The Journal of The Institute of Hospital Engineering June 1985

HOSPITAL ENGINEERING

International Federation Issue

- Telematique and communication in hospital
- Some aspects of equipment maintenance in practice
- Efficient energy plants

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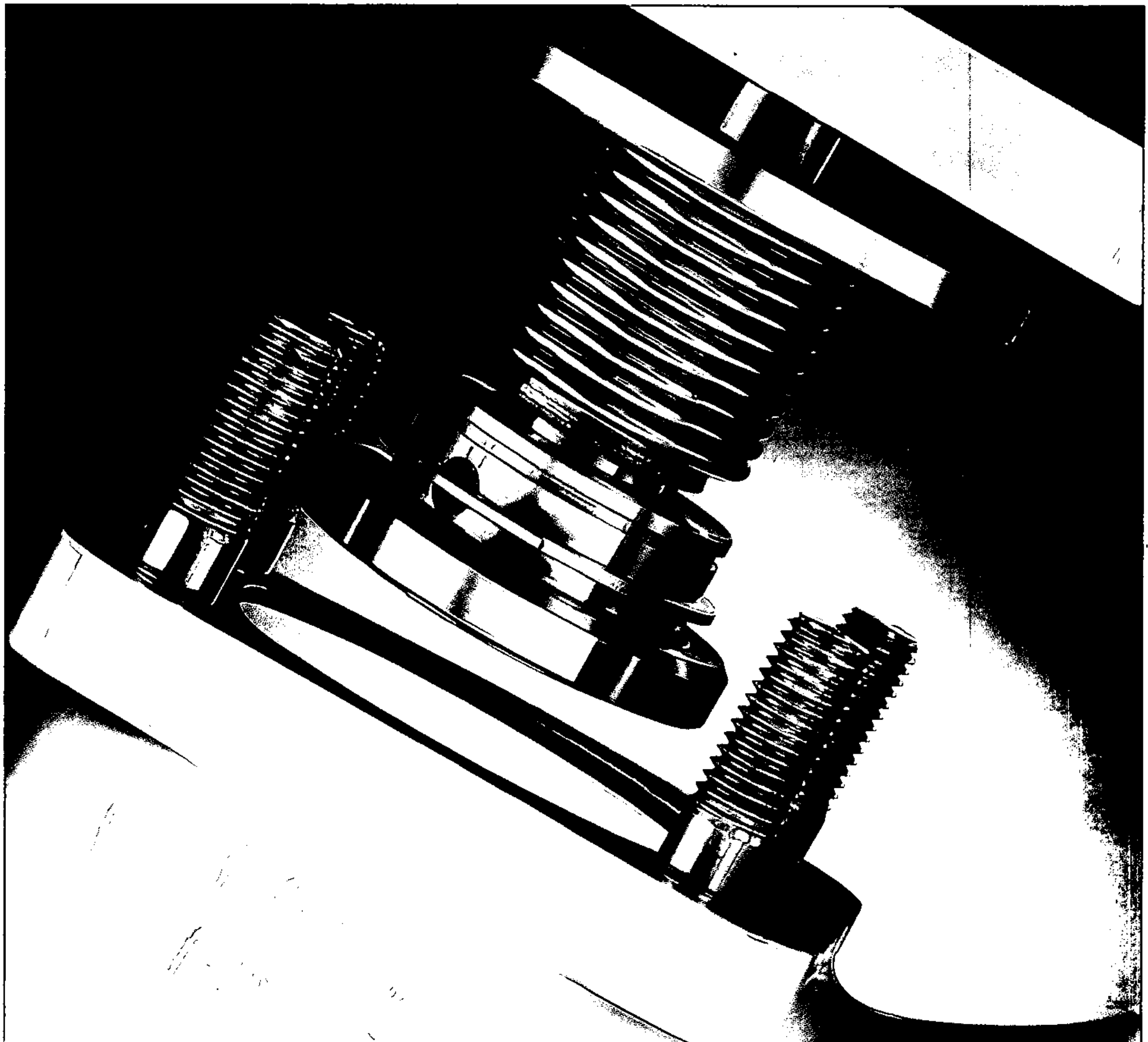

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I.F.H.E.

Volume 39 No 6 International Issue No. 54 June 1985

Front cover picture: Middle East construction — the management challenge viewed by the main contractor is discussed in this issue. Picutre by courtesy of Middle East Construction.

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Institute News

The Engineering Council

Education Investigation

A small team of engineers are quizzing industrial companies throughout the United Kingdom to establish their views on continuing education and training of engineers and technicians as a matter of urgency. The Engineering Council announced that it had set up this working party to obtain information in its attempt to tackle the immediate shortage of engineers and technicians brought about by changes in technology and marketing. This action follows the urgent warnings about the shortage of engineers and technicians which the Council gave a year ago and which have been recognised by the Government, particularly in the Chancellor's Budget statement.

Jobswitch

Architects Co-Partnership

Raymond R Hatfield MIPHE, MIHospE, MIOP has been appointed to the board of Architects Co-Partnership Limited. He continues as Managing Director of Northaw Engineering Consultants Incorporated, the building services subsidiary of ACP.

The Pashler Walton Partnership

The Partners of The Pashler Walton Partnership are pleased to announce that Mr Colin Howlett, MCIBS, has joined the staff of the practice. Mr Howlett will be resident in the Liverpool office and will be responsible for mechanical service works emanating from this office.

Donald Smith, Seymour & Rooley

The Partners have pleasure in announcing that Ray Evans, Gordon Meikle and Christopher Overland have accepted their invitation to join the Partnership from the 1st of April 1985. In addition Robert Brough, Barry Hall, Brian Jones and Jeff Lloyd will become Associates on the same date. Christopher Overland, Barry Hall and Brian Jones are resident in our Manchester Office, Gordon Meikle and Robert Brough are in Glasgow, Ray Evans in London and Jeff Lloyd in Paris. Eric Hunt who has been with the Partnership since 1946 and a Partner since 1957 retired at the end of March.

Lucas Scholarship Fund Award

The Award for 1985 under the Lucas Scholarship Fund was made to DI Sawkins, Holy Cross Hospital, Haslemere, Surrey at the Institute's Annual Conference at Harrogate. The Fund scheme was established by Dr B G B Lucas, Past President of the Institute, and allows the winner to attend the Conference, all expenses paid. The Award scheme is restricted to members under the age of 28.

NEXT MONTH

July/August

will include

Ethylene Oxide sterilisation — the Brompton experience
Professional liability

Cause for concern

We reproduce a news item first printed in the April issue of New Civil Engineer.

A £2000M building programme to upgrade National Health Service buildings is called for in a report from the Building Employers Confederation.

BEC says this work would only bring NHS properties up to a minimum acceptable standard but if capital spending is not stepped up the building stock will continue to decline.

Government's present annual spending on NHS buildings of £400M is not enough to reduce or hold at present levels the backlog of work.

A 10% increase would mean the backlog would not be cleared for another 10 years.

The report is the latest in a series from BEC examining the nation's building needs. BEC president Michael Millwood said: 'The most recent statistics show that 52% of hospital floorspace dates from before 1918. Although older properties are not necessarily outmoded, the overall age of NHS stock must contribute to an inadequate provision of facilities and subsequent lengthening of waiting lists.'

Britain is said to spend less on health than any other major developed country with the exception of Greece, with 700,000 now on hospital waiting lists and about half the total number of beds occupied by elderly people.

The capital spending shortfall takes place against a background of increasing demands from elderly people on NHS services, the report says, and will cause 'totally unnecessary suffering to them and other sections of the community'.■

Building – The nation's needs, spotlight on health service buildings, from BEC, 82 New Cavendish Street, London W1M 8AD, free of charge.

FORTHCOMING BRANCH MEETINGS

Southern Branch: *Hon Sec. A J Styles, 11 Rufford Close, Boyatt Wood, Eastleigh, Hants SO9 4RU. TN Southampton (0703) 777222*
10th July Wessex Body Scanner, Deans Suite, Southampton General Hospital
Oxford Spring Lectures
5th June John Radcliffe Hospital, Oxford.
Should you wish to attend any of the above meetings, kindly notify the Honorary Branch Secretary by completing the slip below:

ATTENDANCE AT BRANCH MEETINGS

Members who intend attending any particular branch meetings are urged to complete this return slip and send it in to the relevant Branch Honorary Secretary so that anticipated numbers for each meeting are known in advance.

To: The Hon. Secretary, ________________ Branch

I would like to attend the meeting on ________________

Name: ________________

Tel. No: ________________

8th Congress IFHE Melbourne Australia. November 1984

Copies of The Directory of Proceedings are still available at A$10.00 posted surface mail anywhere in the world. Available from:
8th Congress Secretariat IFHE
PO Box 302, Prahran,
Victoria 3181
Australia.

Talking Point

Appropriate technology

BASIL HERMON CBE

The author is General Secretary of IFHE

In this issue of Hospital Engineering there is a paper by O Soloye from Nigeria drawing attention to the need to design and install appropriate technology in the developing countries and to train engineers in the skills necessary to maintain the plant, equipment and services in good order. It is as well to remind engineers in the more developed countries of the need to keep things simple when they are designing hospitals in these countries and of the shortage of skills to keep hospital engineering in good working order.

The IFHE initiated courses in Appropriate Technology in 1980 and 1982 but the numbers attending did not make them financially viable even though the need for them was known to be great. The Federation considered running a third course in 1986 at Falfield England but the financial investment necessary would be beyond the resources of IFHE so the risk would be too great without some guarantee that about 20 students will attend.

The cost of accommodating and teaching each student at Falfield for two weeks would be between £1500 and £2000; when the travelling and other expenses are added, governments and employing authorities in some of the developing countries may question whether the money can be found or whether it would be well spent. Yet if these costs were related to the value of the initial and replacement cost of the engineering installations in hospitals it would be seen to be insignificant especially, as said in Mr Soloye's paper, when the unused equipment is taken into account.

So how can this circle be broken? Should it be left to the developing countries to help by providing the teachers and some of the finance. When an appeal is made for money for food for a starving population and to improve their country's basic services, people in the developed countries will give generously yet if an appeal were launched to finance the training of hospital engineers who maintain the services necessary to treat the victims of these situations it is doubtful whether it would succeed.

The Institutions and Associations of Hospital Engineering which are the core of the IFHE know and appreciate the problem but they too exist on limited financial resources relying as they do on subscriptions paid almost entirely by their members. The total membership of these bodies is around 8000 so to raise the necessary finance to run a course every two years would require them to ask their members to pay an annual levy of about £2 a year. Whilst some members would see this as a small sum to contribute others may not agree to do so and unless all 8000 were to contribute the sum raised would not finance a viable course.

An appeal needs to be more widespread. WHO may be prepared to help especially if we in hospital engineering are seen to be trying to help ourselves? Other charitable foundations may also be prepared to top-up any fund that may be raised. Hopefully the larger industrial concerns manufacturing hospital equipment that falls into disrepute because of lack of maintenance may see an investment in Appropriate Technology as being worthwhile.

The IFHE Executive Committee at its meeting towards the end of June will be considering this problem with a view to putting a recommendation to the Council when it meets in Barcelona in May 1986. Hopefully before then the members of IFHE will put their minds to it, debate it at their meetings and generate a discussion through the columns of Hospital Engineering.

IFHE News

D members

Manufacturers

BOC Medishield Pipelines	UK
A P Control Systems Ltd	UK
Dowson & Mason Ltd	UK
MIM Ltd	UK
Static Systems Group Ltd	UK
Medical Gas Installations	UK
IMEF srl	Italy

Consultants

Praetorius Wolf	Canada
Troup Bywaters & Anders	UK
DR Chick & Partners	UK
Cundall Johnstone & Partners	UK
Mott, Hay & Anderson	UK

IHF Special Study Visit

A special study visit is being organised in collaboration with Kupat Holim, the Health Insurance Institution of Israel, and its purpose is to study the broad range of integrated hospital and community care services in Israel. The visit takes place on 17-29 November 1985.

Further details from Miles Hardie, IHF, 126 Albert Street, London NW1 7NX.

New D member

IMEF of Italy

For over 35 years IMEF of Brescia (Italy) has been a leading international name in the disposal of urban, industrial and hospital solid and liquid waste. IMEF designs, builds and installs incinerators for special hospital waste (Haemodialysis departments, infectious departments, kitchen garbage, laboratory or analysis rooms waste etc). Because this cannot be considered as simple waste, special disposal methods are needed to guarantee complete destruction. Special incinerators are used, working on the pyrolisis process, in which waste undergoes a dry distillation in scarcity of oxygen (20-40% of the stoichiometric value) with production of gases essentially formed by hydrogen, carbon monoxide, nitrogen oxide.

These gases are completely oxidated, and reach a temperature of 110-1200°C in a suitable post-combustion chamber.

Thanks to the work of the technical projects staff, two different types of incinerators (mod. 'hot hearth' and mod. LAB) have been patented, and are leaders in the pyrolitic incinerator field. These incinerators have been used in such prestigious hospitals as:—

New Hospital, Riyadh, Saudi Arabia

Ministero Bienestar Social, Mendoza, Argentina

Veterinary Institute of University, Zagreb, Yugoslavia

Bed Hospital, Tripoli, Libya

University Institute, Casablanca, Morocco

Tarbela Hospital, Gujart, Pakistan

Minister of Sanity, Addis Ababa, Ethiopia

Regional Hospital, Siliana, Tunisia

Hospital, Sidi Bouzid, Tunisia

The IMEF incinerators can be equipped with heat recovery systems for the best utilisation of the heat products by the burning of the waste.

Riyadh Medical City

Saudi Consulting House, with WS Atkins & Associates, has been chosen by Hyundai Engineering & Construction Company Limited of Seoul to act as design consultant for the prestigious 1500-bed King Fahad Medical City and associated hospital project in Riyadh, Saudi Arabia. Saudi Consulting House and Atkins will be working with the

Hyundai design team to develop designs as part of Hyundai's 'turn key' contract for the construction and equipping of the project, which includes a 450-bed general hospital, paediatric, maternity, rehabilitation and psychiatric hospital, with an associated health centre and housing and general facilities for the staff of the complex. From offices in Epsom, Riyadh and Seoul, Atkins will be working closely with International Hospitals Group and mechanical and electrical engineers Donald Smith Seymour Rooley for certain elements of the design.

Tharpar Polytechnic

A one year Post Diploma Course in Hospital Engineering was inaugurated by Professor J C Pathak, Director, PGI, Chandigarh, in September, 1984. This is a sandwich course at Tharpar Polytechnic, Patiala, India, with an implant training in collaboration with the Postgraduate Institute of Medical Education and Research, Chandigarh. On the occasion of the inauguration, a one-day seminar was held on the theme 'The present state of hospital engineering services', and was co-sponsored by UNICEF and the Department of Hospital Engineering.

This paper was first presented at the Institute's 40th Annual Conference at Bristol. The author is Head of Bioengineering Group, Department of Medical Physics, Bristol Radiotherapy and Oncology Centre.

Some aspects of equipment maintenance in practice

J A GARRETT CEng FIEE DMS

1 Introduction

It is just 14 years since Study Group 8 published EY1.0 in 1971. The generally poor standard of equipment maintenance, low perception of electrical safety and performance calibration identified by this document was also true of Bristol Hospitals. At this time Bristol depended upon a large number of service contracts for its EBME maintenance although a small number of independent first time technicians had been introduced to effect simple repairs and so alleviate some of the problems of long call-out times, poor and unreliable quality of service typical of many suppliers at that time. In addition, an instrument such as an audiometer, used for prescribing hearing aids was calibrated only if it found its way back to the supplier for repair. It took the crisis of 1974 and the looming financian squeeze to bring about a fresh approach in Bristol. The opening of a new Maternity Hospital gave an opportunity to test in-house maintenance in a new area. A Medical Physics team recently recruited to install, commission and maintain linear accelerators was charged with the task of maintaining the foetal monitoring and ITU equipment.

In a short time the move was acclaimed a success. In-house maintenance could deliver the right service at the right time, at the right cost. Still more it was there at hand to deliver the medical staff from the trauma of its new-found dependence upon electronic apparatus delivering and caring for the mother and her new-born.

The Medical Physics team, then proficient in the repair of linear accelerators and foetal monitoring equipment, adopted the pseudonym BESA, Bioengineering and Applications Unit in order to give it a District as opposed to a Radiotherapy Department identity.

2 Strategy

Encouraged by the success of this first venture into in-house maintenance and with an eye to revenue savings, the District gave BESA the following remit:

1. To IDENTIFY these items of electromedical and surgical equipment which can be maintained in-house AS EFFECTIVELY as a supplier or a supplier's agent.

2. Additionally to CARRY OUT such work at a cost expected to be approximately TWO-THIRDS of the outside contract value.

Development was initially controlled and monitored by a review team composed of the following:

Support Services Manager – to provide a link with DMT

Supplies Officer – to provide commercial link

District Works Officer – to provide links with Works

User – clinical and medical interests

Head of BESA – to indicate technical feasibility

Each service contract to come up for renewal was reviewed three months in advance of the renewal date.

If the decision based on the remit was in favour of an in-house service, the user retained the option to revert to outside contract if dissatisfield with the in-house service.

This approach enabled the in-house service to develop in a step by step fashion both in scope of service offered and scope of equipment cared for. In addition, a labour and materials charge was cross-charged for all repair work outside these arrangements. The current labour charge is £7 per hour. This figure is discussed again later.

3 Scope of service

The service operated by BESA today comprises:-

- Informal equipment selection advice
- Acceptance of all District purchased EBME and Laboratory equipment
- Planned Preventative Maintenance on an estimated £9.0 million worth of equipment.
- Breakdown and repair on an estimated £12 million of equipment.
- Hazard warning, Management and implementation.
- Two on-call teams – Anaesthetic – Electronic
- Innovation of instruments or improvements.

This work is backed up by a variety of outside support contracts and arrangements. Examples of these include:

- Comprehensive service in certain specific areas such as certain specialised biochemistry analysers and complex X-ray units.
- OEM Support to BESA. These arrangements consist of special arrangements for the acquisition of spare parts usually in conjunction with an agreement for manufacturer call-out within the normal call-out response. Such arrangements are made relative to both individual items or groups of equipment from the same manufacturer. Examples of these are to be found in the computer service and some radiological computerised imaging fields.

Certains aspects concernant l'entretien de l'équipement

En réponse à la mauvaise qualité d'exploitation d'équipement, indentifiée dans le document DHSS E7 1.0 en 1971, un organisme interne a été établi dans le service de santé de Bristol & Weston, pour contrôler et excercer cette fonction, quand cela est nécessaire. Le document décrit les bases de son développement en donnant des détails de l'organisation, de sa performance financière et les raisons fondamentales de son rôle, qui se poursuit quelque dix ans après, et cela, dans des circonstances fort différentes.

Table I Scope of Equipment Maintained

Comprehensive	East. value £m	
Gamma Cameras Ultrasound Scanners C.T. Scanner	0.7	
11 DG Computers 3 DEC Computers	0.26	
3 High Energy Accelerators 2 Cobalt Machines etc.	2.1	
		3.06
Anaesthetic Machines Respirators, Ventillators etc.	0.2	
ECG, Defibrillators, Monitors Surgical Diathermy Lasers	0.5	
Maternity, Paediatric, Path., Lab. Microcomputers	0.65	
Southmead H.A. EBME	0.6	
Staff Pagers, Weston EBME Audiometry	0.4	
		2.35
Physiotherapy Traction & Cycles etc. Pathology Microscopes etc.	0.2 0.1	
Opthalmic Optical Equipment	0.2	
		0.5
X-ray Equipment		3.1m
		£9.0m
Miscellaneous electronics Calculators, Stimulators, Projectors etc.		£3.0m
Estimated 4,000 items from 500 Suppliers		

— Call-out by BESA of supplier or manufacturer to complement the in-house service on an hourly basis, the charges ranging from £28-£45 per hour, plus travel.

4 Scope of equipment maintained

Table 1 summarises the variety of equipment supported by BESA for which comprehensive maintenance services are provided. It represents almost every type of apparatus to be found in the wards, clinics, theatres, diagnostic and therapy facilities typical of a major teaching hospital.

The Bristol & Weston Health Authority employs about 8,500 staff and has an allocation of about £70M per annum. Since we do not as yet have a complete computer inventory of equipment we can only estimate that the equipment numbers in excess of some 4000 items from more than 500 British and foreign sources.

Such an all-embracing inventory requires a considerable range of electronic and mechanical engineering skills and attendant organisational structure.

5 Organisation

Figure 1 illustrates the way in which the EBME service is composed of four sections comprising a total of eight teams of specialist technicians. Within this structure there is scope for career progression at the same time as increasing the total experience and ability of the group. In this way specialist and general knowledge in the fields concerned enable the organisation to be efficient. Twenty-seven technician staff are supported by three graduate engineers principally in areas of training, new technology, quality control and management of resources. Each team leader is a sub-budget holder accountable for purchases made and costs reclaimed. Team leaders meet for progress meetings once a week and seminars for all staff are held monthly. In this way many problems are identified before becoming crisis.

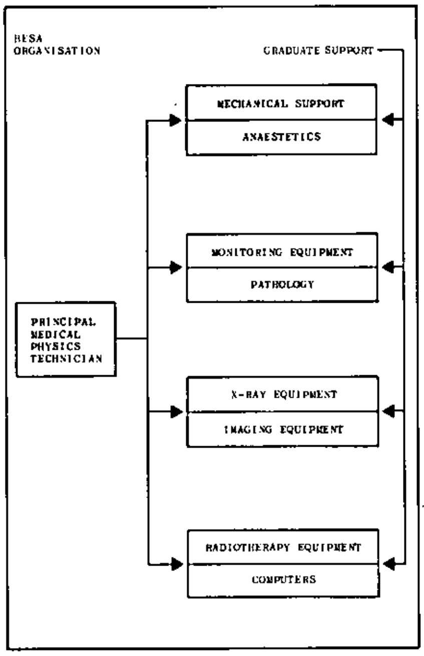


Figure 1

6 Acceptance

All District funded equipment is accepted according to a protocol similar to that set out in HEI 95. This has now been in operation for about 18 months. The scale of the operation is indicated by the following figures for the year 1984/85.

— Capital value accepted £425,000
— Number of individual items 325
— Man-hours expended 350
— Mean time per item 1.1 hours
— Number of faults detected 18 (6%)
— Marking defects (BS5724) 60 (20%)

Faults referred to above are regarded as defects which would render the equipment hazardous to user or patient or ineffective in application.

In each category it is often necessary to return the item of equipment to the supplier. In a few instances the defect is repaired in-house but strictly at the instruction of the supplier and only if the best interests of the user are served in this way.

Examples of faults detected as a result of the Acceptance programme to date are:

— Incorrect colour code of mains lead
— Excessive mains leakage current
— Internal components dangerously insecure
— Malfunction
— Intermittent operation (dry joints and defective controls)
— Essential safety omissions (overtemperature device)

It is clear that a small percentage of equipment supplied to the District represented a finite risk of incident. Acceptance checking significantly eliminated that risk at a cost of about 0.6% of the capital value of the equipment. The procedure is regarded as an acceptable cost for the value which accrues to all concerned. This may be summarised as follows:-

— Problems are resolved before final payment
— Future problems are minimised (eg, documentation obtained while the equipment is in current production.
— Safety control which has actuarial value
— Training opportunity for technical staff
— Opportunity to educate the user on purchase and maintenance specifications.

7 Performance statistics

7.1 Distribution of repair times

An analysis of the repair work undertaken

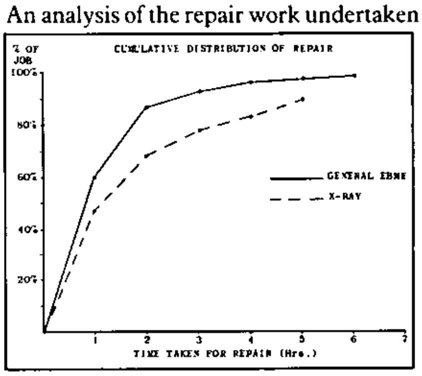


Figure 2

in the year ending April 1984 has a cumulative distribution as shown in Figure 2. Two curves are illustrated, the solid line represents the distribution of repair times for general EBME work being a sample size of 3998 individual repairs, and the dotted line represents a sample of 1110 X-ray repairs.

The results of such analysis are now familiar and compare with experience widely reported.

Our own mean repair time for EBME work generally is 1.3 hrs while the figure for X-ray work is nearly twice that value. This is not surprising as it is partly accounted for by the fact that there is substantially higher proportion of work associated with the removal of covers and a substantial mechanical fitting element involved.

A significant feature of these plots is that 60% of all EBME repairs are completed in one hour and 60% of X-ray work completed in two hours.

7.2 Spare part requirements

Spare part holding is often identified as a problem for EBME and especially X-ray maintenance. Figure 3, is a cumulative distribution of spare parts value consumed in the same sample of repairs as alluded to above in 7.1. Tasks which required spare parts and represented in Figure 3 accounted for 52% of EBME generally and 40% of X-ray tasks. It can be seen that 40% of EBME repairs requiring spares cost less than £10 being (52 x 40) 20% of the total repairs and similarly 5.2% of EBME repairs requiring spares cost less than £100 representing less than 3% of the total repairs carried out. Similar figures pertain to the X-ray work. These figures are also summarised in Table 2.

Many of the parts used will be commonly found in an electronics department equipped to provide small scale electronics support. Substantial holding of reserved specialised spares is not necessary. Downtime can be minimised by the keeping of a small number of special items and by identifying suppliers, distributors and delivery services which can be used at short notice. Alternatively support contracts can be made which will enable parts to be obtained quickly.

8 Finance

As previously indicated BESA has been financed by funds released from Contracts by being allocated two-thirds of the contract value for the same work. In addition all repair work is cross charged to the user budget at £7 per hour. This represents an hourly charge considerably lower than

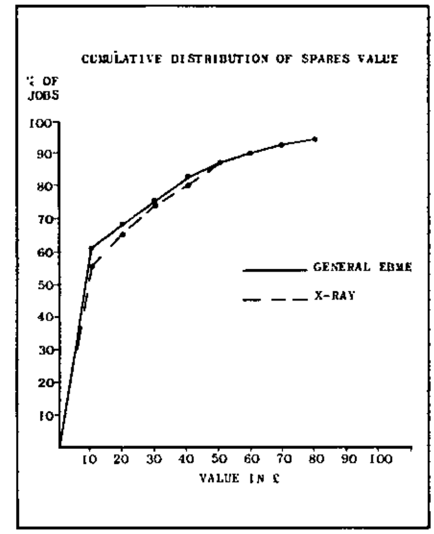


Figure 3

that represented by the ⅔rds contract value. This arbitrary method has served a very useful purpose. In line with Regional policy existing resources were redeployed to fund this activity and as a result a service has been created to meet essential equipment management functions and needs previously unmet. The climate is now such that costing of the activity on a more financially sound footing must be done. An initial attempt at this has been made but has yet to be refined. However the work so far indicates the scale of the salary overheads.

STAFF PTA
4 Graduate Engineers (Medical Physics Scales)
PTB
27 Medical Physics Technician Scales
A&C
1 Higher Clerical Officer

GROSS PAY		£219,000
OVERHEADS:		
PTA Staff	£59,000	
PTA Supervision		
Holidays		
Sickness		
Training		
Meetings		
Advisory	60,000	119,000
Direct Labour Cost		100,000
Overhead rate:		
119,000 x 100% i.e. / 100,000		108%
Hourly rate:		
219,000 (1 + 1.1) = £7.39 per hr. / 32 x 57 x 37		
Employment Costs at 16%		1.18
Heat, light, etc. at £6 cu.m. (460 cu.m.)		05
		£8.6

Realistic direct labour cost £8.60 per hr.

9 Discussion

In practice we have come to recognise that equipment management is wider than maintenance – it encompasses the resourcing, evaluation, selection, acceptance, support, performance monitoring and control. This health District has not seen fit to appoint a District officer as envisaged by HEI 98 whose role is to bring together all these strands. Part of the reason why this has not been perceived as a priority is due to the relatively high profile that in-house equipment maintenance has with all the spin-offs of facilities, skills and experience that this brings with it.

As a Bioengineering support group we contribute therefore largely to the support aspects of equipment management. The circumstances of 1974 caused the District to move away from a service largely dependant upon service contracts to the present one dependent largely upon an in-house EBME service.

In 1984 different circumstances, mainly politicial, are raising a new set of questions over an in-house service. The experience of 10 years, the higher awareness of safety, the value of in-house equipment expertise in evaluation, selection acceptance and commissioning means there will be no turning back the clock exactly to 1974.

We now have data and experience upon which all aspects of an in-house service can be realistically assessed. There is a real danger in this field of focussing on the cost of everything and ignoring the value that now is taken for granted. Equipment management has been responsible for raising the standards of design, reliability and safety of EBME equipment. In-house groups such as that described here have played no small part in bringing about these changes.

The bulk of the work is composed of jobs taking less than 1 hour, the mean job being 1.3 hrs (2.4 hrs X ray). Even ignoring the fact that these times include a minimum time charged for any task the productivity of any external group can at best ever be one quarter to one half that of the on-site service when travelling time is taken into account. Furthermore, account must be taken of the old way of getting fast service by holding surplus instruments. This alleviated the long and uncertain response times of off-site contractors (typically 4 hours minimum). Urgent repairs can be underway within less than 10 minutes. If an estimate of realistic in-house cost is anywhere near correct £8.50/hr. cannot be matched for the service given. I hope we no longer need to debate whose umbrella EBME should shelter i.e., Works or Medical Physics.

It is more important that the people involved be so at an appropriate level, have a professional engineering approach matched by leadership, training and commitment of a high order. We value the tangible scientific benefits of our work which accrue from association with a Medical Physics Department particularly in the general field of performance quality

Table 2. Summary of repair times and spares usage

	Time for Repair of		Mean Time for Repair	% Using Spares	% of Total Using Spares Greater than	
	60%	90%			£10	£100
General EBME	1	3	1.3hrs	52%	52x40 20%	52x5.3 3%
X-ray	2	6	2.4hrs	40	40x44 17%	40x11 4.5%

control. Experience however shows that the grade of Medical Physics technician is inappropriate from two standpoints: Firstly, electronics technicians of technician engineer calibre are in great demand and so are not attracted by grades and salaries offered. Secondly the level of work requires people who are qualified to HTEC in electrical and electronic engineering. These qualifications exceed those requirements of the Whitley Council which are quite acceptable in other branches of Medical Physics.

This issue which requires urgent attention at a national level. In conclusion we would like to express our gratitude to the District Works Officer locally who gives us much tangible help and encouragement in the support and development of this work. Without that collaboration the Bristol and Weston Health District would not today enjoy the benefits described.

As this paper was originally given in May '84, it is possible that by publication some of the information contained may be in need of updating.

This paper was presented at the 8th Congress of the IFHE at Melbourne. The author is Chief Technical Officer (Instrument), University College Hospital, Ibadan, Nigeria.

Planned preventive maintenance of hospital equipment in developing countries

O SOLOYE FIHospE

Introduction

It is estimated that a considerable percentage of equipment in hospitals in developing countries is out of use or never used due to lack of spare parts or lack of trained personnel. Even if the problems of manpower and of repair and maintenance could be solved by the Hospital Engineers, this equipment would not make any significant difference to the health of the majority of the population in developing countries. What should be taken into consideration first is the technology appropriate to the circumstances and health needs of the developing countries where the technologies are needed. Therefore, the challenge of designing and developing equipment which meets the real needs of poorer people is one that ought to be taken up as a matter of urgency.

The problem

Until recently, most people in the developed countries have tended to assume that the best health care is provided in high technology, hospital based medicine and that this must be true for the rest of the world. Other people, however, do not believe it is even true of the developed countries.

Most of the advances against infectious diseases of the last century, eg, tuberculosis, cholera and diphtheria were made as a result of public health measures. Furthermore some of the sophisticated technology to be found in hospitals in developing countries are of unproven clinical value.

In spite of all these advances in knowledge and technology, it is still estimated that over sixty percent of people in developing countries have no access to health care. The high infant mortality rates, the prevalance of disabling diseases and the short life span are mainly caused by diseases that we know how to prevent and treat, eg, bilharzia, malaria, polio, diarrhoeal diseases, leprosy, hypertension, etc. etc.

Six years ago, the year 2000 was declared "Health for All" by the World Health Organisation. By then it was clear that more doctors, nurses, para-medics and more and better equipped hospitals alone could not bring health care to most of the people.

Equipment and machinery in hospitals are often not enough to go round users or not in use due to lack of maintenance, lack of technically trained personnel and lack of spare parts. Even in my country Nigeria where there are Colleges and Polytechnics for technical training, the poor salaries offered by the Government service do not attract employees from these Technical Colleges.

Programmes d'entretien préventif de l'équipement hospitalier dans les pays en voie de développement

Un pourcentage important de l'équipement hospitalier dans les pays en voie de développement est hors d'usage, voire jamais utilisé, en raison du manque de pièces de rechange ou de personnel qualifié. Même si les problèmes de main-d'oeuvre, de réparation et d'entretien pouvaient être résolus par les ingiéneurs des hôpitaux, cet équipement ne ferait pas de différence significative à la santé de la majorité de la population.

Une technologie adaptée aux circonstances et aux besoins de santé des pays en voie de développement, où l'on a besoin de technologies, est primordiale. Le défi de créer et de développer un équipement qui réponde aux besoins réels des pauvres devrait être relevé sans plus de délai.

This is where the Engineers in charge of the small amount of equipment have a lot of work to do as regards regular maintenance of hospital equipment.

The following maintenance guide is strictly followed in Ibadan Teaching Hospital:-

(a) Dropping some switch cleaner on relays and switches regularly on equipment such as surgical diathermy machines, shortwave diathermy machines, stimulators, etc.

(b) Weekly checks on patient electrodes on these machines.

(c) Weekly checks on baby incubators – to ensure that water level is not below normal level, to ensure that required temperature is kept constant.

(d) Dropping of the recommended oil on equipment like high suction pumps, low suctions pumps and the laboratory high vacuum pumps.

(e) Weekly checks on anaesthetic machines and ventilators for possible leakages, etc.

These are just a few examples of what hospital engineers in developing countries are expected to do to increase the life span of their equipment.

Despite this, in most developing countries, new equipment is usually ordered by people who have no technical training and invariably some of the equipment are unsuitable, even the supply voltage may be wrong. Equipment is imported from many different countries and this diversity causes further maintenance problems to the Hospital Engineers. Often spare parts are rarely ordered at the same time and when the equipment breaks down, repairs cannot be effected due to lack of spare parts thus making the equipment invariably useless since manufacturers change models very often.

Moreover, hospitals are mainly based in towns and are often not intended to serve most of the population in rural areas or those who cannot afford the fees. Hospitals cannot provide a service to distant areas or established community based health programmes. However, if the technological skills and materials are supplied to help communities build their own wells or bore holes, maintain them and to understand the importance of clean water, good sanitation, there will be a greater improvement in health developing countries than by building any number of hospitals and centres of excellence!

In order to bring health care to those who now have no access to it, the World Health Organisation, government and international agencies have increasingly emphasised the development of primary health care programmes and on developing appropriate technologies for health.

The solution

A technology is only appropriate if it effectively does its job in the circumstances where it is used. Appropriate technology may not be low technology, it may be quite sophisticated depending on what it is to do and in what conditions. However, equipment that can be manufactured in the country where it will be used is desirable because it will be much cheaper than imported equipment, but in developing countries where hospital equipment is not manufactured, the Hospital Engineers should be involved before any purchase is made so that:

(a) Request for instruction manual, circuit diagram and spare parts-lists can be made before the purchase.

(b) Recommendation for the purchase of spare parts needed to last at least five years.

(c) The Hospital Engineers will ensure that the supply voltage corresponds with the local voltage or recommend an appropriate transformer if necessary.

(d) Training of Hospital Engineers by the manufacturers especially if the equipment to be purchased is highly sophisticated equipment.

(e) The Hospital Engineers should be involved during installation of sophisticated equipment and the supplier of the equipment should maintain the equipment for at least a year – this should be part of the contract from the initial stage.

(f) Because of the fluctuation in the Supply Voltage which sometimes could be as low as 180v instead of 220-240v in some developing countries, appropriate voltage stabilizers should be connected to sophisticated and sensitive equipment or as a special request the manufacturer can be requested to fix into the circuit a built-in stabilizer.

Conclusion

Designing equipment to meet the needs of health services in developing countries requires a fresh approach from designers and engineers. There are already many good ideas in use in developing countries and it is on these designs that we must develop more appropriate technologies.

For success, therefore, the design and development of any equipment must be carried out in close collaboration with the hospital workers who will actually be using them.

However, it is essential for Governments of developing countries to get their engineers involved before purchasing equipment, especially the highly sophisticated ones, as the technical advice of these engineers will help the Government in the long run.

This paper was first presented at the 8th Congress of the IFHE held in Melbourne. The author is Chief Engineer (ENPC) Association Nationale of Hospital Engineers in charge of Direction of Technical Services, Regional Health Centre, Dijon, France. He is General Secretary of ANIEHP.

Télématique and communication in the hospital

J BUSSEUIL

'System STSH.'

Conclusion of tests concluded at Regional Health Centre-Dijon-FRANCE.

To simplify the translation we will start with a glossary:

Telematique: Name given to a system which incorporates computers tele-communication and audio-visual.

C.H.R. De Dijon Regional Health Centre of Dijon (Research Centre).

Systeme Telematique de Surveillance Hospitaliere (S.T.S.H). Name given to the total system.

Door Block: Relay boxes enabling connections to diverses functions.

As a preamble I believe it to be necessary to remind that "Telematique" is most certainly a special branch in Engineering. It can be described as the happy marriage between: Computer, Telecommunication (telephone-telegraph) and Audio-Visual.

For the past year, the Regional Health Centre, Dijon, studies and tests a novel solution to the problem of "Communication and Transmission" across the diverses hospital services. In the course of my account I will try to explain how the idea was conceived, of a System Telematique of Hospital Supervision, (S.T.S.H.) deriving from the ordinary Nurses' Call System operating in line with a 'autocommutateur telephonique'. I will indicate the improvements noticed, the new rapport developed between the staff, the favourable reception given to this new technology by both staff and patients. Finally, I will

Télématique et communication dans les hôpitaux

Le rapport décrit le circuit de communication installé à l'origine pour servir de système d'appel infirmières, mais qui peut inclure d'autres systèmes d'alarme et de communication, y compris des ordinateurs, des systèmes de télécommunication et audio-visuels.

analyse how this evolutive product will provide a constant answer to the development of the Communication in a modern hospital which, in turn will 'marry its Century'. (merge with).

How to Rationalise the Existing Wire Net in a Hospital

The constant evolution technique in hospitals, the introduction of new equipment, new systems, made it imperative to evaluate the existing Wire Net which rebellious character was made more obvious either through breakdowns either during the course of new work.

Electrical circuits, telephone, nurses' call system, fire alarm, fire detection, clocks system, informations (computer), television, emergency lighting etc. etc.. Each one of those circuits was treated separately when introduced, resulting in an impressive display of cables of all types travelling behind false ceilings, shields, basements, low voltage cables often mixed with medium voltage and old plumbing.

In spitè of the complex net created, the system was seldom accessible and any new addition required a new circuit.

It was then necessary to study the total concept of those circuits and to treat them in a coherent manner in order to end up with a system of evolutives circuits. (Lending to further applications).

Our study started from the patient and the equipment surrounding him, that is to say, the telephone and the Nurses' Call System.

How to Best Minimise the Cost of Providing a Telephone Per Bed?

The standard "Nurse Call" by pear shaped switch is extensively used and well received by the patients, however it compels the Nursing Staff to systematically visit the patient whilst often a few words exchanged over a telephone would have been sufficient.

Telephone or Intercom seem to be the answer, however can we impose upon an aged or handicapped person to lift up the receiver from their bed and make a vocal request? We therefore concluded that both "Pear Shaped Switch" and "Telephone" had to coexist (dual system) and that the patient will be given the choice.

We discard quickly the sophisticated intercom, not only because of the amount of wiring to be installed between the Rooms and Bathrooms and Nurses Stations, but one cannot expect the patients to handle a range of unknown apparatus which will congest their bedside table. Granted there are gadgetries which may provide varied forms of visual or audio calls from room to Nurses' Station. Unfortunately, how to expect a nurse to identify a call without conversing with the caller.

The call by "Beeper" is weighty and requires from the staff a certain discipline, the Beepers must be recharged daily and carried at all times. The efficiency of the 'call by Beep' is doubtful.

Therefore we reached the conclusion that our 'Base Communication System in a hospital situation' was to fulfil the following characteristics:–

— to combine 'Pear Switch' and 'Telephone'.
— to be cheap to install.
— to enable an extension of the communication functions in the entire Regional Health Centre without further cables.
— to be adopted by the staff to become the normal channels of communication.

This project was formulated with the collaboration of the Society INFORMEL, a young enterprise from Strasbourg, specialised in the study of Computer and Electronics.

We wish to remind you also, that this project was discussed at length with the Nursing – Medical staff whose remarks and suggestions were strongly taken into consideration.

System STSH/call nurse

This system actually operates in the Regional Health Centre of Dijon, in six units representing one hundred rooms of a total of approximately 200 beds.

It is made up of a video terminal in the nurses' station, a transmitter in each room and a 'Pear Switch' alongside a 'Telephone' by the patient's bedside.

It therefore fills the needs of all the services of classic systems of "Nurses' Calls" and adds to it – modulation, adaptability, evolutivity, complemented with – telephone, clear messages, alarm systems ...

After a few months of trial we discovered that our hypothesis was correct since the majority of patients use the telephone to call the nurse station directly and that the staff admits that they have less to walk than before. We note equally that with some training of the staff the latter has well assimilated the reading of messages on the screen. We foresee that the Nursing and Medical staff will accept with no further opposition to work with the Video system as the system STSH progresses further.

We must also remind you that in accordance with our objectives, the cost of the cables was minimal since apart from the connecting of the Pear Switches in the rooms and the signals in the corridors, only a seven strand cable was laid from the 'Nurses Station' to the 'Patient's Room'. A cost not much different to the one previously experienced in installing a standard 'Nurses' Call System'.

Extension of system STSH

1. A standard of communication (planned).

The Nurse Call System describes a system of communication in a service by a high speed transmitting line with 7 strands, but the ambition of the STSH system is to ensure in the future the communication throughout the Regional Health Centre without having to lay another cable and by using systematically the Telephone Net.
The STSH system therefore creates a standard of communication by which informations as diverses than:–

- remote control of Boiler House (now being installed).
- centralisation of all Fire Alarm (now being installed).
- distribution of Electronic Directory in all services (being investigated).
- distribution of all information (Memo-Medical Records etc.).
- dialogue with internal system (Nurse Records) will be possible.

It goes without saying that for the non-informed user of a Video Terminal, the operations will be made simple to execute, by the introduction of an appropriate language.
It will be therefore possible to provide the Nurses' Stations with a wealth of information whilst no specific training in computer will be required.

2. Call by patient name (planned)

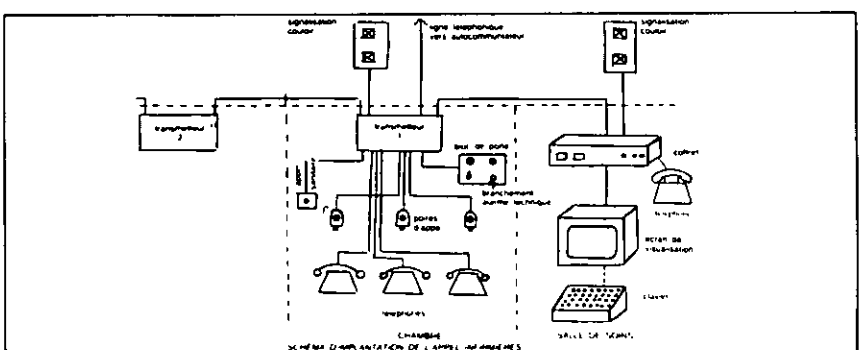
Patient name will be programmed together with bed number and room number. The system will be kept up to date by the nursing staff. It is expected that this service will personalise the patient versus nurses relationship and facilitate the administration of the rooms (wards) as these informations will be transmitted to admitting and accounts offices.

3. Fire alarm (being installed).

According to needs, the system will enable: Alarm to be recorded in Nurses' Station.

Alarm to be recorded at main switchboard.

Alarm will shut fire doors, start ventila-



tion etc. etc.

This can be easily connected to the transmitter located in the patient's room.

4. General electronic directory (being studied).

The Regional Health Centre of Dijon is presently being equipped with an electronic directory which will permit us to know the names and phone numbers of staff and patients in the centre. Without new cable, this information will be readily available.

This will considerably reduce the printed documents. The editing, updating and channelling of documents will no longer be necessary at station level.

5. Other Extensions

It is evident that the circuit so created can handle the exchange of information of all sorts (memorandum, medical records ...) with the following common points.

- systematic utilisation of telephone circuit.
- systematic utilisation of the video-console located in each service.

Furthermore the Nurses' Station terminal may be connected to a recording system which will enable it to keep records of all calls and the time of their answer. In the area of Intensive Care this will provide an answer to possible 'Enquiries'.

Also the whole system is self controlled. Any malfunction will be displayed clearly on the Video.

In fact the STSH must integrate itself in a total program that may be rightly called 'Hospital Telematique Architecture'.

The following graph imagines an "operating program of telematique" as I could introduce in any hospital, within the abscissa the areas of implantation of the diverses terminals and in the ordinate the designations of the diverses applications.

In fact each hospital has a specific program which relates with its size, its structure, at the time. Therefore this graph is only one of many possible examples and of course should be completed with a description of each application and of each function.

Through this graph we observe the wide range of the applications – 'Telematique computerised' incorporating as varied areas as telephone, archives, medical illustration, microbiology ... it is easy to visualise that in the interest of a total concept of Hospital Telematique all areas must be integrated.

a) to duplicate the terminals in one given area (in this case 12 terminals in each clinic).
b) to duplicate the information over a wide area, (in this case the identity of a patient had to be given to ten applications).
c) to create one wire circuit per application (function) certainly a more economical solution if we consider one only application which becomes totally aberrant if we consider the whole concept.

In concluding we can assert that we are gambling a lot on the system STSH to resolve the more difficult problems which arise daily in a responsible hospital.

First of all we must reduce the inflation of cables to install and maintain (circuits) each new piece of equipment or new system installed requiring its own costly circuitry.

On the other hand to avoid the introduction of computers with different languages, different video consoles were incompatible to each other.

It is for these reasons that we have insisted for the STSH system to be standard throughout the Regional Health Centre and that it should be able to incorporate in its net, all systems or equipment already existing and to answer to the most varied needs. Now and then the STSH system fulfils the same services that were provided by the conventional Nurse Call System – telephone, fire alarm, fire detection, instruments failures etc. ... potentially, there are a great many more services to be eventually provided – which is not bad for a system originally introduced and acknowledged by the staff as an ordinary Nurse Call System.

Rider

Nurse call STSH system

Basic system

The Nurse Call STSH is made of:

- Transmitters, one per room (ward)

IMPLANTATION / APPLICATION	ADMISSION	DAY RATE	NURSE STATION	MEDICAL ADM.	NURSING ADM.	BED COUNT	CONSULTIN O.P.	STORES	LABORATOI	ARCHIVES	PATIENTS MED. ADM.	MEDICAL RECORDS	WORKSHOP	SWITCH-BOARD	INTERNAL HOSPITAL	DIRECTOR FINANCE	PERSONNEL DEPT.	ENGINEERI DEPT.	SUPPLY DEPT.	FOOD SERV DEPT.
PATIENT ADMISSION FILE	●	O		O																
MEDICAL RECORD PATIENTS				O								●								
MEDIC/RECORD/ARCHIVES				●			●		O	●	O									
STATISTICS												●			●					
NURSING PATIENTS RECORDS			●	O	O	●														
MANAGEMENT OF DEED		O		O								O								
MEDICAL ILLUSTRATION										O	●	O								
LABORATORY			O						●	O										
BIBLIOGRAPHY							●													
INTER/MAIL				O												O	O	O	O	
PATIENTS APPOINTMENTS				●			O													
PATIENTS TRANSFERS	O	O	O		O									O						
PATIENTS ACCOUNTS		●		O																
MEALS RECORD						O														●
ACCOUNTS DEPARTMENT																●	O	O	O	
STOCK AND INVENTORY								●					O					O	O	O
EQUIPMENT RECORD								O					O				O	O	O	
SUPPLIERS													O			O		O	O	O
STAFF RECORD				O													●	O	O	
PAYROLL																O	●			
HOSPITAL DIRECTORY	O	X	O	O	X		X	X	X	X	X	X	X	●	X	X	X	X	X	X
MEMORANDUM	X	X	●	X	O		X	X	X	X	X	X	X	X	X	X	X	X	X	X
AMORTIZING RECORD																		O	●	
TENDING OF MEDICAL PAPERS				O												O	O	O	O	

CODE: ● MAIN APPLICATION FOR THE CONSIDERED TERMINAL O SECONDARY APPLICATION FOR THE CONSIDERED TERMINAL
X SUPPLEMENTARY APPLICATION FOR THE CONSIDERED TERMINAL.

which control Pear Call switches, Signal Lights, Door relay and telephone line for each room (ward).

- A Unit of Specialised Treatment (U.T.S.) which signals all calls made through the system – it is the Master Control.
- A high speed circuit which connects (U.T.S.) and transmitters. This circuit is made of 7 ordinary wires which can connect up to 63 transmitters.
- The STSH Nurse Call brings a complete range of services to all people in the hospital system.

To the staff in the nurses' station

- Call-back audio/visual of the most urgent call waiting. No Call/Normal, Call/Urgent, Call/Alarm.
- Audio signals as a new call is recorded.
- Video (on the screen) by chronological order, all waiting calls with – Room No., nurse attending, no nurse attending, type of call (normal, without answer, for help), area in the room (bed, toilet, failure of equipment).
- Permanent display on the screen of staff in rooms.
- Records telephone call to nurses' station. Bell ringing and room number appearing on the video.
- In case of extreme emergency, a nurse may trigger the alarm to gather rapidly the staff to the station.
- An ordinary call not answered within 5 minutes from a bed, or 2 minutes from the toilet is automatically transferred to emergency call.

The patient from his room may at his choice –

- speak with the nursing station by telephone just by lifting up the receiver.
- call a nurse to his bed (Pear Call switch) – the pear switch lights up to confirm his call has been recorded.

Nursing staff attending a room (ward) is kept informed of other calls recorded

- Audio signal for all new calls.
- Video light on Door Block – No Call/ Ordinary Call/Urgent Call.

Audio signal 'Urgent Call'.

Staff in room (ward) can place calls in the service

- To ask for help. The nurse uses the Pear Call switch.
- For urgent help. The nurse activates the signal from the Room Door Block. Of course this service is only available to the nurses when they are located in the room (ward).

Automatic supervision of patients

The Door Block has a special plug to which may be plugged any medical equipment – should a failure occur it is immediately shown on the Audio/Video.

The staff commuting through the corridors is kept informed

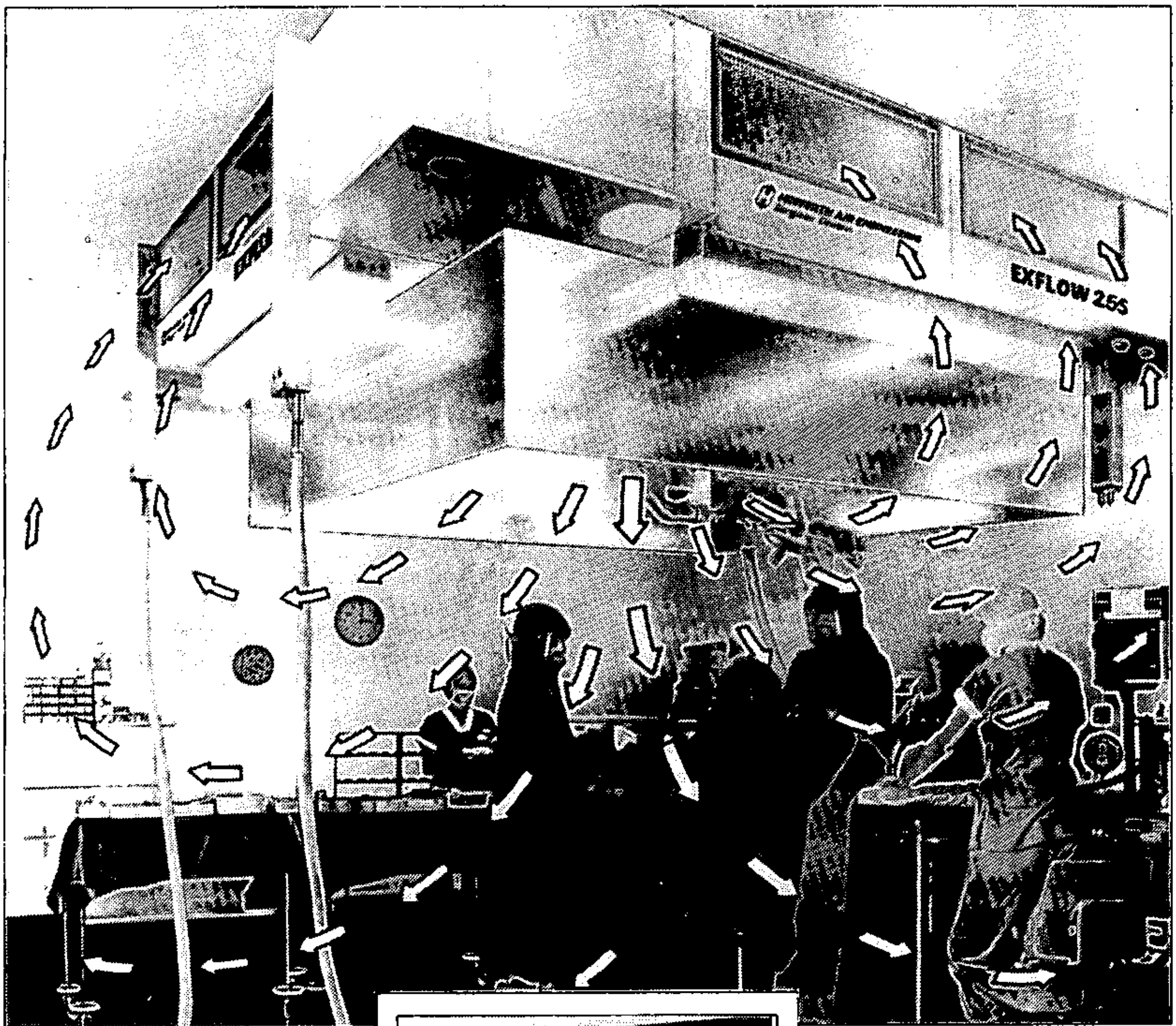
By light signals located above room doors (ward) (No Call/Ordinary Call/Urgent Call/Present in Room/Request for Normal Help/Urgent Call for Help).

Recall Audio-Visual for urgent call.
Recall Visual calling nursing staff back to station.

From her office the supervisor

(Group Sister, Matron) is kept informed of all emergencies.

- Audio/Video recall signal showing Urgent Call or Alarm.


EXFLOW 25S

The author is an Engineering Director and a Council Member of IFHE (ADIAH Spain).

Efficient energy plants

FRANCISCO CASTELLA Dr Engineer

Basic principles

The Spanish Energy Conservation Law and complementary regulations were issued in the first quarter of 1981 by the Ministry of Industry & Energy, in order to promote saving projects, make incentives for investment by means of tax benefits, import duties reduction and preferential credits.

Special emphasis was given to the 'cogeneration' projects, that is the self-production of electricity in parallel to the utility mains, when this self-production had a better performance, lower cost and primary energy reduction, as compared to the utility company.

This is the case with Total energy plants, in place where the simultaneous use of electricity and heat, allows to generating electricity and recovering heat from the total energy plant (otherwise wasted heat), reaching more than 70% of efficiency in the utilization of the fuel energy.

A hospital is one of those places, and one of the best to apply the basic principle of total energy, because of three coincident good reasons:

— The simultaneous use of heat and electricity, exists during the whole year.

— The investment in the emergency generators can be better used when in continuous operation instead of the stand-by position.

— Where the natural gas is used, this clean fuel helps the system ecology and efficiency.

In hospitals, the self-production of electricity covering a percentage of the demand, from 30 to 50%, recovering heat from the exhaust gases and cooling circuits, seems to be a clever idea and in fact many of such applications are operating in Europe (Netherlands) and America (USA).

The above diagram shows the operation of the ebullient system as applied to the Hospital General of Catalonia. The recovery boiler receives the engine cooling water and by means of the high level energy of the exhaust gases, produces low pressure steam (≃15 psi).

The engine jacket is cooled at the ebullient temperature of the condensates. The circulation of fluids is automatic, without pumping, and the regulation is simple and effective. The engine and all equipment in general are prepared and constructed to accept these severe operating conditions.

The application to the Hospital General of Catalonia, has some particular characteristics, since the total energy generators are integrated in a more sophisticated energy plant, oriented to recover energy from any point where, otherwise, in the traditional system, could be wasted. Therefore there are installed other energy recovery systems interrelated to each other in order to automatically get at any time:

— the best energy efficiency

— the lower cost.

The modern and advanced technologies offer many ways to recover energy and compose a highly efficient energy plant. In our project:

— We recover the enthalpy from the exhaust air (Heat Wheel)

— We recover low level thermic energy from the condensing water (Heat pump or also called Heat Reclaim Machine).

— We recover heat from the exhaust gases of the incinerator (Heat exchangers).

— We recover heat from the total energy generators as explained before.

Someone may ask the reason why the sun collectors are not included in the list of applied technologies; really this is a well known technique to produce hot sanitary water in hospitals, since the consumption is very stable all around the year.

In our case, the decisions have been taken not only to get the best efficiency from the energy savings point of view, but also from the economical one.

A computerized simulation of the plant operation was conducted hour by hour in different alternatives and the results of energy used were tabulated and compared in order to select the best solution; according to the data obtained, the complementary support energy of the steam boilers was needed only during three months in winter; this was the period when the energy from the sun could be justified and obviously the ROI coefficient was too high.

The plant

The hospital is a big building of modern design, of 750 bed capacity, 100% air conditioned, of 90.000 sq.m. of covered area.

The energy plant is composed of:

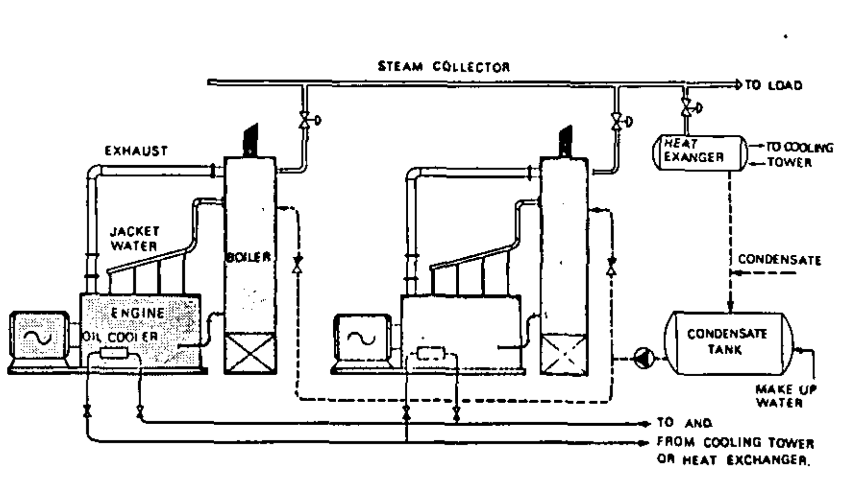
Electricity Supply
3 Transformers of 1200 KVA (mains)
2 Transformers of 1000 KVA (mains)
3 Generators of 900 KVA (Total energy plant)

Steam production
2 Steam boilers of 5000 Kg/h
3 Recovery boilers of 2000 Kg/h (Total energy)

Hot water production
2 Heat pumps of 1630 Kw
3 Heat exchangers (steam-water) of 2325 Kw
2 Heat exchangers from incinerators
2 Hot water storage tanks (70°C) of 80 m^3

Excess heat exhaust
1 Cooling tower of 9525 Kw

TOTAL ENERGY - EBULLIENT SYSTEM FLOW DIAGRAM



Nous appelons energie totale, le processus de auto-génération d'énergie électrique avec récuperation au même temps de l'énergie residuel du combustible utilisé dans la génerateur d'électricité; nous pouvons attendre hauts niveaux d'efficience énergetique (>70%).

Dans les hôpitaux, ce principe est perfectement applicable, puisque il y a une simultaneité de consommation de l'énergie électrique et thermique; d'autre part nous ne devons pas oublier des autres opportunités de conservation d'energie possibles dans les hôpitaux (recuperation air-air, pompe à chaleur, etc.) La combination de ces technologies permet d'obtenir Salles d'Energie d'haute efficience, dont l'operation optimisée automatique est conseillable avec l'integration d'un miniordenateur de Data Center.

Chilled water production
2 Chillers turbo compressors of 1920 Kw
2 Steam fed absorbers of 755 Kw.

The energy flow diagram shows the figures according to the simulation of the computer and clearly define the operation and performances of the plant. The schematic fluid diagram shows the equipment interrelation.

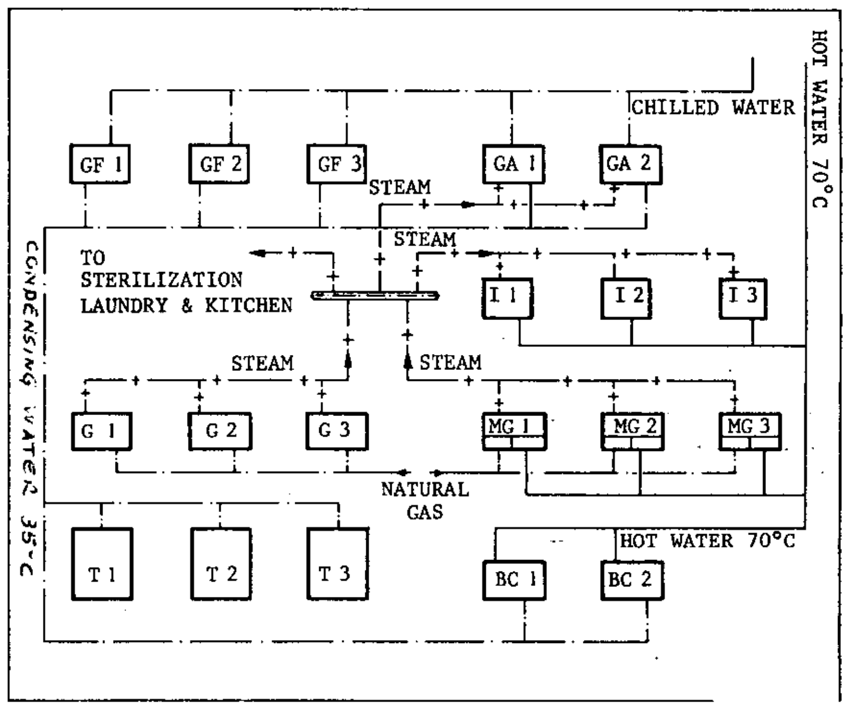
We expect to check these data once the hospital is operating at 100% capacity; but assuming a high degree of accuracy in the computerized simulation program, we may advance and point out the following ratios:

— From 1 Kw/h of natural gas we get
.0,42 Kw/h of steam
.0,33 Kw/h of electricity
which means a 75% average efficiency of the total energy plant around the whole year.

— The plant produces 46% of the electrical demand. The rest comes from the utility company in a flexible parallel connection, thus ensuring a high degree of reliability in the electrical supply.

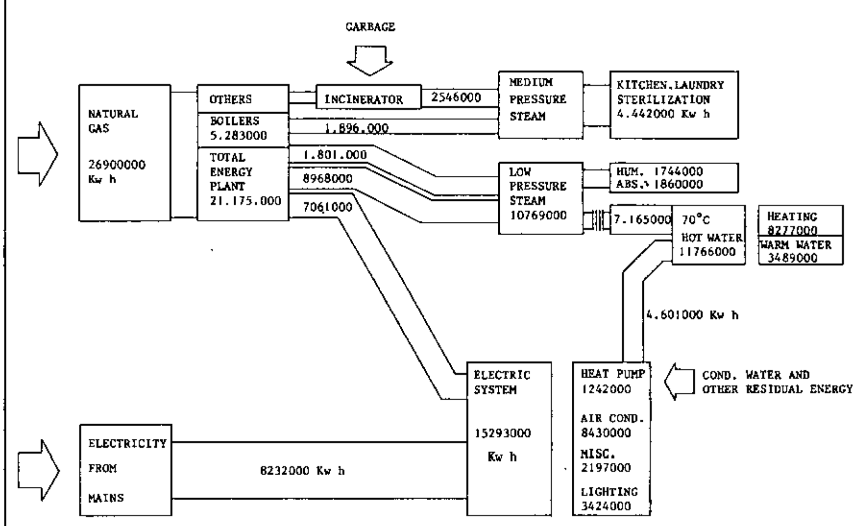
— The hot water system is served by several means:

50% — Steam recovery from the total energy plant
10% — Steam from support boilers
40% — Hot water from the condenser of the heat pumps.



GF : Chillers GA : Absorbers I - Exchangers T - Tanks
G : Boilers MG : Total Energy groups BC : Heat pumps

SCHEMATIC FLUIDS DIAGRAM



ENERGY FLOW DIAGRAM (KW H)

The control

Every machine has, of course, its own regulation and automatic control; however the control of the several machines in a system, when we may use different alternatives in the production of steam, hot water, chilled water, electricity ..., becomes a more sophisticated control.

In fact, every minute someone should take decisions on which alternative is the best one (considered from many points of view) and in what degree each one of the equipments in the system, should be used.

For instance, let us remember that the hot water can be obtained:

— from the condensers of the heat pumps
— or from the steam-water exchangers,
— or from the hot water tanks,
— or from the heat recovered from the incinerator.

The same applies to the rest of the system.

In order to optimize the combined operation of the different equipment installed in the energy plant, it has been developed a special software in a data management centre, composed of the CPU central computer, interactive display monitor, keyboard, printer and auxiliary disk memory.

The signals and analogic data are collected through 10 peripheric intelligent stations distributed all around the building, which digitally transmit to the CPU.

The data centre not only controls the energy consumption but also performs other interesting functions which improve the safety and reliability of the engineering installations and services.

- Monitoring programs, to collect information from the sensors, through the intelligent stations.
- Emergency programs, with regulated alarms studied to cover different situations and emergency actions.
- Maintenance programs, storing information, with capacity to periodically analyze data and automatically generate maintenance instructions.
- Energy management programs, coordinating the operation of the different equipment according to preset criteria, for energy consumption and cost optimization. Data recording and energy reports.

This paper was presented at the Institute's 40th Annual Conference at Bristol last year. It was one of two papers given under this heading. The other by F H Bailey was published in the March issue. The author is a director of RM Douglas Construction Ltd.

Middle East construction – the management challenge as viewed by the main contractor

J DALZIEL MICE FIHE MBIM

I intend to pose a number of questions on the subject and to try to provide at least some of the answers.

1. Why do we go abroad?
2. When do we go abroad?
3. Where do we go?
4. How do we set about it?

Basically the answer to the first question must be that companies go abroad in the belief that by so doing they can increase the profitability of their business.

From the end of the Second World War right up until the mid 1970's the UK Construction Industry enjoyed a period of growth. There had been fluctuations, but the pattern had been generally upwards. People in the industry had by and large enjoyed full employment again with fluctuations, but certainly senior staff had had few worries on the employment front.

In the mid 1970's we ran into the oil crisis, the price of crude quadrupled almost overnight and until the past two years we have seen a steady rise until at present it seems to have settled down at about 30 dollars a barrel give or take a little.

The effect of this vast increase in oil costs was manyfold. It hit British industry very badly and resulted in the slump out of which we are still trying painfully and hopefully to pull ourselves.

The majors in the construction industry, the household names like Wimpey, McAlpine, Tarmac, Taylor Woodrow, Cementation and a few others had been operating as established International Contractors, some for many years. Others, mainly the medium-sized Contractors had been able to expand at home and to absorb the ambition of their staffs by so doing.

With the very serious downturn in work, however, this was no longer the case. The question was posed 'What are we to do?' and the answer in many cases was 'Let's look abroad', for there was no chance of maintaining organisations of the size which had been built up over the good years in the face of the new situation.

So we go abroad for these reasons:

Lack of opportunity at home to maintain our turnover.

Reduced margins due to increasing competition.

To keep our staff usefully occupied and in a position to earn their salaries.

As to timing we choose to go abroad when these points become obvious:-

When we are no longer able to get sufficient turnover.

When margins have been badly hit by increasing competition, and

When we have staff willing and able to undertake the new task.

Which Country?

Where do we go? At the time I am discussing, the oil producing countries had come into great wealth – unbelievable wealth and this had created a construction bonanza. So for the Companies who had decided to gamble on Middle East or Nigerian growth, it was a case of paying your money and taking your choice. Bear in mind that in the sort of Company I have mentioned there was no experience of working in developing countries and so it was necessary to gain information from all possible sources. It was sometimes possible to recruit someone from one of the International Companies I have mentioned, but again bear in mind that they were very involved in the oil country's boom. They had the staff alright, but they could afford to look after them and keep them happy.

So this was a decision left to the Boards and Senior Executives of the smaller Companies. Some have survived the exercise, some have not!

For my own Company we elected for Saudi Arabia. It was good and remained so for a number of years. It is not so good now mainly because of increased competition over the years from mainly Koreans, but also Turks, Taiwanese, Singaporis, Japanese and many others. We then elected to go to the United Arab Emirates. Like many people we chose wrong this time, and after a year of looking for work at a cost of about £100,000 we pulled out. But we had made friends and we have now gone back and are doing very nicely. Around 1981 Oman became a possibility, and we set up there and this also is doing quite well.

How do we set about it? To pick the country as I said earlier you glean information from many sources. The country's UK embassies, the Board of Trade, the Export Group for the Construction Industries, and the Banks are all good UK sources of information. These enable you to carry out fairly detailed desk studies, which in my experience tend to guide negatively, in other words to establish countries to avoid for political or economic risks. Having eliminated the non-starters visits can be made to the hopefuls and once there a visit to the British Embassy Commercial Department or the British High Commission is the usual starting point. The Commercial Department of the Embassies have been transformed over the past decade from being almost useless from a businessman's point of view, to in the main, being absolutely first class. The Commercial Secretary with his ear to the ground, and that covers most nowadays, will quickly give you a list of people to see and potential partners and details of how to set up in business in the particular country. Visits to the Banks are also a useful source of information plus an accountant and a lawyer. About a week in a country will give you some sort of feel for it. A month at home to cogitate and a second visit will perhaps either confirm your views or otherwise.

Operational Choices

Having picked your country and established the viability of working in that country, there are several ways to operate. Mostly the laws of developing countries restrict your methods, but you may choose to operate:-

(a) as an International Contractor with a registered branch and most likely a sponsor, or at least a Mr. Fixit. This is generally for mammoth jobs and it may be that several contractors either from one country or from several will

Le défi de la direction au Moyen-Orient

L'auteur décrit les raisons pour lesquelles les entrepreneurs britanniques décident de travailler à l'étranger, et les nombreuses difficultés qu'ils doivent y surmonter. Les relations entre eux et les personnes influentes dans les pays étrangers, l'utilisation des connaissances locales et les problèmes dûs à l'installation du personnel de la compagnie et de leur famille y est aussi décrit.

band together in joint venture to carry out such a major project.

(b) as a contractor operating from within the country with a sponsor. In this, method you bid for work and the sponsor will want a sponsorship fee, which may be, and certainly used to be, as high as 10% of the contract cost. Once the contract has been secured the sponsor tends to back off and leave you to deal with all of the various problems which will beset you.

(c) as a joint venture company. Here the law is likely to say that the locals have to have a 51% shareholding or more in places like Nigeria, and this is the method of operation of many UK companies. It has the advantage that the local participant maintains an interest throughout the operation and uses his ability and influence to further the business.

So you have decided to go, you have decided when to go and where to go and on the sort of set-up you want. You have chosen your partner and got a company into an embryo state. Let's get down to the practicalities. You need staff and for the first one or two really key jobs it is best to find in-house people on whom you can hopefully rely for their loyalty and integrity.

At three and a half thousand miles away they have a lot of responsibility. You have to settle salaries, living conditions, local offices, airline travel, education – for you are responsible for educating the families – housing, at exhorbitant cost, cars, telephones, telex and many other items. You have to get work permits for your staff. In Saudi Arabia this alone can take two years. You have to decide from where your technical staff, your foremen and your work force will come. You have to recruit reliable UK staff and to try to avoid people with racial prejudice and we have many more in this country than you might think.

Staff Problems

And on the subject of UK recruitment, if I may expand a little, it is not only the man you have to consider it is also the wife and the family. For the man his attitude and acceptability as a person in a closed company community at least weighs equal to his qualifications and ability to do the job.

When you come to the wives then you do have real problems. At one time I interviewed them and this worked until having decided the man was suitable for the job I decided the wife would not fit in. You can imagine that I was then in all sorts of difficulties. How do you tell a man he can't have the job because his wife is incompatible with other wives?

Since we started using third country nationals in many of lesser posts, some of the personal problems have reduced but I'm sure most people would be astounded by some of the moans with which the travelling executive is met.

In the meantime, you and your key people are trying to get the Company going, to get commercial registrations to get on tender lists, and so on, and bear in mind that all the while money is flowing out to the new Company. Even running it on a shoestring it is costing possibly as much as £25,000 a month. So you need your first job and having got it you then need your workforce. Visits to India, Egypt, Pakistan, Thailand, the Phillipines and Indonesia ensue for these are the sources of cheap labour, some good, some not so good. There are conditions laid down, different for each country, for the employment of their Nationals and you have to comply. For your interest, a UK junior engineer and a UK foreman both on bachelor status will cost about the same, about £17,000 a year. Indians with equal qualifications and skills will cost about £8,000.

Difficulties that are peculiar to this form of contracting! The work is technically the same. You apply the same tests to materials and achieve standards of workmanship at least well up to, if not in excess of, UK standards.

On Site

On the site you have to take special precautions in some areas against salt in the soil and in the sands and a lesser extent, the aggregates. Curing of concrete in the high temperatures is more important.

Your third country national (TCN as he is known) has little experience of western technology. Safe working practises for him is a subject totally unknown. He is not skilled at producing a good basic structure. So our supervisors start with raw artisans and labour. But the TCN do bring with them tremendous willingness to work in a way long forgotten in the UK and if you think just for a minute that their income at home is possibly £200 a year and their income in the Middle East is £250 a month, then you will appreciate one of the reasons for this enthusiasm. The contractors supervisors have still to show understanding and if you are in a position of authority you are expected by the TCN to be worldly-wise and to be able to advise on land disputes, family problems, education and so on in the villages of India or the jungles of the Phillipines. If you see that they are properly housed and fed, also see to their personal problems and look after them, they will respect you and work extremely hard for you. In a camp of Indians you can have several different sorts of food and if Indians from each area of the country do not have their preferred food, you have discontent. It is essential that UK supervisory staff are sympathetic and at the same time, remain in authority.

The procurement of materials ranks high as a problem coming only after staff and labour problems.

The people you purchase from may not speak English, they have no idea what BSS means; the chances are that you have no telephone on the site and so materials are bought with legwork. It can take hours to travel even short distances because of the tremendous traffic problems in many of these developing countries. Materials from Europe are at least four months away in time.

You become involved in Letters of Credit and often from pretty disreputable Mediterranean suppliers. Goods when supplied do not come up to the specification. The Greek or Italian supplier whose works you so carefully inspected refuses to supply unless you pay up front.

With a performance bond, if 10% of the contract value, which the client is threatening to draw, you pay and then the goods fall short of the standard. Or if you buy from the UK delivery is late – it nearly always is late – and you can only overcome the problem by airfreighting at a very high cost.

And after all that you have a client who does not speak English and who often does not honour the last certificate and so you have a seriously bad debt situation.

Worth it all?

The final question:- "Is it worthwhile?" and the answer must be "Yes".

Why?

In the first place you have increased the status of your company. In the eyes of your own staff, they now work for an international organisation and that is important. In the eyes of your industry you are now operating as an international organisation and opportunities will come even at home because you have the status.

You have, if you have chosen well and have a little bit of luck, found a better hole, a place in the world where you can earn a better income from the capital you invest and this is after weighing up all the political and financial risks.

You have provided an opportunity for your staff to grow as individuals. Very young men get very senior positions and with the growth they become relatively well-off. I see young men of thirty buying houses, not on a mortgage but with hard cash. They live in marvellous conditions, albeit a bit hot and sweaty. They sail, they swim, they fly and in general they lead a full, satisfying life. Holidays are in Singapore, Kenya, Hong Kong and in Bangkok for the bachelors.

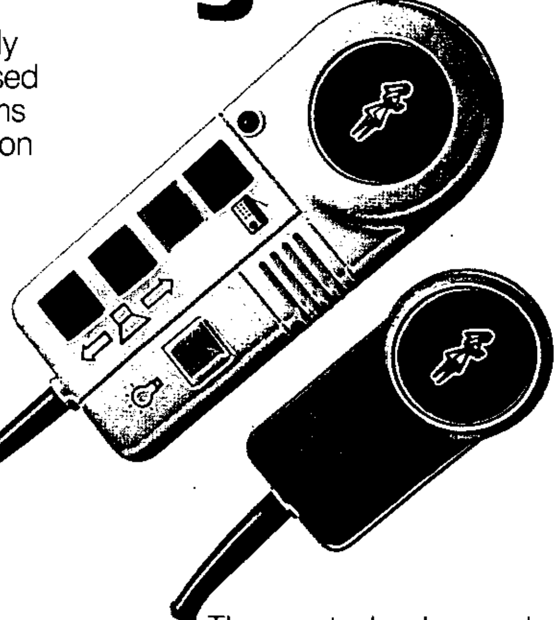
And for the executive? He spends much of his life on the move to the deprivation of his family. Having said that every time you step on board the Boeing at Manchester or London, you are starting another adventure. Who knows, this trip may be the one where you make the real breakthrough. Perhaps you will win a £20 million contract. Perhaps it will have a 10% profit margin. Perhaps Mrs Jones washing machine will not have broken down and the Noritake dinner service she was demanding as a precondition for her husband staying on for another year will have arrived. Perhaps Shaikh Ali will pay you the half million pounds he has owed you for the past three years. Perhaps all the materials for that awful job in Abu Dhabi will have arrived and perhaps (please God) this time you will not have a bad stomach. Please don't all rush to the Middle East. We don't want any more competition than we already have.

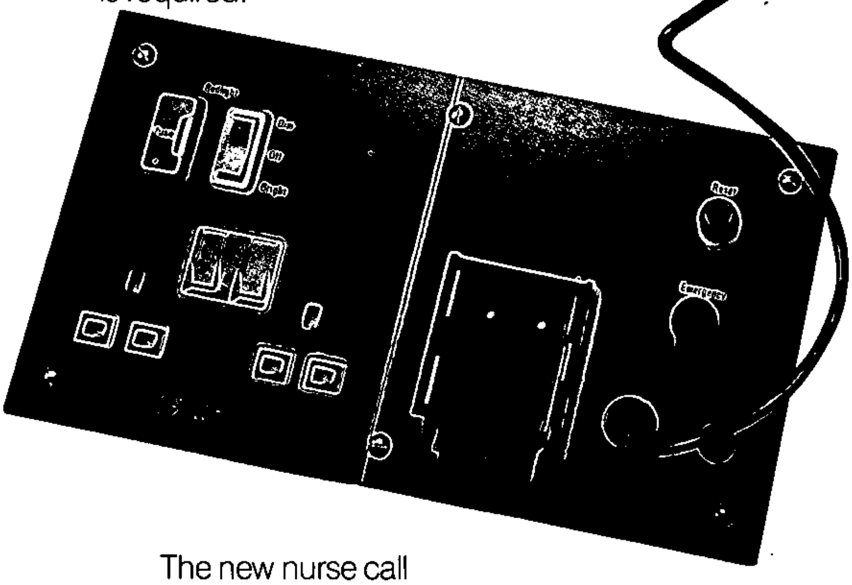
Nurse Call-
help at hand

A breakthrough in patient handset design.

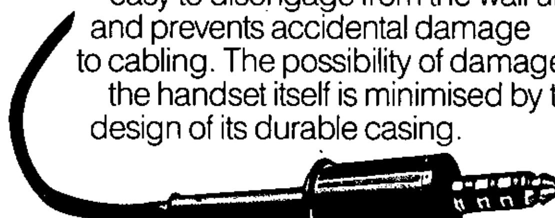
The nurse call patient handset has been completely redesigned by Static Systems in the UK to bring increased standards of help and comfort for patients. Static Systems have over 20 years experience in hospital communication systems, and have applied the latest in microprocessor technology to make their nurse call systems even better and more reliable.

The new-look handset provides a host of benefits. It is lightweight and comfortable to hold; simple to understand and easy to operate; all facilities including radio/TV channels are clearly identified; in particular there is a prominent large call button. There is a small matching call push unit where a facility for calling the nurse only is required.



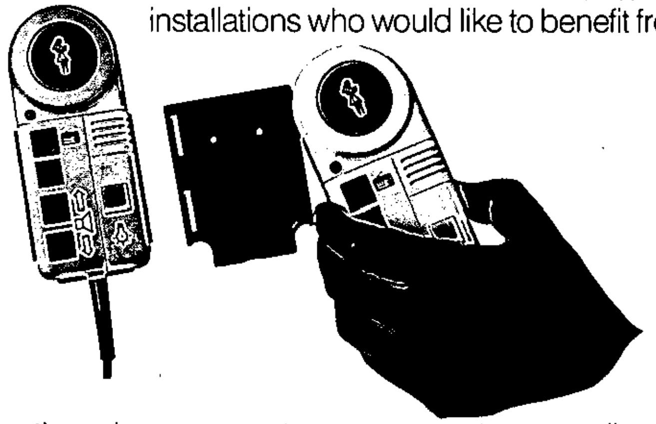


The new technology reduces the number of cores needed in the flexible connecting cable to four, so that a robust jack plug can be used. This is easy to disengage from the wall unit, and prevents accidental damage to cabling. The possibility of damage to the handset itself is minimised by the design of its durable casing.



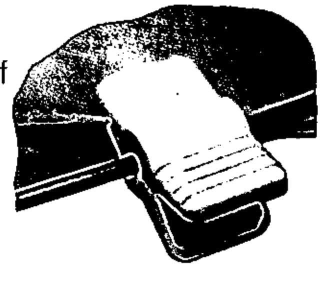
The new nurse call handset can always be kept handy; it comes with a convenient linen clip and a cleverly designed wall bracket.

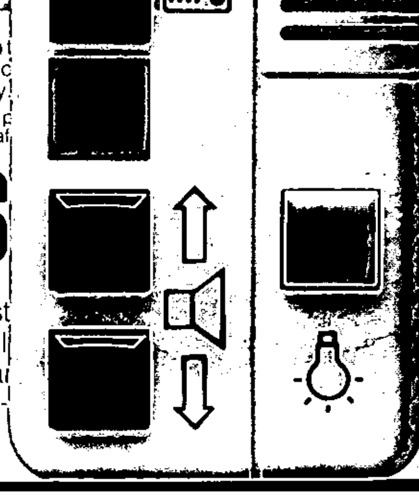
No worries for those with existing installations who would like to benefit from



these improvements: your present nurse call system can be updated.

Take advantage of our improved nurse call system. Patients, nursing staff and maintenance engineers will all benefit.





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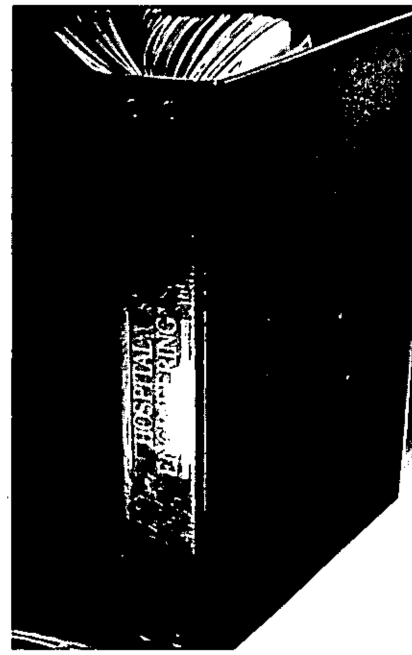

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