Corporation's four-loop reactor system. Having made this choice it was then necessary to decide the form of the rest of the plant design which would make up the total station.

The National Nuclear Corporation (NNC) were asked to prepare this station design to meet British system and safety requirements and to be suitable for construction at the Sizewell site in Suffolk. This design was to be known as the reference design and would be suitable for use as the basis for the preparation of the safety case required for licensing and for the detailed design of the plant.

NNC engaged the assistance of the Bechtel Corporation in this task. Stemming from this alliance it was agreed that the UK reference design should be based on Bechtel's generic design as embodied in the SNUPPS* plants at Callaway, Missouri and Wolf Creek, Kansas. In order to meet British requirements it was necessary to modify this design in some areas, but these changes were kept to the minimum in order to benefit as much as possible from the use of the proven design.

**SNUPPS-Standardised Nuclear Unit Power Plant Systems*

The Reference Design

The main power block of the station comprises the reactor system housed in the containment building, the reactor auxiliary building, the control and diesel building, the fuel handling and storage building, the waste treatment (radwaste) building and the turbine house.

The reactor/turbine house axis runs north to south in line with the coast, with the turbine house to the south and the fuel handling building to the north. The auxiliary building and fuel building surround rather more than half the circumference of the primary containment. The auxiliary building encloses the penetrations of the primary containment. In the remote event of an accident occurring, these penetrations could be a source of leakage of radioactivity and the auxiliary building is designed with ventilation and filtration systems to deal with such leaks should they occur. This building arrangement closely follows the standard arrangement developed by Bechtel for ease of construction and operation.

Other important buildings on the site are the cooling water pumphouse, the secondary diesel and emergency control building, the 400 kV substation and the administration building and workshops.

The reactor auxiliary, control, fuel handling and radwaste buildings are concrete-framed buildings with some structural steel formations within. The turbine house is concrete and steel-framed. The primary containment, reactor auxiliary and control building, fuel handling building, radwaste building and turbine building all have separate foundations. All buildings have appropriate heating, ventilation and air filtration systems.

The Reactor System

The reactor system of the reference design is based on the standard Westinghouse four-loop pressurised water reactor which produces 3425 MW of heat. The reactor is cooled by water pressurised to 158 bar (2250 psi) which is pumped through four closed primary loops, each of which contains a steam generator and a pump. The steam which is produced in the 'secondary' side of the steam generators is passed to two 600 MW turbine-generators which produce a combined nett output from the power station of 1110 MW.

The Reactor and Pressure Vessel

The reactor pressure vessel is fabricated from carbon steel forgings welded together. The upper head of the vessel is retained by a bolted flange sealed with double metal 'O' rings. The internal surfaces of the vessel are clad with a layer of stainless steel to minimise corrosion.

The forgings and the weld metal quality will be closely controlled to ensure that the necessary strength properties are achieved and the vessel will be subjected to exhaustive inspection and testing, both during and after fabrication, and to continuing inspection during service to ensure that no unacceptable degradation has taken place. Similar standards will be applied to all the primary pressure circuit components.

The Steam Generator

The steam generators are of the Westinghouse 'F' type. These are a recirculation type of steam generator with inverted 'U' tubes carrying the primary circuit water. The steam is generated in the secondary water circuit in the shell side of the steam generator. The top of the steam generator includes swirl vane separators and dryers so that steam at 0.25 per cent wetness and a pressure of 69 bar a is produced.

The 'F' type steam generator is a development of earlier versions and has been designed to overcome corrosion problems that have been experienced on some plants.

The Reactor Coolant Pump

The four reactor coolant pumps are of the Westinghouse 100D type driven by 6 MW induction motors. These are vertical single-stage centrifugal pumps with three-stage pressure seals. The motors are mounted above the pumps and have flywheels incorporated to assist the transfer from forced to natural circulation in the event of a total loss of electrical power.

The Pressuriser

Connected to one of the primary circuit loops is a pressuriser vessel which is operated partly filled with water and partly with steam, with electrical heaters and spray cooling to control the pressure in the system. The pressuriser vessel also carries the primary circuit pressure relief valves.

The Fuel Assembly

The fuel consisting of slightly enriched uranium dioxide pellets, is contained in 193 fuel assemblies each of which extend the height of the reactor core. The fuel assemblies each have 264 fuel rods arranged in a 17×17 square lattice array. Each rod is encased in a tube of zircalloy, an alloy of zirconium. The fuel assemblies are supported in the reactor pressure vessel by massive stainless steel internal structures which direct the coolant flow up through the fuel. Reactivity, or power output, is controlled both by 53 clusters of absorber rods, which slide in selected fuel assemblies, and by variable boration of the reactor coolant water using soluble boric acid. The dissolved boron absorbs the excess unwanted neutrons thus controlling the reaction rate.

Safety Protection Systems

There are several systems included which are designed to ensure the safety of the reactor under fault conditions and prevent unacceptable releases to the environment.

1. The auxiliary feed system to the steam generators, which is used in the event of loss of main feed water to remove decay heat from the reactor under pressurised conditions, comprises two electrically driven pumps and two steam-turbine driven pumps, each on their own being capable of providing an adequate flow.

2. The emergency core cooling system (ECCS) which provides cooling to the fuel in the event of a breach in the primary coolant circuit comprises four accumulators, one coupled to each primary coolant loop, and each consisting of a vessel half filled with borated water and half filled with nitrogen at 45 bar (650 psi). If the circuit pressure should fall as a result of a loss of coolant accident (LOCA) this water is injected into the reactor. In addition there are four high-head safety pressure injection (HHSI) pumps and two low-head safety injection (LHSI) pumps (these also provide the residual heat removal system (RHRS) duty).

Operation of two of the accumulators, one HHSI pumps and a LHSI pump to intact loops is sufficient to provide adequate cooling in the event of the most severe loss of coolant accident. Water for this injection into the primary circuit is initially drawn from the refuelling water tank and as this tank is emptied, it is drawn from the containment sumps, where water lost from a breach in the reactor collects.

3. The containment spray system quenches the steam resulting from a loss of coolant accident and thus prevents the containment design pressure being exceeded. The two pumps provide for the spray duty can also be utilised to provide RHRS duty, if required, for long-term heat removal. Four containment cooling heat exchangers are also provided to remove heat from the containment during normal and fault conditions.

4. In addition an emergency boration system and a reserve ultimate heat sink are provided to cater for other fault conditions.

The Containment Building

The reactor and its coolant loops are contained within a containment building which is designed to control radioactivity release during normal operation and to prevent unacceptable releases of radioactive products to the environment in the event of a serious fault. The containment consists of a cylindrical steel-lined prestressed concrete envelope 1.3 metres thick. The containment building has an internal diameter of 45.7m (150 ft) and a hemispherical top dome. The containment diameter is slightly larger than on the standard SNUPPS design in order to accommodate the larger 50 Hz coolant pumps and to provide improved shielding and access and laydown area for in-service inspection and maintenance.

As an added safeguard the primary containment is almost totally enclosed from ground level upwards within a secondary containment boundary which consists of the boundaries of the fuel and auxiliary buildings which has been extended by a steel-framed enclosure building with a hemispherical dome and sealed cladding.

Auxiliary Plant Building

The Auxiliary Plant Building houses auxiliary systems provided to support the reactor in its operation. Of these the main one is the chemical and volume control system which controls the boron content and purity of the primary coolant. This system continuously takes water from the primary circuit and after cleaning it up and adjusting its boron content, returns it to the system, mainly via the reactor coolant pump seals. This is done by duplicate main charging pumps, or by duplicate emergency charging pumps which have been included to ensure high reliability of this function.

Other auxiliary systems include the residual heat removal systems (RHRS) to remove decay heat from the reactor when it is depressurised for example when it is shut down for refuelling, and the component cooling water system which is used to transfer heat from the RHR system, and other reactor auxiliary plant, to the sea water system.

The basement of this building also houses the four high head safety injection system pumps.

Control Building

The control building located adjacent to the reactor auxiliary building contains the main control room, the associated data processing equipment and the reactor protection system central equipment. The main control room is provided with ventilation arrangements which safeguard it against any ingress of radioactivity contaminated or toxic air. In the event of a fire or accident occurring in the main control room which necessitates evacuation, an emergency control room, which includes an auxiliary shutdown panel, is provided at a safe distance.

The reactor protection system is provided to trip the reactor and to initiate a sequenced operation of the necessary safety systems following an incident. This is based on the Westinghouse Integrated Protection system. This Primary Protection System is backed up by a secondary protection system which provides an additional line of defence for those duties.

Refuelling

Approximately once a year the reactor is shut down for refuelling. At that time, the reactor vessel head is removed and one third of the fuel assemblies are removed underwater and taken from the containment, still underwater, to a water filled storage pond in the adjacent fuel handling building. The fuel remains in this building until its radioactivity has decayed to a level at which it can be transported. The remaining fuel assemblies are re-arranged within the core and the new fuel assemblies are inserted. The refuelling mechanical equipment is generally of standard Westinghouse design.

Waste Treatment

Waste processing equipment is provided to treat, as necessary, all liquid, gaseous or solid wastes produced as a result of reactor operations. Most of this equipment is housed in the radwaste building. This building is separate from the main power block above ground, but is connected by an underground tunnel.

Turbine House

The turbines, main generators, condensers, sea water cooling, feed heating and feed pump systems are all based on well established design practice. Each main turbine has one double flow high pressure cylinder, three double flow low pressure cylinders with traverse under-slung double tube plate condensers and twin moisture separators. There are six electrically driven variable speed main feed pumps each of 25 per cent reactor capacity, arranged three per set. There is a high level deaerator associated with each main turbine.

Four main steam pipes, provided with relief valves, take saturated steam from the steam generators to the turbines. To protect the steam generators from corrosion the condensate purification and treatment is very closely controlled and the design effectively precludes contamination by sea water.

The main electrical system is based on the provision of two generator transformers, two unit transformers and two station transformers. The principal a.c. distribution voltages are 11 kV and 415V. The main generators operate at 23.5 kV which is raised by associated generator transformers to 400 kV. Power is then transmitted via the 400 kV substation to the 400 kV national grid system.

Supplies to the station transformers, and through these the essential electrical system, are provided from the 132 kV substation. The essential electrical distribution system is based on four separate 'trains' of supply at voltages of 3.3 kV and 415V.

Four diesel generators are provided in case of the loss of electrical supplies from the grid or the main generators, only one of which is necessary to carry the essential loads.

Facts and Figures

General

Type of reactor:
  Pressurised Water Reactor
Number of reactors: 1
Number of turbine generators: 2

Station output

Rated thermal power of reactor:
  3411 MW
Gross electrical output: 1182 MW
Station internal power consumption:
  72 MW
Net electrical output: 1110 MW

Fuel

Fuel pellets
  Material: sintered UO_2
  Density: 95%
  Enrichment (feed fuel)%: 3.2
Fuel can
  Material: Zircaloy 4
  Outside dia: 9.5mm
  Thickness: 0.57mm
Fuel assemblies
  Basic rod array: 17 × 17
  Fuel rods per assembly: 264
  Rod pitch: 12.6mm
  Number of guide tubes
    for absorber: 24
    for instrumentation: 1
  Number of grids: 8

Reactor core

Number of fuel assemblies: 193
Active height: 3.66m
Equivalent diameter: 3.37
Mass of UO_2 in core: 101 te
Control rod absorber material:
  Ag-In-Cd
Number of assemblies: 53
Absorber rods per assembly: 24

Fuel rod heat rating:
  average: 17.8 kW/m
  maximum: 41.3 kW/m
Moderator:
  reactor coolant water (H_2O)

Coolant

Operating conditions
  pressure at vessel inlet: 158.3 bar a
  pressure at vessel outlet:
    155.1 bar a
  temperature: vessel inlet: 293.4°C
  temperature: vessel outlet: 324.9°C
  flowrate: 18,740 kg/s
  volume of water in primary
    circuit: 334.5m³

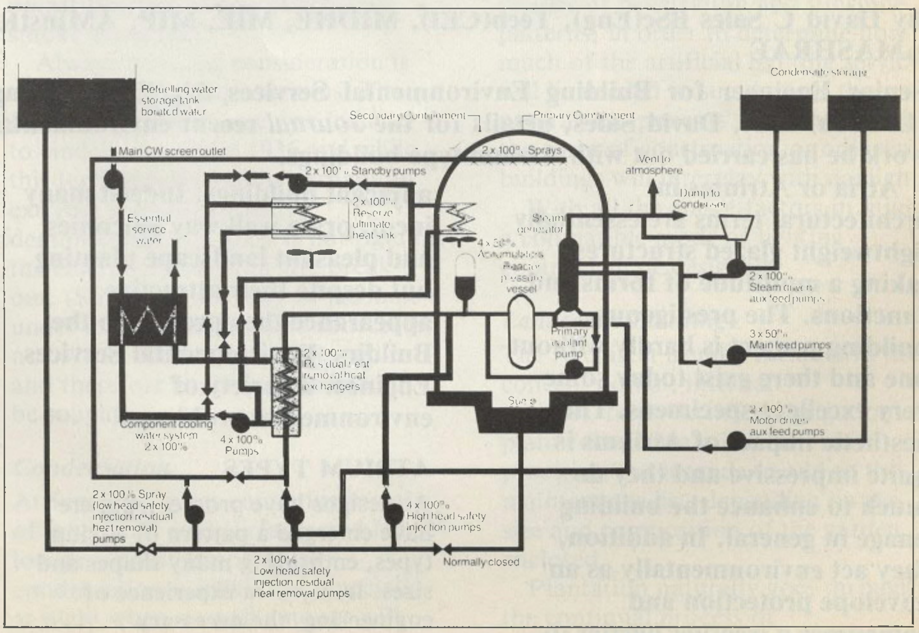
Reactor vessel

Overall height: 13.55 m
Inside diameter: 4.39 m
Total thickness (opposite the core):
  215mm
Material: carbon steel
Internal cladding: stainless steel
Cladding thickness: 3mm
Inlet nozzle inside diameter: 698 mm
Outlet nozzle inside diameter:
  736 mm
Dry weight: 385 te

Steam generator

Number: 4
Overall height: 20.6 m
Upper part diameter: 4.47 m
Lower part diameter: 3.44 m
Materials
  secondary side shell: carbon steel
  tubes: Inconel 600
  primary side shell:
    carbon steel clad with
    stainless steel
Tubesheet thickness: 534 mm
U-tubes: number: 5626
  outside diameter: 22.22 mm
  thickness: 1.02 mm
  total heat transfer area:
    5110 m_2
Dry weight: 325 te

Emergency cooling systems



Reactor coolant side
inlet temperature: 324.9°C
outlet temperature: 293.3°C
flowrate: 4685 kg/S
Secondary steam side
feedwater temperature: 227°C
steam temperature: 285°C
steam pressure: 69 bar a
steam flowrate: 477 kg/s
steam condition: 0.25% wetness

Reactor coolant pump
Number: 4
Speed: 1485 rpm
Developed head: 87.8 m
Flowrate: 6.33 m^3/sec
Pump bowl material: stainless steel
Motor rating: 6 MW
Dry weight: 94.35 te

Pressuriser
Number: 1
Overall height: 16.1 m
Inside diameter: 2.12 m
Volumes:
total: 51.0 m^3
water (at full power): 30.6 m^3
Heaters:
number: 78
total heat power: 1800 kW
Relief valves:
number: 2
opening pressure: 161 bar a
unit capacity: 26.5 kg/s
Safety valves:
number: 3
opening pressure: 172.4 bar a
unit capacity: 52.9 kg/s
Pressuriser relief tank:
total volume: 51.0 m^3
normal liquid volume: 38.2 m^3
design pressure: 7.7 bar a

Reactor coolant pipes
Inside diameters:
hot leg: 737 mm
intermediate leg: 787 mm
cold leg: 699 mm
pressuriser surge line: 292 mm
material: stainless steel

Accumulators:
Number: 4×50%
Total volume per accumulator: 57.3 m^3
Water volume per accumulator: 40.4 m^3
Nitrogen overpressure: 44.8 bar g
Material: stainless steel

Auxiliary and safeguard system pumps

CVCS charging pumps
Number: 2×100%
Design flow: 34 m^3/h
Design head: 1770 m

Residual heat removal pumps/low head safety injection pumps
Number: 2×100%
Design flow: 863 m^3/h
Design head: 134 m

Spray pumps
Number: 2×100%
Design flow: 863 m^3/h
Design head: 134 m

Safety injection pumps
Number: 4×100%
Design flow: 182 m^3/h
Design head: 774 m
Maximum delivery head: 1290 m (125 bar)

Component cooling water pumps
Number: 4×100%
Design flow: 2560 m^3/h
Design head: 60 m

Auxiliary feedwater pumps
Number-motor driven: 2×100%
Number-turbine driven: 2×100%
Design flow: 131 m^3/h
Design head: 890 m

Turbine conditions
Speed: 3000 rpm
Pressure at inlet: 66.6 bar a
Temperature at inlet: 282°C
Flowrate at inlet: 955 kg/s

Condensate extraction pumps
Number per turbine: 2×100%

Main feedwater pumps
Number per turbine: 3×50%
Drive: induction motor
Flowrate per pump: 0.5 m^3/s
Developed head: 973 m
Speed: variable

Circulating water pumps
Number per turbine generator: 2×50%
Flowrate per pump: 13 m^3/s
Developed head: 12 m
Power of the motor: 1545 kW

Containment
Primary
Type: pre-stressed concrete with carbon steel liner
inside diameter: 45.7 m
inside height: 64 m
wall thickness: 1.3 m
liner thickness: 6 mm
design pressure: 3.45 bar g
Secondary
Type: steel fabrication

Refuelling water storage tank
Water storage volume: 1740 m^3
Boric acid concentration: 2000 ppm
Material: stainless steel

ENVIRONMENTAL APPRAISAL OF ATRIA

By David C Sales Tech(CEI), MIDHE, MIE, MIP, AMInstR, AMASHRAE

Senior Engineer for Building Environmental Services, Air Conditioning (London) Ltd., David Sales, details for the *Journal* recent environmental work he has carried out with Atrium type buildings.

Atria or Atriums in architectural terms are essentially lightweight glazed structures, taking a multitude of forms and functions. The prestigeous building project is hardly without one and there exist today some very excellent specimens. The aesthetic impact of Atriums is quite impressive and they do much to enhance the building image in general. In addition, they act environmentally as an envelope protection and sometimes a weather barrier to adjacent buildings. Indeed many incorporate walkway balconies and pleasant landscape planting, but despite their attractive appearance they present to the Building Environmental Services Engineer a variety of environmental problems.

ATRIUM TYPES

As designs have progressed there have emerged a pattern of Atrium types, embracing many shapes and sizes. In my own experience of engineering, the necessary environmental systems required by Atriums, basically three types of architectural designs, have been encountered. Construction materials may vary from transparent membranes with tension cables and supporting mast, to vertical or inclined facades, glazed conventionally to specification, sometimes with curvatures and the like surfaces.

Below are some Atrium types and examples of the application:

- Integral Building-full environmental control.
- Covered External-no direct heating or artificial cooling.
- Exposed Internal-heating without artificial cooling.

Integral Building

Some building projects posses an Atrium as a fully functional annexe and this type can be designed to fulfil numerous uses and client/tenant requirements. The

Coutts Bank in London and certain hotel Atriums are examples.

One particular design I was engaged on in 1980, proposed to include dining and catering facilities with provisions for leisure recreation. The remaining blocks linking the Atrium were purely residential in nature, in fact private hostel style. A focal point was created by the presence of the Atrium itself and also greatly enhanced the public interest in the vicinity, by acting as an unusual environmental attraction.

Covered External

This type of Atrium is simply a transparent cover, usually over areas of high activity such as a terminus, station concourse or traditional arcade. The Old Covent Garden Market Hall is a good example and many of the older railway stations resemble Atriums of this type.

Exposed Internal

Precincts of circulatory movement for people invariably accompany this category. They are occasionally found between building blocks, at entrance halls and receptions. Particular emphasis on this type of Atrium is the facility to provide a buffer zone for people in transition from the outside to the inside of a building premises. Temperature extremes can be more noticeable otherwise. Shopping malls, cathedrals and museum halls typify this kind of Atrium design.

ENVIRONMENTAL FACTORS

In order to begin evaluating the degree of environmental comfort to be achieved in Atrium spaces, the basic factors governing this and their resultant implications must be studied in detail.

Thermal performance, ventilation, fire/smoke control, condensation, acoustics, light and landscape planting (internal) are the main design considerations establishing an adequate level of environmental control.

Thermal Performance

Heat accumulating within the Atrium space due to the action of Winter and Summer sunshine, is an identical process experienced in greenhouses known as the 'Jolais' effect. The massive expanses of glass procedure extreme mean radiant surface temperatures internally: low in Wintertime and high in Summertime. The thermal effect will be mostly felt during the hours of darkness when the night sky radiant temperature is well below that of the inner surfaces. This occasion is the probable time for dew-point surface temperature to decline and condensation to form as a result.

It is therefore important to note here that with such radiant temperature extremes, difficulties in designing for a totally comfortable environment are often encountered.

With regard to the tall and slim Atriums, which are quite common, these create temperature stratification by the natural 'stack effect' and an allowance for height must be made when contemplating thermal comfort systems.

Solar transmission and blockage can be purposely controlled by the careful integration of areas of steelwork, formwork and glazing into the Atrium facades. Natural daylight factors for the various internal zones need to be given thought in context with the fenestration aspects.

Ventilation

Air movement within Atrium spaces is essential not only for occupants but also for positive fire/smoke control and any plant transpiration. Depending on the pattern of useage and densities, the ventilation can be effected by either natural or mechanical means. From the safety point of view for fire/smoke control, it is desirable, and sometimes mandatory, to provide an automatic system of roof smoke release vents, augmented by natural louvre apertures at high and low level in the external facades. The local Fire Officer will almost certainly dictate on the provisions for natural ventilation automation.

Commenting again on tall Atriums, coupled with natural vent points they act as potentially good smoke extractors.

Always a crucial consideration is the fire resistance of Atriums. The famous Crystal Palace was reduced to cinders rapidly in 1936 and while this terrible holocaust is perhaps an extreme example it clearly demonstrates that glass is not rigid in the emergency event of fire break-out. (Structural stability of Atriums under intense temperature sources is not within the scope of this article and therefore expert advice should be sought).

Condensation

Atrium enclosures consisting mainly of inherently cold surfaces and hence low dew-point temperatures, condensation is inevitable especially at night when a small amount will occur. Minute quantities of condensation are not really harmful to the structure and can be tolerated. However, drip channels sited at low level around the Atrium periphery would safely collect any moisture droplets and pass them to drain or directed to internal planters, if incorporated, as extra irrigation.

Acoustics

Hard, impermeable surfaces such as glass and marble, are low absorptive to sound waves which in turn would typically reflect a long reverberation time (that is the time taken for a constant sound source to decay by 60dB). Sound sources originating within the Atrium spaces are thus likely to result in multiple reflections thereby generating echoes. Consideration of internal surface finishes is important to the architect and interior designer, at initial concept stage so that allowances for acoustic linings can be assessed and provided for if thought advantageous to the integrity.

Conversational speech and footsteps are two potential sources of sound generation. Plant foliage on the other hand would offer some degree of absorption.

Light

Provisions for both natural and artificial lighting in Atriums influence standards of decoration, directional character and utility. Overall, the artificial lighting system should be invariably special, and specifically deployed to give the Atrium interest, colour texture and generally enhance the aesthetic impact.

Natural light penetration is unrestricted in highly transparent Atriums but the lighting engineer will obviously need to consider the quality of penetration and sunshine patterns, in order to determine how much of the artificial lighting service will be needed to supplement the natural components. Shading due to the form of construction or adjacent buildings will interplay with daylight.

With all the above factors in mind, a compatible mode of lighting control can be designed.

Landscape Planting

The Architect usually includes in the concept design, internal planters/trees. Artificial irrigation of plant foliage is a minor service provision but it tends to add to the maintenance list, depending on the size and composition of the garden enclosed.

Plantation naturally goes through the continual process of transpiration, which increases the moisture content levels of the ambient air. The rate of transpiration into the space is governed by atmospheric conditions of humidity, temperature and air movement. High humidity percentages will reduce the rate of evaporation and vice versa for a dry condition. Also transpiration will increase with the elevation in air temperature. When the leaf becomes warm, moisture emission occurs more rapidly. Direct sunlight without a warm atmosphere will have this effect (Winter internal condition) since the leaf absorbs radiant energy and its temperature rises.

In moving air currents, the water vapour given off will be swept away from the leaf as fast as it diffuses out, so that transpiration continues rapidly. It can be confidently deduced from this criteria that with plenty of ventilation air, induced by opening up the Atrium to atmosphere, then plant transpiration will be kept within acceptable limits and therefore have no adverse effects.

I have emphasised the biological mechanisms of plantation because more often than not this aspect is not completely understood and if condoned, can significantly add to the diurnal humidity levels.

ENVIRONMENTAL SYSTEMS

Atriums in general only require basic service, as most are intermittent or transient in nature. Background heating in conjunction with ventilation is sufficient in the majority of cases and in Atriums where tighter environmental control is required the comfort systems are more sophisticated, and this trend will continue to grow as Atriums are designed to accomodate people for longer and extended periods of time.

In Winter the naturally cold glass will cause the layers of room air next to the inner surfaces to cascade slowly downwards, giving rise to uncomfortable draughts. Counteractive measures are required to nullify the air currents set up and convective heating systems strategically positioned at low level around the perimeter offset the cold convection. Conversely, radiant heating systems can often provide the necessary energy input to produce comfortable air temperatures in strict relation to mean radiant values of the internal surfaces. Transient zones need only background heating to about 15°C air temperature and popularly take the form as high level radiant panels or underfloor heating coils integrated into the floor structural slabs (marble finish on top).

Those Atriums which call for full environmental control, the first thought of the Building Services Engineer is to investigate the feasibility of utilising the abundant glazing areas as a solar collector (well it was mine anyway). Using my previous project in 1980 as an example, the South facing facades were studied for possible integration of an air solar collector with a second option for a water based system. Air systems similar in principle to those of Sodergren (1973), are termed as hybrid passive/active types where the solar irradiation incident on the building fabric is admitted (passive), harnessed and optimised by circulating direct to the space with fans/pumps (active) or passing to energy storage via building mass to delay and alternate heat flow. Using airways in walls and floors the useable solar energy can by synchronised to diffuse out most efficiently when the Atrium is occupied.

During the Summer, heat can be reclaimed from the air streams for topping up the domestic hot water storage. At nightime the air system can be used to circulate cool air through the building structure thereby pulling down the heat stored in the masses during the day.

Solar collection systems adopting water as the primary transfer medium also work on the passive/active principle and are very beneficial when large quantities of domestic hot water are demanded such as dining/catering premises with kitchens.

Feasibility studies have indicated that air based systems as compared to water type, require larger plant (fluid moving), more complex distribution networks which need maintenance, and may possibly introduce unwelcome noise and demand space. However, the system would have the ability to provide an accurate level of environmental control.

System efficiencies, initial capital investment, pay-back periods and related economics must be precisely analysed to determine the viability of a system for a particular Atrium building.

With regard to Atriums of high activity the space temperatures can be, to a certian extent, limited by inducing rapid air change rates. Odours, moisture and heat must be essentially dissipated. Changing the Atrium volume quickly can eliminate the need for artificial cooling, providing the occupants are entirely sedentary. An assessment of the Atrium summertime temperature can be made to evaluate the requirement to include in the design brief an air-conditioning system.

Summary

Atriums do lend themselves to the design philosophy that buildings can act as energy systems. Accomplishment of this is only by conscious architecture and engineering.

Atria amongst the architectural profession are becoming increasingly popular. Environmental implications of these highly thermodynamic structures are revealing themselves more as the Building Environmental Services Engineer learns about Atrium behaviour.

Each individual Atrium needs to be assessed on its own merits and emanating from my own past experiences in working with them I have taken note of one particular characteristic. The majority of the problems posed are invariably overcome by adequate ventilation, whether it be mechanical or natural in form.

Early liaison with the job Architect is essential to plan into the design openings in the structure to admit the required rates of air flow.

Finally, Atriums have an active future in Building Environmental Engineering but as this article portrays, they must be considered as a total entity with the buildings that they serve.

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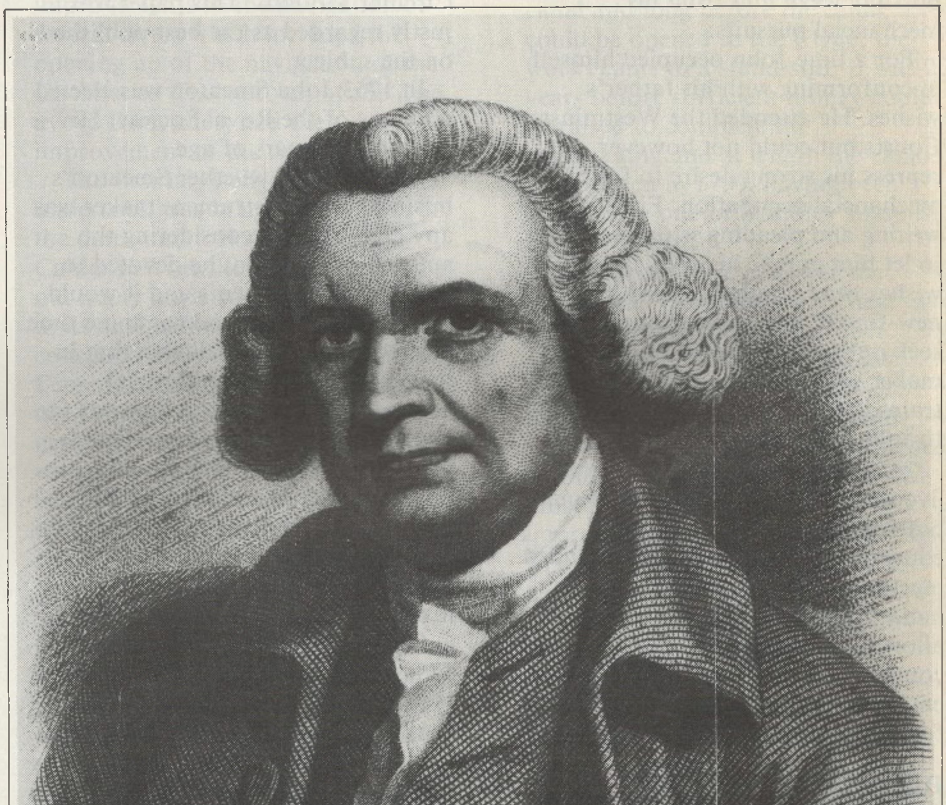
Engineering Masters

John Smeaton
Professional Engineer
& Consultant
(1724-1792)

By J D Wilkins
TEng(CEI) AMIRTE MIE

The significance of John Smeaton in the history of engineering has in the past been insufficiently emphasised; he was a man of good education and was elected a Fellow of the Royal Society when only 29. Unlike many of the early engineers, Smeaton did not have to force his way up through the obstructions of poverty and the lack of education but from his earliest years had the advantage of the best training and education then available.

Although best known for his Eddystone lighthouse he was responsible for many other massive achievements and was the first man in Britain to style himself as a civil engineer. It was in fact due to his influence that the Society of Civil Engineers, the oldest body of its kind in the world, came into being.



BOYHOOD & TRAINING

Smeaton was born at Austhorpe Lodge in the village of Whitkirk near Leeds on 8 June 1724 and was the eldest son of William Smeaton, a prosperous attorney. From a very early age young John showed great interest in using tools and making models of pumps and windmills. When any carpenters or masons were employed on maintenance work around the Lodge John's great pleasure was to stand about the workmen and plague them with questions. His interest in such matters was in fact so great that his father gave him the use of a building in the grounds and supplied him with a suitable set of tools for which he craved. From these tools he made others and by the time he was 16 his workshop was greatly extended and well equipped.

At the age 16 John left school and was employed in his father's office, copying legal documents and receiving the necessary preliminary training to fit him to follow his father's profession, but he showed very little interest in law and although he travelled daily to the office and worked hard at his desk he showed greater enthusiasm in returning home at the end of the day to his workshop.

In 1742 John Holmes (who was to become a lifelong friend of John Smeaton) and who was already being trained in mechanics and was later to become a well-known watchmaker and instrument maker in the Strand, London, spent a month at Austhorpe Lodge and wrote of Smeaton. John was then not quite 18 years old. He forged his iron and steel and melted his metals. He had tools of every sort for working in wood, ivory, and metals. He had made a lathe, by which he cut a perpetual screw in brass, - a thing little known at that time.

Towards the end of 1742 John was sent, by his father, to London to attend the Courts in Westminster Hall. The intention was not only to give him the best legal education which was in his power to provide, but with the hope that he might possibly wean him from his mechancial pursuits.

For a time John occupied himself in conforming with his father's wishes. He attended the Westminster Courts but could not however repress his strong desire to follow a mechancial occupation. Finally, after writing and pleading with this father to let him pursue his own career his wishes were granted and with his new-found liberty he was quick to seek out for himself an instrument maker who could give him the training for the business he intended to follow.

John Smeaton did not however live the life of the average workman but frequented the society of educated men and regularly attended meetings of the Royal Society. He had in fact been given a generous allowance from his father which was continued for the rest of his life and enabled him to start his career on a fortunate basis.

HIS OWN BUSINESS & THE ROYAL SOCIETY

In 1750 he commenced business on his own account as a mathematical instrument maker and in the same year when he was just 26 he read a paper before the Royal Society, describing his own and Dr Gowen Knight's improvements in the marine compass.

In the following year his communication to the Royal Society concerned a special log he had tested on the sloop of war - Fortune. His attention at this time would appear to have been confined chiefly to the improvment of mathematical instruments used for the purposes of navigation or astronomical observation. In 1752, however, he enlarged the range of his experiments for he was reading a paper before the Royal Society on improvements to air pumps. This was in April of that year, and in the following June he read yet another paper on the improvement in ships-tackle, in the construction of pulleys, by which one man might raise great weights. Again in November he read his third paper describing M De Moura's experiments on Savery's steam-engine.

Between the years 1752 and 1753 Smeaton began a series of experiments on which his paper was read before the Society. This won him the Copley Gold Medal five years later in 1759 and it was entitled, 'An Experiment Inquiry Concerning the Natural Powers of Water and Wind to Turn Mills and Other Machines Depending on Circular Motion'. This paper was justly regarded as the best published on the subject.

In 1753 John Smeaton was elected a Fellow of the Royal Society. He was only 29 years of age.

It is doubtful whether Smeaton's business as an instrument maker was any great success considering the amount of time that he devoted to study and experiments and it would seem likely that he had for some time past come to the conclusion that in the course of British industrial advance the field before him was far wider than that of mathematical instrument maker. This would doubtless have accounted for his decision to turn his attention to engineering and various other branches of study in which he was involved.

On a visit ot the Low Countries in 1754 - to Rotterdam, Delft, the Hague and Amsterdam and as far north as Helder, he learnt much and made many notes which were to prove invaluable in the canal-building and harbour improvements he was to undertake in later years.

Shortly after returning to England in 1755 an opportunity arose which gave Smeaton the opportunity to exercise his skills in civil engineering.

THE EDDYSTONE LIGHTHOUSE

The Eddystone Reef lies 14 miles from Plymouth and it lays directly in the path of Channel shipping. The first lighthouse to be built on it was a wooden structure and its builder, Henry Winstanley, died on it seven years after its construction when it was swept away by a gale. The building was started in 1696, and completed in four years. In November 1703, Winstanley went to the lighthouse to supervise some repairs which had become necessary when, on the night of the 26th, a storm broke out and the lighthouse with its builder, and its keepers, was swept away.

The second lighthouse on the Reef was to be built by a London mercer, John Rudyerd, the son of a Cornish labourer, and although his designs were good in that he chose a cone shape which would offer the best possible resistance to the force of the winds and sea, its failure was to lie in that like Winstanley's building, it was of wood.

The means employed to fix the work to its foundation proved quite efficient: dove tailed holes were cut out of the rock into which iron bolts were keyed. To increase the weight and vertical pressure of the building and thereby present a greater resistance to the external forces Rudyerd laid numerous courses of Cornish granite as well as jointing the building efficiently and clamping it with iron.

The structure was completed in 1709, and that it was soundly constructed was proved in that it withstood the fierce storms experienced on that coast for a period of nearly 50 years.

Although the full facts are unknown as to the cause, the lighthouse caught fire on 2 December 1755 and Rudyerd's work was completely destroyed.

As necessity for protecting the shipping of the Channel by a lighthouse on the Eddystone had by this time become even more important, with the increasing maritime trade. Immediate steps were taken to rebuild a replacement for Rudyerd's burnt out shell and the leaseholder at the time, a Mr Robert Weston, asked the President of the Royal Society, the Earl of Macclesfield, to recommend an engineer to undertake the rebuilding. Macclesfield suggested John Smeaton who, at the age of 31, was acknowledged by members to be a master engineer.

The design of the new Eddystone lighthouse was the first of its kind and Smeaton realised that weight was the first requirement in a structure constantly subjected to the force of gales and high running seas and at an early stage he came to the conclusion that the new building must be built of stone and therefore decided to build a core of dovetailed Portland stone, surrounded by an outer crust of granite, which is impervious to the action of marine life. Iron clamps were considered, to bind the stone blocks together, but this idea was soon dismissed as unsatisfactory and the process of dove-tailing, a practice then generally applied to carpentry, though scarcely as yet known in masonry, was adopted.

On Smeaton's first two months visit to Plymouth weather conditions permitted only 10 trips to the reef during four of which he actually got onto the rock. The longest period of work in daylight was four hours and the average journey out and back was taking six - hours when weather conditons permitted any sailing. But as the season advanced it became more and more difficult to carry out operations for many days the men could not land.

The winter was occupied in dressing and dovetailing stones for the coming summer's work and Smeaton himself supervised much of the work to ensure the greatest accuracy in size and fitting. Nearly 450 tons of stone were dressed by the time the weather was sufficiently favourable for building work to commence.

The first stone of two and a quarter tons weight was landed and secured in its place on the morning of 12 June 1757, and by the evening of the second day the first course was laid. Each of the dovetailed courses were cemented in place and then doubly secured to the one below by hard oak trenails. Work continued to proceed as the weather permitted and Smeaton superintended the construction of most of the entire building. By September 1758, the 24th course was finished and this completed the solid part of the pillar and formed the floor of the store-room. This was at a height of 35 feet above its base. Above this point were formed the various apartments for the lighthouse-keepers with walls of 26 inches thick. The structure was finally completed in 1759. With its lantern apex 91 feet above sea level this engineering masterpiece withstood the high seas and storms and was still solid and undamaged more than a century later when it was decided to build again on a different part of the reef because the foundation rock was becoming undermined.

When Smeaton's lighthouse was dismantled after the erection of a new one in 1886, the upper section was carefully brought ashore and re-erected, as a lasting memorial to him, on Plymouth Hoe.

Smeaton married in 1756 and went to live at the family home at Austhorpe which had been left to him by his father. His family consisted of just two daughters, one of whom kept house for him after his wife died in 1784. At Austhorpe he built a tower of four stories. On the ground floor was his forge. On the second were arranged his models of lighthouses, bridges and mechanical inventions for which he was responsible. The third floor was his study and the fourth served as an observatory. When Smeaton was not engaged in drawing plans or writing reports much of his spare time was occupied with astronomical studies and observations.

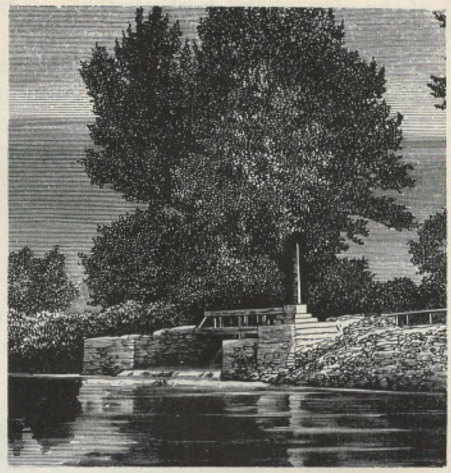
CIVIL ENGINEERING

The list of Smeaton's civil engineering works is a long one and only a brief outline can be given here. He was consulted and planned improvements to the navigation of several rivers which included the opening up of the navigation of the Chelmer to Chelmsford; of the Don ayove Doncaster; and the improvement of the river Lea.

The first large engineering job he undertook was in making repairs of the dams and locks on the river Calder in Yorkshire where he carried out many important improvements in its navigations. He was also consulted about the draining of the Fens. He strengthened the piers of old London Bridge in 1777, and designed a new pumping engine which was placed in the fifth arch, worked by the rise and fall of the tide, to supply the city with water. His efforts in strengthening the bridge prolonged its life for 60 years.

Smeaton built bridges at Perth, Coldstream and Banff. The only one he built in England, at Hexham in Northumberland, proved a failure when in 1782 it was swept away be a storm flood. He was consulted about a new bridge at Perth as early as 1763. The river Tay being subject to sudden floods, which caused a former bridge to be swept away, called for every precaution to be taken with the foundations. The bridge which consisted of seven principal arches and was 900 feet long, was completed in 1772 when it was opened for traffic.

Smeaton's work at Perth was to lead him to a considerable amount of engineering business in the North and the most important work on which he was employed in Scotland at this time, was designing the Forth and Clyde Canal which gave a navigable connection from ocean to ocean. These works were commenced in 1768.



About 38 miles in length it included 39 locks with a rise of 156 feet from sea level to the summit. Although there was little doubt as to the importance of this navigation there was some difficulty in raising the necessary funds to complete this canal and long before the canal could be opened to the Clyde, the works came to a stand-still. It was 20 years before sufficient money could be raised to complete the undertaking and at length the canal was opened in 1790, having been finished by one of Brindley's pupils, a Mr Whitworth.

Coldstream bridge across the Tweed was to be Smeaton's next task and this was opened in October 1766. Another fine bridge of his design was erected over the river Deveron, near Banff in Scotland.

Numerous harbours were designed by Smeaton and these were, for the most part, confined to the improvement of existing works. His first harbour was built at St Ives, Cornwall in 1766, a position where natural land formation formed a perfect haven and played an important role in the then prosperous pilchard fishing and inland mining operations. He was also consulted on numerous other harbour projects from as far apart as Whitehaven, and Bristol on the west coast to Christchurch, Rye and Dover on the south, and east to Yarmouth, Lynn, Scarborough and Sunderland. The proposed improvements at Bristol were eventually carried out by William Jessop but in nearly every other venture the shortage of money prevented any work being carried out.

The principal harbour works actually executed by Smeaton were those at Ramsgate. The position of this harbour, at the mouth of the Thames, was considered of some importance of the purposes of trade as well as a shelter for vessels in time of storms. It was whilst building one of the piers of this harbour that Smeaton first used a diving-bell in setting the foundations. The bell was of square section and weighed about half a ton. It was four feet six inches in height and length and three feet wide, allowing room for two men to works in it with a constant supply of fresh air supplied to them from a pump placed in a boat above them. The harbour covered an area of 42 acres and the piers extended 1 310 feet into the sea. The inner basin was used as a wet dock and also contained a dry dock for the repair of ships.

OTHER ACHIEVEMENTS

The list of Smeaton's achievements is almost endless. His advice was sought on subjects of every description from water-pumping engines, flour-mills, wind-mills, hammer-mills to a lathe. From a list left by him in his own handwriting, it appears that he designed and erected 43 water-mills of various kinds and numerous wind-mills. This was at a time when water and wind power was the main source of prime mover and the steam-engine was in its infancy.

Steam power did not however escape his interest and in order to investigate the subject Smeaton erected a model engine, on Newcomen's principle, near his home at Austhorpe. His experiments were to result in the chief advance on the detail development of the Newcomen engines. His main sphere of operations was in the north-east but he erected one engine in Cornwall which was considered to be the finest of its type in the county and perhaps in the British Isles. This was a 72 inch engine, Cornwall's largest during the whole eighteenth century, at Chacewater Mine. The engine was built by the Carron Company and erected in 1775. Smeaton's accomplishments in improving and bringing out the full powers of Newcomen's engine cannot fail to elicit admiration.

Towards the end of his life John Smeaton turned down many offers of further business and much of his time was spent in his tower at Austhorpe Lodge with astronomical studies and observations. He had also decided to write an account of all his major works and his 'Narrative of the Construction of Eddystone Lighthouse' was however the only descriptive writing he achieved, apart that is, from his many papers to the Royal Society.

On 18 October 1792, while walking in the garden of his home, John Smeaton was taken seriously ill and never recovered. He died on 28 October in his 68th year and was buried in Whitkirk Parish Church.

NEW BRITISH STANDARDS

GREATER GOVERNMENT COMMITMENT TO THE ROLE OF STANDARDS

An exciting year which has seen unprecedented Government commitment to the importance of standards and quality assurance in Britain's trading effort is reported by Sir Frederick Warner, President of BSI, in his Foreword to the Institution's 1982 Annual Report.

'Some of Britain's major trade competitors - indeed the most consistently successful - have understood this central role of standards and quality assurance within their economic strategies', says Sir Frederick.

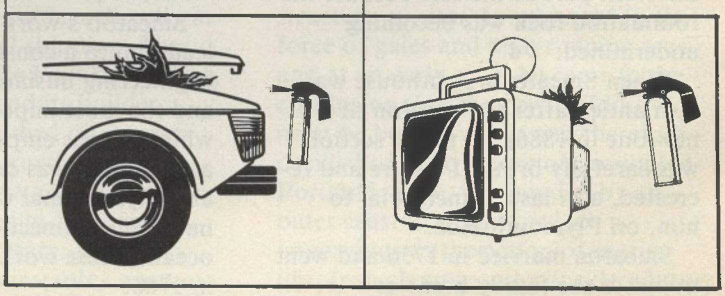
In his review of the year Mr D G Spickernell, Director General of BSI, points out that there have been significant moves towards greater recognition of standards as the source of technical criteria for legislation. The proposed new form of the Building Regulations indicates what could be a useful pattern for the future.

In 1982, 551 British Standards were published -a record total of 8288 pages - covering subjects ranging from scaffolding, falsework, and site invesigation to bicycles, fire extinguishers and child safety barriers. In Information Technology Year two important publications on computer languages, PASCAL and DIAL, were published.

Also, during 1982 new Kitemark schemes were introduced for industrial safety belts, harnesses and safety lanyards, and industrial and safety PVC footwear. A new Safety Mark scheme was established for the safety of electrically energized office machinery.

Demand for the BSI Test House services was lower than expected during 1982 -an ironic situation, at a time when British industry needs these services most. Therefore THE will be promoted even more actively, particularly to smaller companies, in 1983.

THE will move to Milton Keynes, where a new BSI Centre is being developed, in 1983. Work on the initial phase is well under way and should be completed by May 1983. THE will form part of an information centre on technical requirements using a computerized database which will extend the range of BSI services available to industry. Sales and Marketing, together with a range of support services, will also move to Milton Keynes in the first phase.



WATER QUALITY

British Standards Institution has published a further section of **BS 6068 Water quality** Part 1 **Glossary,** namely Section 1.1 **Terms relating to types of water, and treatment and storage of waste water.**

This Standard is being published in a series of Parts, sub-divided into new Sections that will generally correspond with particular international standards. It defines terms used in certain fields of water quality characterization which are grouped under the following main headings:

- Types of water
- Treatment and storage of water and waste water

The new section is identical with the English text of ISO 6107/1, prepared by the International Organization for Standardization, except that for the convenience of translators and others who may wish to check equivalent terms, the index to ISO 6107/1 (which is printed in four languages), has been maintained.
Price: £6.50.

Other Parts of BS 6068 comprise:
Part 2 Methods for physical and chemical testing
Part 3 Methods for radiological testing
Part 4 Methods for microbiological testing
Part 5 Methods for biological testing
Part 6 Sampling

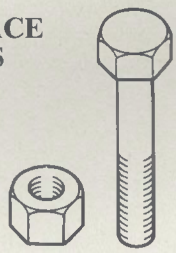
PNEUMATIC ASSEMBLY TOOLS

BS 6268 Reaction torque and torque impulse from hand-held pneumatic assembly tools for installing threaded fasteners, is a new British Standard which is identical with ISO 6544, prepared by the International Organization for Standardization (ISO).

BS 6268 describes a test method for measuring reaction torque and torque impulse from tools of this type, and gives guidance on the evaluation and presentation of measured data. Values are measured on test joints with standardized torque rates as determined by the performance test of ISO 5393. The test procedures described in the new standard are important in that they provide manufacturers with a standardized method of measurement, enabling them to offer their products under correlated technical specifications.

The standard is directly applicable to assembly torque control tools but, in the case of stall-type tools, only the reaction torque can be measured. Impacting, pulsing or ratcheting assembly tools are not covered.
Price: £8.00

AEROSPACE THREADS



BSI has published a further specification in the Aerospace Series of British Standards, namely **BS A 231 Runout and lead threads for rolled threads.** This is identical with ISO 3353 prepared by the International Organization for Standardization (ISO).

BS A 231 defines requirements for the thread runout at the junction of the thread and shank (or thread and head) and, at the end of fasteners, the lead thread, for rolled threads used in aerospace construction. The standard specifies a referee method, by optical projection, for establishing conformity with these requirements.

Although the standard specifically refers to bolts it may also be applied to externally threaded products where the threads are produced by rolling, except where special runout or lead thread requirements are specified.
Price: £5.50.

ADHESIVES

BSI has published details of a further method of test for certain types of adhesives which is one of a series designated **BS 5350 Adhesives.** Entitled **Part C 15 Determination of bond strength in compressive shear,** the new Part describes a procedure for determining the bond strength of a double lap joint by subjecting the test piece to a compressive force. The method is suitable for all types of adhesives and although mainly intended for use under ambient conditions it can be employed under a wide range of temperatures and other environmental conditions. Adhesives for civil engineering purposes are considered to be the most likely application for the new test method.
Price: £4.20

HYDRAULIC VALVES

British Standards Institution has issued in two parts a revision of **BS 4062 Valves for hydraulic fluid power systems** which, by unifying test methods, should enable the performance of different types of valves to be more readily compared. The two Parts together supersede the existing edition of BS 4062 which is therefore withdrawn.

Part 1 Method for determining pressure differential/flow characteristics describes a method of measuring, under steady-state conditions, the pressure differential/flow characteristics caused by the flow through any given path in a hydraulic fluid power valve.

Part 2 Methods for determining performance describes procedures for measuring the steady state of dynamic performance of the following types of valves:

- Directional control valves.
- Non-return (check) valves.
- Pressure control valves.
- Flow regulating valves.
- Flow-dividing valves.

In both Part 1 and Part 2 accuracy of measurement is divided into three classes, namely A, B and C. It is expected that the majority of valves will be tested by means of the Class C methods, whereas Class B may be used where a higher degree of accuracy is required. Class A methods, which necessitate laboratory conditions, may be used exceptionally where the need for great accuracy is considered to justify the much-increased time and cost involved.

Parts 1 and 2 correspond respectively with ISO documents DIS 4411 and DIS 6403 currently under consideration by the International Organization for Standardization (ISO).
Prices: Part 1, £8.00; Part 2, £13.00