The Journal of the Institute of Hospital Engineering November 1982

HOSPITAL ENGINEERING

Mobile Communications in the Health Service

Hospital Engineering is published ten times a year, by Mallard Publications. In January and July the *Hospital Engineering Newsletter* is circulated to Institute Members only.

Individual copies cost
£3.25 UK postage paid

The annual subscription is UK: £27.00
Overseas: £33.00 Americas: $70

Average circulation per issue
(January-December 1981): 2827

ABC

Editor
Christopher Tanous TD

Advertisement Manager
Kate Oriel

All correspondence relating to the Journal should be addressed to:

Hospital Engineering
Mallard Publications
48 Southwark Street
London SE1 1UN, England
Telephone: 01-403 6166

UK ISSN 0309-7498

Printed by JB Offset Printers
(Marks Tey) Ltd
Station Approach, North Lane
Marks Tey, Colchester, Essex

The Institute of Hospital Engineering
20 Landport Terrace
Southsea, Hants PO1 2RG, England
Telephone:
Portsmouth (STD 0705) 823186

Secretary
J. E. Furness MBE VRD*

Hon Librarian
D. L. Hall Esq., FIHospE MIPlantE
MRSH MBIM LHA
49 Fitzroy Avenue
Harborne
Birmingham B17 8RL
Tel: 021-554 3801, ext. 4838 (Office hours)

HOSPITAL ENGINEERING

The Journal of the Institute of Hospital Engineering

Contents

Volume 36 No. 9 **November 1982**

Front Cover: Our cover photograph shows one of London's Ambulances, part of a network which relies heavily on radio communications. (*see article on page 10*).

Institute News

Chartered Engineer Members

Addition of the Institute's name on the Register

Members who are Chartered Engineers may add the name of The Institute of Hospital Engineering against their name on the 'CEng' Register without in any way affecting the fact that they were first registered through their membership of a Chartered Institution.

CEI/ERB have now announced that agreement has been reached on this. Council of the Institute heartily welcomes this news and urges *all* members concerned to take advantage of this and have the Institute of Hospital Engineering added against their names in the Register *as an addition* to their original sponsoring Institution.

Clearly, as the Engineering Council comes into being and commences operations it would be an advantage for the name of the Institute to feature as many times as possible on the Register.

Chartered Engineer (Hospital)

In previous issues of our journal, attention has been drawn to the ability of the Institute of Hospital Engineering as an Affiliate member of the Council of Engineering Institutions (CEI) to sponsor suitably qualified corporate members for Chartered Engineer status on an individual basis. We are pleased to note that a number of our members have been granted this status on the basis of their training, qualification and experience in the specialised field of Hospital Engineering.

A similar process has been taking place so far as other Affiliate members of the CEI are concerned.

In the main the engineers concerned have used their Affiliate Institution as an entry vehicle to Chartered Engineer status.

There are of course many corporate members of the Affiliate Institutions who are Chartered Engineers by virtue of their membership of one of the Corporation members of the CEI (IMechE, IEE and so on).

Representations have been made by a considerable number of these engineers for their registration as Chartered Engineers to be endorsed and indicate their specialist expertise.

As a result, the Chartered Engineer Section Board of the CEI, on which the IHospE is represented, considered the matter and issued the following statement:

Appointment of District Works Officers

North East Thames RHA

Barking Havering & Brentwood	D. Gray, CEng MIMechE MIHVE
Basildon and Thurrock	R. Pym ONC(Elec Eng) HNC(Mech E.) Industrial Admin A&B
City and Hackney	J. Milton CEng MIEE MBIM DMS
Hampstead	J. Sancroft MIPlantE FIHospE
Islington	W. Askew MCIBS FIHospE MIPlantE
Mid Essex	R. C. Raynham TEng (CEI) MIPlantE FIHospE
Newham	D. Rowan TEng(CEI) MIWM FIHospE
Redbridge	M. Barrett DMS ARIBA HBIM
Southend	A. Makinson CEng AMIMarE MIHospE
Tower Hamlets	G. Piper FRICS FIH
Waltham Forest	J. Saunders CEng MIMechE MIProdE
West Essex	J. Brown CEng MIMechE CIBS

South West Thames RHA

Croydon	A. L. Jones CEng MIMechE
Merton and Sutton	G. K. Cruickshank FIHospE
Kingston and Esher	D. Silver CEng FIMechE FCIBS MInstE FIHospE
South West Surrey	J. R. Morris CEng MIMchE
East Surrey	D. A. Youell CEng MIMechE FIHVE
West Surrey and North East Hants	H. Stephenson
Mid Downs	J. M. Simmonds RIBA
Worthing	W. R. D. Salder CEng MIMechE MIHVE

Nominations by Affiliates of Candidates already registered as Chartered Engineers

The Chartered Engineer Section Board has agreed that Chartered Engineers nominated to the Register as corporate members of another member institution should be accepted as registrants of the second member body. The procedure will merely involve the addition of that Institution's nomination to the Register.

The Council received this news with great pleasure and felt that every endeavour should be made to encourage all corporate members coming

within the category mentioned to agree that their names be submitted for nomination as registrants of the Institute of Hospital Engineering in addition to their original member body.

Will those members affected please write to the Secretary giving their assent to the necessary application being made.

Henry Adams Dies

Henry Adams died on 6 October after a long and severe illness. At his final Service, the Chapel at the Torbay Crematorium overflowed with mourners. There are those who regard Henry as the 'Father' of the modern Institute of Hospital Engineering. Certainly, he was one of the founder members back in 1943. And, always, he was closely involved in the policy and progress of the then Institution. Long a member of Council he was, indeed, Chairman for those years leading to Incorporation on 1 January 1967. He continued to serve on Council for a further six years after Incorporation.

Henry Adams was the kindest of men, yet firm, courageous, resolute and steadfast. Never one to shirk disagreement if this were necessary yet in such circumstances his total integrity over-rode all else. And many were the acts of personal kindness, quietly performed and oft unsung. As to his career, suffice to say here that he retired as Group Engineer to the old Glenside and Barrow HMC but then spent a further 5 to 6 years as Clerk of Works to the new Royal Devon and Exeter Hospital. And he had so many tales to tell, in that unmistakable burr of the South West, of his career, including of his earlier days at sea.

He was a man of many interests — his boat, wine-making — too many to list here. But there is no doubt that his first love was the Institute and 'bringing on' the young, not least his apprentices. Where did he find all that time and energy?

What else can be said — except thanks Henry, thanks for everything. You will be missed by so many but long, long remembered.

Our warmest thoughts go to his widow, Evelyn, and family.

250,000 Engineers

On 8 October John Constable, President of the Institute was one of many guests at the celebration by Spirax Sarco Ltd of the enrolment of the quarter-millionth student of their Steam Engineering correspondence course. At a reception at Sudeley Castle, Winchcombe, near to the Company's headquarters at Cheltenham, the student, Mr John Martin, was presented with a decanter, glasses and a silver label engraved to record the occasion. Mr Martin is a member of Messrs Hulley & Kirkwood, consulting engineers in Glasgow, who specialise in hospital design.

Many members of the Institute have undertaken the correspondence courses provided by Spirax Sarco since they were established in 1941. The Steam Utilisation course has now been completely re-designed but, remarkably, remains entirely free of cost to the student. By a happy coincidence the celebration of this unique record of training took place in the year of the firm's own Golden Jubilee.

All-Electric Hospital Experiences

Joint Meeting with CIBS

The Institute is to hold a joint meeting with the CIBS Electrical Services Group, entitled *Early Operational Experiences of Britains' First All-Electric Hospital.*

The venue is The Royal Institution in Albermale Street, London (nearest Tube — Green Park) on Thursday 3 February 1983, and the time, 5.30 pm for 6 pm.

The Chairman of the meeting will be Mr John Bolton, Chief Works Officer and Director General of Works, DHSS and the speakers will be:

Mr M. Cooper-Reade of Eastern Electricity Board, *Aspects of the design of the building services for Fenland House, St. John's Hospital Peterborough,* Mr I. Alexander of East Anglian Regional Health Authority, *Commissioning of the plant and early operation experience,* Mr J. Leary of The Electricity Council, *Energy monitoring of the hospital's electrical consumption.*

They will be followed by adequate time for discussion and questions.

There will be no registration fee for this meeting. Anyone wishing to attend should contact the Institute's Office or their Branch Secretary, so that an estimate of attendance can be made.

Spirax Chairman Tony Brown presents young Consulting Engineer John Martin with a cut glass decanter, whose gold neck label is inscribed 'Midnight Oil'. (see '250,000 Engineers').

"Buildings that cost less to maintain...cost more to build"

Not any more...

You might expect to pay more for a building which for up to 20 years or more will require no maintenance... but with YORKON you won't. In fact, in most cases, you would pay less.

And if you expect that a building which promises savings of 30% on energy costs* will involve higher initial costs of construction... then YORKON will surprise you.

YORKON is a high quality, steel-frame system that overturns a number of preconceptions about building.

Developed from the advanced technology of factory-based building processes, YORKON eliminates the delays and quality control problems of conventional on-site construction. It shrinks building time to a matter of weeks, makes planning easier, and gets your investment working faster.

Offices, medical buildings, computer suites... whatever you need, it's simply the fastest, most efficient way to build.

For your information pack, call (0904) 22277 and ask for Kate Morgan. Or write to **YORKON Building Division, (3GB), Portakabin Limited, York YO3 9PT.**

*Reduction in heating costs compared with requirements of UK Building Regulations for the Conservation of Fuel and Power.

YORKON

It will change your ideas about building

The Watt Committee changes its address

With effect from 29 September 1982 the address of the Watt Committee will be as follows:

The Watt Committee on Energy Ltd
The London Science Centre
18 Adam Street
London WC2N 6AH
Tel: 01-930 7637

The premises of the London Science Centre at 18 Adam Street, London WC2N 6AH form part of the group of Adam houses owned by the Royal Society of Arts (one of the member institutions of the Watt Committee) and are leased to the Foundation for Science and Technology. The Watt Committee will be one of several professional bodies that occupy accommodation at the London Science Centre as tenants of the Foundation, which is a charity established to provide facilities for learned societies.

The Prince of Wales Award for Industrial Innovation and Production 1983

The Engineering Council has announced that the award is to be made again next year. It was initiated by The Prince of Wales in 1980 to help stimulate industrial innovation and regeneration and to foster the creation of new business enterprise based on British inventiveness and new technology.

His Royal Highness has commented: 'I have become increasingly concerned of the need to encourage the commercial development of the many excellent engineering ideas which we as a country are so good at producing. Britain is second to none in original ideas, but we fall behind some of our foreign competitors in developing these commercially and thus fail to reap the reward for the nation's benefit.

In these days of a depressed economy and high unemployment, especially among young people, every attempt should be made to foster the creation of new businesses, and I hope that through this Award more people and companies will be encouraged to take an active part in industrial innovation and regeneration.'

The Prince of Wales has been very encouraged by the response to earlier competitions both in terms of the number and standard of entries and wishes, therefore, for the Award scheme to be continued.

Organisation of the Award is being carried out by The Engineering Council which has been set up by Royal Charter, following the Finniston Committee of Inquiry into the Engineering Profession, to advance the performance and status of engineering in the United Kingdom.

Entries to the Award are open to a wide range of people and organisations who are attempting to create a genuine new business based on an innovation or new idea. These could include private inventors, small firms and new businesses, other companies of all sizes, academic researchers in universities and polytechnics and research bodies.

The closing date for entries is the end of February, 1983, and since it normally takes about two years to determine if a new product is likely to be a success in the market place the Award — as previously — will be divided into two stages. The first, which is the 'innovation stage', will be completed by June 1983, when The Prince of Wales will present certificates to the finalists. These will go through to the second — 'production' — stage, the outright winner of which will be presented with a trophy by His Royal Highness on the BBC TV programme 'Tomorrow's World' in June, 1984. The winner will also receive a cheque for £10,000.

The panel of judges appointed to scrutinize the entries to the competition are drawn from industry, education and the engineering profession under the chairmanship of Sir Monty Finniston, FRS.

Entry forms and further details can be obtained from:

The Engineering Council,
Canberra House,
10/16 Maltravers Street,
LONDON WC2R 3ER.

British Presence at Italian Conference

The Federazione Nazionale Tecnici Ospedalieri (FeNato), the Italian Institute of Hospital Engineers, held its annual conference in Bologna on Saturday, 2 October 1982. The programme included a session to receive information about the way in which the technical services are organised in England. Basil Hermon, RWO, South West Thames RHA, and Chairman of the Institute's Education Committee, accepted FeNATO's invitation to speak.

The conference was held at the Palazzo Affari in the Fiere to coincide with the equipment exhibition 'Hospital '82'. There were about 300 delegates keen to compare the Italian organisation with that in England. The programme also included papers by Italian engineers on the University structure for producing Professional engineers and architects, quality control of engineering plant and services and maintenance of electromedical equipment. A Judge gave a talk about the responsibilities of the hospital technician to ensure that everything operated safely and that equipment is updated as standards change; he had his audience worried that they were all liable to go to jail when they returned to work the following Monday!

Basil Hermon spoke about the structure of the National Health Service, source and allocation of finance, responsibilities of Authorities for technical services, the Technical Managers' role in top management, structures of technical organisations, research and development, preparation and issue of technical guidance and, finally, training.

For the convenience of the Italian audience his slides were produced in Italian and, as simultaneous translation was not available, he gave his talk through an interpreter. He also took with him the extremely well made slide/tape documentary package explaining the way in which Falfield functions and the object of the courses run there; this was shown the previous evening to about 30 engineers who were particularly interested in post-entry training.

Basil Hermon carried greetings to the members of FeNATO from the President and members of The Institute of Hospital Engineering and their President, Osvaldo Amato, returned the compliment.

The Christopher Hinton Lecture

The Christopher Hinton Lecture for 1982 will be delivered by Sir George Edwards OM CBE FRS FEng, formerly Chairman of the British Aircraft Corporation Limited (1963-1975) at 6.00 pm on Monday 29 November 1982, at the Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1H 9JJ. The lecture will be devoted to the assessment, national importance and prospects of the British Aerospace Industry in which Sir George Edwards spent forty years.

Forthcoming Branch Meetings

Southern Branch *Hon Sec: R. P. Boyce Chichester (0243) 781411*

25th November 1.30 pm	Visit to Fawley Refinery	

East Anglian Branch *Hon Sec:'M. Brooke Great Yarmouth (0493) 50411*

20th November	Visit to 'All Electric' Hospital, Peterborough	

Midlands Branch *Hon Sec: W. Turnbull Birmingham (021) 378 2211 Ext 3590*

23rd November 6 for 6.30 pm	Air Flow Patterns in the Operating Theatre	Alexander McGregor Theatre, Dental Hospital, St, Chads Queensway, Birmingham
10th December	Annual Dinner Dance	Penns Hall Hotel, Sutton Coldfield

London Branch *Hon Sec: P. C. Vedast 01-807 7340*

23rd November 6.30 for 7 pm	Optimum Energy Usage	Wolfson Lecture Theatre, The National Hospital

North Western Branch *Hon Sec: E. A. Hately Manchester (061) 236 9456 Ext 352*

10th November	'New Concepts in Medical Oxygen Supply Systems'	Astley Hospital
9th December	Talk and demonstration on Further Advancements in Communications	Plessey Limited offices

Yorkshire Branch *Hon Sec: J. Bate Wakefield (0924) 890111 Ext 293*

20 November	All Electric Hospital Visit	Peterborough
23rd November	Full day Seminar: All Electric Hospitals arranged by the Electricity Council	The Post House Hotel, Manchester

Those wishing to attend any of the above meetings please contact the relevant Local Secretary.

The Engineering Council — Policy Statement

Introduction

The performance of engineering in the United Kingdom is paramount to the nation's future industrial, economic and social prosperity. The revenue earned from the products we make, the services we supply and the business we generate, relies extensively on the quality of our engineering expertise and the development of our manufacturing capability.

It is against this background and in response to the recommendations in the Report of the Finniston Committee of Inquiry into the Engineering Profession, that The Engineering Council was established under Royal Charter. The principal aim of The Council is to advance education in, and to promote the science and practice of, engineering for the nation's benefit and to promote industry and commerce in the United Kingdom.

The Council acknowledges that its primary objective is to encourage and improve the efficiency and competitiveness of British industry and commerce. It has taken its Charter as the basis for its activities. The Council is also aware of the long term nature of much of its work and has taken note of this in setting its priorities.

1. The Engineering Dimension

1.1 The Engineering Dimension encompasses all factors and activities associated with technological capabilities and expertise, in order to improve the competitive performance of industrial or commercial enterprises. In developing this concept The Council is conscious of actions resulting from the Finniston Report and the recommendations from the National Conference on Engineering Education and Training (CONCEET October 1980) broadly related to the formation of Engineers. In the light of these initiatives The Council is devoting its attention to the contribution that Products, People and the Working Environment make to the Engineering Dimension.

1.2 Production and Marketing of Products

The Council recognises that in some areas British industry has fallen behind its major international competitors, especially in product design

and development and in manufacturing techniques: there is an urgent need therefore to attract more of the best people into engineering. The Council is further convinced that marketing is of vital importance to establish the appropriate attitude to product definition and design. The design of new products and processes and the means to manufacture products and install them competitively must be recognised as an interacting and iterative process.

1.3 The Council is determined to secure recognition of the importance of, and current weakness in, manufacturing technology and to seek jointly with industry and academia the means to improve the position. The Teaching Company Scheme and the Engineering Industry Training Board's Manufacturing Fellowship Scheme are good examples in this field, but much more needs to be done.

1.4 The Council has agreed in principle to undertake the organisation of The Prince of Wales Award for Industrial Innovation and Production. The principal aim of the award is to encourage the growth of new businesses based on a technological innovation or an improved product or process.

People

1.5 The Council seeks to achieve a proper balance between engineering and other related activities in an enterprise and to promote a better understanding by management of the place of the engineer. In turn The Council will use its influence to ensure that engineers have a wider appreciation of the business aspects of the enterprise and are trained and equipped to manage.

1.6 The educational phase of an engineer's development calls for greater injection and integration of relevant practical experience into courses. This in turn requires a more positive response from industry to provide more industrial training places. Success in design, development and manufacture requires engineers with expertise in more than one discipline. The initial training and experience of engineers should include exposure to the concepts of good business practice, including finance and marketing. There is less enthusiasm for the treatment of finance and marketing as independent disciplines during undergraduate education. Practising engineers will be encouraged to gain a greater appreciation of the role and importance of finance and marketing functions. The Council expects that engineers will prepare themselves to become leaders and managers of industry.

1.7 The Council is conscious that some first-class engineers better suited to the engineering functions are attracted into management for reasons of pay and status. This cannot be in the long term interest of the company or the individual. The Council will, therefore, identify and publicise attractive career structures for prospective engineers, possibly similar to the special merit promotion system operated for scientists in the Civil Service and for technologists in certain large industrial companies.

The Working Environment

1.8 The Council accepts the need to change fundamentally the attitudes and initiatives towards engineers throughout industry. To meet the needs of industry, The Council will interact with and consult relevant organisations including (a) The Fellowship of Engineering, (b) the Professional Engineering Institutions, (c) companies in industry, financial institutions and trade associations, (d) Government Departments, (e) educational establishments and research organisations, and other bodies such as the National Economic Development Office (NEDO), the Manpower Services Commission (MSC) and the Engineering Industry Training Board (EITB). Towards this end, The Council is enquiring directly from industry the emergent knowledge and skill it requires of engineers and technicians and, in the course of so doing, identifying present bottle-necks and taking account of existing and anticipated developments in technology over the next decade. The approach to this enquiry will be through companies quoted in the Financial Times share listing where engineering is a relevant consideration and at the same time to seek the views and co-operation of the Engineering Employers' Federation (EEF) and the Confederation of British Industry (CBI). The Council is proceeding with an initial pilot scheme involving a representative group of companies from each sector of engineering activity. Information will be sought from Chairmen or Chief Executives with the aim of obtaining a response from engineering management, rather than from personnel managers or manpower planners.

1.9 The Council recognises the contribution that the financial institutions concerned with investment in industry are making, and will encourage them to give a higher priority to questions about engineering. For example, how much is spent on product development, what is being done to train engineers and how many are qualified at the different levels. The aim is to make both the financial institutions and companies, particularly those in manufacturing industry, more aware that engineering resource is a major criterion in assessing a company. Substantial investors, including the Industrial and Commercial Finance Corporation (ICFC), large superannuation funds and clearing banks are being asked to contribute to this important aspect of The Council's work.

1.10 The Council having been given the responsibility of creating its own Register of Engineers, one of the main aims of The Council is to secure a much better understanding in industry of the value to it of employing Registered Engineers, Technician Engineers and Engineering Technicians. This will take time but is an essential long term objective.

2. Education and Training

2.1 The Council is convinced of the importance of attracting more able men and women into the profession in order that they may play their part in the greater success of British industry.

Their education and training ranges from the teaching of mathematics, science and technology in the schools to the technological courses offered by universities, polytechnics and technical colleges to training in industry and later up-dating of engineers throughout their careers.

2.2 It is The Council's intention to promote a higher standard of technological literacy within the education system and to engender a better understanding of the contribution that engineering makes to the life and prosperity of the nation. The Council is determined to encourage the development and teaching of mathematics, science and technology in schools in a way which is relevant to the needs of society, industry and the engineering profession. It is, however, important that this education must not be narrow. The country needs engineers who are literate, articulate and widely educated.

2.3 The Council acknowledges the valuable work which has been carried out by a number of organisations in the field of engineering education and intends to build on the various initiatives which are proving effective. For example it will support the Standing Conference on Schools, Science and Technology (SCSST) with the Regional Organisations (SATROs).
2.4 Starting from the recommendations of CONCEET, The Council is formulating policies in regard to the development of the secondary school curriculum and examination system and will use its influence in this area. The Council is concerned that greater recognition should be given to courses in schools, which adopt a project approach to learning, without sacrificing the intellectual content of basic mathematics and science based subjects.
2.5 The Council will seek to influence those responsible for offering careers advice in schools and will examine what is being done to investigate young people's attitudes to careers in engineering and will encourage further research into this subject. In seeking to achieve this, The Council recognises the closer integration which must be achieved between the curriculum and careers education. In line with the Finniston recommendations The Council is keen that more girls should be persuaded to take up a career in engineering and will seek ways of assisting those who desire to enter the profession.
2.6 To emphasise The Council's commitment to improve the level and quality of the recruitment into engineering, it has taken over from the Department of Industry (DoI), the running of The Young Engineer for Britain Scheme. The principal aims of the scheme are to demonstrate the engineering potential of young people and to encourage them to enter the profession.
2.7 The Council recognises the contribution from engineers whose education and training lead to specialisation at an early age. However it recognises that in comparison with our international competitors there should be more broadly based courses in engineering.
2.8 The Council is convinced of the need to increase the liaison between industrial companies and universities, polytechnics and technical colleges. It expects to see more engineers in industry teaching in academic establishments, and more senior academics spending more time in industry and consultancy work. The Council will also take steps to encourage the recruitment of industrialists with senior management experience into engineering faculties, especially at professorial level.
2.9 In association with the Professional Institutions, The Council will be assessing the engineering degree courses offered by universities and polytechnics. Account will be taken of the guidance being given by the National Advisory Body (NAB), The Council for National Academic Awards (CNAA) and the Department of Education and Science (DES) in respect of public sector degree courses. The Council is aware of the differing approaches to extended courses being taken within the tertiary education system and of the distinctive view from industry on the desirable number and content of these courses. Following a joint meeting with the Secretary of State for Education and the Secretary of State for Industry The Council is in consultation with the University Grants Committee (UGC) and the NAB to see how The Council can work with them in determining the content and priorities, i.e. higher education of engineers.
2.10 The Council is concerned at the reduction of available training places in industry and is appreciative of the need to integrate practical training with university and polytechnic courses. To assist this process, The Council will be considering the establishment of an Industrial Central Council on Admissions (ICCA) to assist universities and polytechnics in developing more sandwich courses. The Council has established and will work in close contact with the DES, the MSC and the Industrial Training Boards (e.g. EITB and CITB).
2.11 The Council recognises the accelerating pace of technological change and the effect this is having upon the engineering industry. To ensure that industry remains competitive, it is essential to provide continuing education throughout an engineer's working life, both in the technological and wider business senses. While much of the responsibility for this task falls on industry itself, there is a significant contribution from higher education establishments, the professional institutions and the Open University.
2.12 Such is the importance of continuing education that it is considered undesirable that HMG should require this activity to be totally self-financing both within industry and academic institutions. During a pump priming period, it should be seen as a national investment in an important educational resource.
2.13 The Council intends to give special consideration to the education and training of Technician Engineers and Engineering Technicians in recognition of the valuable contribution they make to industrial performance. There is already considerable concern that there is a shortage of technicians in some parts of industry. This whole area of activity will become of greater importance as The Council's work develops and it is intended to work closely with interested bodies, such as the Technician Education Council (TEC), and the Scottish Technical Education Council (SCOTEC). Continuing education is as important for technicians as for professional engineers, and The Council recognises that the Open Tech will have a special role to play in this area.

3. Professional Institutions

3.1 The Engineering Council's Charter states specifically that The Council shall establish and maintain a register for the purpose of registering by stages professional engineers, technician engineers and engineering technicians, and shall from time to time nominate Chartered Engineering Institutions and other bodies corporate or unincorporate to identify persons meeting the standards and criteria for education, training and experience determined by The Council. Furthermore, the Charter specifies that the register is to be established and the list of nominated bodies published within two years of the date of the Charter, that is by 27 November 1983.
3.2 The Council has already made it clear that it wishes to work with and through those nominated institutions in the accreditation of courses and the setting of standards required for qualification. The Council sees a major role for the Professional Institutions in this area. The Council does not preclude other institutions outside the present Engineers Registration Board (ERB) structure from being included in future developments. The Council recognises the independence of the institutions, and has not prejudged the position of affiliate institutions and others. In time The Council will expect to represent the UK Engineering Profession on international organisations.

3.3 The principles outlined in the previous paragraphs will be incorporated in the Bye-laws of The Council.

Timetable

3.4 The Engineering Council believes that it is important that the grant of the title 'Chartered Engineer' and the designatory letters 'CEng' should be assumed by The Council, to avoid any conflict in nomenclature which could otherwise arise when the Register of Engineers is set up. Discussions are taking place with the Council of Engineering Institutions (CEI) to achieve this as quickly as possible. The Engineering Council has been informed that the CEI must obtain a two-thirds majority of its Board, followed by a two-thirds majority of Chartered Engineers, to enable the CEI to transfer the title.

3.5 It is hoped that the following time table can be achieved. Agreement by the CEI Board by November 1982, followed by a postal vote by the Chartered Engineers, so that the transfer of titles formally approved by The Privy Council may be achieved by February 1983. Following a six-month period, during which the ERB of the CEI would be expected to work in parallel with the committee system set up by The Engineering Council, a final transfer and the formal setting up of the new Register is envisaged by the summer of 1983. The Council is conscious of the need for a smooth transition and gives an assurance that all those in the process of education and training will be allowed to complete the formation of their professional status under existing rules.

Protection of Existing Titles

3.6 The position of Chartered Engineers is fully safeguarded in The Council's Charter. They will be transferred as of right to the corresponding section of the new register. This guarantee will be maintained, even if the holder's Institution should not become a nominated Institution. The Council also undertakes to see that all Technician Engineers and Engineering Technicians at present on the ERB's Register will be similarly safeguarded, and remain in their respective categories. The Council undertakes to set standards at least equal to those at present applying to the three categories of registrant for CEng, TEng and Eng.Tech.

Grant of Titles

3.7 The Charter of The Council allows individuals to be registered after the acquisition of adequate experience (at stage 3 of registration of professional engineers) without being members of an institution. However, the Charter also makes it clear that the title CEng can only be granted to individuals who are members of nominated Chartered Institutions where these exist in the relevant discipline. No such provision is made for the Technician Engineers and Engineering Technicians in respect of their title. Notwithstanding, The Council will seek to encourage the Technician Engineers and Engineering Technicians to be members of appropriate institutions.

3.8 Provision will also be made for overseas graduates to be placed on the Register, so long as they meet the requirements to be laid down by The Council.

Annual Fees

3.9 It is the intention of The Council that the annual fee for Chartered Engineers will be determined by The Council and will be collected through their respective institutions. The Council anticipates that it will remain at a modest level of the few pounds a year which is paid currently to the CEI. Annual fees for Technician Engineers and Engineering Technicians will be set with regard to present circumstances and The Council's expressed intention to encourage membership of an appropriate institution where this exists.

CEI Examinations

3.10 In addition to taking over the registration of the profession, The Council will wish to establish an examination process equivalent to the present CEI system, through which candidates without an accredited degree may progress to Chartered status.

Nomination of Institutions

3.11 The Council will work through nominated institutions in matters concerning accreditation of courses, training programmes and experience leading to registration of individuals. Nomination standards will be set and published by The Council and institutions will be assessed prior to acceptance as nominated institutions. The Council does not intend to set any arbitrary limits to the number of institutions which can be nominated. Responsibility for nominations will rest with The Council aided by the Standing Committee on Professional Institutions. Nominations will be reviewed periodically once an established list has been produced. In the meantime there will be a temporary dispensation enabling institutions which are now ERB members to continue to act as if they were nominated institutions.

Special Categories

3.12 The need for licensing of certain categories of engineers is recognised by The Council.

4. The Engineering Council Organisation

The principles of the committee structure of The Council and the methods by which the members will be chosen are outlined in this section and these will be incorporated in the Bye-laws.

The Council Membership

4.1 The Charter of The Engineering Council states that for the period of three years, the first Chairman and up to 24 members will be appointed by the Secretary of State for Industry. Thereafter the Chairman and members will be selected by The Council from a list. It is envisaged that when a steady state is reached, each member will be appointed for a three year period, with approximately eight new appointments or re-appointments per annum. The bodies which will be asked to put forward names for the list will be:

1. Nominated Chartered Engineering Institutions.
2. Organisations of employers.
3. Education establishments.

In making the selection, the Charter specifies that the Chairman and at least two-thirds of the other members shall be Chartered Engineers and that at least one half of the members shall have experience as employers or as managers of practising engineers and of engineering technicians.

Engineering Council Committee Systems

4.2 The Committee structure will comprise Standing Committees to cover: (i) Professional Institutions, (ii) Education and Training, (iii) Industry (iv) Technology and Product Design and (v) Finance and General Purposes.

Membership of these Standing Committees will be limited to members of The Engineering Council. The Council will from time to time set up sub-committees of these Standing Committees onto which other individuals can be co-opted. For example, the Education and Training Standing Committee is setting up a Schools sub-committee.

Engineering Registration Committee System

4.3 The responsibility for the control of registration of engineers will rest with an Engineering Registration Committee which, while being ultimately answerable to The Council, will be sufficiently autonomous to encourage the voluntary effort required. The Registration Committee will be linked to four Executive Groups, each of which will carry out registration and accreditation for engineers in the range of disciplines of the institutions within the group concerned.

The Executive Groups

4.4 The Executive Groups will cover Chartered Engineers, Technician Engineers and Engineering Technicians. It is presently considered that four groups will be the minimum practicable, taking note of the disciplinary affinity between various institutions. This choice mirrors very closely the four groups which the Fellowship of Engineering has set up to achieve its purpose. However, The Council appreciates that there are certain institutions within groups which have an even closer affinity of interest and is considering possible sub-groups or divisions of interest within a group. Thus whilst The Council intends to start on the basis of four groups for ease of communication, it proposes to write into the Bye-laws the facility to increase this number if considered desirable at a later date. Each Executive Group will be headed up by an Executive Group Committee.

Engineering Registration Committee Functions

4.5 This Committee will recommend to The Council the definition of the procedures, standards and criteria within which the Executive Groups will handle the respective classes of accreditation and registration. It will maintain a facility for dealing with exceptional cases. It will be responsible for the register of Chartered Engineers, Technician Engineers and Engineering Technicians, as well as for the list of accredited courses and training programmes. The Engineering Registration Committee will require two co-ordinating committees to ensure compatability of standards across the groups. The functions of the Executive Group Committees will be to harness the experience and expertise within the institutional structure for the purposes of carrying out registration and accreditation on behalf of The Council.

The Register

4.6 The Register of The Council will be computer based and will have separate categories for Chartered Engineers, Technician Engineers and Engineering Technicians: each category will identify the three stages of career development which are set down in the Charter. It will be capable of assimilating the present Engineers Registration Board data, but will hold greater information including addresses for those in each category.

Executive Group Committee Membership

4.7 Each Executive Group Committee will be supported by a Chartered Engineer sub-committee and a Non-Chartered Engineer sub-committee. It is proposed that two-thirds of the members of the Executive Group Committee will be Chartered Engineers and they will be appointed by the Nominated Chartered Institutions on a constituency basis pro-rata to their Chartered Engineer membership. The remaining one-third will be appointed in a similar manner by the nominated Non-Chartered Institutions. Where the constituency is too small for one member to be nominated, then various institutions will be grouped together and a member chosen to cover these institutions. In addition, The Council will be represented on each Executive Group Committee.

Engineering Registration Committee Membership

4.8 The Engineering Registration Committee will be responsible under the Council for overall policy, and will set up sub-committees to co-ordinate the standards for registration and accreditation across the four groups.

The Membership of the Engineering Registration Committee will comprise:

(1) A Chairman appointed from the existing members of The Council.
(2) Two other Council members, one from the Professional Institutions Standing Committee and one from the Educational and Training Standing Committee.
(3) Three members appointed from each of the four Executive Group Committees and comprising in each case: the Chairman or Deputy Chairman of the Executive Group Committees, who will be Chartered Engineers plus two members (or their nominated alternatives), one representing the Chartered Engineers and one representing the Technician Engineers and Engineering Technicians.

In putting forward these proposals, The Council is fully aware that this is a system of nominated appointments, based on the Engineering Institutions. A system of direct elections is not proposed, since registration and accreditation are matters of peer judgement, best handled by nominations from the individual institutions. The Council considers that the democratic safeguards for the registration of the profession are covered by the electoral system used by the individual institutions for their own Councils.

Engineering Assembly

4.9 The Engineering Council is giving consideration to the possibility of an engineering assembly which would meet periodically to debate matters of interest and concern to the profession, and to make recommendations to The Engineering Council. Membership of this assembly would be on the basis of elected representation.

5. Funding of The Engineering Council

It is the intention of The Council that the Secretariat will be small and of high quality staff and that it will work through, and with, other appropriate organisations. The cost will be limited to the overheads associated with a Secretariat limited on present assessments to 25–30 people. For the first three years it is being funded by a grant-in-aid from the Government. Thereafter it will look to the Professional Institutions, Government and possibly industry for its funding on the basis that each sector has a responsibility to assist The Council in its objective of raising the performance of engineering and engineers for the nation's benefit. It would not expect to receive more than half its funding from any one of the three sources.

This paper was first presented by the author at the Institute's Annual Conference at Stratford-upon-Avon in May 1982. Mr Morgan is an Electronics and Communications Engineer with the Welsh Health Technical Services Organisation.

Mobile Radio Communications

R R MORGAN BEng(Tech) CEng MIEE FIHospE

Introduction

To introduce my subject I would like to quote a small paragraph from one of our National newspapers.

"In order to carry Blood Samples from a City Hospital to the Analysing Laboratory 3 miles away, Devenport Hospitals have decided to use pigeons to carry the containers. The result of this will be to give an improvement over the present service and also to reduce the costs of the present arrangements."

You may wonder when this article was printed. Perhaps you will be surprised to hear that it was only just over a year or so ago!

This example is not intended to illustrate how short our hospitals are of money, but to demonstrate that whilst attitudes towards new technology must change, we do not always need the tremendous advances in technology to solve many of our problems. We must always consider the basic requirements. I am sure that some miracle of science could have been developed to speed these samples on their way. But at what cost? Technical sophistication would not necessarily provide us with the best solution.

We often marvel at the wonders that telecommunications can provide. Instant plane bookings, the ability for millions of people to automatically telephone each other, television pictures from the moon etc., etc.

However, there are times when we must come back down to earth. Whilst this technology is available to us do we, in the Health Care field, really need the high degree of sophistication in Telecommunications? Perhaps industry and commerce need these highly sophisticated systems, in order to secure instant data and statistics or manage their instant by instant cash flow. But it is my experience that what we really need in the Health Service are reliable communications systems with only a very limited amount of sophistication. We are all here to aid our medical colleagues in providing efficient and cost effective technical support facilities with the minimum of frills — and the benefits to the patient being our prime concern. My experience has led me, and many of my colleagues, to the conclusion that in the field of mobile radio communications our needs can most effectively be met by good reliable voice communication systems with only a limited amount of sophistication.

My aim is not to provide a technical exposition on radio communications but to attempt to present a general background to the present facilities and how they are developing. I will introduce some new ideas which are coming along and finally look to the future. However, I would like to clarify that, in respect of this paper, radio communications will relate to wide area communications which cover many hundreds or even thousands of square miles as opposed to local communications in hospitals or other health establishments, which are designed and licenced for that limited site only. Also, whilst the vast majority of the paper is relevant to the 4 consituent countries of the UK, minor technical differences do occur between the four countries.

Radio communications is, in the life of the National Health Service, fairly new. It was not until 1974, when the ambulance service joined the National Health Service and brought with it a network of control centres and radio communication systems, that we really had any large wide area communications systems. Until then, what did exist, were small, isolated, perhaps single site systems for specific local purposes. The process of combining the many former local authority ambulance controls to Area Health Authority, or Metropolitan Services is now complete and larger and more efficient controls exist. Only 50% of the former total number of controls now remain.

The effect of this has been to provide a more flexible and higher standard of service using less control centres. With the ability to integrate radio communications and health care functions to include works, administration, transport etc., the concept of health service communications centres are now more readily capable of being effectively developed.

Development

Originally, ambulance mobile radio systems used the very high frequency (VHF) low band part of the radio spectrum (about 70-90 MHz) with 100 KHz channel spacing. However, over the years since 1948, a random mixture and types of radio systems developed until, in the late 1960's, every combination of frequency band and modulation existed. So many non-compatible arrays of radio systems existed it was impossible to consider an integrated ambulance service capable of operating across local boundaries. Eventually in 1970 the Department of Health, in conjunction with the Home Office, issued guidance

	VHF	UHF
Number of Radio Channels	34	2
Frequency	166/171 MHz	453/459 MHz
Channel Spacing	12.5 KHz	25 KHz
Form of Modulation	Frequency	
Methods of Working	Two Frequency Simplex	
Maximum Radiated Power	25 Watts	

Figure 1: Allocated NHS Spectrum.

in England and Wales rationalising all the systems into one compatible network.

The final spectrum allocated — together with two UHF channels later allocated for use in conjuction with major incident vehicles — is shown in *Figure 1.*

Results of the changeover have been most successful. In addition to the routine benefits such as the ability to seek assistance when out of range of one's own radio system or to assist other services when appropriate, the concept of a national emergency radio channel to be used in major accidents or disasters has been achieved.

The policies and concepts of our Ambulance and other communication systems are impressive. This concept of rationalised block radio channels for all services in England and Wales (and also a separate block for use in Scotland and Northern Ireland) is particularly unique. However, it is all too easy to become complacent. We are in an age of rapid technological development and the Health Service has at its disposal knowhow and facilities which can be developed both technically and operationally, to further improve the care of the patient. With radio communications being a 24 hour necessity for the ambulance service, it imposes a considerable financial implication on the NHS. To maximise these facilities a concept is developing in many authorities, where many other disciplines are provided with communication systems based on the ambulance control.

Many ambulance services throughout the country have developed their controls as integrated communication centres, which incorporate radio communications for many health services users. Typical users are shown in *Figure 2.* As Engineers we should strongly support this development and see it as an efficient, cost effective and logical extension of the present high capital and revenue consequence investment in telecommunication systems.

Figure 2: Typical Users of Radio Communications.

- ☐ Ambulance Service
- ☐ Community Nursing
- ☐ Blood Transfusion Service
- ☐ Renal Dialysis Service Teams
- ☐ General Practitioners
- ☐ Works Departments
- ☐ Transport/Stores Vehicles

Before we examine the present situation regarding these systems, let us first briefly look at the growth in mobile radios for England and Wales.

Figure 3 shows the growth in mobile radio since the late 1940's. A steady climb occurred until the early 70's when an acceleration occurred — particularly since 1974. This marked increase is mainly due to three reasons:

1. equipping and consolidating all the ambulance fleets,
2. providing radio communications for non-ambulance use,
3. reusing 'tired' ambulance radios for non emergency use i.e. most old radios are not sold or scrapped but returned for use by a lower operational user.

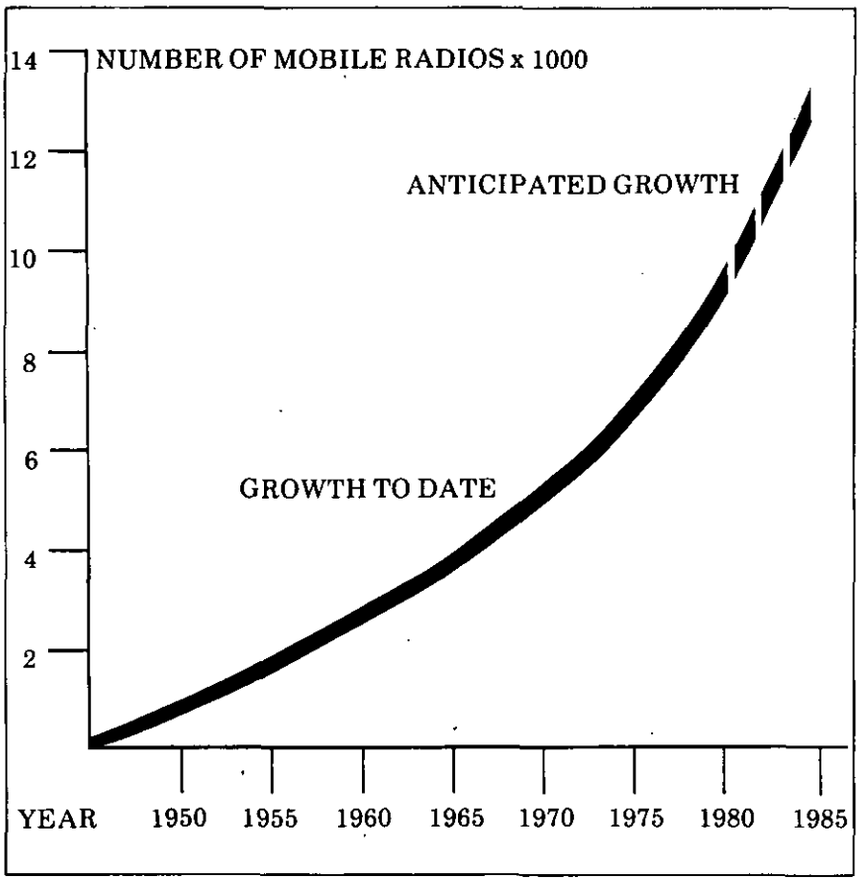
Figure 4 gives the present statistics for mobile radio communications, together with their estimated capital and revenue costings.

Figure 4: Mobile Radio Statistics.

☐ Ambulance Controls	105
☐ VHF Base Stations	450
☐ Radio Links	150
☐ Mobile Radios	12000
☐ Estimated Replacement Costs	
Systems	£15-20m
Radio	£ 5- 7m

This is no small part of the Health Service state. Even so, whilst I have estimated that the present like for like replacement value of all radio communication systems is in the order of £15 to £20 million, experience is indication that when these schemes are replaced they are usually provided

Figure 3: Growth of Radio Communications.



not on a like for like basis but incorporating improvements, such as multi-user access of selective calling etc. The capital value of future schemes could, therefore, be in excess of this figure. Although, overall, other benefits accrue which should show improved patient care — particularly, in the case of integrated telecommunications — reductions in revenue can be achieved.

Provision of Services

How should be provide for these developments? Historically, the planning and design of ambulance service radio communication systems has, with few notable exceptions, been a joint effort between the ambulance service and the various radio equipment suppliers.

It is considered that these arrangements were perhaps adequate in the past. But, with present day technology, and the ever increasing competition between manufacturers offering various alternative solutions, it is essential that a clear, technical specification, containing engineering standards and proposed operation of the radio system is prepared, particularly as the cost per Region of a Radio System is on average £1 — 1.5m.

Since 1974 a number of Regional Health Authorities have developed 'in-house' telecommunication expertise in order to assist ambulance and other health disciplines in the planning and design of radio communication systems. With the continuing need for technical guidance, representatives from each of these regions together with Wales, Scotland and Northern Ireland meet under the auspices of the DHSS Inter Authority Working Group No.7, to produce telecommunication guidance material for use within the NHS. Also represented on this working group is a representative of the Regional Ambulance Officers. Perhaps the most familiar product of this group is the 'blue book' entitled "Ambulance Service Communications", published in November 1976, but later updated and reprinted as a DHSS Engineering Data Sheet. Approval has recently been given for this Data Sheet to be further updated and incorporate new developments and techniques described in later data sheets.

Other guidance produced by the group and also Home Office documentation etc. is listed in the bibliography and references at the end of this paper.

The type of service offered individually by the regional communication engineers range from theoretical specification preparation to full radio survey and site detail specifications. With the considerable capital investment and technicalities of radio communications it is vital that Authorities have access to independant bodies — preferably 'in-house' — to plan and design their radio communication systems.

It is interesting to note that the NHS is now one of the largest national users of telecommunications without a full national range of 'in-house' expertise for contract planning.

Maintenance

It is estimated that the maintenance cost of NHS radio communication schemes is now in excess of £1 million per annum and is undertaken by one of the following methods:

1. Radio Equipment Supplier.
2. Independent Contractor.
3. In House (or other Government or Public Department).

The vast majority, over 90%, are maintained by the supplier with the remainder being maintained by one of the other alternatives. A survey into the standards of maintenance has shown a wide variance in quality.

As we are spending public money it is essential that the standards of maintenance are effectively monitored by a qualified NHS (or Consultant) Radio Communications Engineer. Alternatively, if this is not possible, using the system and documentation which has been prepared by the DHSS Working Group 7 in order to ensure that manufacturers performance specifications are actually being maintained.

The Way Ahead

Earlier in this paper the concept of integrate communication centres for all NHS disciplines was identified. This had led to the need to further review the present technical and management consideration of mobile radio telecommunications.

It is not intended to give a depth review of all the procedures and technicalities involved, but just to identify a few ideas and thoughts, which should be kept in mind when designing systems and also the implications of increased radio usage in our block of radio channels.

As with the Ambulance Service, many of the other services provided are not constrained by County or other established boundaries.

The services provided by the Blood Transfusion Service or Renal Dialysis Technicians are usually on a regional or sub-regional basis and need a fully rationalised communication system with a similar concept to that of the Ambulance Service in order to communicate across established boundaries.

There are many ways of achieving this, but I feel the best solution is to ensure that all NHS radio services are operated in the same frequency band as the Ambulance Service. A number of advantages are listed below.

1. Services which cross health authority boundaries can easily be contacted by any health authority radio network.
2. Services which are unlikely to require extensive radio facilities can share a radio channel within an authority.
3. All radio equipment in use in the NHS can be similar. Hence a central purchasing contract would be possible.
4. A common frequency and form of modulation would simplify planning and maintenance.
5. Inter availability of equipment in times of emergency would be of great benefit to all disciplines in the NHS.
6. When the equipment provided for emergency services is renewed redundant equipment can be re-utilised on less urgent services.
7. With increasing difficulties obtaining facilities and masts for radio communication systems the quantity of aerials needed could be considerably reduced if all systems were in the same frequency band. Using special techniques, saving in rental charges can also be achieved.

In Wales we have already taken a policy decision that all wide area radio communications systems would follow this concept, and our present and future integrated controls are being designed for all NHS users to operate within the High Band VHF part of the radio spectrum using frequency modulation (166/171 MHz FM).

Radio Channels

Throughout England and Wales we have available to us a maximum of 34 radio channels, which are frequently repeated over the two countries. With correct management of these channels on a national basis, there is

no reason why they should not meet our requirements for many years to come, both for the ambulance and non-ambulance communication systems.

Increasingly, however, concern is being expressed in many quarters regarding the shortage of radio channels for mobile radio users. The radio spectrum is finite — you can't squeeze a quart into a pint pot! One of our future difficulties therefore is likely to be that of obtaining additional radio channels from the Home Office, (Radio Regulatory Department), even from within our own block of channels.

If we wish to follow the concept of using channels all within switchable range for all NHS services, then the allocation of these channels must be undertaken with considerable foresight, or else massive interference problems will occur between radio channels in our own block with the high possibility of them very rapidly 'running out'.

Unfortunately, unlike many other industries and organisations such as the Electricity Boards, Gas Undertakings, Forestry Commission, Automobile Association etc. we are not masters of our own destiny, having overall management of our own block of channels. If we wish to extend the life of our channels and maximise their usage it is essential that they should only be managed and operated by the NHS who would also have the ultimate responsiblity for resolving any interference or difficulties arising in the operation of the radio systems. In this respect an examination of the possibility of the DHSS/NHS managing their own channels is under review at the present time.

Nevertheless, before we can assess our requirements, it is vital to determine what radio channel loadings we have at present.

Let us look at how we could determine our channel loadings in order to see when additional channels are required.

An examination of the number of mobile radios per channel for the ambulance service in England and Wales has shown that they range from 10 in one Health Authority to 160 in another. A very wide variation.

Up to the present time a number of rules of thumb have been applied for the number of mobile radios capable of being operated on one channel. Clearly, these rules of thumb are inappropriate when more and more users of different operational requirements and usage need to be contained within the 34 radio channels available — especially as it is highly improbable that any additional radio channels within suitable range will be allocated to the NHS by the Home Office.

It is also in the financial interest of the NHS that additional channels are not used unnecessarily as these consume considerable amounts of capital and associated revenue consequences. Where different services need radio communications but do not wish their messages to be heard by others, methods are available which enable them to share a channel and appear to the user as if they were on separate channels.

How can we determine whether a radio channel is saturated? One technique that has been developed by DHSS and Working Group 7, automatically looks at the minute by minute occupation of a radio channel and, after processing, produces a computer print out. The loadings of a channel can be averaged over any period of 5, 15 or 30 minutes. This computer printout — as shown in *figure 5* — shows the radio channel occupancy of an ambulance service

Figure 5: Computer Printout of Radio Traffic Data.

BRIEF SAMPLE OF ANALYSIS OF AMBULANCE RADIO DATA
AMBULANCE SERVICE MID GLAMORGAN
Channel 29A
Frequency 166.525 KHz on 28 September, 1979
Averaged over 15 minute periods from 08.15

PERIOD FROM	PERIOD TO	AVGE % USE	PERCENTAGE USE OVER PERIOD 0 10 20 30 40 50 60 70 80 90 100
08.15	08.30	45	XXXXXXXXXXX
08.30	08.45	56	XXXXXXXXXXXXXX
08.45	09.00	50	XXXXXXXXXXXX
09.00	09.15	64	XXXXXXXXXXXXXXXXX
09.15	09.30	43	XXXXXXXXXX
09.30	09.45	52	XXXXXXXXX
10.00	10.15	50	XXXXXXXXXXXXX
10.15	10.30	29	XXXXXXXXXX
10.30	10.45	20	XXXXX
10.45	11.00	36	XXXXXXXXXX
11.00	11.15	51	XXXXXXXXXXXXX
11.15	11.30	51	XXXXXXXXXXXXX
11.30	11.45	49	XXXXXXXXX
11.45	12.00	36	XXXXXXXXX
12.00	12.15	14	XXX
12.15	12.30	33	XXXXXXXX
12.30	12.45	42	XXXXXXXXXXX
12.45	13.00	39	XXXXXXXXXXX
13.00	13.15	36	XXXXXXXXX
13.15	13.30	56	XXXXXXXXXXXXXXXX
13.30	13.45	69	XXXXXXXXXXXXXXXXXX
13.45	14.00	44	XXXXXXXXXXX
14.00	14.15	42	XXXXXXXXXXX
14.15	14.30	29	XXXXXXXXX
14.30	14.45	25	XXXXXXXX
14.45	15.00	44	XXXXXXXXXXXX
15.00	15.15	25	XXXXXX
15.15	15.30	28	XXXXXXX
15.38	15.45	35	XXXXXXXXX
15.45	16.00	48	XXXXXXXXXXXX
16.00	16.15	24	XXXXXX
16.15	16.30	46	XXXXXXXXXXXX
16.30	16.45	40	XXXXXXXXXX
16.45	17.00	50	XXXXXXXXXX
17.00	17.15	61	XXXXXXXXXXXXXXX
17.15	17.35	17	XXXXX
17.30	17.45	4	XXX
17.45	18.00	0	

which combined all emergency and non-emergency work onto one channel. No other channel was available.

The capital cost of the technique used in this scheme amounted to approximately £4,000. In addition to these benefits others can accrue. With the rapid increase in radio communications not only for the NHS but for all other users, the possibility of interference dramatically increases. Only with correct engineering and techniques such as aerial combining can these risks of interference be reduced. With aerial combining systems the addition of a further base station is a simple matter of purchasing one extra "black box" and plugging the equipment in.

The Future

So far we have covered the concepts and techniques of what is in use and these that are actually with us now. What about the others just on line or planned for the future?

Most of the existing radio schemes were installed between 1969 and 1974/5 and are now coming up for renewal. Should we renew them on a like for like basis or integrate with other forms of communications such as telephone, telex, data etc? An examination of communication routes of all these facilities in most authorities will show that they follow a common path.

In Powys, we have taken advantage of this fact and are bulk buying Broadband speech/data circuits from British Telecom.

This will enable us to easily add other facilities to the networks — such as wide area paging, computer links etc., as and when deemed necessary by the authority.

This scheme, which will be installed over a five year period, will integrate all radio, telephone paging telex, facsimile etc. into one network such that, in respect of telephones, no health establishment would need to pay more than a local call to any other establishment, which in the case of this authority can be up to 90 miles away. In fact most Health Service calls will be free over the private network. In addition direct and automatic telephone access to mobile radios and the wide area paging system will be available.

If communications are examined as one subject and not as a number of isolated systems, vast savings can be made. A saving of a million pounds over ten years is envisaged with this planned network. Savings in other ways can be achieved by scale. One region in England is replacing its radio communication networks as one contract for all the Health Authorities of the region. Savings in the order of a third to half a million pounds have been achieved by a single large contract which has been tendered for at the approximate price of £1.1 million pounds.

Some of you may consider that the question of radio communications is a somewhat specialised function. However, the full facilities available from the works organisation are vital.

The technical specification and contract for such systems, while perhaps not being the normal engineerng type specification, still needs to be carefully prepared and managed, the new systems may have a considerable amount of building and engineering work to be carried out in circumstances which are unusual in the Health Service. In many instances, masts have to be erected, control accommodation has to be designed and built, some of these facilities perhaps being required on virgin land in high remote areas of the country.

The fleet size was 115 vehicles whilst it was estimated that the maximum vehicles on the road at any one time was 35. This channel was not deemed to be overloaded although it was considered that it was nearing its maximum capacity at certain times of the day.

It can be shown statistically that, from the print-out shown, a mean waiting time of 25 secs occurs when the channel is 60% loaded. Clearly channel loadings and capacity depend on how long one is prepared to wait to made a call. For emergency services this must be low but for non emergency it could be considerable.

If any authority is considering applying for an additional radio channel or studying its existing loadings they can avail themselves of this facility which should in the first instance be via their Regional Engineer to the DHSS.

Alternatively they could contact any member of Working Group 7 for advice and guidance.

Aerial Combining Systems

Another problem which is likely to be encountered more frequently in future is that of obtaining aerial facilities on radio masts. Historically the NHS does not generally develop its own radio sites but resorts to using sites owned by other bodies ranging from the Local Vet to the Home Office, or the BBC.

In the majority of cases this is a better solution, since with the limited capital available to us, it is unlikely that development of radio sites on hill tops or other locations can be shown to be cost effective in the short term.

Unfortunately, with increasing environmental awareness in the UK, permission for the erection of additional radio masts by any user can be difficult. Existing masts are often full and the need to provide aerial combining systems — which combine many transmitters and receivers to operate through only 1 or 2 aerials — should be considered — although insome cases, it may not be technically feasible owing to the spacing of the radio channels used by the authority. Normally, every transmitter and receiver of a base station on a radio site has its own aerial and it is obvious that with rental costs of approximately £300 — £600 per base station a system with 4 or 5 base stations per site, the rental costs can be high.

One of our communication centres in Wales (South Glamorgan) has communication facilities for the Ambulance Service, Transport Services — such as stores vehicles, — and for the local hospital doctors and GP's. It also provides a wide area paging system and a channel for the national emergency reserve (ERC) system for this country. All these operate on high band FM, are within switchable range of each other and are adequately spaced for aerial combining to be considered. This enabled us to consider an aerial combining system as a means of reducing revenue. The system which is shown in *Figure 6* combines all the receivers and transmitters into one aerial which is located on a water tower some 150 metres from the actual control centre itself. The aerial feeder cable is laid across land owned by the Health Authority and then onto land owned by the Local Council. Without the use of aerial combining systems this site could not have been considered due to the loading restrictions dictated by the local Water Authority. The rent for this one aerial carrying five systems is £100 per annum compared with possibly £1,400 per annum using

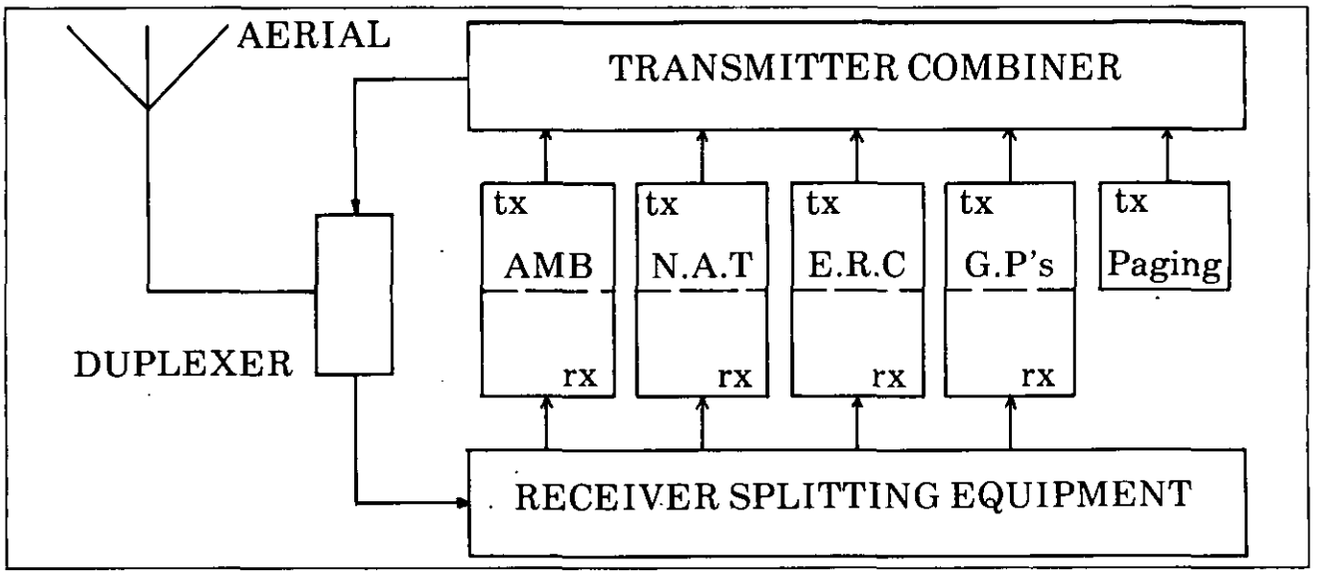


Figure 6: Diagram of Aerial Combining System.

normal techniques of multiple aerials.

I can assure you this is a challenge to any engineer or building officer. With the many facets that have to be considered in the planning of a radio system, a good lead in period of perhaps 12-18 months is required before installation can proceed.

Conclusion

In summing up, radio communications have become a major part of the Health Service Estate and in many areas it is becoming integrated with other forms of telecommunications.

Many millions of pounds will be expended per region on all forms of telecommunications in the next few years. Let us not look at them in isolation. Integrating our communication systems will make life a lot easier and also achieve revenue savings. Look carefully at the future and explore this new world.

I often think of a remark that was made by Lord Kelvin in 1897 (just before he was made president of the Institute of Electrical Engineers) whilst watching the trials being carried out by Marconi into this revolutionary new method of communications called radio. Following the trial he said:-
"Telegraphy without wires is all very well but I'd rather send a message by a boy on a pony"!

Acknowledgements

I wish to thank the Welsh Health Technical Services Organisation for allowing me to prepare and present this paper. In particular I would like to thank my colleague, Din Patel, for his considerable assistance in the preparation of the paper and many other colleagues at the DHSS and in the Health Service for their help.

References and Bibliography

DHSS Data Sheets

DF 1.0	Glossary of Terms	1979
DF 8.0	Hand Portable Radio Communications	Nov 1976
DF 9.0	Ambulance Service Telecommunications	Feb 1978
DF 10.0	Guidance on the preparation of Standard Specifications for Radio Equipment	Oct 1978
DF 11.0	Guidance on the provision of Major Accident Telecommunications	April 1980
DF 12.0	Non Speech Tone Sequential signalling systems for Private Mobile Radio in the NHS	—
DF 13.0	*Radio Communication Equipment*	*June 1980*

DHSS (Chief Ambulance Officer)

	Monitoring the maintenance of Ambulance Mobile Radio Sets	July 1979

Her Majesty's Stationery Office

	Handbook for Private Mobile Radio users	1978

Others

P J Mann	Combined Communications in the Health Service	DHSS Telecommunications Symposium. Dec 1977
R R Morgan	Health Care Radio Communications in the United Kingdom	6th International Congress of Hospital Engineering July '80
Smail, Lloyd, Mann	New Communication Service for primary care	British Medical Journal Vol. 282: Jan '81.
K H Gregory	The Regional Communications Scheme	Ambulance Journal Nov/Dec 1981

Mr Kelly is an Area Works Officer with the Bolton Area Health Authority, having previously been employed as an Architect by the North Western Regional Health Authority. One of his major interests has been involved the use of prefabricated structures and various systems. He has been involved in the Hospital Service since 1952 and has been a member of a DHSS Advisory Committee on the building of Teaching Hospitals.

The Case for the Prefabricated Building

G D KELLY ARIBA ARICS

Introduction

Prefabrication can be defined as the construction of a building, either whole or in part, on a non-traditional basis using components manufactured off site and erected to a pre-determined system based on some form of modular design. The materials used vary according to the particular design or system; these can be summarised as:

(a) Built using timber as a basic material, framed up and infilled with panel units
(b) Built using steel or reinforced concrete frames and infilled with panel units
(c) Built using a mixture of the above, plus traditional forms of construction.

The reason for the development of prefabrication is obvious in that the components can be manufactured in a factory to controlled conditions and dimensions, making more use of machinery than would be possible on the site.

It has been with us a long time; even in the middle ages some form of system building existed in the construction of timber frames infilled with 'wattle' of 'daub' but since 1946 we have seen a tremendous expansion in this field in the hope that the methods of the manufacturing industry could be introduced into building to produce a cheaper and more quickly erected product. (An extract from the British Medical Journal dated August, 7 1915 is very interesting — nothing changes! See Appendix 1).

The 1950's and 1960's saw the proliferation of certain systems and based thereon, buildings were erected using timber, steel and reinforced concrete. Many of these systems have failed, both on grounds of economy and performance. The buildings have, in many instances, cost considerable sums to maintain due to their being unable to withstand the climatic conditions and some have even had to be demolished or are due for demolition due to structural failures or unsuitability — for example — many high rise blocks of flats, system built, are now acknowledged as failures.

Traditional building is obviously the most satisfactory, long term concept for both initial cost and maintenance because it is based on what, by past experience, has been found to be the most satisfactory method of construction and materials to suit the particular locality but it has certain deficiencies — namely;

(a) The time required to design and erect a building, coupled with the apparent shortage of skilled building labour and increasing costs
(b) The cost of traditional building have tended to increase rapidly due to the way the building industry is organised and the inflationary costs of labour and materials so that clients are often faced with a total bill considerably in excess of their initial proposals.

Suitable occasions for the use of prefabricated structures

These can be listed as follows:

(a) Where a building is needed quickly for a short term
(b) Where a building is needed to extend, adapt or re-use existing buildings for a limited period
(c) Where a building has a known short life — say — 15/20 years or up to 40 years; then it is reasonable to suppose the site would be cleared
(d) Where speed of erection is critical to the client's needs and traditional construction would take too long
(e) Where a combination of the above factors exist but, nevertheless, the client requires a permanent building then a combination of prefabrication and traditional building methods can be used.

Many proprietary systems are now on the market for the provision of what, in effect, is instant accommodation. These buildings are manufactured in standard sizes and can be brought onto site and joined together to form one large or separate buildings. They are usually pre-manufactured on a steel base frame which is supported on site on concrete flags or blocks, free-standing on the ground, which can then be covered with gravel or other form of paving. The foundation required is light and it is usually sufficient to strip the top soil and spread the load; this can be achieved in difficult cases by constructing concrete strips. The buildings are usually constructed in a mixture of metal, timber and plastic, pre-finished both internally and externally, complete with electrical services so that they can be connected up and occupied. Heating is usually by electric elements or, alternatively, a low pressure hot water system or convectors

can be installed. Toilets and kitchen units are available.

Such buildings have obvious advantages for the quick provision of office or similar accommodation but are not suitable for patient use other than for relatively short periods of time. Their probable life, if retained on site, would be a maximum of, say, seven/eight years. In the redevelopment of hospitals, they have an important role to play in that they can be used for decanting purposes with relative ease.

In the case where a building is needed for, say, 20/25 years, the timber prefabricated building has a lot to commend it. Many specialist manufacturers exist in this field who provide satisfactory structures. They can be constructed either on a solid concrete foundation covered in asphalt with a suitable floor finish or can be provided with timber floors above the normal Building Regulations site concrete, together with a perimeter concrete or brick foundation.

These buildings are manufactured on a modular basis according to the particular manufacturer's system. The timber is, of necessity, high quality and is framed up in the form of a post and lintel design with infilled wall panels, the roof being composed of timber beams formed in plywood. The roofs are then covered in timber framed units and roofing felt is usual. Various external wall panels are usually in plywood, either painted or covered in patent finishes which are now available. Such buildings can be insulated to a high standard by using fibreglass. It is possible to reduce the heat loss by 23% compared with normal traditional construction, if double-glazing is employed and a 100mm fibreglass quilt.

Prefabricated structures need to be built of selected quality structural timber, suitably treated against rot or attack by insects by the patent processes available. External finishes need not be always painted — many of the protective timber stains available are attractive. The use of materials which do not require maintenance is increasing and one firm produces a 'Maintenance Miser' prefabricated design incorporating aluminium or PVC windows with brick cladding. The flat roofs used on such buildings can result in high maintenance costs but if a high quality finish such as 'Amascoflex' is used, then this can be considerably reduced and is comparable to traditional costs.

If the building is desired to have a life of up to fifty years, then it is possible to consider a form of construction based on concrete foundations with suitable floor finishes — a prefabricated structure, either with a flat or pitched roof, which can then be clad externally with brickwork or stone, the cladding being of a non-structural nature. This practice is used extensively in North America in the domestic market. The advantages are that the interior can be prefabricated and erected quickly. The interior of these buildings is in plasterboard which gives the necessary fire precautions requirements. The roofs can either be flat or covered with traditional type roofing materials, such as slate, tiles or concrete interlocking tiles.

Moving further into the last type of building where certain portions are prefabricated but the majority of the structure is of a traditional nature, there are on the market a number of systems which are based on the construction of traditional type foundations, the supply and erection of a manufactured steel frame to standard dimensions within which fit standard components in the form of either concrete wall units or brick cladding with standardised fenestration and windows. These systems have much to commend them in speed of erection and the final appearance externally is a traditional one.

The market for prefabrication must increase and although it has had many failures, a point must be reached in the relatively near future when manufacturing techniques overtake the cost of traditional site construction. At present, site construction costs are said to be cheaper than factory costs but with the development of manufacturing methods, the use of the 'Silicone Chip' and computer controlled machinery, obviously it is only a matter of time.

Therefore, I suggest that we should all think along these lines when considering the future.

Special types of prefabrication

Certain national companies have developed prefabricated buildings to a very sophisticated level in the provision of a complete system based on steel frames with external wall panels designed to minimise maintenance, utilising steel, plastic or aluminium. These buildings are so designed that they can be erected from a complete kit of parts and, obviously, are the fore-runners of probable methods of construction in the future. They are much quicker to erect than traditional buildings but it does not follow that there would be any savings in costs.

Time scales

The time scale for the erection of buildings, as have been described, can vary according to local site circumstances but it can be said that the demountable type of building — that is the instant accommodation — can be fully functioning on site within six/ten weeks.

Prefabricated timber buildings of the simpler kind can be functional within six months.

The more advanced types for which a life expectancy of thirty-five/forty years is required can be occupied within nine/twelve months.

In the case of prefabricated portions incorporated in traditional buildings, large private hospitals, costing in excess of £1,000,000 have been erected and brought into operation in sixty-six weeks.

It is difficult to envisage how this could be achieved in traditional construction.

Costs

The cost of prefabricated structures is hard to generalise on but the cheaper type can be erected at the present time for approximately £100 — £120 per square metre. The better quality type of structures vary from £150 — £200 per square metre and the more sophisticated type, such as a hospital, would cost at present approximately £450 per square metre. A typical example cost would be £330 per square metre at 1978 prices.

The cost of good quality prefabricated construction is comparable with good quality traditional but it is true to say that with prefabricated timber buildings or such buildings with traditional cladding, a saving can be achieved over similar traditional costs of between 10% — 20% and even more is not unknown.

Works Officer's viewpoint

When Works staff are faced with the client's needs for the rapid provision

of accommodation within existing hospital complexes, there is a great attraction in being able to erect prefabricated buildings, as have been described, quickly and although they have not the life of a traditional building and would cost more to maintain, there is no doubt that they *do fulfil a need.*

The Royal Commission has indicated that a considerable deficiency exists and that the Government should institute a crash programme. It is difficult to visualise how a crash programme could be effected without the use of prefabricated buildings as described.

The traditional type of District General Hospital, built up over a period of years, lends itself to infillings by prefabricated buildings and again I stress that these are not meant to have a long life but to be capable of being removed when no longer required.

Therefore, when existing buildings have already passed the end of their useful life but are kept going out of necessity, it would appear logical to use prefabricated construction to, in effect, improve the occupancy as a whole until such time as these existing hospitals can be replaced.

In designing such buildings a Works Officer can refer to a considerable volume of materials and expertise. The Timber Research and Development Association can be helpful in the case of timber structures and it is wrong to think that these need to be only single storey. Multi-storey structures are possible, based on the use of timber or steel frameworks, and comply with the fire regulations.

The most satisfactory job can be achieved by using the 'Package Deal' contract and the Joint Contracts Tribunal are shortly to issue revised forms of contract covering:

(a) The complete package deal where the contractor designs and constructs
(b) The package deal where the client provides the initial design and the contractor provides detailed design and constructs.

The designer needs to pre-determine the client's intentions in the fullest possible detail, provide Room Data Sheets and, if possible, a Specification or even a Bills of Quantities, itemising exactly the accommodation to be provided, the standard of construction, the finish and the provision of fittings — as would be the case for a traditional building. This then enables the Specialist Contractors to design their building and make the best use of their system, avoiding alterations once work starts on site. The contractor is in exactly the same position as a General Contractor and it is certainly desirable that the substructure should be based on a Bill of Quantities so that this can, in effect, be measured.

The future

The future of the National Health Service is difficult to forecast but certain trends can be reasonably assumed:

(a) That medicine will change rapidly in its form and treatment in the next thirty years.
(b) That micro-processors will mean much more electronic equipment will be used to diagnose, investigate, anaylse and treat patients.
(c) That there will be increasing tendency to automate and mechanise health services. The processing, recording and control of staff, patients, visitors etc., will need more electronic devices and computers. Machines will increasingly do the work that is now done by people.
(d) The stay in acute hospitals will become shorter, linked to the high costs of the specialist medical facilities.
(e) Long-stay hospitals will be planned and operated with a minimum of staff, based on automated devices. It may be possible, as a result of the 'Chip', to provide the full range of diagnostic and treatment facilities economically in much smaller hospitals — say forty beds — so that the Cottage Hospital, suitably improved, could become viable.

These trends will require maximum flexibililty in space and accommodation use so that departments can grow, contract or be re-arranged to suit future developments.

Building health facilities, to provide for this maximum flexibility, is a difficult task. The Nottingham Teaching Hospital is an example of this, using traditional construction with each operational floor having a completely separate service floor. Obviously, this is a costly investment but could well prove to be worthwhile.

The prefabricated building has a substantial contribution to make in this respect. It is usually possible to re-arrange the accommodation because the internal walls are only partitions and easily altered. If required, the building can be removed or re-erected completely.

In the case of traditionally designed health buildings with the multiplicity of rooms required by Hospital Building Notes, it is difficult to envisage how they could be easily re-arranged without extensive rebuilding.

The future must mean an acceptance of new technology and a willingness to try new techniques. In the world of the prefabricated building no doubt failures will occur but great successes will also be achieved. If we can progress in this field so as to provide successfully such structures economically with a minimum of maintenance requirement, then obviously a considerable market exists both in the United Kingdom and the world at large.

The National Health Service has a contribution to make by using such buildings where suitable and encouraging their development. It should not be determined to build only in traditional forms but rather look forward and act in an enlightened manner whenever this is consistent with its needs. Eventually health space requirements will be computerised and could then be translated by computer into building elements which, by linkage together, would be able to provide the enclosing envelope of the building structure.

Such a feature could only be achieved by prefabrication of the requisite elements.

The management of construction contracts in the United Kingdom is said to be less than efficient by comparison with North America and the E.E.C., both in time and cost performance norms. In support of a policy to improve both, it is suggested that prefabrication can make a contribution by reason of the discipline it imposes in modular design, pre-planning of construction and work on site. It is pointless to produce a highly efficient manufacturing unit for building elements unless the same standard of efficiency can be extensively applied to site work. In this type of building it should be possible to achieve a level of site efficiency above traditional methods.

Before closing, I would like to refer to the excellent work that has been carried out by the Oxford Regional Health Authority and the Oxford system they developed, based on a steel frame infilled with P.V.C. coated steel panels, supplied complete with windows and inside finish. I regard this system as an essential step towards what I believe is the future form of building. Although this system has had its fair share of criticism, I believe its basic conception is correct.

Product News

Pipe clamp probe

A new clamp probe (CKIP2MP) has been developed by Comark Electronics Ltd for the heating and ventilation industry, although it has applications in other spheres.

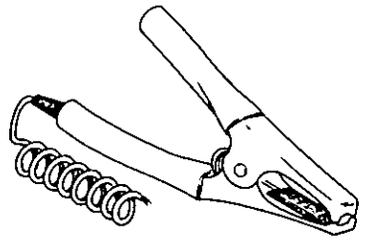
It measures pipe temperatures up to 100°C and offers a means of obtaining flow and return comparisons and balancing radiators. The thermocouple material is type K (Ni-Cr/Ni-Al) and the jaw opening is suitable for 15 mm to 38 mm pipework.

When using the clamp probe in conjunction with a thermometer, the engineer can make a survey and fault diagnosis even on a large and complex system, and this very quickly according to manufacturer's claims.

The clamp probe is supplied complete with two metres of coiled cable and a factory-fitted miniature plug.

Details are available from: Comark Electronics Ltd, Rustington, West Sussex. BN16 3QZ. Tel: Rustington (09062) 71911.

Pipe Clamp Probe



Power supply monitors

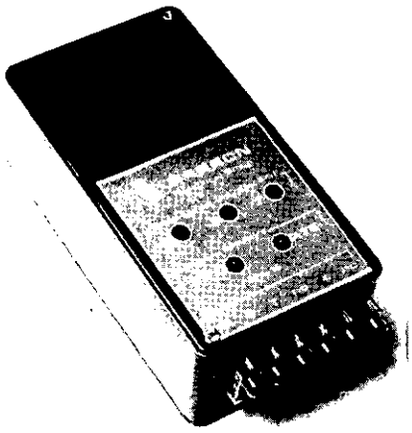
Equipment for monitoring mains power supply to life-support equipment in hospitals, and switch on emergency power service automatically in the event of phase failure or under-voltage, is now available from Barron Electrical Group.

Designed to monitor 3-phase supplies of between 380 and 440 volts a.c., these phase failure units from the Barron BE30.40 Series can also be used in a similar way to safeguard lighting and heating services.

Various models are available, all incorporating advanced solid state circuitry. Prices of standard units are from under £18 (plus VAT), while special-purpose models can also be designed to meet specific non-standard requirements.

Full details of models and applications are available from Barron Electrical Group, Breakspear Road, Ruislip, Middlesex HA4 7SG. Tel: Ruislip (08956) 37123.

Power supply monitor.



Electronic phase converter

A new British-made electronic phase converter is aimed at bringing the advantages of three phase electrical supply to premises only connected to single phase. Moreover, several electric motors may be supplied by a single converter provided that their combined load does not exceed 5 HP.

Variations in load are sensed automatically, eliminating the need to make manual adjustments before switching machines on or off. Equally, adjustments whilst machines are running are unnecessary.

Provision is made for different single phase voltage inputs. There is a three phase output connection.

The manufacturers suggest that the electronic phase converter is suitable for engineering workshops, wood machinists, manufacturers of furniture, food, textiles, clothing, printing, and packaging machinery, as well as heating and ventilating systems.

Further information is available from Capital (UE) Ltd, 12 Tulip Tree Avenue, Kenilworth, Warwickshire, CV8 2BU. Tel: Leamington Spa (0926) 54293.

Classified Advertisements

Appointments and Situations Vacant

NORTH WEST THAMES REGIONAL HEALTH AUTHORITY

REGIONAL ENGINEER

Scale: Region 1

£18,021 - £21,608

Following the retirement of the present post-holder, the Regional Health Authority wishes to appoint a suitably qualified and experienced manager to the post of Regional Engineer.

The successful candidate will be responsible for maintaining high standards of design and for the efficient and cost effective working of the Regional Engineer's Division of the Regional Health Authority Works Department and providing the Regional Works Officer with advice on all engineering matters.

Applicants must be a Chartered Engineer and a Corporate Member of one of the Institutions of Civil, Mechanical, Electrical or Electronic and Radio Engineers or the Chartered Institute of Building Services.

Peter Bathurst, Regional Works Officer, will be pleased to discuss the appointment informally. Telephone No. 01-262 8011 Extension No. 218.

Further details and application forms may be obtained from the Regional Personnel Officer, North West Thames Regional Health Authority, 40 Eastbourne Terrace, London W2 3QR. Telephone No. 01-262 8011 Extension No. 411 (Answer Phone).

Closing date for applications: 22 November 1982

Please quote reference number 896.

CHIEF ENGINEER

(Director of Plant Facilities)

Saudi Arabia

Excellent tax free salary

AMI is recruiting for the King Khaled Eye Specialist Hospital in Riyadh, Saudi Arabia. This 263-bed eye specialist hospital is one of the most sophisticated of its kind. It will be managed by the joint venture of AMI/GAMA.

The hospital, which is scheduled to be opened in December, is a spectacularly designed building situated in Riyadh, the cosmopolitan capital of Saudi Arabia. It will quickly become the country's leading referral centre for the treatment of eye disorders.

Benefits include a highly competitive tax free salary with a valuable completion of contract bonus, up to 60 days annual leave, including public holidays and, of course, free medical care.

Whilst living abroad, you can expect a particularly high standard of living, with attractive, fully furnished accommodation on the campus, which also offers many sporting facilities, including swimming pools and tennis courts.

To work at the King Khaled Eye Specialist Hospital, you must hold a British or Irish passport, and preferably have Middle East experience.

For an application form, please contact:

Ms. S. Frame or Ms. M. Gooding,
AMI International,
11 Welbeck Street,
London W1M 7PB.
Tel: 01-486 7982.

AMI International

District Works Officer

£16997 – £20499 inc.

Applications are invited from suitably qualified and experienced officers currently employed in the NHS for this important and responsible post in one of the country's most challenging Health Authorities.

The estate of Bloomsbury Health Authority is over one million cubic metres in volume which is 1/9th of the North East Thames Region's entire estate. The estate budget is over £8m. The Health Authority is looking for an enterprising and modern approach to the management of this large estate.

The successful candidate will provide a single point of direct contact on works matters with the client profession and the DHA, and will provide advice to the DMT and the DHA on all matters of estate management.

Applications are invited from former Area Works Officers, Area Engineers, Area Building and District Works Officers employed in the NHS in England and Wales.

Application forms and job descriptions are available from:

The District Appointments Unit
Bloomsbury Health Authority
The Middlesex Hospital
Mortimer Street
London W1N 8AA
Tel: 01–636 8333 Ext 7328

Personal enquiries to Mr M. C. Malone-Lee, District Administrator, (Telephone 01–388 7011 Ext 23) are welcome.

Closing date for applications: 12 November 1982.

Interviews to be held on 19 November 1982.

BLOOMSBURY
Health Authority

BIOMEDICAL ENGINEERS

Saudi Arabia
Excellent tax free salary

AMI is recruiting for the King Khaled Eye Specialist Hospital in Riyadh, Saudi Arabia. This 263-bed eye specialist hospital is one of the most sophisticated of its kind. It will be managed by the joint venture of AMI/GAMA.

The hospital, which is scheduled to be opened in December is a spectacularly designed building situated in Riyadh, the cosmopolitan capital of Saudi Arabia. It will quickly become the country's leading referral centre for the treatment of eye disorders.

To cater for this specialist medical need, the hospital has a research and teaching facility with 12 operating rooms, emergency room and an out-patient clinic, all incorporating the finest, most up-to-date equipment.

Vacancies exist for Biomedical Engineers with experience in any of the following areas:

ANAESTHESIA
X-RAY
ECG MONITORS AND DEFIBRILATORS
LABORATORY EQUIPMENT

Clearly, working in this magnificent hospital you will gain not only valuable international experience and job satisfaction, but a great deal more.

Benefits include a highly competitive tax free salary with a valuable completion of contract bonus, up to 60 days annual leave, including public holidays and, of course, free medical care. Contracts are normally two year renewable, although a one year contract may be considered.

Whilst living abroad, you can expect a particularly high standard of living, with attractive, fully furnished accommodation on the campus, which also offers many sporting facilities, including swimming pools and tennis courts.

To work at the King Khaled Eye Specialist Hospital, you must hold a British or Irish passport.

For an application form, please contact:

Ms. S. Frame or Ms. M. Gooding,
AMI International,
11 Welbeck Street,
London W1M 7PB.
Tel: 01-486 7982.

AMI
International

The end of the pager as you know it.

Let's be honest. Most paging systems have limitations. A 'bleep' leaves much to be desired.

Let us introduce the most advanced pager in the world. It even tells you why you're wanted.

Cass Teletracer 2800 is unique. User programmable, its incredible range of facilities include up to 20,000 address codes, full 5 digit LCD for special message codes, an ability to memorise and recall the last two messages and even interfacing to page from a telephone is standard.

Teletracer 2800 offers a complete range of group calls with any combination of receivers. It can give silent signals, light signals, 'Do not disturb' status and call rerouting with emergency override and absence indication. It can even be an automatic alarm clock.

As well as the alpha numeric display, five distinctive bleep codes are provided, plus two more for special applications, a 'fault' or out-of-range code and an alert when batteries are low.

Unlike conventional factory programmed pagers, Teletracer 2800 can be programmed and re-programmed in seconds by you – the user.

Teletracer 2800 makes your current paging system obsolete. And it shows.

Cass back-up service is impressive too. A nationwide network second to none.

Head Office and Service Centre:–
CASS ELECTRONICS LIMITED,
FREEPOST, Crabtree Road, Thorpe,
Egham, Surrey TW20 8BR.
Tel: Egham (STD 0784) 36266.
Telex: 934593.

THINK CASS FIRST

CASS

Cass Group p.l.c.

First in communications – paging, telephone, intercom, broadcast distribution, call and alarm systems.