TENTH INTERNATIONAL CONFERENCE OF WOMEN ENGINEERS AND SCIENTISTS

PREPRINTS

TOWARDS THE THIRD MILLENNIUM: THE ROLE OF THE INTELLECTUAL POTENTIAL IN A NEW WORLD

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ICWES ONE TO NINE

Dr. Elizabeth Laverick
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INTRODUCTION

In the' Sixties', with the increasing interest in nondiscrimination and equal opportunity in the Western world, conferences concerning the role of women in the scheme of things were not unusual, and the position of women in science and engineering, where women professionals had little visibility except in the USSR, was (and still is) a favourite subject for discussion and analysis. However, as Aileen Cavanaugh, then President of the United States' Society of Women Engineers said at the official opening, in 1964, of the First International Conference of Women Engineers and Scientists held in New York, (ICWES 1), such debates, "had taken place for far too long without the benefit of facts, and most often by people - including both men and women - who had never met a woman Engineer or Scientist." So, when I was invited to address the Japanese Forum of Women Engineers on the subject of "Women Engineers and Scientists Worldwide" I naturally turned to the published reports and proceedings of that Conference and the following eight such Conferences, which have taken, place between 1964 and 1991. I was fortunate enough to be able to attend seven out of the nine, and preparing this gave me great satisfaction as I looked back and tried to put into perspective what I have learned from those Conferences about women engineers and scientists worldwide.

HISTORICAL BACKGROUND TO ICWES

The First International Conference of Women Engineers and Scientists took place in New York City whilst the great World Fair was in progress and the World Fair Organisers declared June 15 1964 to be Women Engineers and Scientists Day. The World Fair made a great impact on the Conference:various exhibits were visited on the first day of the Conference including General Motors Futurama and Behind the Scenes and Second Mobil Exhibit. The second day was devoted to technical tours including Bell Labs and the new Research Center of IBM. The third day we got down to business. The Conference had taken as its theme "Focus for the Future - Developing Engineering and Scientific Talent". Its aims (to quote Aileen Cavanaugh yet again) were "to look at the future technological needs of a peaceful world, define those areas of endeavour in which our scientifically inclined and inventive youth of today - boys and girls alike can find their opportunities for service to their fellow men of tomorrow".

The Conference brought together more than 400 delegates from 32 nations to exchange information and to create new patterns and new plans for the activities of women engineers and scientists. In her keynote address *Dr.* Lillian Gilbreth, a renowned management consultant who, with her husband, pioneered the study of time and motion, which became so important in Industrial Engineering at that time, said "we have come together to focus our attention on the future needs of the world. We shall try, through pooling our diverse experiences, to estimate what those needs will be and then to consider ways in which we can best contribute to those needs."

The Technical programme consisted of six sessions. The first session considered the requirements for engineering and scientific manpower to meet the challenge of sustaining the expanding population of the world, and the technical services needed in support thereof. The following three sessions established the specific types of scientific and engineering talent needed, describing the state of the world in the major areas of human need, namely, food and water, clothing and shelter, heat and power, communications and transportation. Session Five covered the current status of women engineers and scientists and information was published about Australia and New Zealand, Europe, Iran, Japan, North America, the Philippines, South and Central America, Syria, Turkey and the USSR. Session 6 was in the form of a symposium on "Developing Engineering and Scientific Talent", at which various eminent people were invited to contribute statements as a basis for discussion. There is no report of the discussion as such, but a summary statement emerged from the Conference which pointed out the many ways in which science and engineering

Were contributing to improved world living conditions, and the possibility of achieving the outstanding potential of the future by co-operation. Also emphasized was the inadequate supply of trained personnel to implement future world needs.

Finally, the Conference resolved:
1. To encourage each participant to report about the Conference in her home country or region.
2 To encourage women to increase their participation in the professional societies in their countries.
3 To encourage women to enter the field(s of engineering and science) and to improve their qualifications not only during their student days but throughout their professional life.
4 To maintain the central file of women engineers and scientists used for this Conference and enlarge it as much as possible.

So ended the First International Conference of Women Engineers and Scientists. It was attended by a delegation from the UK of some 22 engineers and scientists, who were so inspired that on their return they persuaded the Women's Engineering Society in the UK to host a second such Conference. This took place in the University City of Cambridge in 1967 the technical theme chosen was "The Application of Technology to World Food Problems".

The inaugural address was given by Dorothy Hollingsworth OBE, a chemist and Head of the Food Science Advice Branch of the Ministry of Agriculture, Fisheries and Food.- Her address was entitled "Nutritional Goals in a World Context", and in it she traced the growth of thought on the application of nutritional knowledge to the problem of feeding populations. Experiences in the UK since the beginning of this century were used to illustrate certain general principles. International action in matters of food started with the League of Nation's concept in the 1930s of "the marriage of health and agriculture". This was followed by the setting up in 1945 of the Food and Agricultural Organisation of the United Nations for the purpose of raising nutritional levels and standards of living worldwide. Twenty years on and it was clear that the difficulties were even more daunting than anticipated, and a food crisis of staggering proportion was predicted by 1985 unless the rich nations drastically increased aid to poor nations for food and population control programmes. This address provoked much discussion and formed a stimulating introduction to the ensuing sessions on "Enough for everyone", "The Use of Power in Agriculture", "Increasing Food Production" and "Future Trends".

Again, there was a second theme - "The Woman Professional Engineer" and Jo Webb, an American chemical engineer and author gave the opening. Address, entitled "Science versus the Humanities - a harmful dichotomy". She put forward the hypothesis that science and the humanities are not separate and unrelated, but are subclasses of philosophy. She traced the division between the rational and the intuitive approaches to an understanding of life, through the ages to the present day. She expressed the view hat changes in education to emphasise the importance of both modes of thinking were imperative, as was the need for, and satisfaction to be found in, social responsibility combined with professional commitment. Jo Webb also reported on a survey, which she had carried out in which she invited 34 people from different countries to complete a questionnaire about women engineers. She pointed out that professionally qualified women engineers were in a striking minority in every country in the world one in three in the USSR, one in one thousand in the USA. Her questionnaire was an attempt to collect information about women engineers on a common basis, something that the first ICWES had failed to do.

Most importantly, during the Conference a meeting of delegates was held to discuss the possibility of further cooperation between women engineers and scientists. In addition to delegates representing Supporting Societies from France, Italy, Japan, USA and UK, there was one delegate from each country, and a few interested observers. After a lengthy discussion, the major points, which emerged, were as follows:

1.There was an unanimous desire for the continuation of International Conferences of Women Engineers and Scientists.
2. However it was agreed that, although an international secretariat to organise the Conferences was desirable, the cost would be prohibitive. Each Conference would therefore build upon its predecessors and self help, and enthusiastic volunteers would provide the necessary workers. Even so a host organisation would be very necessary.
3. A Conference representative in each country was desirable who would organise her own voluntary supporting and fund-raising sub-committee.
4. Three years was a reasonable gap between Conferences.
5. The Conference venue should move round the world.
6. Conference participation should be truly world wide and a great effort should be made to secure the attendance of delegates from all countries

A third Conference was mooted for 1970, and a small international committee was entrusted with the task of ensuring the continuity of the Conferences. Its members were drawn from Africa, Asia, Europe, Latin America, the Middle East and North America. The Chairman was Isabel Hardwich from the UK, the Honorary Secretary of the ICWES 2 Organising Committee.

So ICWES was well and truly launched!

ICWES 2 was the first Conference to introduce "The Bringing of Greetings Ceremony". On the eve of the Conference delegates were invited to attend in national costume, and each country delivered greetings to the host country. This was followed by a "get to know you" party. Of course, we English are at a great disadvantage when it comes to national costume, and rely on the Scottish and the Welsh to represent the

United Kingdom. However with countries such as Austria, Brazil, Ghana, India, Iran and of course Japan, to mention just a few; it was a most colorful evening, and the UK delegates were put in the shade.

ICWES 2 vied with ICWES I in providing a wide range of visits, some technical and some cultural (taking Jo Webb's comments on unification to heart). Based as we were in the City of Cambridge, using the facilities of the University, we were able to tour some of the historic colleges and enjoy such differing pleasures as an organ recital in King's College chapel, and a demonstration of Morris dancing - a ritual English folk dance symbolizing death and rebirth, performed by groups of white-clad men wearing bells and carrying sticks and handkerchiefs. The host Society also gave its *own* party in the historic town of Bury St. Edmunds where, in the Athenaeum, the 18th Century assembly room where Dickens used to give readings, we "treated" the delegates to a full-blown demonstration of the Scottish pipes, and haggis for supper. An additional attraction was the post Conference tour of the Irish Republic. All in all, the Conferences are a golden opportunity for delegates to learn more about the heritage of the host, as well as getting to know each other.

THE ICWES SERIES

So, ICWES 1 and 2 were a great success involving 374 and 313 delegates respectively, 87 from 32 overseas countries at ICWES I and 191 from 35 overseas countries at ICWES 2.

The third ICWES was held in Turin, Italy, in 1971 this time with 233 delegates, 188 from overseas. They discussed "Planning for Progress" and "Women's Professional and Family Duties". The Opening took place in the Royal Palace, Palazzio Madama. The Inaugural address, given by Professor Andrea Ferrari Toniolo examined and analysed five points relating to the deep links existing between technical and human progress. 69 papers were presented on various topics Energy Sources, Communication and Transport, Computer Technology, Housing, Town and Community Planning, Industrial Production and Human Engineering. The second theme, "Women's Professional and Family Duties" attracted a further 28 papers.

It was at this Conference that the meeting of delegates, in addition to choosing Poland as the host country for ICWES 4, discussed the format of the Conferences. Clearly some delegates felt that time should be allowed for more detailed consideration of the topics, for example by working groups. Some would have preferred less time to be spent on the papers (which should preferably not be too specialised) and more time in discussion. However it was appreciated that the large number of papers could provide a greater opportunity to learn how other countries resolved their problems also that some organisations would not support delegates if the theme were too narrow. In practice each of the three Conferences was quite different from one another.

Again, the program included the possibility of visiting places of historic interest and beauty as well as of technical interest. Particularly memorable was the visit to the historical motor museum which was followed, after a luncheon provided by the Fiat Company, by a trip round their manufacturing facility where the UK delegates were particularly interested to see women and men working together on the production lines. This was something you would not have seen in England at that time!

Four years later found us in Cracow, Poland - the first time for many of us "behind the iron curtain". Again more than 30 countries were represented and there were 148 foreign delegates in a total of 618. The themes were "New Techniques in the Service of Mankind" and "Contemporary Sociological Problems of Women Engineers and Scientists". The Opening address was delivered by the Scientific Secretary of the Polish Academy of Sciences and President of the Council of the Polish Federation of Engineering Associations, Professor J an Kaczmarek. He told us that in Poland "women accounted for 46% of the labour force. They constituted 39% of manpower with University education, 54% with secondary school vocational education and 70% with general education. 50% of medical doctors were women, 91 % dentists and 83% pharmacists. They account for 31 % of the University teaching staff. They are active in light industry, food and agricultural industry as well as in printing, electro-technical and chemical industries. They playa more and more important role in the scientific life of the country. They are awarded about 25% of all university degrees". Not surprisingly, 50 of the 106 papers were given by Poles.

At the Delegates meeting, where 32 countries were represented, the Chairman put forward the aims of ICWES as: *Firstly,* to bring together professional women engineers and scientists worldwide. *Secondly* to encourage the use of technology for the betterment of life, and *Thirdly* to consider how to increase the participation of women in this. These aims were adopted, and although slightly differently worded are still the aims today. In discussing the host country for ICWES 5 it was recorded that "There was a general feeling that Japan would be an ideal venue". (There were six Japanese delegates present at ICWES 4). However the Japanese representative regretted she was unable to commit the Society of Japanese Scientists. In the event no definite offer to host ICWES 5 was forthcoming. After the Conference an offer was received from France and accepted by postal ballot among the delegates.

Rouen, the ancient capital of Normandy situated on the River Seine, became the venue for ICWES 5, and it was at this Conference that the meeting of national representatives confirmed the aims of ICWES, and laid down Guidelines which included the composition of the Delegates meeting and its purpose (mainly to decide the host for the next Conference). They also regularised the ICWES Continuity Committee set up

At ICWES 2. Their responsibilities are to encourage organizations to put forward proposals to host the next ICWES, and, once the host is agreed to assist in the dissemination of its details. These guidelines can only be amended at the Delegates meeting. Some minor amendments have been made in ensuing years. Finally, the offer to the meeting by India to host the sixth ICWES in 1978 was unanimously accepted.

The theme chosen for ICWES 5 - Technology and Freedom - included a session on "Information of women on scientific and industrial careers and their training in these careers", as well as sessions entitled "Industrialized production - wherefore?" "From the transfer of technology to industrial cooperation" and "Responsibilities of the Research Scientist". At the close it was emphasized that engineers and scientists have not only a responsibility to their professions but' also to the public. This responsibility is of the utmost significance to women scientists and engineers, who are in a better position to convey their knowledge to a seldom well-informed public and to help all women to realize they should not be unconcerned with a world ruled by technology but have a part to play in it.

1981 took us to Bombay to discuss "Science, Technology and Society". The Conference was opened by Indira Gandhi, the Prime Minister. It was a great thrill to meet one of the few women Prime Ministers in the world. There was a large delegation from India, mainly from academia and research institutes and many of the papers they presented were highly specialised and concerned with very specific research problems. Only 18 papers were offered by delegates from overseas, of whom there were 55 in all. Many of these took the opportunity to extend their stay following the Conference, and to learn more about this fascinating continent.

In 1984 ICWES returned to the USA, to Washington D.C. with its museums, galleries, historical monuments and of course the White House. The theme was "Technology - an International Bridge"; its aims were to reduce the gaps in understanding and knowledge among the peoples of the world. Not only was it run in conjunction with the US Society of Women Engineers' National and Student Conferences, but the extensive programme of talks was arranged in three parallel sessions covering 15 topics, ranging from Defence, through Technology and Society to Transportation and Our Planet Earth. There were also sessions on Undergraduate Education, and Women in Engineering and Science, Ana for those papers, which did not fit into any of 14 topics there was a "Pot Pourri" session. Industry was very much to the fore at the Conference, running recruitment evenings and participating in an exhibition. Professional development workshops were available most afternoons, proving a great attraction to the younger delegates. Technical and other tours abounded usually at least six to choose from every afternoon! We were spoiled for choice...

1987 took us to the Ivory Coast - the theme "Science, Technology and Development". The Conference was opened by the Head of State, preceded in procession by a group of Kings and Chieftains resplendent in beautiful robes and carrying golden carved staffs and maces. The theme was explored at plenary sessions, and working parties met to discuss "Science and Women", "Communication and Transfer of Technology", "Science and Development" and "Sciences and Techniques". Recommendations from the working parties emerged at the final plenary session. Visits were made to the Port Authority, palm nut plantations and a power station. The Conference ended with a buffet banquet, with African dancers and fireworks, and an enormous ICWES iced cake!

And so to ICWES 9 - hosted by the Women's Engineering Society (UK) at the University of Warwick in Coventry, England in 1991. The theme was "Communication" and topics included Transport, Satellites and Telecommunications, Basic Sciences, Information Transfer, Technology Transfer, Education, Career Development and Gender issues and Demographics, i.e. the education, training, employment and status of women engineers and scientists worldwide. It attracted 466 delegates including 139 from 41 other countries.

On the first evening a "Bringing of Greetings" ceremony was held followed by a party in the form of an Old English Fayre, which included stalls providing such Old English delicacies as Game pie, Syllabub and Mead (a honey-based drink), and entertainment from Morris Dancers and a Jazz band. We were honoured by the "visit" of the famous Lady Godiva who in the 11th Century rode naked through the marketplace of Coventry in order to persuade her husband to reduce the taxes he had imposed on the town.

Needless to say a variety of tours, technical and social, were made available, and, learning from the Washington experience, a career guidance and training seminar was held for the younger delegates. With a view to increasing the number of girls interested in engineering, AND to tell our delegates more about our country, the opportunity was taken to hold an exhibition in parallel with the Conference with stands from industry, government and educational and professional organizations. A series of educational events was also held during the week to which local schools were invited and in which delegates were also able to participate. These included a WISE (Women into Science and Engineering) bus, (a travelling exhibition offering hands-on experience), part of a project organized by the Engineering Council and the Equal Opportunities Commission to tell schoolgirls about Science and Engineering. Also a lecture for schoolchildren organized by the Institution of Mechanical Engineers was given by the Post Office. This was attended by some 1000 pupils, who also visited the exhibition.

The delegates meeting, held on the Thursday, appointed the new ICWES Continuity Committee. They agreed that subject to their scrutiny of detailed proposals, the Nigerian offer to host ICWES 10 in 1994 be accepted. However, because of political

Instability in Nigeria, the Continuity Committee was NOT able to confirm the acceptance of the Nigerian offer Fortunately Hungary stepped into the breach and offered to host ICWES 10 in 1996.

So what can we learn from the ICWES series so far in terms of its stated aims?

Firstly the figures of attendance and of countries represented show that our first aim, that women active in the fields of engineering and science shall know each other worldwide, is being achieved (see Table 1). More needs to be done to promote the Conference worldwide, and to help us all to keep in touch. However, a lot has been learned also in terms of getting to know MORE about each other, and this I will discuss again under the section "The status of women engineers and scientists".

Secondly, the themes chosen have been wide ranging and, in line with our second aim, have enabled us to consider and discuss areas where technology can be used for the betterment of life. Not only has this encouraged a large number of papers, and attracted large audiences, but also the papers have provided an impressive record of the growing technical contributions made by women in these particular areas over the last 27 years

. This is of course, by example, impinges on our *third aim* - that the participation of women in engineering and science shall be increased. In addition many of the papers in the sociological sessions discussed the different ways in which countries are tackling the problem of the shortage of women engineers and scientists, and the waste of talent that this implies.

Table 1.

INTERNATIONAL CONFERENCES OF WOMEN ENGINEERS AND SCIENTISTS (ICWES)

	Year	No. Of Delegates	No. Of Countries
ICWES 1 (Focus on the Future) USA	1964	374(87)	32
ICWES 2 UK (Application of Technology to World Food Problems) (The Woman Professional Engineer)	1967	313(191)	35
ICWES 3 ITALY (Planning for progress)	1967	233(188)	32
ICWES 4 POLAND (Contemporary Sociological problems of Women Engineers and Scientists) (New Techniques in the Service of Mankind)	1975	618(148)	30
ICWES 5 FRANCE (Technology and freedom)	1978	146(103)	30
ICWES 6 INDIA (Science, technology & society)	1981	394(55)	17
ICWES 7 USA (Technology- An international bridge)	1984	1204*(54)	9
ICWES 8 IVORY COAST (Science technology &development)	1987	221(51)	21
ICWES 9 UK (Communication)	1991	466(139)	42

( )=Overseas

+= Combined with SWE Students Conference

WHY HUNGARY?

Dr. Zsuzsa Szentgyorgyi

Why just Hungary was chosen to be the scene of the 10. International Conference of Women Engineers and Scientists? Why this not too big - or, better to say, small - country on the edge of Central Europe: not in the very center of the developed rich but not just on the real peripheries, where the newly rapidly developing countries, and the desperately lagged behind nations are thronging. Halfway between the center and periphery lives here nations, which have taken this land before one thousand and a hundred years ago, became a part of the European culture, and, has been a creative contributor of this culture for the centuries. The territory of the country is round 93 thousand square kilometer (about two and a half times larger than the Netherlands), and the GDP per capita is about 4,5 thousand dollar pro year.

You can always draw a balance between the facts what a country has and has not. I could cite you quite a long list what we do not have: first of all, being in the very center of the continent we are devoid of seashores, and so, big international harbours as well; here have no rich ore and coal mines, and our medium rich oil- and natural gas-fields were mainly depleted during the Second World War by the German, and after the war by the Soviet occupiers. We have no high mountains, quick rivers because some decades ago we were deprived of them. And, last but not least, my contemporaries and our predecessors survived a long series of fallen revolutions and fights for freedom, lost wares, invaders, occupiers, colonizers - and among them liberators who immediately became the new oppressors themselves.

Quite a sorrow list of the "having-not"s. On the other side, however, Hungary can be much more characterized by a number of "yes, we have" treasure, values, and abilities. Good soil for agriculture, mild and temperate climate, beautiful landscapes are exceptionally valuable. Here, we have the Balaton, Europe's biggest warm-water lake, lots of thermal sources and springs, here flows the big river, Danube, and so, we have a big international harbour on her. Situated on the cross-roads of nations and physical roads, Hungary is apt for a vivid traffic of goods and transit not only of real products but - what is *more* significant - of ideas, knowledge, culture as well.

I think, the real and chief values of our country can be found in the culture of the Hungarian people. A small country, which gave eleven Nobel-prize winners the world! Soon have I to add, however, that ten of them got the prize abroad, and not in the homeland. Nevertheless they were Hungarian, not only because their overwhelming majority was born here, held a Hungarian family name, but, what is more important, they were brought up here, and established here at least a part of the scientific bases to their outstanding results. Two of them: the chemist George Olah and the economist-mathematician John Harsanyi were given the highest scientific prize last year. They were grown-up people already as they left the country. And if we go back in time, in Hungary was born, brought up and partly worked here Ignaz Born, Mozart's close friend, the pattern of Sarastro's figure, a giant in the science and practice of mining and metallurgy, and establisher of the world's first scientific society. The two Bolyai's, father and son, the great mathematicians, especially John, the son, who "created a new world" in mathematics, now every day's bread of the modern physics. In the recent century a legion of Hungarian geniuses swarmed into the world, mainly to England and the USA, flying from the Nazi's terror after 1933. Theodore Karman, founder of the modern aerodynamics, Dennis Gabor, Nobel-prize winner, inventor of the holography, Leo Szilard, an extraordinarily original genius, co-inventm:-ofthe nuclear reactor, Eugene wigner Nobel-prize winner, one of the great est physicist 0 the 20. century, John von Neumann, founder of the modern electronical digital computers, Nicholas Kurti, world-champion in producing extremely low temperatures. The only Hungarian who got the Nobel-prize in the homeland, Albert Szent Gyorgyi, the discoverer of the vitamin C left later on. the country too, and lived in the USA. They were the Martians on the Earth, as Professor George Marx called them in his famous book.

All these people and a big number of less famous but very valuable other were compelled to leave Hungary mainly because of political reasons - first of all Jews, whose naked life was threatened not only by the

German occupiers but by their Hungarian collaborators too. The wind of wars, revolutions and counter-revolutions, or sometimes simply the lack of perspectives had blown out hundred thousands, perhaps millions of Hungarian people - gifted, skilled, whose creative force was used and enjoyed by luckier nations.

Yes, our country is windy, very windy, not only in real but in transitive meaning too. To live on the cross-roads is often dangerous, not always an advantage. On the other hand, however, probably just this sharp and difficult situation made Hungarian people extraordinarily adaptive, docile, quick to understand and enterprising. May be, this was one of the reasons that the ICWES Council chose Hungary. Of course, among other reasons we have not to forget the great historical social transition in the early nineties. Those time Hungary belonged to a region being highly interesting in the eyes of the international public opinion: one of the newly independent, post-communist countries, perhaps the most open among them. And there was just another reason, why the year 1996 was chosen. When the ICWES Committee decided to organize in Budapest the 10. Conference, our capital was the planned scene of the next World Exposition. That is why the Hungarian Organizing Committee firstly suggested for the Conference the month May, since the Expo was due to open its gates in June this year, and it seemed evident that the ICWES Conference would be an accompanying and introducing event of the Expo.

In 1994 turned out, however, that the country is not able to undertake such a big event, mainly because of economic reasons, and so, the Hungarian government and the Parliament renounced it. So, along with the diminishing World Exhibition this possibility disappeared for us. That is why we postponed our Conference to a more suitable date. Early autumn, the Indian Summer (what is called in Hungarian by a less polite name, the Summer of Old Ladies) in this region used to be a very nice, sunny and mild part of the year, in contrast to the capricious young summer.

So, why Hungary? I think and hope that I could answer the question, and justify the answer as well. You are welcome here, in our small - but small is beautifull, not rich but developing country, with charming landscapes, nice cultural memories, and hospitable people. Beside the Conference enjoy the hospitality of Hungary! We try our best that our dear Guests spend here pleasant days and bring good memories with themselves.

WOMEN INTO SCIENCE AND ENGINEERING

Baroness Platt of Writtle CBE DL Fe ng

Patron, WISE
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The prosperity and quality of life of all nations depends on the intelligent application of technology and innovation in all areas of life. To do this countries need well-qualified engineers, both women and men. Throughout all fields of education, industry and commerce, and in government, encouragement needs to be given to girls and women to study science and technology and pursue careers in those fields. Empbyers need then actively to recruit women, and put into practice flexible working arrangements so they can retain those valuable women engineers when they also have children.

In 1993, our Engineering Profession in the UK were very pleased when the Government Office of Science & Technology published, "Realizing our Potential". I quote from the first page:

"The understanding and application of science are fundamental to the fortunes of modern nations. Science, technology and engineering are intimately linked with progress across the whole range of human endeavour: educational, intellectual, medical, environmental, social, economic and cultural. They provide - through tools as diverse as mathematical modeling, biotechnology and earth observation from space - a vital part of humankind's armory for solving long-standing, world-wide problems, such as poverty and disease, and for addressing new global challenges such as those facing the environment.

The history of the United Kingdom has shown the intimate connection between free trade, the application of science to tradeable products, and national prosperity. The industrial revolution which played so large a part in creating the modern world was made possible by our great engineers of the eighteenth and nineteenth centuries. In a world where ever fiercer competition prevails, history's lessons are highly pertinent"

It is not often that Governments make statements of this kind, and back them up with a programme of ongoing action. The White Paper has set up a complex Technology Foresight programme involving many people: Industrialists, Academics, researchers with special expertise in particular areas of technology, to try to foresee where Britain should concentrate her productive and innovative capacity, so as to result in wealth creation and a better quality of life for our country in the future. Engineers of course will have to be deeply involved. That is good for our profession in the UK, both in achieving public respect, but also in encouraging engineers to take a broad view of innovation,. and not concentrate on their own narrow speciality.

If people are to retain their standard of living and the sort of public services that prevent hardship to the handicapped, the elderly, and the inadequate, nations must sell their goods in the markets of the world in order to ear» the money for public and private provision. Because other countries have been quicker to apply the new technologies to

Production and manufacture than the UK, they have been able to reduce prices and take our markets. The UK has to catch up in this race and produce more economically too. They say the British never see the writing on the wall until they have their backs to it, and there is an element of truth in that. However, up and coming sunrise industry in our country does appreciate the urgency of the matter, and is hard at work applying new technology and regaining its marketing position in the world and will be backed by the Government policies outlined in "Realizing our Potential". In that sort of situation it is everybody's business in all our countries to see that children do not leave school frightened of the new technologies, which are going to permeate their working lives in the 21st century.

To have the necessary technologically, literate human resources ready for the 21st century, it is essential to make science and technology and chartered, both men and engineering attractive to girls as well as boys whose working lives will all be in the 21st century and that must be as true universally as in Great Britain. As sir waiter bodmer said in his presidential address to the association for science education, "Everybody needs to be scientate". That needs to be true throughout theirschool career. And we hope afterwards that girls the interest in science will be kept up all through their livesjust as much as the boys. The world would be a better place if that interest were awakened and maintained worldwideThat is not to suggest girls and boys should be educated narrowly in science, just as they should not be educated only in the humanities. Either exclusion is unacceptable in an increasingly knowledge based society. it is the interaction of the so called two cultures which is so essential. The cultured person must be knowledgeable right across the board: arts, science, and humanities-the lot.

Later in a working environment, because of the ever increasing sum of knowledge, human beings in all our countries will have to work in teams contributing from the base of their own specialisms, but at the same time being able to imagine how the whole jigsaw of specialisms of a team can fit into each other to the enhancement of the whole product whatever that product might be. An earlier broad education, including practical technological experience will stand them in good stead throughout their working lives.

An industrial in-house magazine showed an illustration of the control board for a system of theatre lighting. In the past, too easily drama could be categorized as an art. How artistic would a performance be today without specialist lighting for dramatic effect, quick spot lights, or color change? Where would a production be without microphones judicially placed for sound effect and the acoustic enhancement of the actors' voices so the merest whisper can be heard everywhere in the theatre or, indeed, if it be a televised performance, in the homes of people throughout the world? Whether it be in tourism, air travel or running an hotel, an art gallery, a school, an orchestra, a hospital, a bank, a departmental store or a factory, the manager of the future, and many of the people working there, will have to have a basis of scientific knowledge and of the applications of new technology if they are to survive in a highly competitive world

The British Engineering Council with assistance from the Department of Trade and Industry has for a number of years been developing the initiative "Neighborhood Engineers" so that eventually there will be two or three volunteer engineers-either technician, incorporated, or chartered, bothmen and women-attached to every secondary school, to work with teacher, perhaps to help with problem-solving project, and thereby to raise the profile of engineering in school. Engineering is not a school subject; very few teachers have any experience of the reality of the subject, so that children are not encouraged to take it up as a career. It is hoped that this initiative in putting over the reality, and the enthusiasm of the volunteer engineers for their chosen career will encourage more boys and girls to become engineers too- and they must be enthusiastic and interesting. Boring engineers with old-fashioned attitudes will actually put young people off so they have to be well chosen!

Young people are usually very environmentally interested and caring, both boys and girls, but perhaps particularly girls. They often do not connect engineers with caring for the environment, which of course they must. The UK Engineering Council believes that engineers must always bear in mind the effect of their projects on the environment and asses their associated risk to people, and the danger of pollution of the atmosphere, land rivers etc. The Council has issued a Code of Practice, and is offering prizes nationally to encourage high standards amongst engineers in this sort of activity. If carefully thought-out total policies to protect the environment are brought into action at design stage, instead of as a last minute bolt-on afterthought, money can actually be saved, and more cost-effective production processes achieved as a result.

Britain signed the Rio Agreement on limitation of environmental pollution, which requires strong policies in action if targets are to be achieved worldwide, and development on behalf of humanity is to be sustainable. Engineers who care

About the enviro11llent and can innovate so that the necessary/ technological. Programmes are executed efficiently and economically and lead to commercial, success will be much in demand. These ideas are put over sympathetically in schools too, which is seldom the case unless practicing engineers and scientists are personally involved.

In 1994 the first decade of the WISE campaign (Women into Science and Engineering) was cerebrated; I chaired its committee when it was over as hard and mechanical. In fact the first set up in 1984. It has now been in action for12 years

The Equal Opportunities Commission had long felt that literally half the talents of the nation were being neglected in the field of science and engineering and the engineering council, of which I was the only women member, set up in 1981 as a result of the finniest report, decided right from the start that they would encourage more women into our profession. Those firm resolutions were. Behind the -setting up of the WISE campaign in 1984. The fact that in Britain there were nine hundred thousand eighteen year olds in 1981 and six hundred thousand in 1995, a dramatic drop of a third, has lent great urgency to the matter. If the so far untapped resources of the talents in girls Heads are not brought in, the quality of the profession of engineering and indeed all technology-based professions will fall drastically. That would have unfortunate results for our country, and I expect. Similar situation exists in many countries throughout the world.

Because of this, the UK Government initiated a national study, and published "The Rising Tide", another White Paper at the order of the Office of Science and Technology and I quote from the first page:

"By the year 2000, Great Britain will have approximately 23.5 million women aged 16 years or over: women will re and medicine, to make our lives more healthy, present 46 per cent of the civilian labour force. Demographic trends and changes in economic activity rates show that four fifths of the projected net increase in the civilian labour force in Great Britain to the year 2006 will be women. The full potential of this expanded labour force needs to be tapped.

One area of particular importance in underpinning our economic~ competitiveness and quality Life science, engineering and (SET). The Government in its recent White Paper "Realising our Potential: a Strategy for Science, Engineering and Technology", acknowledges that women are the country's biggest- single most under-valued and therefore under-used human resource’"'

Those statements are of fundamental importance in promoting the prosperity of our country. For far too long these careers have been regarded as a male preserve.

Changes in fundamental attitudes in society take several decades to become acceptable, especially in unfamiliar fields like these, there needs to be a fundamental rethink if opportunities for girls are to be more equal. Too often engineering have heated our homes, produced labour saving equipment and mechanical aids for the handicapped, life saving incubators for premature babies, aids to industry and medicine, to make our lives more healthy, comfortable and less dominated by dudgery and disease than they have ever been throughout not just be part of the science curriculum often at percent they are not mentioned at all.

Over the past few years a great deal has happened for the good in education: new technologies have been introduced, computers are more common, equal opportunities policies are progressing in schools in Britain. Nevertheless the need for girls to be technologically competent is an urgent one and one cannot start too early.

One of he EOC's publications - "An Equal Start". Shows the little boy sewing, and the little girl drilling a piece of wood. If efforts are not made to counteract the traditional assumptions, girls will always work with soft materials and never with hard; boys will always play with mechanical toys but never learn to cook or clean or care for children. All that leads to individual helplessness for both sexes when they grow up. If both sexes learn all of the skills, both will have more confidence and independence, both at home and at work, and more choice of skilled careers.

The Engineering Council together with a teachers' union commissioned a report by Professor Alan Smithers and Pauline Zientek of the School of Education at the University of Manchester called "Gender in Primary Schools". It shows that of over 500 five year olds questioned 95% of boys thought car repairs could only be done by men whilst 86% of girls thought that only women should mend clothes. The report shows gender stereotyping firmly established' in the minds of these five year olds. 73% of boys and 66% of girls thought that scientist; could only be men, which just Shows the built-in prejudices .that have to be overcome in both sexes. Interestingly children of mothers with professional' occupations were less stereotyped than the others.

Both this report and "An Equal Start" put forward recommendations for action both in nursery and primary schools to combat these prejudices, but clearly once again it is a long-term battle.

These days' computers are far more available in both Primary and Secondary schools in the UK. It is vitally important that girls as well as boys have hands-on experience, that the software is not all Star Wars and the like, but is angled towards other interests so that girls feel it is relevant to their lives too. Otherwise they label it as just Boring, switch off, and take no further interest; a disaster both for them and for all our countries.

Various reports over the years have shown that many more boys than girls have hands-on experience of computers at home. They still tend to be boys' toys and the boys can monopolise them if the teacher does not control the situation. Girls only computer clubs in the lunch hour can help, in which the girls familiarise themselves with the machines, and can go back to mixed groups when they are more confident in their use.

The Engineering Council has published, "Problem solving in the Primary School", which is science based. As in all other Engineering Council publications it assumes that teachers and schools will encourage girls and boys equally in their interests in technological and scientific subjects and will make sure that the problem solving is orientated towards subjects in which girls are interested. There are encouraging signs that this is happening.

Too often, when girls want to be engineers, it can be the teachers that put them off. Girls often say they want to work with people, and unenlightened careers staff steer them to teaching or nursing. Those are excellent careers if the girls have a vocation in that direction, bout too often they slide into them because no one has explained to them that engineers work with people too. The design production and marketing team includes engineers, accountants, graphic designers, and production, advertising and marketing staff. Engineers must explain their ideas clearly to all those people. to men and' women on the shop floor, to the Board of Directors and last, but perhaps most important of all, to the customers. Without satisfied customers firms go to the wall. An intelligent, technologically qualified woman can bevery good at exercising her charm and thoughtful nature to explain the product, listen to the customer point of view and see that the customer gets what he or she wants. Those facets of the profession are seldom emphasized at school and. that is where "Neighborhood Engineers", especially women, can persuade girls of a much more attractive and realistic picture of the profession of engineering.

It is very difficult for a youngster still at school to imagine what a job is like. Films are a help. A film was made in Canada about women engineers, showing one who had developed a new type of artificial leg. The top consisted of a water bag. She fitted it to a man who had, only recently, had his leg amputated. She then pumped it up gently so he could walk comfortably, much to his gratitude. In the same film a woman engineer was explaining to a nurse how to operate a very sophisticated incubator for saving babies' lives. One has only to look around the home to see the contribution engineers have made. Without them we would not have deep freezes, refrigerators, vacuum cleaners, washing machines, central heating, and all the applications of electricity to take the drudgery out of life and to improve our comfort. Very often women have a particular contribution to make to the design of these domestic appliances because of Their practical experience.

Women are now working successfully in very unexpected places. Over the years I have met young women site engineers on major construction projects, a manager of a light metal forging factory, technicians on helicopter design and production, senior engineers in electronics factories, and one under 30 who had just returned from laying sewers in Kuwait. There are many more.

They demonstrate by their relaxed and pleasant attitude and their technological competence and efficiency that they know what they are talking about Clearly their employers are pleased to send them as their ambassadors. They are also a great asset in the school to describe their jobs and career prospects and why they enjoy their profession of engineering and find it challenging and exciting

The British Women's Engineering Society is doing an excellent job collating lists of these young women who are prepared to talk about their job to girls in schools. Being near to their own age the girls can relate to them and really understand what makes the myth that to be an engineer means to be unfeminine, which is a very real fear in the minds of Image girls. Recently two attractive young women engineers walked into a classroom with their briefcase and high heels, "Bright-eyed and based-tailed and said to the girls,"and who do you think we are?" "no", said these two young women "engineer!" from then on the door was open the girls were much more interested ,career staff need to display a very positive

Attitude if they are to succeed in encouraging girls into non-traditional careers.

If local industry can send young women involved in interesting jobs to talk to the girls that is very worthwhile. Young women nearer to the girls in age can all about the reality of their jobs and encourage girls to realize that they too could be knowledgeable and take on responsibilities in their work without losing femininity. That will encourage them to see that their school work in science and technology can be of immense value in the development of lifelong rewarding career they used to say that diamonds are a girl's best friends. Nowadays-scarce skills are a girl's best friend. You can only sell diamonds once. You can scarce skills every month, every year for the rest of your lives.

There are now six WISE buses on the road. The first one was launched by the Prime Minister. There is a bus now financed entirely by British Gas, another one by British Rail. They travel in the firm's house colures so they can advertise their generosity, for which the WISE committee is very grateful. They are naturally overbooked because they give girls a new and practical insight into science and technology with their computerized pneumatic and electronic equipment. They give the girl's hands-on experience, technological careers literature and videos and there is a general atmosphere of encouragement for girls. They are a very exciting arrival in any school playground and are bound to take the interest of girls and their teachers, and we hope, of their parents in the evenings, and destroy unrealistic ideas of technology-based careers.

The UK Engineering Training Authority has done a lot over the years to encourage girls to take up careers in engineering. Their Insight courses have been very successful giving girls of seventeen four days taster courses .1n universities where they see the engineers' departments' women engineers and visit industry. There are five hundred places for seventeen year old girls in their lower sixth year and about two thirds opt for careers in engineering afterwards on an informed basis. The courses. Are equally valuable when girls make up their minds not to take up engineering, but on an informed basis.

ENTRA also provide a variety of incentives to employers and to girls to become technicians, which is very valuable work as so few people realize what rewarding careers technicians can have. In my view, in England we do not give enough attention to the encouragement of middle ability children who could be much valued members of the workforce at technician level. A British Institution for Electronic Technicians and the Women's Engineering Society run an annual competition - "Young Woman Engineer of the Year". Of course, the real winners in that competition are the employers who employ those outstanding young women. Encouragingly, BTEC, the technician qualification awarding body in the UK, reports an increase of women involved in their engineering courses from 2% to 5% over a decade.

As a result of the WISE campaign a lot of employers started to produce special recruitment literature just for girls. For example, Marconi "The wise guys came to us, but not enough wise women". British Gas published their teenage magazine GETWISE. Wetlands produced an excellent recruitment leaflet, "Girls use your craft technician skills to become an engineer". As a result, Southwest Television produced a programme. Lorna Tucker was one of the technicians they had encouraged. The interviewer said to the Training Officer, in a very patronizing way, "And are these girls much use to the firm?" Toe Training Officer said, "Yes, they are an extremely valuable asset. One of them, Sue Roth well, won the "Technician of the Year Award" in Westland's this year." Then this patronizing voice I said to Lorna, aged nineteen, "What do you think you have got that the boys have not got?" she looked him straight in the eye and said, "Class!" So she had too. They were lucky to have her. They do find that these pioneering girls are very able and she won the "Technician of the Year Award" the following year, not surprisingly, and some years later is now sent by her firm on a management course in France.

The House of Lords Select Committee on Science and Technology, of which I was a member, in its study of Education and Training in the new Technologies, emphasized the importance of support for a continuing WISE campaign in schools and colleges as an important long term solution to the problem of skills shortages.

However, as the report says, "The short term needs of industry can only be met by increasing further the amount of retraining and conversion courses. In particular there should be more courses designed to meet the needs of women re-entering employment.

There should be a large-scale increase in provision of continuing education and in employers' updating and retraining programmes, which have an importance approaching that of initial education. Individuals will have to recognize the importance of self-improvement in retraining."

There are many mature women within the workforce today not fulfilling their capabilities and

Willing to retrain to attain promotion and responsibility, who did not have the opportunity when they were young. Enlightened employers will seek them out, and enable women to use their skills and talents to the full, equally with men, to their own and their employer's advantage.

The Confederation of British Industry organised a conference in response to a Government Committee Report on the shortage of Information Technology skills. All day the message was, work away in the schools to change attitudes, but that is the long-term solution. The short-term solution is in retraining the existing workforce.

When employers spend thousands of pounds in investing in new and more productive high-tech mach tech they must also invest in the retraining of the workforce, women as well as men, so that the operation of the machinery will be properly understood and it will achieve i» maximum benefit. Human resource development at all levels is just as important as technological development, and Universities, and Further Education Colleges can be a great asset in providing new opportunities and well designed access courses for mature students wishing to improve their skills in technological fields of work. Many interesting initiatives are happening in Britain to allow women to attain the necessary preliminary skills to enter higher-level courses in technological subjects confident of success.

West Cheshire College Engineering Department recruited 18 women all over 25 on to a course in mechanical electric and electronic technology. To the delight and pride of the course tutors all gained 1st Class Technician Certificates including 31 distinctions and 103 Merit Passes.

The WISE campaign has been a success due to all the support the EOC and the Engineering Council have received from many institutions, Industry and Commerce and the Government from the Prime Minister downwards. The Engineering Council has produced WISE booklets, which give information on courses available to girls in schools and colleges. Women, I am glad to say. Now form about 14% of all undergraduates in engineering, increasing from 7% onirst years only in 1984, and without reducing the percentage of women students in science. That is a major step forward since 1941 when I went up to Cambridge. Then there were 5 of us amongst 250 men, and later on we discovered there had only been 9 ever before! We were not even a statistic!

I hope what I have said is helpful to you in I encouraging more women to study technological subjects such as engineering. After that it has to be realized amongst employers that they will need to be able to combine successful careers with happy and responsible family life, and that must mean providing more flexible working arrangements convenient to employer and employee.

In the 21st century, it is to be hoped that fathers will take very much more responsibility in the I upbringing of children, together with mothers, I and parental leave will become more commonplace, instead of the vast majority of the responsibility remaining with mothers as it does I today, so that they feel guilty leaving their children while at work and guilty at home not utilizing their technological skills. Those fundamental changes in Society's attitudes again need several decades before being accepted in depth throughout the Community.

Most women, although not all, want to combine happy and responsible family life with a successful career. Professional women foreseeing progress in responsible careers mostly put off having their families until there thirties. This is just the time I when young men are studying for MBA's and finding ways to grasp new responsibility and Experience so as to forward their careers. When children arrive, it is important that both parents are involved in their upbringing. The present mentality of 6 days a week, 10 hours a day duty if you want promotion, is bad for industry and commerce and bad for the involvement of both parents and needs to change fundamentally in the 21st century. The upbringing of children is vital to our future Society and responsible parenthood is the key to its success

Each family needs to work out how that is to be thought out in practice, but employers cannot opt out of those decisions, and must take responsibility for the provision of a variety of flexible working arrangements, so as to achieve mutual convenience between employer and employee, whether male or female, so that all parties continue to benefit from hard won and expensive, technical skills and in-house expertise. Those technical skills, education and expertise will have been acquired at considerable public and private cost and must not be wasted. If flexible arrangements are not available and clear to employees, the unspoken message can lead to ambitious and highly intelligent women deciding not to have families. That may be very sad for them personally, but also genetically disastrous for our nations.

Opportunity 2000 was launched in 1991 with the aim of pressing for more family friendly policies for the next century. It is a voluntary organization which Lady Howe chairs and has proved very successful in that now about 300 major firms belong covering over 25% of the UK workforce.

The Prime Minister spoke at the launch and said amongst other things:

" I want to see all women having the same opportunities as men. We want more women in top posts. Relatively few men think that combining career, marriage and children will involve choices or pose dilemmas. But for women these three simple human ambitions are stiIIbard to combine.

This is the problem we must tackle today, and which Opportunity 2000 addresses. It is above all about changing attitudes. The time has come to ask why women should need to be prepared to conform to traditional working patterns. Why can't work be organised on a part-time basis, with or without job sharing? Why can't career breaks be recognized as something positive from which people might actually gain in terms of effectiveness and fresh thinking?

We increasingly need to come to terms with these facts. I am delighted that the employers participating in Opportunity 2000 have done so. I hope many more employers will follow suit. It is in their interests to do so."

In Britain, as the Prime Minister highlighted, major employers have been increasingly focusing on providing more flexible working arrangements so that women can combine successful lifelong careers with happy. and responsible family life. This is of course especially important for technologically qualified professional women where, if they have a period out of employment, they may lose touch with progress in their field of work, and updating their skills and expertise, and never return. This is a major loss of public and private investment that no country can afford.

The most important thing when a woman asks for maternity leave is for her line manager to sit down with her and discuss her lifelong career aspirations, and then to settle either at that time or later in her maternity leave what arrangements will mutually suit the employer and employee in future, with the aim of not losing important investment in skills and in-house expertise. The key to success is understanding and flexibility between the woman and her line manager and her firm. It m.1lY be that flexitime, part-time work, job shariDg, Off-site working, childcare vouchers, parental leave, yearly contracts, provision of I childcare, either together or separately wiII solve the problem to their mutual satisfaction.

I The Engineering Council early on in the WISE campaign set up a career break working party and produced a report and video for the Boards of Companies explaining how these sort of policies could be practically put into action. As a result, many large engineering companies now have a wide variety of flexible schemes in action, so girls who become engineers now will benefit from them!

By the time of the Millennium the Sex Discrimination Act in the UK wiII be 25 years old, and of course there have been many developments in legislation since then to make working conditions more equal between men and women, and there will be more by the year 2000. That progress needs to continue, so that equal opportunities are thoroughly accepted throughout Society, whether it be in schools, colleges or universities, in industry and commerce, in Government, and in families throughout the world. I At present there is still a long way to go, so that efforts must continue well into the 21st century building successful experience, continuing to make progress both recruiting and retaining many *f* more women in careers in science and engineering.

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THE INFLUENCE OF SCIENCE AND HI-TECH ON MODERN LITERATURE

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Abstract: The increasing impact of women in the sciences and technology should be compared to their increased participation in all aspects of culture and literature. Moreover, there is a mutual, two-way influence between science, philosophy, literature, and the arts. Women artists, writers and poets allocate in their literary works a more central place to scientific and technological subjects, ways of thinking, concepts, and terminology. These subjects were regarded for along time as the closed province of male writers. Among other ways in which the canon has been opened, there is a subversive narrative of women writing about the "Zeitgeist", and about developments in science and technology, and their cultural implications concerting the post-modern, virtual reality era. The feminist revolution in Israeli poetry and prose in the last two or three decades was expressed, among other things, in the appearance of women poets who view the world in a way deeply influenced by contemporary concepts derived from science and technology. This subject usually follows earlier processes, in which subjects previously forbidden for women were integrated into feminist literature, like politics and race. The present process of transforming the marginal into a central aspect of contemporary culture, which is dominated by scientific and hi=tech progress, resulting in new means of communication, and Life' world of media. **In** Israeli poetry, the main force who write about these mutual interactions between science, society, politics, philosophy and literature is Bejerano. I would like to discuss her poems, pertaining to these themes.

I. INTRODUCTION

Maya Bejerano is one of the most important. contemporary Israeli poets. She entered Israeli poetry in the 1970's; her seventh published volume, *Whale,* which includes the major poem, "Sex, Car, and Love Later," follows *Ostrich, The Heat and the Cold, Data Processing, Song of the Birds, Voice,* and *Selected Poems.* Bejerano is a "Tel Aviv poet," uniting the Israeli view with the broader cosmopolitan awareness. ofour time. The daughter of Sephardim Jews who immigrated to Israel from Bulgaria and settled in Jeff and Bat Yam, she addresses philosophical and universal issues of political injustice, representation, language, and media in the framework of Israeli existence today.

Independent and highly committed both politically and artistically, Bejerano reflects in her life, as well as in her poetry, the current crises in women's existence. Female poets, such as Rachel and Leah Goldberg, have always held a central position in modern Hebrew poetry; they expressed in lyrical poetry their personal emotional worlds, including disappointment in love and loneliness, a trend that characterizes even Dahlia Ravikovitch, a major revolutionary poet, whose early poems came out in the late fifties. Yet, Ravikovitch' s feminist protest poem "Mechanical Doll," a milestone in the history of Hebrew poetry, still shied away from the direct confrontations with social, political, and scientific subjects that are essential to Bejerano's poetry. Among Israeli women poets only Yonah Wallace preceded Bejerano in introducing questions of philosophical and social truth, metaphysics, language, and gender to Israeli women's poetry; to these themes Bejerano has added the components of media, simulacra, high tech, and scientific innovation.

This study surveys Bejerano's poetry as a whole, emphasizing the transition from the search for truth

In the "real" physical world by means of lyrical epistemology to the internal truth, the knowledge of existence by way of tormented insatiable love. In all her poems Bejerano also examines the various discourses of language, using not only the language of the arts, but also scientific discoveries, to explore the universe and the human condition.

II. FROM PHILOSOPHY TO SCIENCE

Data Processing and *Song of the Birds* are poetic philosophical tractates, focusing on consciousness and observing the world, human existence, and themselves I. The critic Ariel Hirschfeld2 has categorized *Song of the Birds* as a "philosophical poem," and found in it a parallel to a :'medieval encyclopedia" in its concern to define and give value to phenomena by selecting and analyzing them. The book as a whole deals with such eternal problems as the relationship between consciousness and the observed world, ultimately inquiring whether human consciousness can ever comprehend the world and discern reality and truth. Bejerano's poetry illuminates these ancient questions, together with the question of language itself, in an original way. In her work, modern existence, the relationship between individuals, love relationships, ethical values, scientific discoveries, and technology all combine to create the importance and excitement of this poetic cosmos.

Bejerano asks if phenomena can exist as external objects, outside and beyond consciousness, or does the world exist only within the human thought that conceives it? Should the natural sciences be understood as an a priori system or as a construction created by the human consciousness, which attempts to structure the natural phenomena it perceives? As the philosopher Kant pointed out, the human being who -seeks to know the world of phenomena has first to structure it; the transcendental structures in which. Human beings live are their own creations.3

Data Processing and *Song of the Birds* are series of poems that deal, in various ways, with consciousness as a separate entity that reacts to the world and seeks a connection with .4t, observing the wonderful structures in existence, the processes developing, the metamorphoses of phenomena, becoming excited by the miracle of finding an echo of itself within them. This wonder becomes enhanced when consciousness finds an echo not only in known objects but also in the discovery of strange, unimagined combinations of which it was not previously aware.

Bejerano is interested in all aspects of natural phenomena, including science and technology, and she uses them creatively. She discovers their beauty, their "wondrousness," and develops from them a poetic system of "the new laws of natural Phenomena." Although there have been other poets who used science as a subject of their poetic works, the meaningful innovations in this poetry is the discovery of the profound nature of a new epistemology, apparent in new states of mind that transform the concepts of reality, imagination, and art. The discovery of X-rays and optical fibers, for instal1ce, which can literally penetrate the heart and lungs, has completely altered the meaning of the biblical phrase "Sees the veins and the heart" (Jeremiah 20: 12). Phrases like "landing on the moon," which used to belong to the realm of imagination, change their meaning, their logical position, and their emotional impact from the moment they acquire a literal meaning or external existence within reality. Scientific innovations break down epistemological laws and define in a new way the boundaries between the possible and the impossible, object and subject, reality, imagination and art. Bejerano believes that despite the dehumanization it creates, technology also carries some advantages when it creates a new mode of thinking, bringing forward new kinds of beauty, aesthetics, language, and syntax, new genres, and the essentials of a new kind of poetry.

III. CONSCIOUSNESS, IMAGINATION AND SCIENTIFIC TERMINOLOGY

For Bejerano, consciousness tries to unite itself with reality's systems and laws. Phenomena that disprove common conceptions and the refute complacent expectations create the atmosphere of surprise in her poetry. Thus, optical fibers are exciting because they break accepted rules. She prefers the description of phenomena that are in themselves miraculous, powerful and surprising, such as the making and structure of a synthetic sapphire or a botanical guide to unusual plants, to augmented metaphors that strengthen and broaden the subject described ("your eyes are like an ocean in flames"). The subjects she chooses for her poems represent the unexpected and the precisely rare, independent of the poet's emotions or imagination. She selects them from all aspects of reality: rare corals, optical fibers, the process of studying, the nature of photography; all are described in a direct, factual, and concrete way within the framework of their own terminology, as if classified in a scientific lexicon. The infinity of possibilities, the exhilaration of the imagination, and the sense of being faced by the miraculous: these derive from the intrinsic properties of the phenomenon itself, rather than from the elaborations and metaphors of the poet. The infinite journey "To the Star of the Soul" (5) is a revelation of the many qualities and diverse aspects that break down all barriers of definition and allow terminology elasticity. The "star of the soul" is indeed the goal of Emotional, intellectual, and metaphysical craving; as' the innermost part of the soul, it is the nearest and

The most intimate of all, and as a star it is celestial, unreachable, and the most distant. The voyage is transition, the ascent, the closing. The most physical aspect contains within itself the most metaphysical.

To the Star of the Soul

Let there be let there be let there be Half my way half my way To the star of the soul - Riding an invisible optical fiber I was a beam of light, the shortest voice frequency A beam of light, a voice frequency moving towards **My explosion** And right after that--a tiny ball I was a young UFO Invulnerable and transparent, seeing yet unseen and in front of me--a watery blue-gray screen .The whole niverse, and in it--a panel of buttons

*A button for wondrous events--situations and
*A button for wondrous people--relationships and deeds
*And a button for wondrous places--happenings and
*A button for wondrous things--tools materials and
*A button for wondrous plants, colors and
*A button for wonderful animals--life and

All of them set in the star of the soul like spice beds without spices ,Distant, blind from Earth's vantage point Planet Earth --an alarm button. On the panel of buttons in the blue screening the star of the soul far away in silence.

The language used in this poem expresses its nature: "Let there be *let there* be *let* there be." *Cosmic* creation is being renewed rhythmically, a broadcast, the music of rhythmic energy. The same energy at the same time has an impact on several senses. When searching for structures similar to itself, consciousness looks for contact, sense, and compatibility. Understanding may be intellectual, but its motivation *is emotional,* prompted particularly by fear of death. Classification, one scientific methodology "seed to system..ti".. the phenomena of the world, at the same *time* expresses the human need to control, derived from the feeling of loss and *disorientation.* As Bejerano *writes,* "And the *classifier* is terrified of death; numbers are *his mighty shield in the* face of death" (3). *To classify is* an attempt to exhaust, to survey, to understand, to quantify, to distance oneself without objectifying, without being carried away.

Classification For Clara S.

To classify, to cleanse yourself
To classify, to purify yourself,
To classify. to remain
To number the flesh, to frame so as not to be swept Away
A frame intangible and weightless
Hovering in the mind of the classifier; who is he, who is she, what is this?
Death is approaching, hopping; crumb-shaped birdfood, a wind is blowing
They rise into the air, light death crumbs, islands of ruins around him and he,
Who is he, she who is she Sitting in an armchair and classifying death; Seneca and Diogenes were smiling peacefully,
Carolus Linnaeus, Mr. Dewey in his later work
Archimedes sitting in the shade, Socrates shakes his Hands, the schlemiel;
And the body of Moses our teacher;
They all accept death crumbs like lovers,
Innocent and weak, singing birds.
And the classifier is terrified of death, he classifies it,
Numbers are his mighty shield in the face of death, his sword,
Numbers are at his expense;
He's choking slowly, perpetually sealed ledger
You can't find an open window that's not numbered
The number stuffs every mouth and orifice
That lets in air, only in dreams can it be stamped
How can we classify death? What's this,
What is it to classify murder? The heart rooted up
From a girl's body? The Loch Ness monster, the rape
By plural bodies of a singular, the strangler with a golden wire
The gold is the one thing, the last breath another;
A number for each crumb, the rattle of the sick,the miserable;
The starved *noise,* how *is is* possible--the remotest death,
Love and the passion of reason?
How is it possible to classify the motion flowing into stars,
Even the revenger's steel hands, the terrorist's,
Who runs with a leader's decorated head sunken in frozen beasts?
To *classify* the *terrible impulse, in* precise relation to prevents the less terrible
How to *input* them, classify
The passing moment, before everything *is* wiped out
In the *big* boom, the *collision* of *exploding* gamma rays
A wondrous laser beam like a pewter wand, basking
And generating power cells for *the world;*
How to classify imagination, breathing not only outside the mouth
But in a square-edged frozen ark
And he sits apart from all this magma
And has to come up with tranquil numbers.

This poetry revives the contacts and the proximity between the seemingly contradictory drives in human nature and nature as a whole: fear and

Understanding, science and imagination, the factual and the poetic, the mundane and the miraculous. It is intelligence, based on the deep connections among the plethora of appearances, which unites the multiplicity of points of view into one, unified entity.

IV. SPACE AND TIME

When searching for the unifying and common elements in reality, the individual is striving to "touch *himself' (Spaceship)* and "be in touch with himself' as a path to the solace which will enable him "to be happy being here" and to "return to life" (50). Humankind tries to save itself first by isolation, to flee to the remotest realms like space, and then to return to earth and be united, to feel in touch with the various aspects of existence. In this way God, nature, existence, and consciousness are fused together. Consciousness returns to itself from the totality of the universe, from its depth as well as form its external realms, from outer space. The poetry of consciousness written by Bejerano is reminiscent of the philosopher Spinoza's conception of God: "The greater the number of things the mind understands by the second and third kinds of knowledge, the less subject it is to emotions that are bad, and the less it fears death,4 and, the more we understand particular things, the more we understand God."5

In "The Bamboo" the poet discovers an echo of herself: "Like me, once in 11 hundred years the bamboo flowers..." (28) Similarly, she discovers happiness in the understanding of the miraculous elements in her own life, which, in the very concept of its uniqueness, enriches the observer. Here, too, the poetic element is found in the phenomenon itself rather than in the poet's imagery; the excitement results from the "objective" observation, and not from attributing emotion to objects or creating exciting situations. Observation becomes part of the phenomenon. Poetic imagination is neither symbolic nor surrealist; it does not derive from other realms; it is concentrated in the objects themselves and their evolution. This way of observing the miraculous in all aspects of existence is interwoven into all the poems of this collection.

The miraculous expands and is intensified by its connections to each of the wonderful phenomena, and thus the whole poetic cosmos is constructed. At the moment that consciousness succeeds in relating to the world of phenomena by means of excitement and discovery of systems, the facts themselves are transformed into poetry. In that instant the center of events is transferred to the observer himself, who becomes emotionally awakened by the phenomenon: "once in a hundred years the bamboo *flowersllike me, in the wondrous,* a wondrous animal" (28; italics mine). Humans are the "wondrous anima."

Within a world equipped with modern, developing technology, the concepts of the near and the distant dramatically change. It is possible to reach distant places by missiles, satellites, swift vehicles, and instantaneous communications. Cameras and television enable humankind to visit every corner of the earth and to penetrate into the depths of the globe and the human body. Everything that until recently was regarded as remote in all spatial dimensions, internal as well as external, and even in time, has become accessible. Scientific discoveries have brought to light things that were hidden, reducing distances to a minimum or completely annihilating term. We receive information in "real time," without time intervening between an event and it's reaching our consciousness. The camera may bring things closer or make them more remote, upsetting the accepted "order" of space. It can also alter time: the process of a flower's growth, which may take several months in nature, can be presented by a movie camera during several seconds. This, and other technological means, has transformed the hidden realms of existence, once described only in an imaginary manner, into observable facts.6 Television screens can show an apple larger than a building, and this will not seem, as did the painting of the apple by Magritte, surrealistic. Films have accustomed us to observing ancient cultures interwoven with modern traffic jams, without distinction between the historical and the contemporary.

Technological inventiveness thus completely upsets our previous conceptions concerning space and time and all the laws derived from them, creating new states of consciousness, states of mind, which demand a new epistemology. What does closeness mean, in the sense of both proximity and intimacy, in a world where the annihilation of distance does not create it? The various means of overcoming physical distances give us, emotionally, only the illusion of proximity and intimacy. The problem is transferred to the realm beyond the physical; our craving for "realness," intimacy, truly touching the object of our desire, is on a different level from the closeness provided by technology. In our world of simulacra, there is always an illusion: objects only seem to be accessible to the touch, whereas in fact they retain their remoteness. In this new structure, human craving is transformed. The meaningful task is no longer to overcome the physical distance, to reach the moon or the bowels of the earth. The human search is directed now toward the sense of reality, the true contact, "the real thing," instead of substituted simulations and demonstrations that are the by products of technology. Scientific triumphs over physical space created new emotional and philosophical distances, deep in human consciousness, that express themselves in the sense of fallacy and of "missing the right thing."

The desired proximity is achieved when consciousness becomes aware, and discovers and systematizes a way to relate to variegated phenomena, to recognize them and discover their intrinsic meaning. Even if technology itself is rational and abstract, in its understanding consciousness discovers and creates elements of connection, solace, and intimacy. In the last poem in this collection, "Spaceship," which is to some extent a "Space Odyssey," we find an ode to the beauty of space, of the spaceship itself, and of space technology; the book ends with the sentence: "But-how to go back home, we wish...we are happy to be here/sane...in the knowledge that we have touched ourselves and returned to life" (50).

Bejerano's poems explore states of mind and the disruption of the familiar laws of consciousness and their relevance. Consciousness, which searches for intimacy, reacts in wonder, surprise, fear frustration, alienation, despair, humor, or joy. In all phenomena consciousness looks for contact, for an echo of itself, even when they are difficult to understand, like "how to copy a scent," "genocide," the innermost aspect of an object or its disappearance:

Data Processing 60

My face is beautiful when I am understood;
Something in my innermost core that turns
To the depths, sunk in darkness
Awakens to life and slowly slowly hovers
The angel of my privacy, fly angel of my spirit.
Stretching his finger toward "my other" -- a human countenance upon me
Because understanding is germination
Touched by inspiration and electric beauty...
My face is beautify when I am understood
It expends to the dimensions of a broad gate
In the hundreds of hues of color in the paper
In the clay's face and its shavings.

The world described in these poems is one conceived through a screen or a monitor. The screen appears in almost every poem in this collection. It governs everything and represents everything, and the price of misrepresenting the world, shrinking and reducing everything to its own size. It becomes the window and the mirror of modern consciousness. All the senses are transformed "translated" on the screen, into a visual language of imaging. Modern technology constantly creates situations evoking synesthesia, a response by one sense to the impressions of another? Bejerano does not create synesthetical metaphors but describes situations with such structure and characteristics. Musical sounds, electromagnetic currents, and the "feel" of materials are transformed by technological means into visual images on the screen; even the senses of taste and smell, the movements of bodies ("Radar"), and the body's limbs are measured and undergo a process of quantifying so they can be viewed on the computer's monitor. The whole world of the senses is translated into the imaging language of the screen. In scientific work, for instance, the colors presented on the monitor are used as signifiers of different categories, as in medical tests, where blood in the veins can be marked by the color blue, evoking all the associations of "blue blood" and all those resulting form the absence of the red. The screen is thus one of the most important reasons for the confusion of our conceptions relating to space, time and dimensions.

The poem "Song of the Birds" (39) stresses the multiplicity of discourses and aspects of all worldly phenomena. In contradiction to the past concepts that viewed science as inimical to art and nature, in Bejerano's worldview art and science, like all other relapse, are segments of nature. Her poetry emphasizes the lyrical element in all phenomena, revealing the poetic aspect that is added to the factual in the laws of reality and science. She brings to light hidden aspects or destroys accepted notions when she uses optical fibers as one would use a horse of a broom for riding. "She rides an invisible optical fiber" (5). She surprises the reader, because usually we do not conceive the fiber as a stick used by a rider, even though we know that energy flows in it. Means of communication are transformed into means of transportation. Bejerano transforms functions usually thought unchanging by playing with them, expressing their many elastic possibilities. This union of message and medium is reminiscent of Bejerano's earlier cycle of poems about the "Optical Fiber," where the poem itself was a reconstruction, a recapitulation of the pace, the energy, and the matter of waves transformed from auditory to visual, so that telephone calls consist of human message flowing within the almost unseen fiber.

The Optical Fiber

Let there be let there be let there be
Half my way half my way
To the star of the soul, riding
A transparent optical fiber,
I was a beam of light, a frequency-
A binary number; and inside me a word
And another word and another word
Like beatings of light and darkness for an electric heart
Sending quivering signals, waves, rows of waves as a storm
From one end of the earth to another;
And there, at the end of the earth, the bewitched number will return
Into a regular number within a fraction of a second,

And from the thin optical fiber a cooing
Is heard as if from a pit of sleep: "I love you"
Words and angels out of blooming fibers
Beaming hundreds of flowers in the velocity almost of light
And all of this is only a laser light call inside a fiber optic stomach
Reliable and refined, thin and hollow as a string
Transparent as glass and impenetrable as a riddle.

Every phenomenon is both functional and, at the same time, an idea, a logical entity. The singing of the birds becomes a physical-biological phenomenon with a neurological aspect, since the voice box producing the sounds contains many nerve ends ("Syrinx: The Name of the Box of Singing in the Bird's Chest" [39]). The factual-scientific description evokes the lyrical-metaphysical one: the nerves are also the material creating the singing, the producers of the music that evokes an emotional response. The nerves are also the strings of sadness. On the behaviorist level, the singing of the birds is a communicative language, a code of behavior. The physical aspect does not exclude the lyrical one; on the contrary, it enriches the emotional response of the audience, who moves from one aspect to another and ascends to the musical-poetic level of the singing. In this way, the sentiment and the idea present in all natural and scientific phenomena must be discovered by the poet and the reader. This poetry is focused on physical, biological, chemical, and factual changes rather than psychological processes. The psychological is reflected in the apparently scientific description.

Every phenomenon is automatically charged, becoming a metaphor. Whether UFOs, chemicals, spaceship, accident, cave, or crime, we respond to the subject matter of the poetry of Maya Bejerano with fear, shock, calm, happiness, or excitement, surprised at the discrepancy between her representation of the phenomenon itself and our expected response, like an empty camera that takes no pictures (6). Her art accepts the contradiction, celebrates it, and gives it life as a poem inquiring into the meaning of the breakup of old physical laws and their transformation into new realities. In the poem "The Story of Pedro Rolan and Maria Cortes (Empty Love)" (7), the prisoner Pedro assumes that Maria will marry him. This assumption is based on a wrong interpretation of her behavior. Their relationship is "lots of activity, unformed as yet." Consciousness discovers, when the poem unfolds, that in every act of interpretation there is an element of misunderstanding, a revelation that brings consciousness into harmony with "form," a new law. The ending of this poem surprisingly presents Maria marrying, "as a simple fact," another man whose name is also Pedro; the prisoner Pedro is astounded and shocked, as is the whole world around him. But consciousness understands that all the pieces of information and the hints in Maria's behavior were, from the very beginning, misleading: "They were just pantomime," meaningless gestures. The prisoner remains bound "in his imagination, his prison," while consciousness has already understood a new kind of order--the impossibility of knowing the truth.

The poem "Empty Camera" also addresses the destruction of expectations and the understanding of a new law through constant movement between the charming and fascinating on the one hand, and the frightening and threatening on the other. The photograph is supposed to give eternity to the "moment in gesture," but there are no such moments; a photograph cannot impart eternity "to the moment of the surfacing of the most profound elements of a personality" (6). In this poem, like the one on the unrequited but short-lived love of Pedro Rolan, "there was a mistake, just a mistake."

In Maya Bejerano's poetry, materials taken from l1}any areas of existence enrich both the realms of phenomena and the realm of poetic experience. The poetic element is found within the phenomenon itself, into which the poet's observation is incorporated. Her originality is expressed in the human apprehension of the miracles, the beauty, and the structures hidden in the state of things or in the phenomena, and the ways in which scientific advances create new relationships between human consciousness and the natural world, bringing the - previously unattainable within human grasp. Yet I nostalgia and cravings remain, for even if physical I differences can be overcome, the poetic desire to ibridge the gap between the new realities and the absent essences remains. This gap is the eternal field I In which imagination and poetry flourish.

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2. Ariel Hirschfeld, in his review of the book in *Yediot Ahronot,* November 1, 1985 [Hebrew].
3. See Samuel Bergman, *God and Man in Modern Thought* (Jerusalem, 1947) [Hebrew], 6. "Kant, indeed, reversed the order: it is not the objects that determine a man's mind, but it is the mind that determines the objects by its creative activity, that endows our world with its fundamental forms. This human creative ability is relevant only to the world of phenomena in which we live, and not to the

objects themselves, in their objective existence."

4. Baruch Spinoz.a, *The Ethics,* part V, proposition 38, trans!. S. Shirley, in Baruch Spinoza, *The Ethics and Selected Letters,* ed. S. Feldman (Indianapolis, 1982), 222.
5. Ibid, proposition 24, 216.

6. Walter Benjamin, quoted in Rudolf Arnheim, *Film als Kunst* (Berlin, 1932), 138, realized the infinite possibilities of the camera, and made the analogy to psychoanalysis in terms of its immense power to destroy conventional worlds and recover worlds that were unknown and unseen to us: "Then came the film and burst this prison-world asunder by the dynamite of the tenth of a second, so that now, in the midst of its far-flung ruins and debris, we calmly and adventurously go traveling. With the close-up, space expands; with slow motion, movement is extended. The enlargement of snapshots does not simply render more precise what in any case was visible, though unclear: it reveals entirely new structural formations of the subject. So, too, slow motion not only presents familiar qualities of movement but reveals in them entirely unknown ones which, far from looking like retarded rapid movements, give the effect of singularly gliding, floating' supernatural motions." And, as he wrote elsewhere, "The Work of Art and the Age of Mechanical Reproduction," in *Illuminations,* ed. Hannah Arendt (New. York, 1968), 236-37: "The camera introduces us to unconscious optics as does psychoanalysis to unconscious impulses."

7. Synesthesia is a well-known device used by poets in all cultures and generations, intermingling impressions of various senses to create a poetical emotional unity (e.g.: "the people see the sounds" [Exodus 20 18]).

SOCIO-ECONOMIC SITUATION, DEPRESSION AND MORBIDITY IN THE HUNGARIAN FEMALE POPULATION

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Two national representative studies were conducted in Hungary to analyze the psychosocial background factors of ill health of the population during the historical socioeconomic changes. In 1988 10.662 females, and in 1994-95 9.811 females representing the Hungarian female population according to age and place of residence. Were examined.

Depression was measured by shortened Beck Depression Inventory. Health behaviour, dysfunctional attitudes, hostility, ways of coping, purposes in life and social support were examined. Health status was quantified by sick days in the last year, by the Disability questionnaire and by self assessed health related quality of life. Demographic and social-economic factors were examined. With the help of multivariate analyses depression was found to be the main mediator between socio-economic factors and ill health of the population. Among women, low level of education showed the closest connection with depression and overall morbidity rate. In 1988 the depression and ill health of women was more closely connected to the overall economic situation of the family, such as housing conditions, access to a car. According to the results of the 1994-95 survey, the employment status of women became more important, the depressive symptomatology and ill health is significantly more common among women with low employment status and among unemployed women.

Among the psychosocial background factors cynicism, lack of purposes in life, lack of social support from parents and relatives were in closest connection with depression. Between 1988 and 1994 a significant polarization of the psychosocial and health status of the female population can be observed, with extremely high levels of depression and ill health in persons relatively less successful during the process of socioeconomic polarization of the society.

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IS THE SOLAR RADIATION BENEFICIAL OR HARMFUL?

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Abstract: Beneficial and harmful effects of solar radiation are presented. The latter ones have of increasing interest because of the ozone depletion causing the increase in the UV -B components of the solar radiation. The expected increase of the damaging effects' due to increased UV-B radiation is to be quantified by field and personal dosimetry. Based on the results obtained with biological dosimeters, elaborated by the author and her coworkers, a monitoring network was established. Annual profile of the biologically effective dose and its dependence on the geographic localization has to influence the attitude of sunbathing/tanning of the people.

Keyword: solar radiation, ozone depletion, beneficial/harmful effect of UV-B

INTRODUCTION

Beneficial effects of the solar radiation have been used for curing purposes even in the prehistoric age. Its corrscious application for medical treatment has started in the second half of the last century/beginning of this one. Treatment of skin disorders by solar radiation is connected with the activity of the Danish dermatologist, Niels Finsen, Nobel-prize winner in physiology and medicine In 1903. Heliotherapy introduced by him, became step by step not only a tool of medical treatment but a powerful prevention possibility of different diseases. Thus the tanned skin became an indicator of fittness and healthy condition especially in the white skinned population. People living in cities had desire to spend summer vacation on seaside sunbathing in order to get colored skin. Thus the aim of vacation was rather brown skin then the relaxation and less attention has

been paid to the health than to the tanning effect.

TREATMENT

A profound change in the general opinion took place since the middle of the last decade as the ozone depletion was detected by Farman and his coworkers (1985) over Antarctica and the same phenomenon was found in the northern hemisphere as well Stolarski et al., 1992). Moreover, a continuous decrease of the stratospheric ozone was found also in the middle latitudes (M.Blumthaler, 1992). In Hungary the general decreasing trend is about 1. 7%/1 0 years (Nemeth et aI, personal communication). Ozone depletion effects the whole atmosphere, it became 1! Global environmental problem. Therefore both depletion and its consequences have general effect on the living and inanimate systems of the world. The function of the ozone layer is to protect the Earth from the short wavelengthcomponents of the solar radiation, i.e. from the UV-B radiation. UVB entering the Earth surface can induce special photochemical reactions leading to different damages of living systems. With decreasing stratospheric ozone concentration the UV -B content of the solar radiation increases, consequently the solar radiation from the viewpoint of biology seems to be. More harmful and the light of the Sun with a weakened ozone shield endangers the whole biosphere.

Human health damage caused by UV -B radiation manifests as acute or late damage of the skin and eyes. Acute skin disorder can be erythema (skin reddening), appearing within a short (a few hours) latent period by white skinned population after exposure to Sun, and what is worse, sunburn of the skin after extreme solar exposure can be also induced. Similarly acute damage of the eyes is the inflammation of conjunctiva or in more serious case that of cornea. Disorders, induced by solar I Radiation, having long latent period (years, decades), are skin aging and skin tumors, while in eyes these are the cataracts leading to blindness. Relation between exposure to UV of the population and skin cancer incidence has been demonstrated earlier (Sliney, W olbarsht, 1981), but more attention has been paid to this fact after discovering the ozone depletion and analyzing its consequences. According to the prognostics of UNEP (1989, 1991) an increase in the skin cancer and cataract incidence is expected in the future following the progressing ozone reduction.

Immunesuppression, initiated in the skin by UV radiation, is a further damage affecting the human health. Immunsystem, having many folded function, is responsible for resistance against infections, for effectively of active immunization, resistance against cancerous proliferation, etc. Thus immunesuppression as UV effect can influence the general health of the world population.

Considering both the aforementioned positive and negative effects of UV radiation, one can ask the question, whether the solar radiation is beneficial or harmful and does the ozone depletion amplify (and if it is, in what extent) the health risk of the population.

This question is one of the crucial problems of the environmental scientists and according to our opinion, adequate monitoring The biologically effective doses, responsible for the different biological (harmful) effects is essential to get an appropriate answer. Moreover, for the correct assessment of the human health risk, a worldwide monitoring network and long-term monitoring are necessary (Ront6 et al. 1995).

In our laboratory the basic concept and the practical realization of the biological UV dosimeter have been elaborated (Ront6 et al. 1992, 1994) and applied for the aforementioned purposes. Two different biological dosimeters have been developed and used as personal dosimeter and for field monitoring in appropriate measuring sites, partly in national and international cooperation. Based on the experiences available over the world and on our own measuring results, considering the cost-benefit concept is suggested. Moreover, a right attitude in tanning/sunbathing can be advised *with the* aim preventing health damage due to solar radiation but , utilizing its beneficial effect.

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WORKSHOP--LOW BUDGET ACTIVITIES TO INTEREST GIRLS IN SCIENCE AND ENGINEERING

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Abstract: This is a workshop of simple low-cost science activities that women role model facilitators can carry back to their home countries. Participants are invited to bring their own materials and demonstrate them to others. Sign up at the ICWES 10 Registration Desk to be a demonstrator.

Keywords: demonstrations, women role models, low-cost science, and simple science, hands-on

One of the most successful ways to interest girls in science and engineering is to provide hands-on activities for them to carry out with the assistance of women role models. This presentation is a three-part workshop to help prepare the role model facilitators to carry out such programs in their home countries. It will feature a number of activities that require only very simple, easily-obtained materials that can be carried out with a minimum of preparation in locations with minimum facilities.

In Part I, as participants gather they will do "Try It Yourself' openers--brief science experiments suitable for all ages. (15 min)

In Part 2, participants in the ICWES workshop will actually carry out activities, receive instructions and some materials to take home, and earn about programs in which the activities have(been used and suggestions on adapting them to local conditions. The workshop activities have all been tried and found interesting by students of all angstrom pre-kindergarten through adults as well as their families. Many disciplines of physical science, anathematic and engineering will constitute the topics covered. (20 min)

Part 3 is sharing time in which persons who register with me at the ICWES Registration Desk Upon arrival will have 4 minutes each to demonstrate I similar activity. If more proposals are submitted than time permits, the remainder may be presented in an informal setting later.

SUCCESSFUL NETWORKING BETWEEN PROFESSIONAL ENGINEERING, SCIENTIFIC AND EDUCATIONAL ORGANIZATIONS

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Abstract: This activity is in two parts: In the first part a panel of members of the USA Society of Women Engineers will describe its activities networking with other professional organizations. In the second part, all those attending ICWES 10 will have an opportunity to display information about their organizations and to exchange information and ideas with other participants--TO NETWORK! To reserve a networking space for your organization, bring materials and sign up at the ICWES 10 Registration Desk upon arrival.

Keywords: networking, partnerships, and exchange ideas, professional liaisons

PART ONE--HOW THE SOCIETY OF WOMEN ENGINEERS NETWORKS--A panel discussion; participants to be announced.

Under the Professional Associations Liaisons Committee, the Society of Women Engineers has worked out a number of cooperative ventures with other professional societies. These have included such activities as holding receptions at national conventions of other engineering societies to get to know their women and student members; exchanging exhibit booths and pages in program books at conventions; providing opportunities for several such groups to imeract at various regional and national meetings. In addition, the Society of Women Engineers has made many efforts to network with educational organizations through such activities as presentations at local, regional and national educators' meetings; sponsoring jointly With other groups various engineering-science activities and workshops for K-12 students and educators in conjunction with meetings; obtaining a grant to supply SWE materials to educators. The panel discussions will give opportunities for those attending to ask questions and offer suggestions.

PART TWO--A NETWORKING SESSION FOR REPRESENTATIVES OF ORGANIZATIONS ATIENDING ICWES10

Each organization represented at ICWES X will be able to participate in an actual networking session with all other ICWES attendees. In one large area, table space will be available for these organizations to display information about their organizations and programs, to answer questions and to talk to other interested women. This will allow exchange of ideas and information, discussion of possible joint projects, and actual networking between women themselves. One of the most important aspects of ICWES is the opportunity to meet other women. The role of the Society of Women Engineers will be to organize and facilitate this networking session.

To take part and reserve a networking table space for your organization:

1. Bring information about your organization and its programs with you.
2. Upon arrival at ICWES sign up at the Registration Desk to get a space reserved. This list will be posted before the session.
3. Bring a small sign with the name of your organization.
4. Get members to be at your space during the networking session.
5. NETWORK!!!

The organizer of this session wishes to thank Dawn Plaisance, Chair, Professional Liaisons Committee, Society of Women Engineers, Ciba Geigy, POBox II, St Gabriel LA 70776 USA, phone 504-6421383, email: dawnbel @aoI.com for her assistance in preparing this session. She may be contacted for additional information.

THE INTERNAL CONFLICT OF WOMEN TODAY - BALANCING CAREERS AND FAMILY LIFE

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Women today are assuming a greater role in the workforce and also continuing their responsibilities at home. According to US data, 60% of women with a child under the age of six are in the workforce, up from 39 percent in 1975. In dual-income families, 81% of women assume the responsibility for cooking, 87% for shopping, 78% for cleaning, and 71 % for taking care of the children. Unlike men who see their primary role in the family as the breadwinner, women tend to view all their roles as equally important-wife, mother and worker.

The demands of women today are immense. Pursuing a professional career, is almost incompatible with children and family life, because conditions at the workplace usually do not take family obligations into consideration. Women are either forced to drop out from work, to be able to take care of their children, or continue working and not spend sufficient time with their families. This often leads to internal conflicts, feelings of stress, guilt and fatigue.

In a Hungarian national representative study (pop. no. 12,600), the physical, psychological and socioeconomic status of the population was surveyed. Results show that 47.3% of Hungarian women are working, compared to 55.8% of men. This indicates, that Hungarian women share a great part of the financial responsibilities of the family.

The majority of women working in the workforce are between the age of 40 and 49 (90.5%). Only four percent of the women work after the age of sixty. 8.9% of the female population has a university degree and holds a leading post at their workplace. 16.4% of the women work in other intellectual occupations. Women working in highly qualified jobs are mainly between the age of 30 and 49 (35%). This age group seems to be the most active at all levels of the female workforce.

The average number of children in a family in Hungary is 1.5, this number is somewhat lower (1.3 children) in families where the mother has a university degree or holds a leading post at her workplace.

The average points on the abbreviated version of the Beck Depression Inventory (BDI) was 8.7 among all the women surveyed. This was somewhat lower (5 points) among women who fill in leading posts and higher among unemployed women (10.6 points). 83.7% of highly qualified women are in normal range of the BDI score, 12.2% are mild depressives. Only 59.3% of women not working fall into the normal BDI range, 11.6% have severe depressive symptoms.

LIFE EXPECTANCY AND WORKING CONDITIONS AMONG HUNGARIAN WOMEN EMPLOYEES

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There has been an extensive discussion of the women roles in the economic development, science and technology although the expansion of higher educated women increased by 1980 up to 40 percent of the world's higher educated population. Although GECD proposed to increase the number of girls and women studying non-traditional subjects such as science and engineering, women's work is still concentrated in the assistant or even lower level in many East European countries and only very few professionals able to rich top positions.

In Hungary women have independent jobs since 1950s. In the first period of communism they were involved in the heavy industrial work similar to man coming from the rural environment. Although later this equalization was criticized by health professionals still in 1994 out of 1.7 million employed women 794 thousand women were working in unskilled position in the heavy industry, repair and services. The younger generation became more educated and took the easier jobs in health and social works acting as nurses, teachers, or administrators in the government offices.

The health effect of this sudden change in life styles was already measurable in 1980 and the tendency of life expectancy decreased and the mortality rate dramatically increased in Hungary since the middle of 70s. Nowadays the situation for women in workplace is even more critical. The lower educated women population is naturally forced to return back to the family life racing children, parallel to the increase of the unemployment rate. At the same time the government moved out the money from the social support and welfare from the children care therefore the nursery schools and the day care centers are not available for free of charge anymore, and their number is also dramatically reduced. The number of nursery schools reduced from 1305 (1980) to 675 (1994). The number of kinder-gardens is still stable however for ten times more fees. Its number varied between 4600 and 4700 within the last 20 years. In the Hungarian family if the father is unemployed the mother has a better chance to find jobs, because the labor market prefers the less expensive women work. Therefore the unemployment rate is higher among the unskilled men than in women in Hungary.

Generally the morbidity rate of women is higher, although the life expectancy is 10 years longer than for the man in Hungary. This difference is partially biologically determined and is probably due to the better coping of problems among women. There seems to be three factors are influencing the women health and their quality of life in Hungary:

- **Life standard:** morbidity and mortality rates in all main disease categories confirm that people at the lower end of the social scale have the poorest health causing inequality in their vulnerability and health.

- **Job condition:** social support resources and the extent to which they fuel in control 'of there work is a main factor of well being. Professional status and training have a direct bearing on work condition. There is a great imbalance between the job demand and the control of quality of work among men; usually in the jobs mainly held by women there is a marked mismatch between job demands and perceived level of control. Blue-collar jobs carrying a higher health risk for women include packing, production of electrical goods, textiles, clothing manufactures, but also health risk can be detected in many white-collar jobs in health-care, engineering and services.

- **Family condition:** the health status is markedly influenced by the marital status; divorced people are more vulnerable and less able to handle the environmental stress and physical loading.

As the 21 st century approaches, the growing stress and pressure of work is becoming an alarming prospect, particularly if there is no corresponding improvement in the psychosocial resources needed to cope with increasing job demands.

FEMINISM-RELATED DYSFUNCTION IN SOCIALIZA TION

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Abstract: New models of the division of labour within the family have underscored a task oriented, emotionally neutral, genderless mode of operation in early parenting. Soaring divorce rates and the increase in births out of wedlock have multiplied the number of single parent households Feminist influences can be detected in each of these developments. The feminization of the teaching profession coupled with the submissive attitudes of male teaching staffs have all but eliminated the distinctive male model from later stages of socialization. Finally, the feminism-dictated hysteria about "politically correct" ways of courtship and male female intercourse has rooted out much of the spontaneity and warmth of earlier patterns of communication. The dysfunction seems to be less transitory than most of us would hope.

QUANTITATIVE AND QUALITATIVE CHARACTERISTICS OF WAY OF LIFE AMONG HOSPITAL FEMALE DOCTORS

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Abstract: Proportion of women among the hospital doctors increased in Hungary after the World War II., Mainly in certain specialties (internal medicine, ophthalmology, etc.)., Main characteristics of this vocation are: stressfulness, frequent unexpectedness in the activity, uncertainty in finishing the working hours, limitations in free weekends, holidays and being on duty that unifies the all other features. Ratio between working hours and spare time is altered. Somatic and psychic burden is larger for the women than for the men. Being on duty represents the focus of the problems. Consequences of it are: demand to transpose the household tasks, to get substitution in childcare taking, to miss some events. Moreover, its psychic effect can be observed on days prior to and after the duty day (tension - upset state - exhaustion). These commitments influence the content of spending the spare time. The women can less compensate their burden with intellectual and social activities than the men can and less time remains for scientific work. In this respect, support of the spouse is important. Marriage conflicts are common. As the result of this kind of way of life, recently less female doctors intend to become or remain hospital doctor.

GENDER DIFFERENCES IN COGNITIVE FUNCTIONS OF THE BRAIN

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The differential specialization of cognitive functions in the left versus right cerebral hemispheres is one of the most spectacular characteristics of the mature human brain. In brief, the left hemisphere is specialized (in 95% of the population) for language and related serial processing of information, while the right hemisphere is specialized for nonverbal processes, including three dimensional visualization, mental rotation, face recognition, understanding the meaning of facial expression etc. The "left brain" or dominant hemisphere is analytical, logical, perceives time - past and future -, the "right brain" or the "minor" hemisphere is more emotional, holistic in information processing, is creative, and has (if the person has at all) sense of humor. Several lines of evidences suggest, however, that the brains of the two sexes may differ in their patterns of cerebral asymmetry, resulting in differences in cognition as well. Here we would mention only a few examples, which might be of interest for further consideration.

1.Because of hormonal differences, the early differentiation of the two hemispheres is somewhat slower in boys than in girls. This sexual dimorphism in neural organization underlying cognition may have (therefore) educational implications: the learning "rhythm" of boys between 4 and 10 is remarkably different (slower) from that of the girls, which would necessitate different teaching approaches in the school for boys and girls at this early learning period.

2. In girls both hemispheres retain a greater plasticity for a longer period than in boys, suggesting that females may have a lower incidence of developmental disorders associated with left-hemisphere disorders. Indeed, developmental dyslexia, aphasia, infantile autism, stuttering are more frequent in males - and language deficits are prominent symptoms in all of these syndromes.

3. In general, due to the extended plasticity of the developing hemispheres, the laterality of functions in the female brain is not as expressed as in males. Some lexical elements of speaking for instance are represented also in the right hemisphere (in females) and females are in general more reactive than men to stimuli with emotional content. Males often score higher in tests of mathematical reasoning (algebra is "localized" in the left hemisphere) and in understanding spatial relationships while females score higher in tests of verbal fluency. and in the meaning of facial expression.

4. Some brain regions (frontal and temporal lobes) of men age faster or earlier than those of women. This is due to an especially high androgen receptor population early in development in these brain regions, which make these regions more susceptible to aging effects later in life.

These gender differences in brain functions are, of course, based on statistical data. Individual differences might and usually do overlap, - this is why we, females or males, rich or poor, are all distinct personalities.

THE VALUE OF ESTIMATING IN PRICING CONSTRUCTION PROJECTS

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Abstract: For many years, it has been believed that prices for construction projects are determined by forecasts of contractors' costs. Such belief is embodied in widely employed procedures for price determination - as described in methods of measurement and a variety of books and papers. However, relative movements in building costs and tender prices give clear indications that, at least for individual projects, factors other than contractors' forecasts of cost are of importance; in particular, the impact of 'market conditions'. Given the people-orientation of marketing and the factors derived there from, which, increasingly, are employed by clients of the industry to differentiate between contractors, it is suggested that gender-traits are likely to be of significance in contractors' obtaining projects. Thus, the personnel and personality influences on the operation of the technical processes of estimating and bidding to secure survival and success in then demanding socio-economic environment of the construction industry are examined. The value of estimating in pricing construction projects appears to be highly questionable, whilst the importance of the emergent personnel issues are under-recognized.

Keywords: Marketing, construction estimating, bidding

INTRODUCTION

Several publications are produced each year on various facets of estimating and bidding which tended to focus on particular issues - accuracy in estimating, variability of price predictions by consultants, bidding models etc. The vast majority of these are founded on the assumption of the traditional estimate-tender relationship in which forecast cost plus 'mark-up' yields price.

For many years, the construction industry has used cost estimating (cost forecasting) as the basis for price determination on individual projects. A large number of texts describe estimating techniques in highly detailed but also highly traditional approaches - such as costing carpentry and joinery items. However, the emphasis on individual projects tends to obscure the underpinning business essentials as embodied in the requirement for survival and the criteria for successful performance of organisations.

The industry retains, and in many ways acts to maintain, high degrees of masculinity and, hence, male domination. Women and feminine traits are excluded both actively and passively - those women who do work in the industry do so either in "Womens' jobs" or conform to the industrial noms of behaviour (some reinforce such behaviour); those who are not prepared to comply either leave or are labeled "revolutionary feminists" and tend to be ostracised in consequence. Thus, in all but a very few exceptions, the talents and potential contributions to the well being of the industry are lost. (For a discussion of these issues in detail, see Gale, 1994.)

Recent research into marketing (CIOB, 1993) and procurement of construction projects (Bound and Morrison, 1993) has found that the changing incidence of procurement systems indicates that the traditional view of estimating methods has altered. Furthermore, female leader traits are found to be a positive attribute to managerial success.

PRICING

The majority of tenders for major building projects are submitted as components of sealed bid auctions (Flanagan and Norman, 1989). Debate has surrounded assumptions of the nature of the construction bidding market - such as flex-price

Competition, contestable markets (Flanagan and Nonnan, 1989; Button, 1985) and oligopoly (Flanagan and Nonnan 1989). Such debate has fostered consideration of. the appropriateness of game theory for analysis of constructors' bidding, reflecting the apparent divorcing of cost and price for individual projects.

Friedman (1957) initiated a continuing debate concerning models of contractors' bidding. Friedman's' model, and that proposed by Gates (1967), examined the probability of a contractor's bid being successful (lowest) when submitted in competition with a known number of, or an unknown number of, other bidders. A central feature of both models was the contractor's forecast of costs. Such models have been extended to adopt a utility approach (egs. Carr, 1982; Willen brock, 1973), despite major inherent variabilities in utility analyses (see, e.g., Skitmore, 1989). Notably, most models do not incorporate assessment of the accuracy of contractors' estimates (or, at least, of the proportion of such estimates for which accuracy may be detennined - the successful bids). Estimating and bidding are quite different and distinct but, unfortunately, often confused concepts. Estimating accuracy is the degree to which the forecast cost equates to the actual cost of executing the work on the project (given identical conditions or allowances for differences - care is needed in making and making judgements over such allowances) whilst bidding accuracy is a rather nebulous concept lowest bid; forecast of lowest bid; forecast of the mean of the bids received...etc.

The majority of documents' concerning contractual arrangements, procurement and pricing deem that traditional estimating has been employed and that price comprises predicted costs plus mark-up. It is common for sub-contractors' prices to be built-up from predictions of resources necessary to complete the work, detennined from analyses of drawings and specification data. Only subsequently, if at all, are such prices converted into constituents required by the project's Bill of Quantities (BQ). Main contractors have developed resource (perfonnance and cost) databases to denote requirements for execution of BQ items whilst acknowledging that BQ measurements of items of 'finished work' usually are not suitable for cost-based pricing. Hence, the project constituent price model is appropriate only rarely for cost-based price determination.

Some preliminary work has been carried out to detennine contractors' bidding procedures; in particular resource considerations (Odusote and Fellows, 1992), information flows, estimating, marketing and changes in procurement systems (Fellows 1992a; CIOB 1993). A contractor's bidding decision chain begins with the bid/no bid decision (Ahmad and Mainkrah 1988). Thereafter, much variability is hypothesized to exist concerning the decision pathway to submitting a bid, the pathway's being detennined by the bidding procedure adopted. Notably, the array of possibly pathways range from the 'traditional' procedure (estimate - tender conversion - bid) to the market price degeneration = bid.

Flanagan and Nonnan (1982) found that contractors' bidding behaviour is likely to be affected by project technical factors, project managerial factors and market factors. The results of Fine's (1975) investigations also emphasise the role of market factors in contractors' price setting.

Price variability has been investigated by many researchers from the perspectives of consultants. Morrison (1984) providing one of the more detailed quantifications of sources of variabilities, attributes consultants' average coefficient of variation of 15.5% in predicting lowest tenders to:

Variability in lowest tenders received in competition	6.60%
Variability due to using cost data from previous lowest tenders	5.00%
Inherent variability of the estimating Technique (pricing BQs)	1.85%
Variability due to making adjustments to the chosen cost data	6.90%
Variability due to imperfections in the cost data employed	11.00 %

Such variabilities depend on the stage of design at which the price forecasting is executed, data available and the technique employed; as noted by Bennett (1982).

Barnes (1972) found the coefficient of variation (cv) in contractor's estimating to be 7% whilst Morrison (1984) found it to be 8.22%. Carr (1982) suggests that, 'contractors' relative costs are random variables and represent the major variation amongst bids. Kaka and Price (1993) found that, 'Errors in estimating affect the shape of the value curve and lead contractors to submit different tenders for the same project.' Wootton (1982) noted that only 620% of project costs was in the control of the main contractor. Hence, if contractors' cv in estimating lies between 7% and 8.22%, whilst price forecasting variability is, at least, (cv) 6.5% (Bennett, 1982) and the variability of lowest tenders received in competition is 6.6%, it appears that market forces are of major influence on price determination, both directly and via their impact on sub-contractors' bids (the primary component of main contractors' cost/price forecasts).

Preliminaries 'is the main area within a tender where a contractor can seek to gain a competitive edge by adjusting the tendered priced... (Solomon, 1993). Eastham (1987) noted the importance of sub-

Contractors' prices in main contractors' bid formulations. The variability of sub-contractors bids has been investigated by Runeson (1988) and by Uher (1990) - the coefficient of variation (CV) of general contractors' bids was 5%-6.6% whilst the mean CV of sub-contractors was 9.8%. Within groups of sub-contractors, bids were normally distributed.

Clearly, in a bidding environment which is harsh for all bidders, at whatever level, attention to potential 'profit enhancements' is accentuated - cash flow manipulations, claims etc. Ahmad and Minkrah (1988) found that, 'Experience, judgement and subjective assessment are the only tools which are being used in making bid decisions.' Although estimating should be (ideally) independent of the individual, the use of data bases comprising arrays of Performance averages, the updating mechanisms used, the need to select data and adjust it to reflect conditions predicted for an individual project demonstrate the need for exercising judgements. The consequence is variability of cost forecasts between estimators (as well as between estimates). Generally, the market judgements brought to bear to convert estimates into tenders are far more subjective! Henc39 e, human judgements playa majorrole in bidding for construction projects, irrespective of what procedure is adopted.

MARKETING

The traditional approach to marketing tends to focus on transactions - transaction marketing. The 4Ps of the 'marketing mix' - Product, Price, Promotion, Place - are primary considerations; expanded by Booms and Bitner (1981) to 7Ps by including People, Physical Evidence and Process.

Kotler (1986) defined marketing as, 'the human activity directed at satisfying needs and wants through an exchange process'; Ohmae (1988), suggests that marketing concerns discovering what customers want and orienting the firm to satisfy those wants - clearly a use value based view. A further aspect is the perspective of the general body of consumers and the *customers* of the particular firm which raises questions of the size of the pool of consumers, of the pool of *customers* and the permanence of each. , Certainly, sales focuses on the customers whereas marketing has important considerations of consumers (the actual and potential customers of the firm).

Morgan and Morgan (1991) assert that the, 'marketing function.. Encompasses all elements that influence the client's decisions towards the service offering.' As construction is a service, whether for design" or construction activities, it is subject to the major problematic features of services - Intangibility, Inseparability, Heterogeneity and Perishability which can be addressed as noted by CIOB (1993).

Lim (1990), Morgan and Morgan (1991), CIOB (1993) found that the UK construction industry regards marketing as selling. Whilst selling (of which a major component is promotion) is a vital element of marketing, it is only an element; a view that selling is synonymous with marketing clearly leaves a large, consumer-oriented void for exploration and, potential, exploitation.

Developing the marketing plan includes SWOT analysis (Strengths and Weaknesses - of the organization; Opportunities and Threats - in the market). Especially for international activities, environmental factors (PEST - Political and legal, Economic, Social and cultural, Technical) must be evaluated carefully. Due to use of 'standard' procedures for letting construction work, cost leadership strategy has been, virtually, forced upon constructors - and, since the introduction of forbidding, on consultants - due to the widespread assumption that price = cost + mark-up and the client mix (most are naive).

Perhaps particularly in developed economies, marketing consideration are moving from the historic focus on 'transaction marketing' towards 'relationship marketing', from short-term focus on individual transactions (sales) to developing enduring relationships and, hence, repeat orders. Levitt (1983) believes that '...the purpose of a business is to create and keep the *customers,'* Good relationships, which, inherently, foster trust, should encourage *customers* to earlier adoption of a supply 'novelty', if offered by a supplier with whom the customer has a good relationship. The construction industry should therefore, explore the benifits from relationship marketing and strives to remedy its current fragmentation.

EMPIRICAL FINDINGS

Results of several surveys of marketing (Lim, 1990; CIOB, 1993; Patel, 1993) and advertising activities (Namo, 1991; Velasco, 1993) are synthesised briefly. Generally, the data were obtained from postal questionnaires of samples of clients, consultants, contractors with semi-structured interviews to provide more details of particular aspects.

Hong Kong contractors' advertise (1) to increase their reputation (2) to increase turnover and (3) to enhance their market position. Consulting structural engineers in UK use advertising (1) to inform clients of the practices' capabilities, (2) to provide reminders of the existence of the practice, (3) to induce purchase of the practices' services and (4) to support/shape the image of the practice. In Belgium,

it is usual for consultant structural engineers to be engaged by the (design and build) contractors; there, engineers emphasise technical factors in their advertising.

UK contractor's marketing targets clients primarily little attention is devoted to existing clients (which, for the sampled contractors, provide 75% of their turnover); architects provide a secondary target. A similar pattern occurs in advertising by contractors in Hong Kong and by consulting structural engineers in UK.

For advertising, professional and industry journals are used widely (and adjudged effective), followed by entries in more general directories. Especially consultants find personal visits to clients to be useful in promoting the practice whilst all groups employed 'corporate entertainment' - sports events, formal dinners/lunches - to establish and maintain contacts with new and existing customers

It is notoriously difficult to determine casual links between marketing/advertising initiatives and their consequences on performance of an organisation. In selecting construction contractors and consultants, clients often obtain information from various persons - business and social colleagues, architects; the 'golf club' (word-of-mouth) mechanism. Hence, the importance of establishing and maintaining a good reputation and, in particular, of targeting architects is of great importance. Notably, in UK, about 17% of consultants and 31 % of clients had preferred contractors; in Belgium 77% of the engineers were appointed regularly by contractors (i.e. those consulting engineers had regular/repeating clients).

Consultants' advertising emphasises (1) range and quality of services, (2) expertise, (3) experience (4) previous projects, (5) fee. In Belgium, engineers' experience is the major factor governing their engagement, supplemented by previous relationships with contractors; fee was ranked fifth.

Generally, much emphasis is placed on gaining repeat orders. Repeat orders are gained by establishing good buyer-seller relationships which Patel (1993) found to result in improved quality of service primarily but, often, accompanied by cost savings. In the eyes of clients and contractors, good buyer-seller relations comprise (1) confidence, (2) loyalty and (3) trust. Such relations require client orientation - primarily continuous improvements in the quality of service provided, taking immediate action to rectify defects/ address complaints, view the relationship as provision of a service (rather than selling a product) with the objective of providing a reliable, high value-added service. Resultant advantages include a close understanding of each other's. Needs; mutual confidence; better value for money; improved communications, efficiency and company performance.

GENDER ISSUES

Clearly, good communication is essential in marketing. Helgesen (1990) and Case (1994) found that women leaders use collaboration and participative communication whilst men leaders use more directive and unilateral communication

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Kvande and Rasmussen (1993) researched differences between men and women (graduate engineers) in various organisations and found greater variations between employees in different firms than males and females across the total sample. Hierarchical organisations operate in stable markets and afford men systematically better opportunities, however, organisations operating in turbulent, changing markets tend to have flexible, network-type structures and provide opportunities which are not differentiated by gender. The necessity for the 'dynamic networks' to accommodate changes has moulded their corporate cultures to foster experimentation - including employing women in non-traditional jobs. In the dynamic networks, work is organised in teams in which the employees do not have clearly defined tasks and responsibilities but through team identity and flexibility, contribute their skills and expertise to the completion of the work. Synergy and sentience are fostered. The function of managers is to be co-ordinators of teams; decisions follow from consultations and managers must be able to delegate, cooperate with colleagues and to inspire. K vande and Rasmussen found that women believe such qualities to be of particular importance for managers and believe that they have appropriate qualities to offer.

Schein (1975) and Morrison et al (1987) emphasise that women who progress in organisations tend to be those who (learn to) fit in with the existing structure and 'culture'. The 'culture' of the construction industry is characterised by crises, conflict and masculinity, which is likely to yield a cultural mismatch for the majority of women; the image of the industry acts as a notable barrier to entrants (for men as well as for women), as noted by Gale (1994). The lack of female role models and peer group support exacerbates the difficulties.

Ferrario (1990) found that women have significantly stronger team management style than men expressed as high regard for people and for task. Vinnicombe (1987) found that women are more 'visionary' than men in their approach to business. Hence, masculine cultures are characterised by dominant power relationships and results orientation whilst feminine cultures are characterised by

Emphasis on interpersonal relationships and process orientation. .

Handy (1984), Kanter (1989) and Clegg (1990), for example, identify the trend toward de-hierarchization in organizations, the flattening of the managerial hierarchy by reduction in the number of layers, as is common in dynamic networks. Kanter found that big companies in North America are moving towards maximizing their core business competence in conjunction with 'hierarchical trimming' and that the boundaries between the company and its environment is becoming more permeable with the creations of ('Japanese - style') strategic alliances with other companies, sub-contractors, suppliers etc. Partnering arrangements in the construction industry is a manifestation of a similar process.

CONCLUSIONS

Contractors and consultants regard marketing to be selling and promotion of their services. However, there is slowly increasing recognition that marketing is a much more basic strategy requiring client orientation of the organization. Client-orientation requires attention to components of non-price competition, often to the domination of the traditional (capital) price competition for the award of projects

Construction clients are value seeking and they now place considerably more weight on (their perceptions of) the abilities of the lower-bidding contractors' project management teams to produce good project *predominance* than is recognised by contractors.

Naive clients, contractors and some consultants rely on competitive bidding to secure a low price to yield individual commercial advantages. Such short tennism exacerbates conflict as 'minimal money' becomes the focus, to the detriment of trust and hence, claims etc. flourish and performance suffers.

That the construction market, especially for sophisticated clients, is moving from transaction marketing to relationship marketing - with the focus on expressive performance (PEOPLE) - is not recognised adequately by the construction industry. The people-role as both technical and social experts to foster organisational success has yet to be pursued; 'ownership', interest and involvement are essential ingredients to obtain good performance, participant satisfaction and repeat orders.

According to 'Relationship Marketing', the fostering of good relations between participants often will outweigh (marginal) price differentials. Collaboration/co-operation is much more conducive to long term survival/success than is competition. Thus, generalising gender traits, the more nurturing, people-oriented and conflict avoiding/co-operative approach more common amongst females is likely to be more valuable and more successful in securing new and, more especially, repeat orders than is the aggressive, macho, overtly competitive and selfpromoting approach which is more common amongst males!

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INTEGRATED COMMUNICA TION/INFORMA TION SYSTEMS IN THE CONSTRUCTION PROCESS

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Abstract: The presentation introduces two research projects dealing with "Integrated planning and communication in the Construction Process". The contribution of these projects for the entire constmction process is essential as they are aiming, to: a) more effectiveness, efficiency and quality, b) better structuring and c) new elaboration of principles for integrated planning. The results show that there is a real need for integrated communication in the construction process and that we have yet only scratched the surface of an important subject deserving more in depth research.

Key words: teamwork, increase in effectiveness and quality, communication, integrated planning

1. OUTLINE

Two research projects are contributing a lot to the heated discussion in Switzerland about "Integrated Planning and Communication in the Construction Process". The three major objectives of these projects are:

- An increase in effectiveness, efficiency and quality of the planning and erection of buildings through an integrated mode of cooperation and goal-oriented project management, and through optimal use of advanced computer and telecommunication systems

- The structuring of the erection process in building construction in phases, functions and activities, as well as the definition of all relevant flows of information and documents

- The elaboration of principles and instruments for the integrated and computer-supported management of facilities during their use.

2. INTEGRATED PLANNING AND COMMUNICATION DURING CONSTRUCTION

This project was performed from October 1992 to September 1995 at the Swiss Federal Institute of Technology in Zurich (ETHZ), in close collaboration with the construction industry and under the patronage of the Center for Integrated Planning in Construction (CIF Constmction).

The results gained during the three years of work on this project can be divided into theories and concepts on one hand, and procedures and methods that are directly applicable on the other hand. They cover a wide range of subjects and are summarized in five partial reports, answering the following questions:

- What can a structural model for integrated Planning look like?
- What can a communication model and product model for integrated planning look like?
- What principles and conventions are necessary for better information and data exchange?

- What are the possibilities for the future use of database systems in construction?
- What information about organisation, processes, and data for better facility management is necessary?

A large number of new discoveries were made; numerous results for science and the construction industry were found and have already been put into practice

.

3. INTEGRATED PLANNING DURING DESIGN

This project has started in spring 95 and will be finished in summer 97 at the ETHZ in close collaboration with two banks (industry partners) and under the patronage of CIP Construction.

The project is based on the hypothesis the already in a very early phase of a project:, the design process should be supported by an interdisciplinary team. The main goals for such teams are:

- Create synergies between different branches of, science (human, social, nature and technical sciences
- Good global solutions from the start thanks to the participation of a representative of every branch

It is not easy to build a team that is more effective that the sum of its representatives. Questions that the project tries to answer are:

- What are the necessary tools for such teams and what procedures can help a team to get started?
- What methods can foster creativity and thus lead to good solutions?

The presentation will focus on and discuss all problems such teams may come across and highlight solutions that lead to more effective teamwork.

A NEW ALTERNA TIVE OF TORSIONAL TORQUE COMPENSATION IN AN ELASTIC TWO-MASS DRIVING SYSTEM

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Abstract: The paper presents a high-performance speed control for torsional vibration suppression in a two-mass dc. motor drive system, which has long shaft. The proposed controller is based on a state feedback control stmcture,And uses a reduced state-observer and a disturbance observer. The features of the control method is that it yields a robust system with respect to torsional vibration suppression. Simulation results show that vibrations caused by mechanical resonance can be effectively suppressed.

Keywords: two-mass elastic driving system, torsional torque, oscillation suppression, state feedback stmcture, reduced state estimator, poles placement, and derivative disturbance estimator.

1. INTRODUCTION

In the industrial applications where the load is coupled to the driving motor by a long shaft (such as steel industry, paper industry, textile industry, robots, etc.), due to the finite but small elasticity of the shaft, mechanical vibrations occur, producing undesirable effects. These effects are often initiated by abrupt change of the reference and/or of the load, and materialised in a speed difference between motor and load speed, so the shaft is undertaking a large torque, this continuous stresses the shaft, fatigue the shaft material, which may result in disastrous accident. This vibration is not only undesirable, but also the reason of the system instability.

The major problems of the control system are: the mechanical vibrations (due to the elastic shaft), the uncontrolled load disturbances, the plant uncertainties (parameter variation, unmodeled dynamics) and plant constraints (actuator saturation, load speed inaccessible). Several control algorithms have been examined for the suppression of the torsional vibrations in the motor drives. (Korondi et al., 1995), (Ji et aI., 1995a), (Ji et aI., 1995b), (Ohmae et aI., 19R7), but the most promising approach is the state feedback control.(Dhaouadi et aI., 1993). However this approach needs not only the values of the motor current and speed. but also shaft torque, load speed and load torque disturbance. One approach to get all these informations is to estimate the load torque and observe internal states from the input and output informations.

The ratio R oh these frequencies R = ω1/ ω2 is called the resonance ratio, given by (4). It is difficult to suppress the vibrations caused by mechanical resonance when R becomes close to 1.

$$R=\sqrt{1+js/jm} \quad (4)$$

CONTROL LAW DESIGN

The primary objectives in the control system design are to achieve a fast response, to suppress the mechanical vibrations and disturbance rejection. To satisfy these requirements the present paper propose a feedback structure, shown in fig.2. It consists of a combination of state feedback control (a state observer is used) and a tensional torque feedback (a disturbance observer is also used).

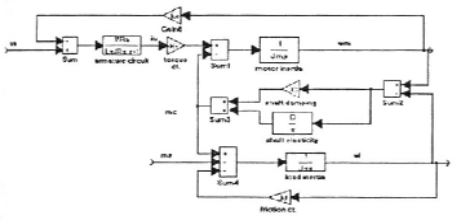

Fig.2.The proposed controller block diagram

3.1 State feedback and observer design

To have a direct control over the system time response, the pole placement method is used for the state feedback gains design [preitI and Porumb, 1994]. A proper poles placement ensures proper performances for SFCS. In the literature there are given different recommendations regarding poles placement. Based on the results of previous researches (preid and Porumb, 1994), (preid and Porumb, 1996) a new method of poles placement is proposed *poles placed on ellipse.* The main advantages of the method are:

- as well for continuous as for discrete SFCS, for poles placement general analytical expressions are given, that are particularised according to system order;
- the performances ensured are very good: fast and well-damped response (small overshoot) of SFCS (even if system order is high).

The analytic expression of poles placement on the ellipse is:

$$P^*v = \acute{\omega}_0.\cos[\pi/2+(2.v-1).\alpha] \pm \acute{\sigma}m.\sin[\pi/2+(2.v-1)\alpha] \quad (5)$$

Where:

$$\acute{\omega}0= \acute{\omega}0.\cos(\pi/2+\pi/4)/\cos(\pi/2+\pi/2.n)$$
$$\acute{\sigma}m= \acute{\omega}0.\cos(\pi/2+\pi/4)/\sin(\pi/2+\pi/2.n) \quad (6)$$

n- system order.

The result is the placement of the poles on an ellipse of equation (7)

$$(\acute{\sigma}/\acute{\omega})^2+(\acute{\omega}/\acute{\sigma}m)^2=1 \quad (7)$$

The only problem designer is dealing with is tile proper chosen ώ0… ώ0 chosen so SFCS poles (5) are on tile left side of plant poles and on the right side of estimator poles.

For the system under consideration two of the state variables are measurable: motor armature current Ia and motor speed ώ m it is therefore desired to design a reduced order observer to estimate load speed ώ s.and angular difference ⌂θ

The reduced model is:

$$x_r'(t) = Ar \cdot Xr(t) + Br \cdot U(t) + B_{rv}(t).\, m_S(t)$$
$$y(t) = Cr^T \cdot xr(t) \quad (8)$$

Where $x_r=[\omega_m.\ \Omega s.\ \Delta\theta]^T$

$$Ar=\begin{vmatrix} -D/Jm & D/Jm & -C/Jm \\ D/Js & -D-kf/Js & C/Js \\ 1 & -1 & 0 \end{vmatrix}, \quad Br = \begin{vmatrix} K/Jm \\ 0 \\ 0 \end{vmatrix}$$

$$Brv=[0\text{-}1/Jso].Cr^T=[1\ \ 0\ \ 0] \quad (9)$$

The reduced state estimator equations are:

$$Xr'(t) = (Ar - L.\ cT).\ xr(t) + Br\ .\ u(t) + L.\ y(t)$$
$$y(t) = cr^T.\ Xr(t) \quad (10)$$

Where L, the observer gain constants are calculated to place the eigenvalues of estimator matrix (ArL'cT r) at the desired locations, and consequently shape the observer dynamic. Observer poles are also placed on ellipse, but necessarily on the left side of plant and SFCS poles. The only problem the designer must solve is the distance between SFCS poles and observer poles. For the simplicity of the calculus one can use Ackerman's formula.

3.2 Torsional torque estimator design

the disturbance observer designed for the two-mass System estimates the torsional torque D i'l8 that reacts on the motor. Fig,2 shows the feedback (ta) of the estimated torsional torque through a low-pass derivative filter. This feedback has also damping effect on the 2 mass systems, and suppresses the vibrations of mechanical shaft. The feedback gain ta depends on the plant parameters. A maximum value often is obtained (Sugiura and Hori, 1996)

$$ta \leq talim = 2.\sqrt{Jm/D(1+Jm/Js)} \quad (11)$$

Time constant T d of derivative observer is chosen so equation (12) is fulfilled:

$$T_d \ll T_{mechanical\ osc} \quad (12)$$

In order to suppress vibrations sufficiently, the smaller T d is the better. However it is difficult to implement a controller with too small T d .

Remark: In order to ensure a fast response with zero steady-state error to speed reference step input and load step disturbance the control structure presented in figure in fig. 2 is supplemented with a PI load speed controller.

4. SIMULATION RESULTS

The proposed speed controller is verified by numerical simulations (using Matlab with Simulink). The driving system consists of a dc motor coupled by an elastic shaft with the load, has the following parameters:
Pn=18.5 W, comN=36 rad/sec, KM=5.06 N *miA,* Ke=5.06 V/rad sec, Ra=2.7 .0, La=l.l mH, C=2 N m sec, D=76 N m sec/rad, Jm=O.l kg m2, Js=0.063 kg m2, KIO.07 N m sec/rad.
The controller parameters are:

- SFCS gain constants: Kc T =[0.07 0.118 -21. 7] (obtained for mO=30, based on eq. (6»- state estimator gain constants: L=[46.1; -18.9; .0.35]
- torsional torque estimator gain constant: ta=O.5 - torsional torque estimator time constant: Td=O.01.'

The disturbance observer designed for the two-mass):
The supplemented PI load speed controller has the following parameters:

- Gain constant K=2
- Integral time constant Ti=0.04

Fig. 3 shows the response of the designed control structure to step variation of reference input and step disturbance input. The performances of the designed control structure are very good: small settling time, no overshoot in motor speed response, very small overshoot in load speed response «2%) and a complete suppression of torsional torque.
Due to the simplicity of the designed control algorithm no problems occur at digital implementation.

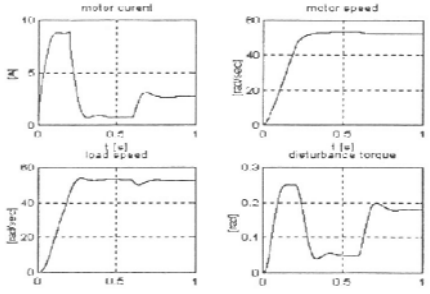

Fig.3 response of the designed control structure

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SMALL ELECTRICAL DRIVES IN HOUSEHOLD

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Abstract: In the last few years new types of small electrical drives have been developed. The aim of this paper is to present the construction. and operation of these drives. It is important to ensure the optimal performance, the maximum available power (torque) with a given construction and to find the most efficient control strategy.

Keywords: electronic commutated motors, controlled hybrid motors, floppy drives, servo drives.

1.INTRODUCTION

The low power electrical drives are used in a wide range of application in all areas of our life. A lot of them are used in apparatus of household, in cars, in computers and office-machines, etc. The most of them are simple drives, but there are a lot of new contructions, which include new sensors and. Equipment oriented IC-s with efficient speed control.

2. APPLICATIONS OF SMALL DRIVES

A group of drives has no control. These are powered by constant voltage supply, which may be the network with *220V/50Hz* or a battery or an accumulator as in cars. The actual speed of a given drive can be resulted by the load curves of the driving motor at the instantaneous load and friction. These simple drives are for example in coffee mills, and in cars to move the windows and seats, etc. An another group of drives has similarly no control, but the speed of the motors can be changed in a few grades. For example in hair-drier there are serial switched resistance grades in the armature circuit, while in washing machine and in cars on purpose to move the windscreen-wiper there are motors with two or more armature coils which can be switched over. There are a group of drives, in which the speed of motors is changed by mechanical transmissions. There are in household many electrical drives too with variable speed but without control. Sewing machines or turmix-machines are fed generally by variable voltage supply to change the speed. If the drive has no control the user can sense well if the load is too big. In high level applications there are only drives with efficient and accurate speed control, for example in videos and in floppy or hard disc drivers. Rescently there are a lot of new construction.

2. TYPES OF SMALL DRIVE S

All the conventional motor types may be the bases of small drives: DC, asynchronous, synchronous, reluctance or step motors. But there are many differences in their constructions and in their electrical control. Conventional DC motors have high efficiency and their characteristic make them suitable for use as servodrives. Unfortunately they have commutator and brushes which are wearing and so require maintenance. The speed controlled DC drives are fed by 1/4 or *4/4* transistorised choppers or direct

Converters. There are construction specialities in the motors like the moving-coil (coreless) or the printed winding.

A lot of small drives are built with step motors. Their advantage is the simple control, disadvantage is thnon smooth speed. They are used above all in printers or in floppy- and hard disc drivers as headactuator, etc. There are also inverter fed asynchronous drives in household, for example in novel controlled washing machines. But there are direct from 50Hz working synchronous or reluctance drives as well for example in synchronous clocks with constant speed.

In the last few years two new types of drives have been developed:

- the electronic commutated small motor drives, and
- controlled hybridmotor drives.

The behaviour of these are similar. The rotor of these motors is a permanent magnet field system. The armature coils of stator carry the current which is synchronised to the position of rotor magnet. Both types are provided with efficient current and speed control to ensure the optimal performance of the drives. It is easy to realise the speed detection in the case of both drives. The construction and the operation of the two types are totally different.

4. ELECTRONIC MOTOR DRIVES SMALL COMMUTATED

There are cylindrical and disc type motors. The construction of a disc-motor is shown in Fig. 1. The rotor is flat as a circular plate and magnetised in axial direction. The magnet has eight magnetpoles (pole-pair: p=4) on the diameter D of the circle, the pole dividing is $T p = 360 / P = 90$. A mechanical angle of 90 is equivalent to an electrical angle of 360. The stator coils are found on printed board arranged flat. Because of this the air-gap is relative big. The two diametrical coils of the three-phase winding are switched serial (Fig. 1.). The effective length of conductors which perpendicular to moving magnet field let be signed by I . The number of turns is N . If the current of phase "a" is *i a'* then the produced torque of the conductors signed I is

$$m_{al} = \sum_{j=1}^{N} DlBj(\acute{a})ia \qquad (1)$$

where *B j (a)* is the magnetic flux density on the place of the j-th conductor. The *B j (a)* is varies on rotating. The conductors signed II are displaced by *at* from conductors signed I, and their current has opposite direction. If the *B j (a + at) = - B j (a)* relation for the magnetic flux density is true, then *mal = maJI* and *ma = 2mal'* In Fig. 2. the torque *m:** is shown if the phase current *i a'* is constant (I) and if the distribution of magnetic flux density has ideal square shape. The other phase-coils "b" and"c" are Symmetrically arranged. Then the *mb*** and *me*** torque components are similar to *ma*** , only by 2 *T p* / 3 shifted if *i a = i b = I* .

The method of control is to cut the section from torque-curves where the torques are constant with desired sign. If we choose a current V.s. time function *i a (I)* according to Fig .2.c. synchronised to the *a* rotor position, then we get the torque, *ma(/),* similarly with *ib(/)or ic(!)* we get *mb,(t)* or *me (I).* The opposite direction of current causes opposite direction of torque. The resulting three-phase torque m is shown in Fig. 2.e. , the letters referes to the phase and to the direction of current which causes the actual torque component.

The resulting torque is

$$m = 2NDIBmaxI = kTI , \qquad (2)$$

Where *kT* is the torque constant of motor. The torque has no pulsating component and his value is the available maximum with the given current I , if the distribution if magnetic flux density has ideal square shape and the three-phase currents are synchronised to the rotor angle according to Fig. 2.e. and their time function has square shape too. The synchronising of the current is the task of the so-called "electrical commutator". To detect the rotor (magnet) position are used Hall-elements to produce control signals for the electronic switches. The motor is working from a transistorised full bridge.

The whole scheme of the speed controlled drive is shown in Fig.3. The controller alters the voltage *U.* of motor with the help of the serial switched transistor TE, which can work continuously or in switchmode. The speed control has two main mode as well there are analog and frequency control. The reference signal of the frequency control is generally a divided signal of a quartz-generator and the controller is a PLL (phase-locked-loop) circuit. For the speed detection a meander coil is used (see Fig. 1.). This coil is arranged on the printed board. It can sense the k-th field harmonic of the magnetic fl\LX density (k=19...23) and has a signal with k-th periode in a single turning.

4. CONTOLLED HYBRIDMOTOR DRIVES

There are cylindrical and disc type motors. The construction of a disc-motor is shown in Fig.4. The rotor is ring-shaped permanent magnet placed in an iron cup. It is magnetised in radial direction and the magnet has 16 poles (pole-pair p=8) the pole dividing is " p = 360. / p = 45.. The armaturecoils are on the 24 salient poles of stator and it is a three-phase winding. The air-gap is smaller as in the case of electronic conunutated motors. The value and phase-angle of current is controlled and synchronised to the rotor position.

Let us give current on the coils of two neighbouring theeth so, that the polarities of their exiting will be opposite to each other. Let be $i\ a = +1$ and ic = -I corresponding to PA-NC conduction configuration but only with two theeth. As long as a north-south pole pair with appropiate direction do not take place symmetrically opposite to the two theeth there is generated a torque $m\ ac$ on the rotor magnet. Compared with other positions in opposite state is the ψac flux connection the greatest. Let be the rotor position here . α_0 .If the rotor angle deviate from α_0 by a minimum amount $\Delta\alpha$, then a bring-back torque is generated. If $\alpha<\alpha-\Delta\alpha$. a then this torque is positive, if $\alpha>\alpha-\Delta\alpha$. Then it is negative. It is supposed the superposition of flu.x-connection of magnet and coils.

The voltage equation of motor is

$$u=iR+d\psi_{ac}(\alpha,I)/dt \qquad (3)$$

Where

$$\psi ac = 2N\varphi_M + Li.$$

Here i is the current, R is the resistor of coils, N is the number of turns, L is the self-inductance, $\varphi M\ (a)$ is the permanent magnet flux in the two theeth, which varies with the thooth-surface depends on the rotor angle. A typical linear variable flux connections curve is shown in Fig.5.b.

In the equation (3) the mutual inductance, the ironsaturation and the interaction between the two flux components are neglected. The self-inductance L is nearly constant because of the rotor is cylindrical. The power balance is

$$P_{be}=P_{cu}+P_{mech}+p_{ma\ gn}$$

Where

$$P_{be}=ui, P_{cu}=I^2R, p_{mech}=m_{ac}W,$$
$$P_{ma\ gn}=d(Li^2/2)/dt$$

From these we get the next from

$$Ui=I^2R+m_{ac}W+Lidi/dt+(1/2)i^2(\partial l/\partial\alpha)(d\alpha/dt). \qquad (4)$$

Let us substitute ψ ac into equation (3) and multiply by i, than we obtain

$$\boldsymbol{ui = i2\ R + 2LNid\ \varphi\partial_M / dt + id(LI)/ dt},$$

or $$ui = I^2\ R + m_{ac}w + 2Ni(\partial\varphi_M / \partial a)(da / dt) + i^{2(}\partial l/\partial\alpha)(d\alpha/dt)+i2(\partial l/\partial\alpha)(d\alpha/dt)+iLdi/dt \qquad \textbf{(5)}$$

Comparing the equation (4) and (5) we get for the torque

$$m_{ac} = 2Ni(\partial\varphi_M / \partial a) + i2(\partial L/\partial a)/2 \qquad \textbf{(6)}$$

The second term is the relutance torque, which is significantly smaller than the first one.

If this two-theeth conduction configuration is maintained then the torque is in accordance with Fig.5.b. To get the whole torque of the PA-NB conduction configuration we must multiply the torque (6) by eight since the coils of a phase are dis~buted on 8-8 salient poles ($p\ s$ = 24 / 3 = 8) .The area of the negative flux-connection cannot be used because of the torque is instable. The flux-connection and the torque curves in Fig. 5.a.-b. would be repeated six-time, if we would drawn the other five (pA-NC, PB-NC, PB-NA, PC-NA and PC-NB) connection configurations. In Fig.5.c. is shown, at which time-interval should generate the P A-NB configuration so we get the torque in the required direction. It must be synchronised to interval I if we want positive torque and to II if we want negative torque. If the six current conduction combinations are changed symmetrical one after the other, then the resulting torque m is shown in Fig. 5.e. Its value m is constant and equal to $psmcc.max$. If the second part of (6)is neglected, then

$$m = 2PsNi(\partial\varphi_M /(\partial a), m = kri, \qquad \textbf{(7)}$$

Where k_t is the torque constant. The resulting torque is smooth funtion of time, if $(\partial M /(\partial a)$ is Constant in the all conducting configuration. The scheme of speed controlled hybridmotor drive is similar to the scheme of electronic commutated motor according to Fig. 3. The synchronised current conducting interval is choosed by an "electronic commutator", which is based on Hall-elements detecting magnet position. The speed and current control are similar as in the case of electronic commutated motor. The only difference is in the arrangement of the meander coil and in the detecting. The sensor coil is on the printed board. The permanent magnet of the rotor is so magnetised, that there is a many pole magnet (for example 60 pole) in axial direction in addition. This superponed magnet induces in sensor coil the tachometer signal. In the most applications the speed is controlled by PLL methode.

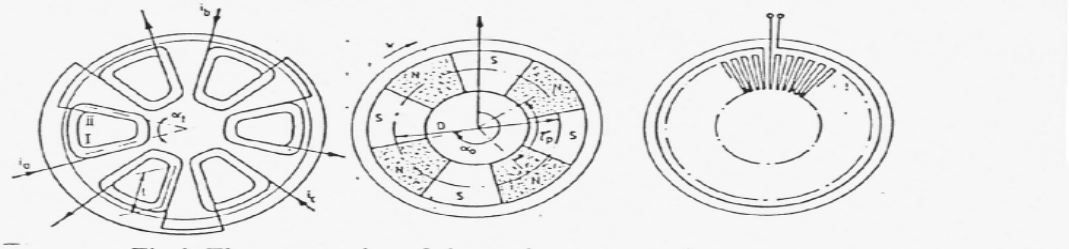

Fig.1. The construction of electronic commutated motors

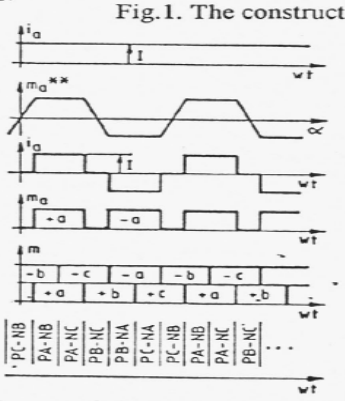

Fig. 2. Torque of electronic commutated motor

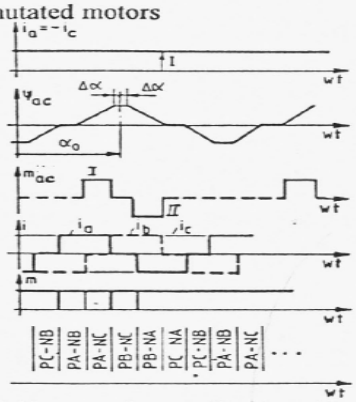

Fig.5. Torque of controlled hybrid motor

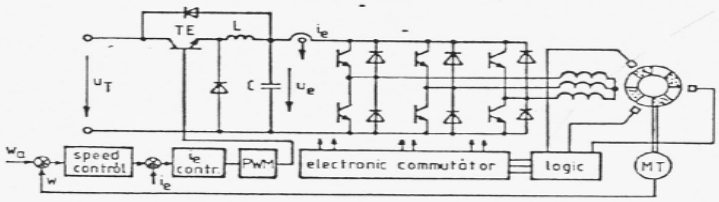

Fig. 3. The scheme of speed controlled drive

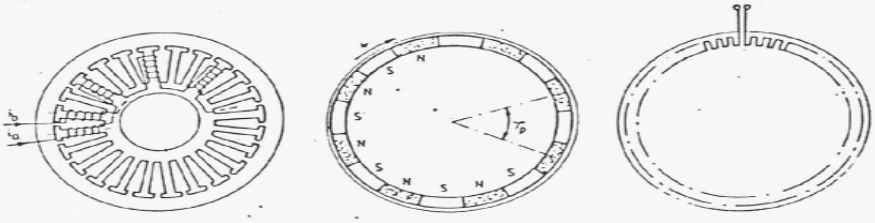

Fig. 4.The contruction of hybrid motor

5.Conclusion

it is shows in this paper what is the most efficiency control strategy at the new types of small drives. It is shown how the optimal performance and the maximum available torque(power) with the given construction are ensured . The behavior of both drives is similar to the conventional DC drives because they operate by K_T torque constant; wich has a maximal value in the given construction

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ELECTRONMICROSCOPY INVESTIGATION ON 10 NM PARTICLES OF MAGNETITE

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Magnetite nanoparticle investigation is useful for the study of natural science. medicine and technology. Though electron scattered amplitude of magnetite reciprocal lattice face diffraction pattern was calculated to sure that lines, such as (Ill) and (222), ware contained. The diffraction pattern lines on electron microscopy film seemed not to contain those lines, then for the purpose to make sure of existence of those lines. the sample of 10 nm magnetite particles of magnetic fluids was prepared for the observation of electron microscopy and characterization.

Keywords: scattered amplitude. Electron diffraction, ferricoloid. Characterization, external magnetic field. a chain of magnetic nanoparticle

1. INTRODUCTION

Magnetite nanoparticle investigation is useful for the study of natural science, medicine and technology, For example, the nanoparticle chain was found in a magneto tactic bacteria which are living living in segment in the sea or pond, and have be come the origine of the stone magnetite. It was also found in the chiton teeth. Another example is that the potential of superparamagnetic par ticles(SMP) in particular coating to provide the necessary reactive amino groups used in the subse uent modification steps, which is used for antibody or agent of NMR. Though electron scattered amplitude of magnetite reciprocal lattice face diffraction pattern was calculated and sured that lines, such as (111) and (222), was contained, the diffraction pattern lines on electronmicroscopy film seemed Not to contain such lines. Then for the purpose of the surance of those lines, the sample of 10 nm Magnetite particles of magnetic fluids was prepared for the observation of electronmicroscopy and char, factorization.It, made in industry, was put on a specimen grid of copper mesh with collodion.Four samples was prepared under four conditions. At the first, it was (l) in the case of the absence of external magnetic field. The second was that in the case of the existence of applied external static magnetic field which a neodymium magnet produced,(2) parallel to the grid surface and (3) perpendocular to the grid surface. The last was that (4) in the café that the magnetic field met with the grid sur face at 45 degrees angle. As a result of observation through electronmicroscopy, it was found the spot of (222) line diffraction pattern in the case of (2) that missed in the diffraction picture of the first case (1), and the (111) line was clearly exposed on the film. Then, it was characterized $Fe_3 0_4$

2. CALCULATION OF STRUCTURRE FACTOR OF $Fe_3 0_4$

Magnetite cubic crystal basis could be drawn as referee to the cubic cell by Wyckoff -- and Shiratori.et al.(Fig.1)(Main basis was cubic diamond.) As the result of the calculation of the scattering amplitude of electron diffraction, it was sured the existence of those line, (111) and (222), even though they ware very weak.

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3. PREPARATION OF THE SPECIMEN FOR

ELECTRONMICROSCOPY INVESTIGATION

At first, a very thin colodion was prepared on copper grid. Next a pluck of after was put on the colodion from glass micro. pipet, and then ferricoloid was added by thrusting with needle (a little. of ferricoloid on the top of needle, 0.5 mm in length and O. 24 mm in diameter.) The". concentration of ferricolloid became one to 1000 for original ferrifluids. In the three cases mentioned above (2),(3) and(4), an external field was applied among two neodymium magnet (14 mm in diameter and 0.6 mm in height and 700 gauss in magnitude of magnetization). The grid surfaces of samples ware set up parallel and vertical to magnetic field(Fig.2). Three hours later only water were dried in the room atmosphere.

4. 0BSEVATION OF SPECIMEN THROUGH ELECTRONMICROSCOPY

In the case(l) of absence of external field,(lll) line was very weak and (222) line was missed on the film (Fig .2). But another lines were clearly exposed. Lattice constant was 0.8323 nm obtained from Au referred. (At first, camera constant, Lb, the product of camera length, L, and de Bloglie wave length of electron,b, was decided using the' surface distance of Au, d, and radius, r, of diffraction pattern from Lb = dr.) That was very appropriate length compared with authority,' In the case of parallel magnetic field to the grid face, (111) line was weak and spot of (222) line appeared (see the arrow mark in the picture of Fig. 3). Its distance from the center was coincident with the estimated radius. In the case of vertical magnetic field to the grid, (111)line became stronger than that of another case but some of spot(Fig. 4). In the case of the fourth, there was nothing to write down. Another problem was how the arrangement of particles under the external magnetic field compared with Monte-Carlo calculationFig.3 showed that a number of particles in a chain of magnetitenanoparticles were six .on average.. The diameter of particles was 9.8 nm on average.

5. RESULT

Magnetite crystal structure was different from the structure of cubic diamond in the point of disappearance of (331) line and appearance of (222) line in the structure factor calculation. Then (222) line was not appeared on electron microscopy film at random arrangement of particles on the colodion upon the copper grid but arrangement for an orientation along external magnetic field used two pieces of neodymium magnet brought "to the good result, (222) line was appeared.

6. CONCLUS ION

The method of characterization of ferricoloids through electron microscopy was difficult in the preparation of specimen. But it was succeeded in observation of magnetite and could characterized.

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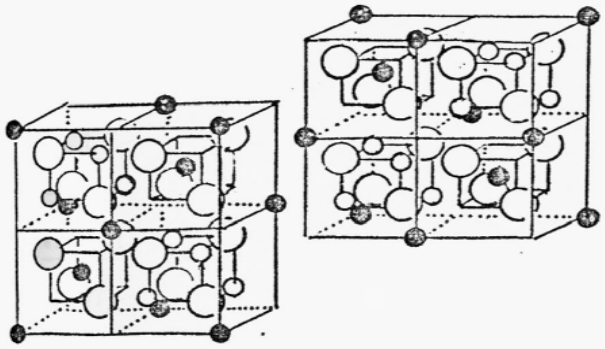


Fig.1 The structure of Fe3O4

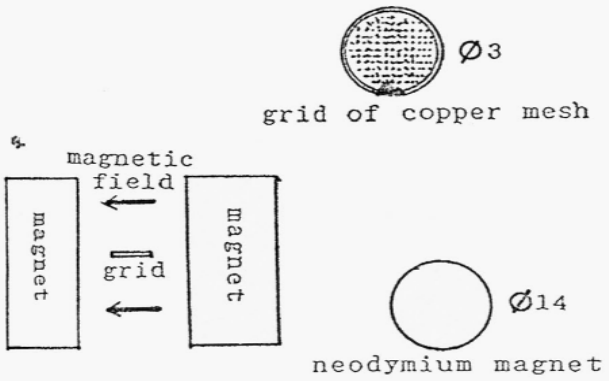


Fig.2 A drop of water on the grid

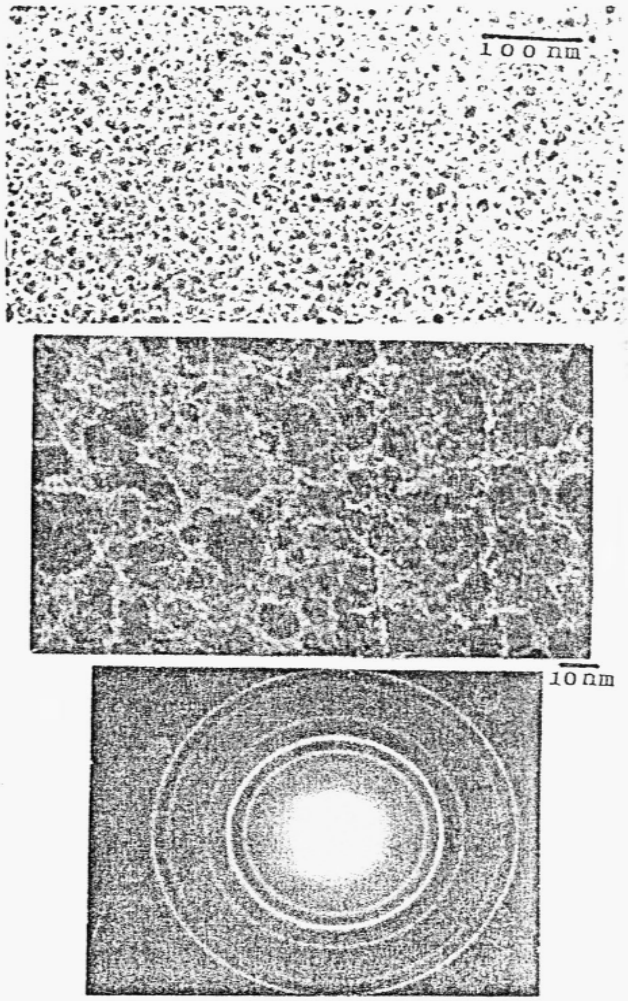
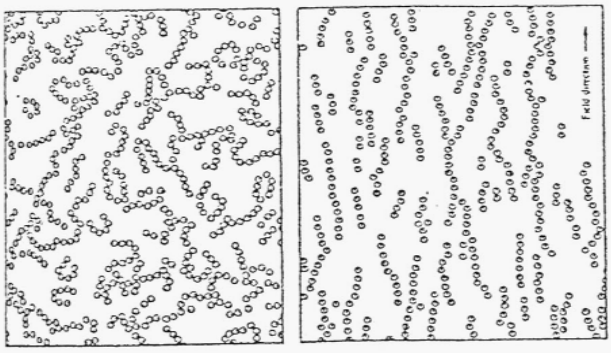


Fig.4 Fe3O4 nanoparticles on collodion



Monte Carlo simulation in two dimensions: (a) clustering in absence of external field; (b) chaining in presence of field. (*After Chantrell et. al. 1982.*)

FIg. 3 Monte-Carlo calculation

FILM 6190 Sample Fe_3O_4 V=150kV Date 95.12.01

NO	Int	x_1	x_2	$\Delta r = x_2 - x_1$	d	a	$x_2 + x_1$	n^2
1	vvw	47.32	52.99	5.67	4.795	8.306	100.31	3.020
2	s	45.59	54.79	9.20	2.955	8.358	100.38	7.952
3	v s	44.79	55.61	10.82	2.513	8.336	100.4	11.00
4	w	43.68	66.68	13.05	2.084	8.334	110.31	16.00
5	v w	42.15	58.15	16.00	1.699	8.325	100.30	24.05
6	w	41.64	58.65	17.01	1.598	8.306	100.29	27.18
7	s	40.92	59.34	18.42	1.476	8.350	100.26	31.88
8	vvw	39.78	60.45	20.67	1.315	8.320	99.73	40.14

Miller indices : h, k, l $n^2 : h^2+k^2+l^2$

x1, x2 : position

Int: Intensity d:distance of lattice plane

a : lattice constant

vvs : very strong vs : very stongr

w : weak vw: very weak vvw : very very weak

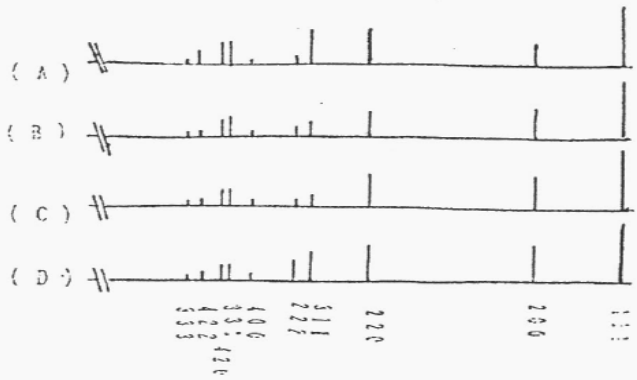


FIg.5 Au pattern lines classified under five degrees
(A) Seveley. 1970 (B) classification
(C) calculation
(D) evapolated gold thin film for reference (300 A)

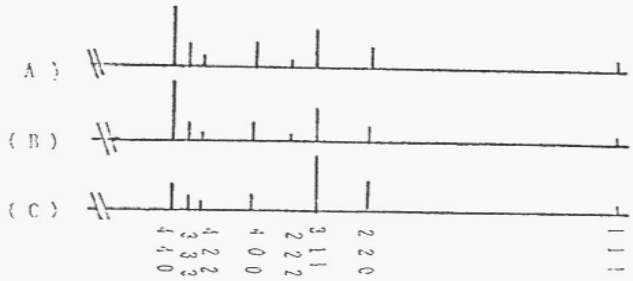
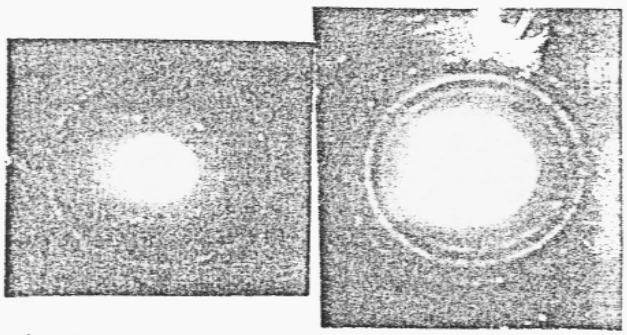


Fig.6 Magnetite
(A) calculation
(B) under five degrees
(C) lines exposed on the film

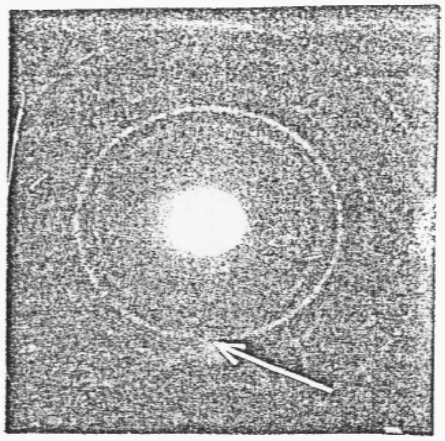


(A) inner lines (B) outer lines

-	n°	*
1	3	3
2	8	7.98
3	11	10.85

* : $(r_i / r_1)^2 \times 3$
(r_i : i-th radius of Debye-Scherer ring)

FIg.7 External magneteic field vertical to grid (111) plane exposured strongly
(222) plane not exposured



	n°	*
1	3	3
2	8	8.0
3	11	11.0
4	12	12.1
5	16	16.0

* : $(r_i / r_1)^2 \times 3$
(r_i : i-th radius of Debye-Scherer r

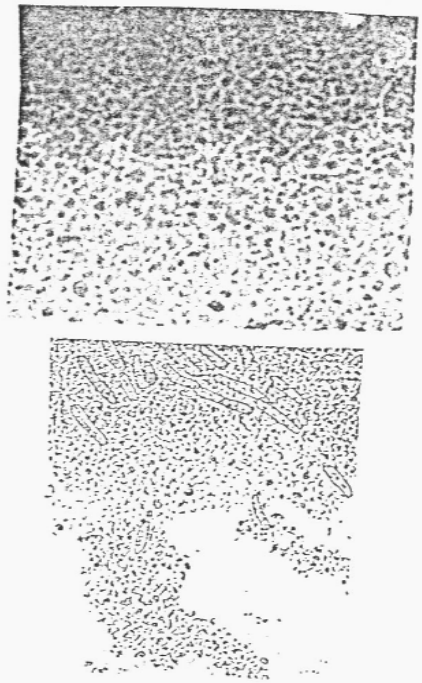


FIg.8
External magnetic field parallel to grid 150kV

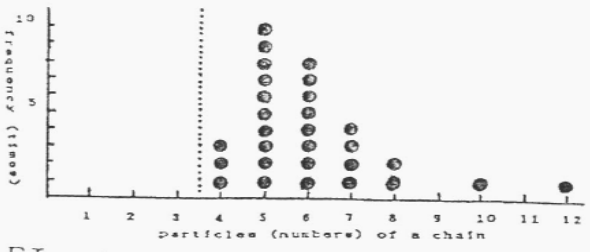


FIg.9 particles number of magnetite nanoparticles in a chain

FORMATION OF A P-N JUNCTION IN TiO_2 UPON VOLTAGE APPLICATION

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Abstract: The formation of a p-n or a p-p + junction in Fe doped $Ti0_2$ upon the application of a bias is studied through computer modeling. The dependence of the type of junction formed, doping level and applied voltage is discussed with reference to experimental results.
Keywords: modeling, mixed conductors.

1. INDRODUCTION

A computer model has been used to study ionic motion in alkalihalide films (Potamianou *et aI.,* 1990), a-quartz (Potamianou *et aI.,* 1995) and yttrium stabilised zirconia (Potamianou and Thoma, 1994), having given results that are in good agreement with experimental ones as reported in the literature.In the present case the model is applied to Fe doped TiO_2 , a material reported as a mixed conductor at elevated temperatures.

2. THE NUMERICAL MODEL

Since both negative and positive charge are present, the one-dimensional steady state governing equations, neglecting recombination of charges and surface effects are written:

$$-\varepsilon_s \ \partial^2\Psi(x)/\partial x^2 = p(x) \quad (1)$$

$$j_p(x) = -q\mu_p P(x) \partial\Psi(x)/\partial x - qDp \partial p(x)/\partial x \quad (2)$$

$$jn(x) = -q\mu_n n(x)) \partial\Psi(x)/\partial x + qDn \partial p(x)/\partial x \quad (3)$$

$$j(x) = j_n(x) + j_p(x) \quad (4)$$

$$\partial j_n(x)/\partial x = 0 \quad (5)$$

$$\partial j_p(X)/\partial x = 0 \quad (6)$$

Where the symbols used and their physical significance are listed in Table 1.

Table 1 List of symbols and their nominalization factors.

Symbol	Physical quantity	Normailsation factor
Ψ	Potential	$V_t=KT/q$
N	Negative charge concentration	N
P	Positive charge concentration	N
ρ	Total charge concentration	N
J_n	Negative current density	$-qD_0N/L_D$
J_P	Positive current density	$-qD_0N/L_D$
J (x)	Total current density	$-qD_0N/L_D$
μ_n	Anion mobility	D_0/V_t
μ_p	Cation mobility	D_0/V_t
ε_s	Permittivity	ε_s
L	Sample thickness	L_D
V	Applied voltage	V_t
X	distance	$Ld=(\varepsilon_s V_t/qN)^{1/2}$
T	Time	L_D^2/D_0
D_n	Antion diffusion coefficient	D_0
D_p	Cation diffusion coefficient	D_0
D_0	Unit of carrier diffusion coefficient	Im^2/s

Equations (1) through (6) are rewritten in a nonnalised fonn with nonnalisation coefficients given in Table 1. The iterative method used to solve the set of nonnalised equations follows well-established finite difference techniques (Smith, 1971; Press *et ai,* 1987) with a second order accuracy in space. A unifonn charge distribution for all charge species and a linear potential drop are considered as initial conditions. Constant applied voltage and zero current at the electrodes are taken as boundary conditions. The penneability of one electrode to O_2 is

Also taken into consideration in the boundary conditions.

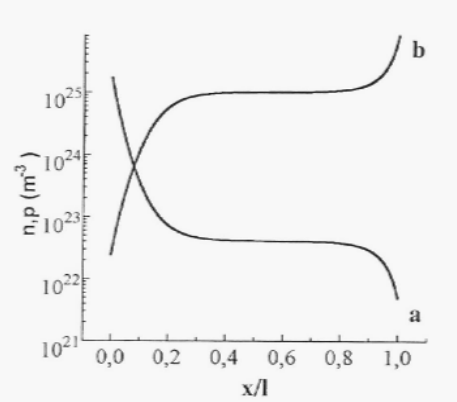

Fig. 1. Distribution of positive and negative charge concentration along the sample after the application of a positive bias. (a: negative charge distribution, b: positive charge distribution).

3. RESULTS AND DISCUSSION

The model is applied to Fe doped retile (TiOz) a type material at elevated temperatures. Rutile is a mixed conductor (Carpentier, *et ai,* 1989) and besides electrons and holes, ionic contribution is also taken into account, since at the temperature under consideration ions are sufficiently mobile. Oxygen vacancies, which are reported as predominant point defects in the undoes TiOz are considered here, as web as Fe3+ ions, which incorporate substitution By for Ti4+ ions into the retile lattice and form acceptor centers. Overall neutrality is taken into account. The sample is sandwiched between two electrodes with one of them blocking and the other kept under a fixed oxygen partial pressure.

The application of a voltage defamed as positive with respect to the porous electrode kept at zero bias results in the formation of a p-n junction and that is, regardless of sample length or concentration numerical values (Figure I).

The depth of the junction formed, though measured from the blocking electrode, is controlled by various parameters.

Concentration values have a strong effect on the junction depth as far as majority carriers are concerned, as shown in Figure 2.

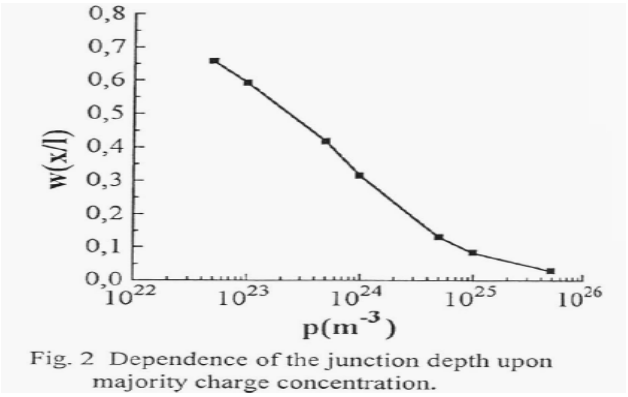

Fig. 2 Dependence of the junction depth upon majority charge concentration.

Fig.2 Dependence of the junction depth upon majority charge concentration

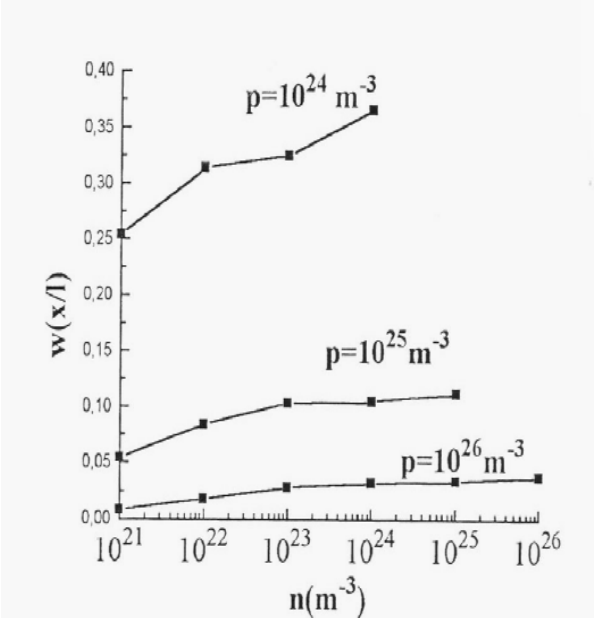

Fig.3 Dependence of the junction depth upon minority charge concentration for various positive charge values

Figure 3 shows the effect of minority carrier concentration on the junction depth for various values of positive charge concentration. The effect of minority carrier concentration as shown inFigure 3 is much weaker than the effect of majority carriers shown in Figure 2.

Also, the junction depth is bias dependent for low applied voltages, becoming practically constant with increasing bias (Figure 4).

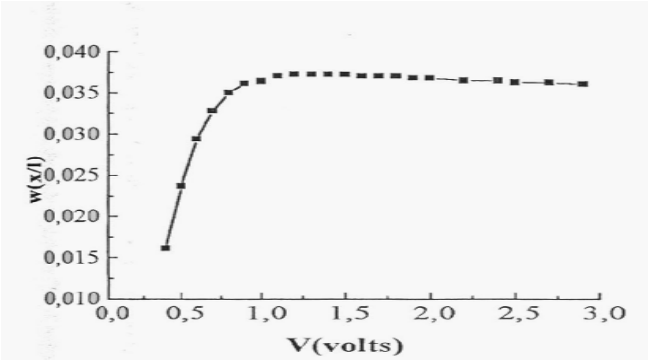

Fig.4 Dependence of the junction depth upon applied bias

In Figure 5 the connation of a p-n junction in a Ti02 sample is shown in comparison to a p- n junction formed in a SrTi02 sample fret the application of positive bias. The different material dielectric constants (Carpentier, *et ai,* 1989; Agasiev, *et ai,* 1991) result also in a difference in the depth of the junction formed.

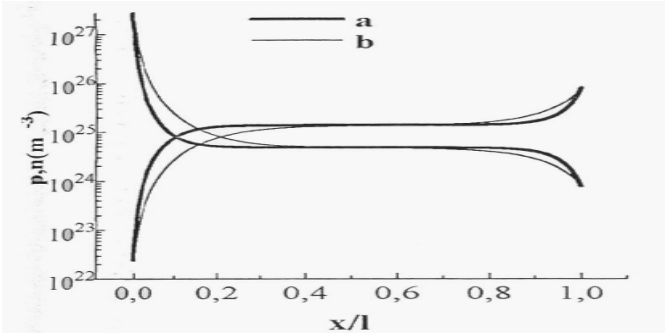

Fig.5 p-n junction formed after the application of a positive bias on (a) TiO_2 sample (b) $SrTiO_2$ sample

Application of a negative bias in respect to the porous electrode leads to the formation either of a p-n junction or a p-p + one, both depending on the sample length and charge concentrations (Figure 6).

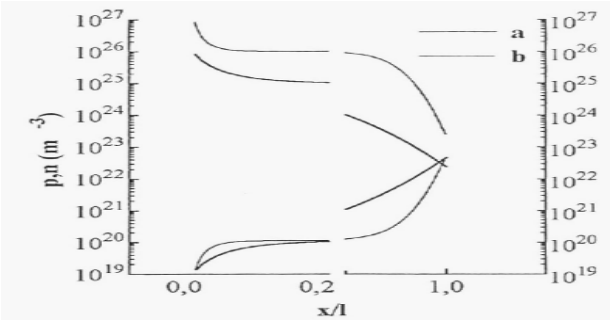

Fig.6 Application of negative bias resulting in the formation of (a) p-n junction ,(b) a p-p+ junction

The above results are in good agreement with experimental results reported (Klingler and Weppner, 1994). Furthermore, the dependence of the junction characteristics upon various parameters is a step towards further understanding conductivity in mixed conductors.

The dependence of current flow through a sample which has been previously polarised, upon polarising conditions is under investigation, which the authors hope will give a fuller understanding of the experimental results as reported by Klingler and Weppner (1994).

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METEOROLOGY IN MEDICINE AND BIOLOGY

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Abstract: Recently there are a lot of experiments looking for connections among weather, electromagnetic environment, agrochemical data and mortality, morbidity and biological and laboratory parameters as well. The environmental effects can be examined separately but they work in a complexity, and they modify the effects of each other. The authors aim was to find hourly biosynoptical code system, which can be used for forecasting and retrospective analysis as well. Recording of the weather events hourly for six years circadian and annual rhythm of them 71was recognizable. It was possible. to demonstrate the relationship between time of meteosynoptical situations and symptoms of some diseases that show typical circadian rhythm.

Keywords: meteorology, weather, circadian rhythm, vegetative system, environment, biotropity

1. INTRODUCTION

There is a strong relationship between the living organism and its environment. This relation is reciprocal. The environmental factors affect to the organism, who have to protect himself. This protection can be realized by active or passive manner. One source of the environmental factors is the atmosphere. Its phenomena are described by meteorology, and its effects on human or other organisms are described by biometeorology.

In the ancient time Hippocrates had studied differences in the influence of the north and south wind on people. Since that time a lot of atmospheric parameters have been studied. In 18th century the connection between the climate and disease expansion, in 19th century the climate therapy came to the front of research. In the 20th century concept of fronts brought breakthrough. More and more studies have been made about correlation between. physiological or pathologica parameters and meteorological processes follow tire developmerrt of physiological sciences in the interest of deeper exposure of inherency.

1.1 Weather sensitivity in the population

Weather sensitivity in the population is 30-60%, it depends on the individuals' age, residence, physical state, illnesses etc. Ordinary women are coldfront sensitive and men are warm front sensitive in Hungary. Elderly people are mostly coldfront sensitive, and women after menopause mostly can get cold front sensitivity (Ormenyi, 1987). Identifying the type of the patient's weather sensitivity is very important, because various sensitivity type people having the same disease require another pharmaceuticals.

Beside of meteorological elements (temperature, wind, relative humidity, precipitation, sunshine) (Jendritzky, 1993), geophysical factors (electric field, electromagnetic radiation, solar flares, geomagnetism) can be more important, and the type of weather sensitivity can be named as geophysical biotype.

A meteorological parameter becomes biological parameter when starts adaptive mechanisms of the living organism. If the patient knows his type of weather sensitivity, getting a forecast he can

Protect himself (with help of pharmaceuticals or avoiding risk factors). The health system can get decisions on population level (preparing hospitals, surgical rooms, staff etc.) in time.

1.2 *Code systems in the biometeorology*

The parameters affect collectively, so it is better to make a complex code system to describe almost all meteorological situations and take into account the seasonal, geographical and individual differences (Bucher, 1993). The authors made a meteorological synoptic code system for the Carpatian basin, which describes all weather situations and takes into account local characteristics and the level of biotropity (mild. moderate, strong).

There are two type of code systems used in biometeorology. One of them is a daily detailed system and suitable for forecasting. But when the exact time of the outbreak of a disease or any biological parameter is well known, it is better to use the method of weather hourly detailed analysis. The authors' hourly system is based on German model (Daubert 1955).

1.3 *Rhythms in biology*

It is well known that every living organism has a rhythmicity which depends on the rhythmicity of the unliving environment (Halberg, 1977; Reinberg, 1974). This rhythm can be daily, monthly, seasonal or yearly. Biorhythms can have exogene and endogene origin. The exogene causes are light, weather, climate, geophysical parameters, etc. The endogene rhythm can be connected to the vegetative nervous system.

In the realization of ~he weather sensitivities the periodic activity of the vegetative system and the onset of the weather fronts is fundamental (Daubert, 1958). The circadian rhythm of the human vegetative system was examined and determined with help of the atmospheric electrical environmental factors, and found relationship between the low pressure weather situations and the vegetative system (Ranscht-Froemsdorff, 1962). If the weather situation (e.g. warm front) incline to force the sympathetic tone of the organism and the vegetative system tends to its sympathetic tone this condition can cause a higher incidence of certain cardiovascular diseases. On the other hand if the weather situation (e.g. cold front) incline to force the parasympathetic tone of the organism and the vegetative system tends to its parasympathetic tone this condition can cause a higher incidence of gastrointestinal diseases (Onnenyi, 1988).

By Help of the code had recorded system weather events in Budapest hourly. The authors tried to find circadian and seasonal rhythm of the meteorological situations since some biological factors showing a circannual or circadian periodicity.

2. MATERIALS AND METHODS

The base of the code system is originated from Daubert (1955) which was adapted to Hungarian conditions. In order to hourly recording the codes describe the period of an ideal cyclone and the phases of fronts. It contains also the upperfronts, stability and the local turbulence respectively.
The system classes the different weather situations among four main categories:

- high pressure weather situations (1-5)
- transitional weather situations (6-8)
- low pressure weather situations (9-26)
- additional weather situations (27-30)

Data recording has happened for six years in hourly details. Data recording had been made by Computer Association Clipper 5.2d DBU, data processing had been made by Microsoft Access 2.0 and statistical analysis had been made by Microsoft Excel 5.0 computer programs.

The controlled data series have been processed and relative frequency distributions of code occurrence and appearance have been examined in different time periods (e.g. hourly, monthly, seasonally). Duration of weather situations has been described as well because biological effect is in connection with the appearance and not with duration of weather situation over 12 hour period.

The six year period was short for examining the rare code situations that is why they have been merged and as uniform front codes has appeared. The fronts and their components have been examined by X^2 -test.

2.1. *Rhythmicity and seasonality*

If the data series is long enough, their distribution is Gaussian and the average and standard deviation of the frequency can be calculated. These values have been determined for summer and winter months and on the base of Student-t distribution a confidence interval has been fitted. As the frequency distribution for six year data series are not too long those codes were looked seasonally different of which confidence intervals had not any overlap.

2.2. *Weather situations and vegetative system*

Circadian periodicity of weather situations and human vegetative system (Ranscht-Froemsdorff, 1962) had been compared by X2 -test. Comparison had been calculated for the whole and different parts of the period. Relation between weathersituations and some diseases which have biologically circadian rhythm had been examined. These biological parameters were mortality, birth, certain respiratory parameters, atopic dermatitis, cardiac infarction, Prinzmetal angina STelevations, cerebral infarction, epilepsy, bacterial and viral infections, ocular pressure, perforation of peptic ulcer, migraine. The biological rhythmicity curves were taken into consideration on the base of Reinberg (1974), Reinberg and Smolenski (1983) and Bucher (1993).

3. RESULTS

3.1. *Seasonality of weather situations*

By help of the code system weather events in Budapest had been recorded hourly for six years. This period was enough to find a circadian and a seasonal rhythm of the meteorological situations.

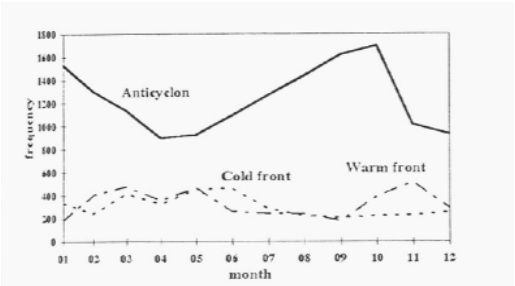

Fig. 1. Yearly occurrence period of anticyclones and fronts

Anticyclone situations are the most frequent in September and October; their number is twice as much as in April and May. Warm fronts are relatively rare in the summer (June-September), and cold fronts are more frequent in spring than in autumn. *But* the seasonality was not significant in complex entirety.

3.2. *Relationship between weather situations and disease*

Some biological factors showing a circannual periodicity had been examined perhaps they can be in relation to meteorological situations. As it is well known, birth number is relatively rare in spring and summer, but more frequent in autumn and winter. It means that conceptions happen in winter and spring and the changeable weather can stimulate it.

The mortality of the upper respiratory infections and diseases of the cardiovasculatory system is maximal in winter and minimal in summer. The winter period is full of warm fronts, humid anticyclones, upper warm fronts, which are very biotrop weather situations.

Asthmatic attacks are very frequent in autumn, because this season has mostly anticyclonal weather, which cause higher concentrations of air pollutants. Another thing is that the pollen concentration is high in summer, but the relatively frequent front activity can lower it.

3.3. *Circadian rhythm of weather situations*

WEATHER TYPE	PEAK HOURS	LOWEST HOURS
Anticyclone,Fair weather	1 a.m.-4 a.m.	9 a.m.-6 p.m.
Down Slide Motion	9 a.m.-11 a..m.	NC
Anticyclone mostly in winter	5 a.m.-8 a.m..	10 a.m.-4 p.m.
Warm advection in the upper level	2 p.m.-6 p.m..	3 a.m.-4 a.m.
Warm front in the upper level	7 a.m.-8 a.m.	9 p.m.-12 mn.
Warm front	10 a.m.-l p.m.	11 p.m.-3 a.m.
Prefrontal part of a cyclone	9 a.m.-12 m.d.	10 p.m.-12 mn.
Warmsecoter	8 p.m.-IO p.m.	7 a.m.-9 a.m.
Center of cyclone	8 p.m.-12 mn.	9 a.m.-l p.m.
Cold front	3 p.m.-8 p.m.	12 mn.-4 a.m.
Lability with cold front	12 md.-l p.m.	NC
Turbulence	11 a.m.-5 p.m.	2 a.m.-8 a.m.
Local thunderstorm	11 a.m.-6 p.m.	NC
South wind	10 a.m.-4 p.m.	8 p.m.-12 mn.

NC = not characteristic

Table 1. Circadian rhythm of weather events in Budapest

Fig. 2. Shows the circadian rhythm of fronts and anticyclone situations. The characteristic intervals of anticyclonesare 11 p.m. - 2 am. and 10-11 am. Warm fronts are relatively frequent in daytime and

Frequency of cold fronts is maximal at 5 p.m. but maximum interval is l-6 p.m. Characteristic time interval of different codes are detailed in Table 1.

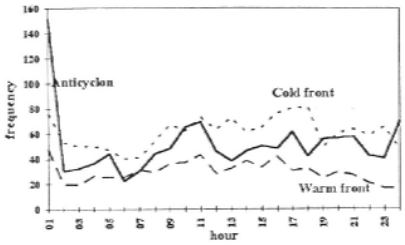

Fig. 2. Circadian appearance period of anti-cyclones and fronts

3.4. Relation of weather and vegetative system regarding the circadian rhythm

Circadian rhythm of the weather events is interesting. In the realization of the weather sensitivity the function of the vegetative system is important, which show an expressed. Rhythm (Ranscht-Froemsdorff 1962). The periodicity of the meteorological processes outside and the vegetative system inside can strengthen the biological effect. For example if the weather cause increased sympathetic tone (such as a warm front) and the organism's tone is sympathetic too, we can find an increase of the cardiovascular diseases. Or in contrary, the parasympathetic predominance and the cold fronts in the same time can cause intestinal diseases. But in these situations we must not forget the individuals type of weather sensitivity.

The human vegetative circadian rhythm is biperiodic, one higher peak in trophotropy at 2 a.m., one lower at 3 p.m., with low points in ergotropy in the same time. The high peaks in ergot ropy are at 9 a.m. and a lower at 6 p.m, with the low points in trophotropy

We can found relationship between vegetative periods and the characteristic periods of weather events. Homogeneity test (chi square test) showed, that down slide motions, warm fronts with ergotrop tone or cold fronts with peak of parasympathetic period respectively can occur simultaneously which situations incline to force the outbreak some diseases.

3.5. Relation between circadian rhythm of weather situation and different diseases

The effect of a warm front can start 4-6 hours before arriving. Mortality, birth, angina attack, brain infarctions with peak at 4-6 a.m. may be in connection with this.

Cardiac infarction happens mostly at 9-10 a.m. coinciding with the maximum of down slide motions, warm fronts and paradox cold fronts. By some authors a second minimum of circadian rhythm of cardiac infarction IS at 9-10 p.rn. When the maximum of cyclone center and warm sector can be observed.

As the hypertonia and cerebral hemorrhage is most frequent at 9-10 p.m. and the second maximum is at 9 a.m. these events can be affected by: atmospheric situations as mentioned above too.'

Dyspnoe is characteristic at 7 a.m. when the upper! warm front and the prefrontal warm front effects,. have a maximum.

Diurnal rhythm of epilepsy depends on sleeping period but it has a characteristic maximum at midday as well. This point is the maximum of all atmospheric situations which follow the rhythm of the diurnal temperature and this is the break point between the warm front and clod front situations.

Perforations of peptic ulcer occur at 4-5 p.m. and a second peak can be observed at noon and 10 p.m. The correlation is well to the maximum point of cold fronts.

4. CONCLUSION

- This code system is suitable for the biometeorological forecast of the weather.
- By rhythmicity examination of the code system it was demonstrated the biological inherency successfully.

In the next time forecasting based on this code system can give more information for the medical health care system.

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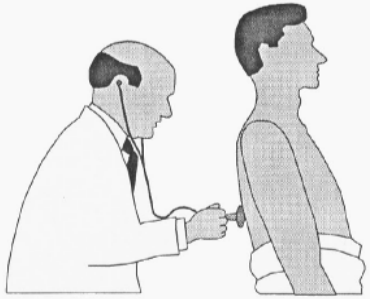
Successful Implementation of Integrated Information Systems

Erdélyi Erzsébet
Andersen Consulting Senior Consultant

New Challenges in Public Sector Organisations

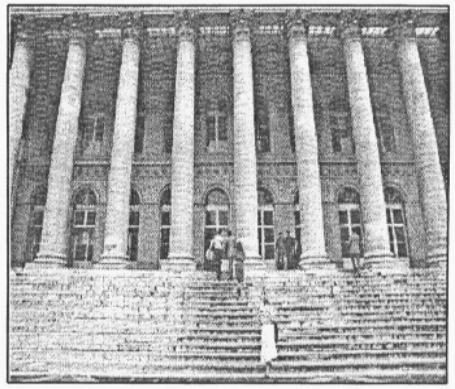
Health Care

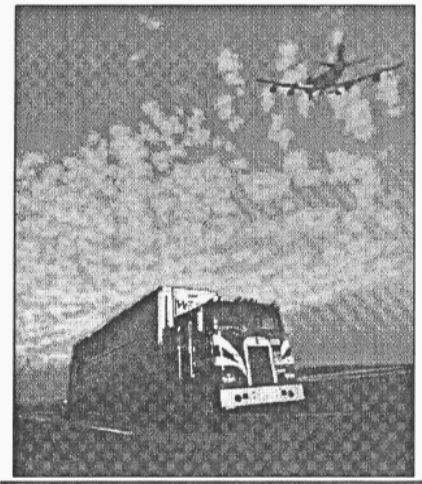


- Introduce patient identification, expert systems
- Increase visibility
- Enhance efficiency of resource deployment
- Introduce controlling and control systems

Government

- Increase customer orientation
- Enhance efficiency of resource deployment
- Introduce controlling and control systems
- Introduce new management culture and delegate responsibilities



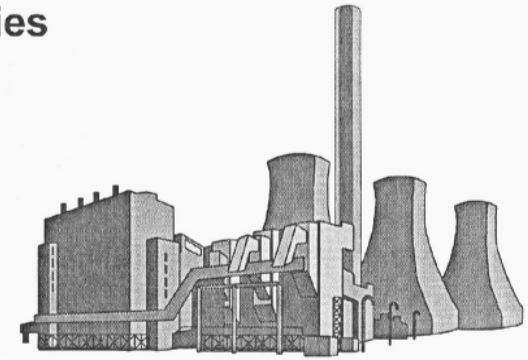


Transportation

- Team profitably with other providers
- Expand products/services to create a future
- Control costs

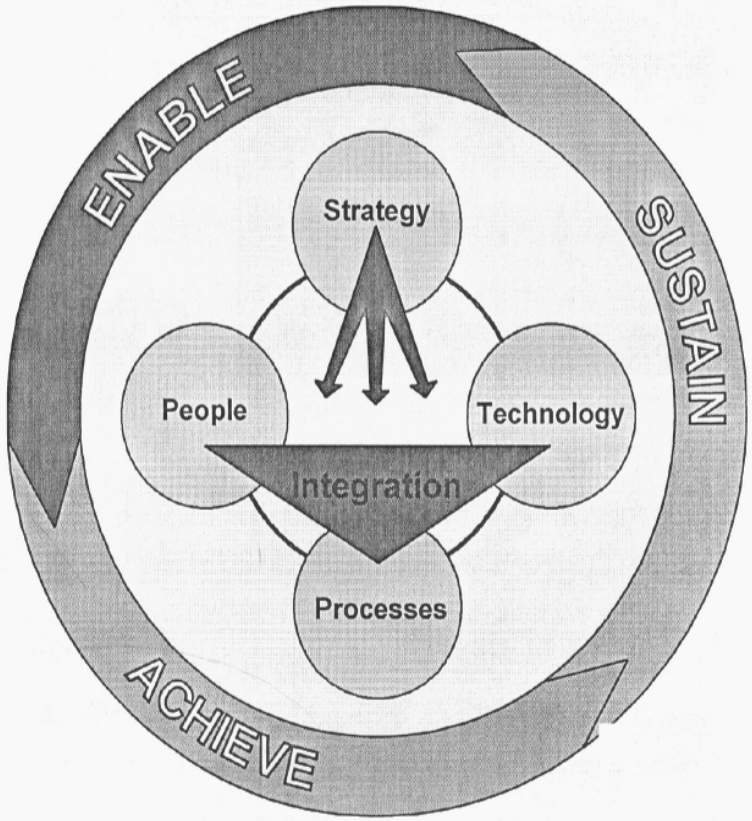
Utilities

- Quick response, decentralising
- Focus on customers
- Regulated pricing

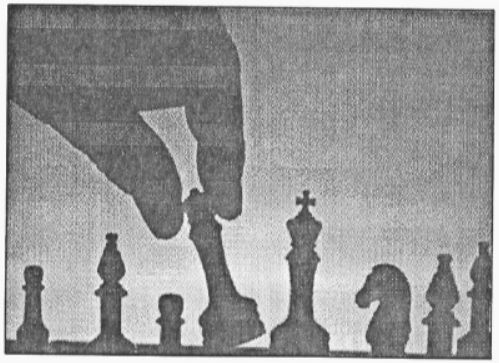


Facing the Challenges: Systems Implementation

Aligning strategy, people, processes, and technology to achieve improved business performance

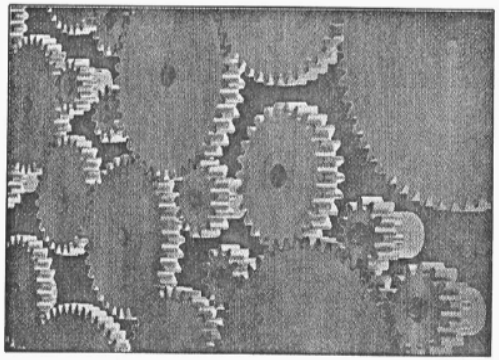


The Business Integration Model

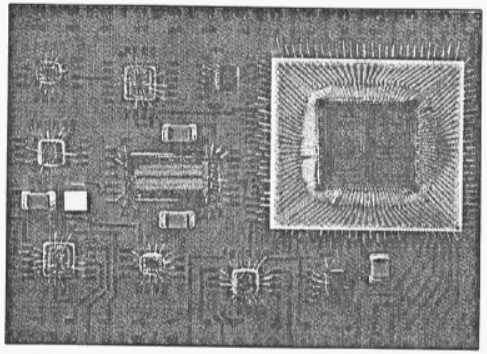


Develop of a customer-orientated strategic vision to optimize long-term success

Develop people and organization



Re-engineer and streamline business processes to optimize resource utilization

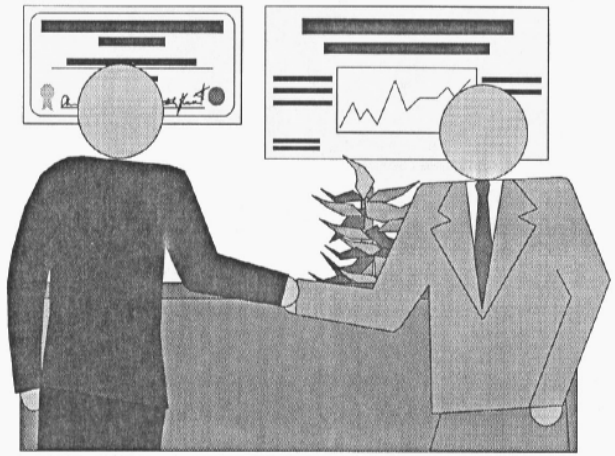


Use appropriate technologies to support processes and people

Turning Vision Into Reality

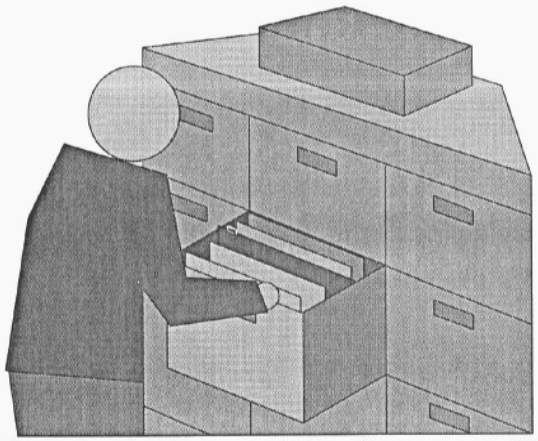
A continuous cycle of planning, monitoring and controlling. A trade-off between costs, schedule, quality and risk.

Program Management is



- A leadership discipline for simplifying the management of change and complexity.
- A deliverable oriented focus based upon sound business principles.
- An integrated business approach that recognizes the interaction of Scope, Quality, Risk, Time and Cost.

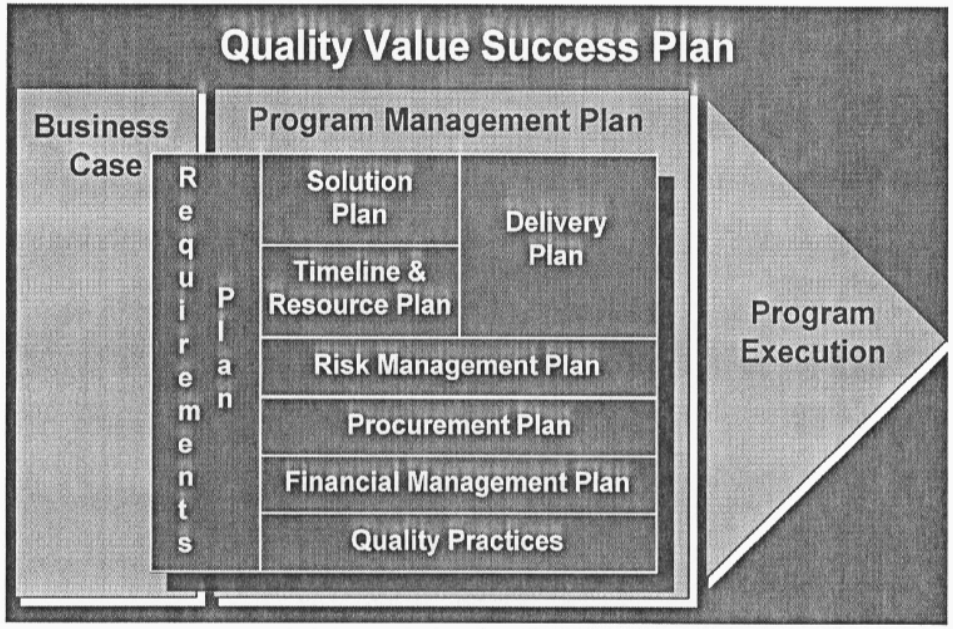
Program Management Is NOT



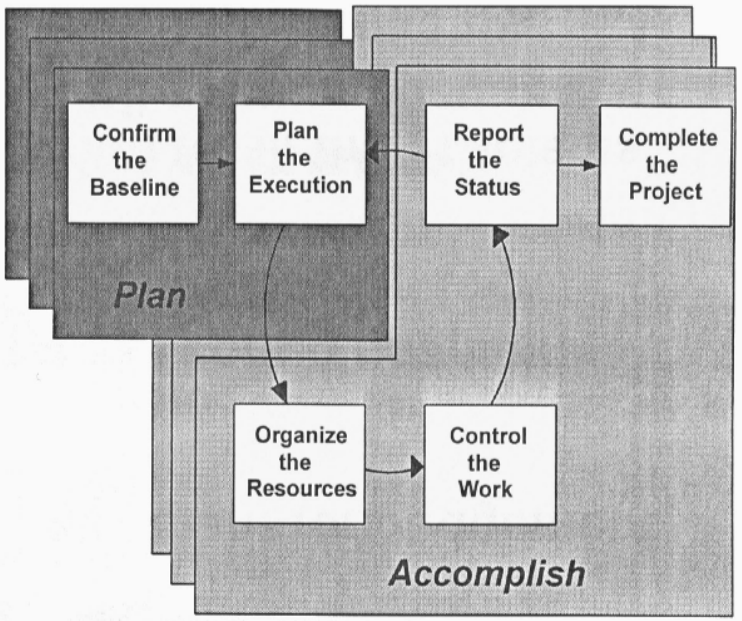
- An Administrative Function
- A Replacement for Judgement
- A Methodology
- A Science
- A Solution to all the Problems

Excellence in Systems Building

Program Management



SI Project Management



Methodology

Methods Updates	System Testing	Estimating
ENACTS		

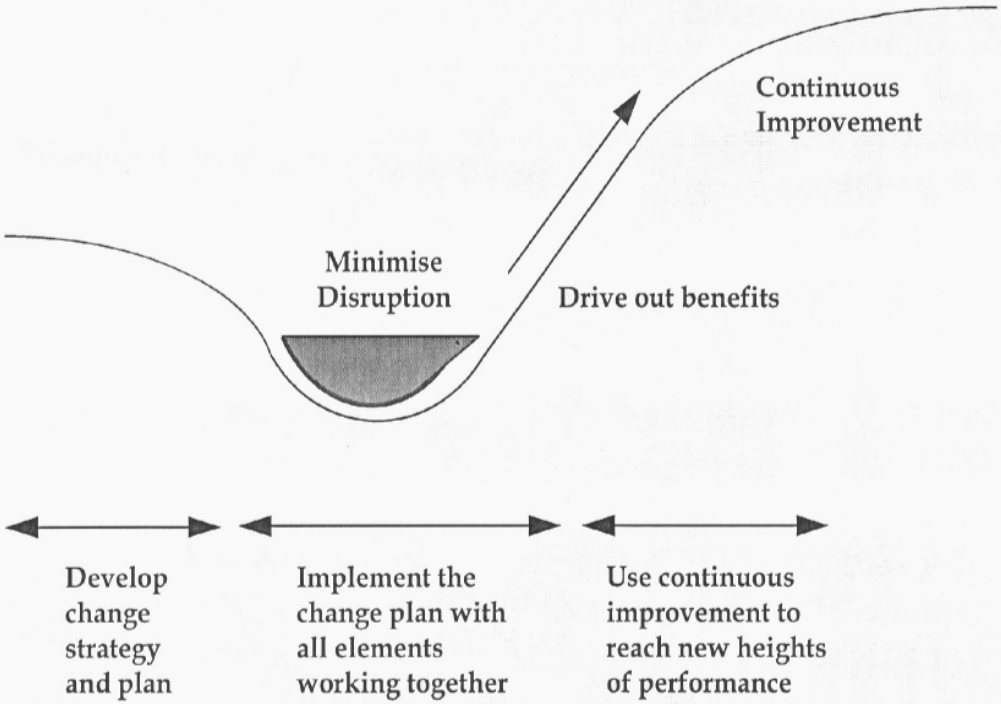
Consider the Management Challenges When

- implementation project lasts over two-three years, roll-out periods of many months
- there is a need for concurrent delivery of multiple systems
- responsibility is required over full system's life cycle, including operations and support
- delivering business benefits rather than just systems
- ownership and risks are shared among multiple parties

Double Challenge for Women

- Systems development and computer technology is traditionally man's world
- Systerms implementation inlcudes not only programming and testing, but impact on people, organisation, processes
- To achieve success, the project needs managing user expectations
- Success depend highly on user satisfaction, many endusers are involved

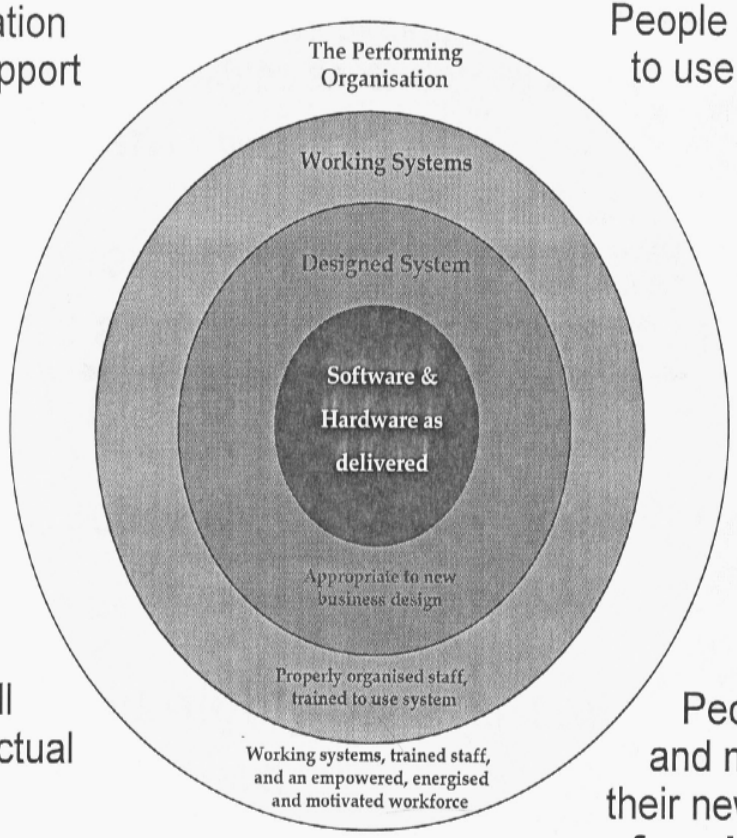
The Change Curve: The Human Reaction to Change



No systems implementation work can be successful without managing the Change Curve: Minimising the disruption and drive out the benefits of change as soon as possible.

The End Result: A Performing Organisation

Hardware and communication should be well sized to support the data handling and communication needs

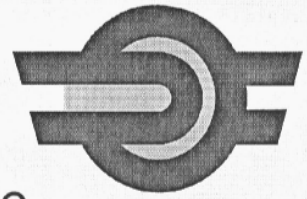


People should be trained to use the system effectively.

The system should be well designed to support the actual business operations.

People should be empowered and motivated to carry out their new roles within the **performing organisation.**

Let's talk about examples...



MÁV Rt.

Project: Development of a nationwide Transportation Management Information System

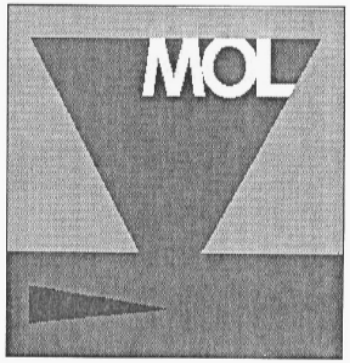
Activities:

- Analysis of the business processes and their information needs
- Systems design
- System's implementation
- Roll-out planning
- Training program development for more than 7000 users

Unique features:

- Client-server architecture, 24 hour system availability
- Multinational team size peak: 100
- World Bank funded, AC acted as general contractor with Tandem, Siemens, Netweave

Projects: Package Systems Implementation for Financial and Managerial Accounting, High-spot review of the organization's main business functions



Activities:

- Implementation of the SAP General Ledger, Accounts Payable Accounts Receivable, Cash Management, Management Accounting and Sales modules
- Development of strategic, change and process re-engineering project initiatives

Unique features:

- English - Hungarian team
- Business integration project covering strategies, process, technology, people

COMPUTER-ASSISTED DECISION SUPPORT SYSTEMS FOR MEDICAL APPLICATIONS

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ABSTRACT: The application of case-base reasoning and neural network techniques to medical databases can be powerful techniques to aid physicians in making decisions about the management of their patients, in various types of medical units. Case-based reasoning allows to match cases (patients) using a predetermined hierarchical structure, a single patient parameter (text or numeric), to similar parameters contained in a clinical patient database. The output produces a group or patients which can be selected by matching exactly on certain characteristics or they may be matched "as closely as possible" using a gradient of patient properties. Neural network analysis is a pattern recognition technique which uses a training set of patient data (text or numeric) to seek mathematical relationships between various subsets of patient parameters. The discovered relationships learned from the training set are then applied to estimate desired outcomes. In this application to the ICU, the outcomes selected were mortality, length of stay, and hours of ventilation.

KEYWORDS: Medical infoIl11atics, case-based reasoned, artificial neural networks.

1. INTRODUCTION

The quick tempo of illness in critically ill patients has spawned numerous testing (monitoring) technologies, which arc evolving rapidly (Gardner, 1990: Zaloga, 1990) and generate large volumes of information however. These monitors and hospital information systems are often unconnected, and generate many separate outputs. Recent literature discusses the usefulness and drawbacks of neural networks and expert system as a means of collating this information to aid in clinical decision making (Chemo, 1990: Misiano, 1990). thus need, coupled with the limitations of current severity of disease classification systems, such as the APACHE (Knars et al., 1986), TISS, SEPTIC INDEX etc., attests to the importance of developing an integrated approach to process this amount of infoll11ation. Most neural network and expert system developments in medicine, as decision- aid tools, have narrow applications.

The case based reasoning and neural network techniques developed by the Medical IDEAS Research Group are using various medical databases with a view to generalise the theory so that the techniques can have wide applications in the future. These techniques are currently being assessed with regards to their specificity, sensitivity and predictive values, involving a comparison of real clinical data, and data outputs from the measurementsystem developed.

2. METHODOLOGY

The research approach selected was to respect closely the manner in which physicians and nurses work in the patients units of interest. When a patient seeks medical attention, the physician interacts with the patient through the constructs or the medical model. An ancient ethical and intellectual code for the physician and provides structured interview and examination techniques directed toward establishing a diagnosis and a management plan.

The diagnosis is usually stated as a pathophysiologic condition. Until a definitive diagnosis is established, often overlaying multiple chronic the physician deals with *a* working diagnosis. Implicit in this approach arc the concepts of a diacritical diagnosis, investigative plan and treatment plan. The differential diagnosis consists of a list of other likely pathologic entities which " may explain the patient's condition. The investigative plan deals with the uncertainty in the differential diagnosis and invokes testing strategies to "rule out" or "rule in" the conditions suspected in the differential diagnosis. With the treatment plan, the patient's need for comfort is attended and an attempt is made, using surgery and/or medications, to return the pathologic state *to* the nom1al physiologic state. The modem interaction between the physician and the patient is often supplemented, especially in hospital practice, by testing systems (e.g. body l1uid analysis, imaging, electrical signal analysis). Testing systems arc used to reduce the level of w1eertainty during the process of establishing the diagnosis and to monitor the emotiveness of the medical interventions (therapy).

A large medical database of over 2000 intensive care patients; containing 98 fields of clinical and administrative information on patients admitted to the ICU at Dr. Everett Chalmers Hospital since 1988 was collected prospectively, with some retrospective chart review. In the current system, up to seven medical diagnoses and multiple procedures can be recorded, with auxiliary space for free-from comments. Significant events in the ICU course *of* the patient and complications that occur can also be noted. Current developments include a new screen Jar parameters enameling coronary article)' and valve surgery patients. Another project consists in extending the case-based reasoning technique to a temporal study of rheumatoid arthritis patients (Gaskin & McKinnon, 1995).

The ICU database was integrated into the 'smart' system simulation and an early version of the case-based reasoned used ART-1M software (Automated Reasoning Tool ft)r Information Management as the matching engine. The case-based reasoned used a modified Rete match algorithm to develop a match score based on string, word, character, or number matching. This alg01ithm is faster than conventional matching algorithms and allows (partial) matches or mismatches to he done on a string of characters, or on similar words in a string of words. Character matching uses trig rams to accommodate misspelled words. Number matching allows for the match eight to be scaled prop0l1ionatcJy based on a triangular function of the pm1icular patient tiled. Each of these methods *of* matching and the match \\eights associated with them were selected in direct consultation with physicians *to* set the default values. The extant system allows physicians to 'fine tune' any *of* the matching field weights to a patient's specific characteristics or to desired weight scaling (Frize et al.:Taylor et.a!., 1993). This flexibility is important, since The same procedures peI1lnmed on individual patients may have varying degrees of significance. As more information is known on the index patient case and entered into the program, the matched cases also change. When a patient has been discharged from the unit, the patient history' is automatically added to the patient database. This allows the accuracy and quality of the data to improve with time and with use. The new prototype, IDEAS for ICUs (Intelligent Decision Aid System for Intensive Care Units) blends the rule-based ability along with the knowledge *of* medical experts on the team ill1d issues warming depending on the outcome *of* the matched cases.

Case-based reasoning is based on a weighted relationship of parameters developed in conjunction with physicians. It compares the ten closest matching cases to the current patient case. A thrice week clinical trial was done with the case-based reasoner in the Chalmers Hospital intensive care unit. More comprehensive trials are being planned for the systems in Winnipeg, Saskatoon and Fredericton in the I 996. In addition to using this technique with ICU patients, a new research endeavour is now applying this technique (with appropriate variations) to a longitudinal database of rheumatoid ill1hlitis patients. The objective is to develop a technique for assessment *of* various patient outcomes.

Another aspect of the project was to assess the applicability and usefulness of various patella classification techniques to process critical care infom1ation. During the initial development, the feed" forward back propagation artificial neural network (ANN) was chosen because of its case of implementation and past success on vinous classification tasks (Buskard et aI., 1994: Frize et aI., 1995). The performance of a neural network is affected by its architecture (the number of layers, the number of hidden units, etc.). Experimentation with various architectures led to the selection *of* a hack propagation feed-forward ANN. The weight's of the network were adjusted in such a way as to minimize the mean-squared error at the output *of* the network. Given a sufficiently large training set, a sufficiently large neural net should implement the optimal Bayesian classifier and error rate. In practice, the neural network error rate is usually higher than the Bayesian error rate due to the fact that the training seaside and network size arc limited and that the training algOlithl11 may find a local minimum, instead of a global minimum.

This technique. was used to estimate length of stay in the ICU and Intermediate Care areas, the duration of artificial ventilation requirements and estimation of mortality. A number f the input variables consist of the physiologies compounds of the APACHE scoring system, in addition to other variables such as sex and the unit from which the patient was trans felted (admission

Source). The output predicting the various outcomes was compared to true patient data from the large database collected. Approximately two-thirds of the patient files from the large ICU database were used as a training set and the remainder as a test set to evaluate the performance of the classifier. A new ANN is currently under development using a coronary-artery bypass and valve surgery patient's database. Outcomes, in this case, are similar. to the ICU study, but other parameters will be added in the Future (McGowan, 1996).

3. DISCUSSION AND RESULTS

The case-based and neural network systems collate a large amount of clinical information and presents it in simplified formats". Clinicians may thus use the system to find the group of the closest matching cases to their current patient case. This approach is similar to that used by physicians when they are thinking" I have seen a patient like tins" and provides instant recollection of past Cases that may be relevant to present case. In an intensive care unit (lCU) setting, for example, aspects of the history of the selected group may then be displayed graphically in terms of outcomes, such as mortality, length of stay hours of artificial ventilation, procedure utilized and complications encountered. a graphical user interface has been developed using Visual Basic in the MS- Windows environment. The interface is user-friendly' and the medical staff on the research team have participated in evil)' step of the development of its coil figuration.

Preliminary work with the neural network has already achieved an improvement in the accuracy of predicting morality and length of stay. It has also produced the first results in estimating the duration of artificial ventilation (Frize et al, 1995). Clinical trials will assess the effectiveness and usefulness of both] systems and whether they have an impact on length of stay, mortality and hours cry illation, in a population similar to that Found in the databases.

4. CONCLUSION

This research is meant to enhance the conventional medical model used by physicians for patient management in an Intensive Care enviroml1cnt. It uses previous patient experience recorded in a large clinical database with new patients and generates outputs, which may be helpful for physicians in their decision-making. This approach may be applicable to other patient care environments and current efforts are focused in generalizing the tools and theory for wider applications in the future.

5. REFERENCES

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ENERGY -- NOW AND FOR THE NEXT CENTURY

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We are all on this planet together in an ever-expanding economy. The accumulation of centuries of scientific discovery and engineering skills are yielding unprecedented opportunities.

I will discuss a few of the developments that are in use and some fantastic projections for the future. These projections are not just science fiction but are predicted by renowned specialists.

New technology is applicable tc many facets of life; such as, transportation, food production, city planning and zoning, medicine, architecture, and the exploding world of entertainment.

Fred and Wilma Flintstone in the dinosaur age probably used wood from trees and shrubs for heating and for cooking.

Available for us today are solar energy, wind energy, thermal power, electricity, coal, peat, petroleum products, gas, oil, and various types of applications for energy needs as well as wood products.

Extensive deforest ration is a severe threat to the environment.

Solar energy includes both active and passive applications . . Appropriate design user the heat. From the sun for shade and for: heat absorption. Parabolic mirror reflectors to capture and to transmit heat energy, photovoltaic devices to convert the sun's heat to an electric current, and solar water heaters are in use. There are even solar cooking ovens on the market.

Bio-energy utilizing manure and plant residue is a dynamic world industry.

Energy storage and distribution is of course required. Thanks to adequate power distribution we can turn on the light switch or plug in the computer or the television.

Improved batteries assist us also.

New Methods of power production and energy storage are being planned and used on a, large scale.

With high-temperature, superconductivity, vast quantities of electric power can be stored efficiently for use as needed.

New materials facilitate many of these developments; their applications have increased exponentially.

The study of electro-magnetic field theory is improving motor efficiency and also may make possible microscopic motors.

With improved motors, electronic devices, and improved design of airplanes, transportation is being transformed.

The suggested convergence of cable television, telephones, computer access, facsimile machines, and radio into multiuse functions is

Being juggled by both the engineering world and the financial giants.

Inherent problems include civil rights, the standard of living, and the environment. How can peoples and governments respond to these challenges and opportunities?

The ability to apply these scientific achievements requires technical skill, management, finances, and government.

Perhaps as members of a fortunate scientific society we can contribute to the well-being of the world for the next century and beyond.

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Rapid change is occurring with de-centralized modular power sources. There are improved ways of transforming energy now and for the future. The results influence many areas of life; transportation, communication, food production, and medicine. Factories, businesses, and residences benefit.

On-site power can be produced using solar power, biomass, natural gas, hydrogen, methane from garbage, oil, coal, wind power, geothermal energy, and electricity from generators. New materials make some of this possible.

The design of cities, towns, and villages can evolve because of this energy distribution.

Cost-effective solar power brings electricity to remote areas. Large solar collectors transform the power of the sun to electricity using solar voltaic cells, solar film, and solar reflectors. The storage (perhaps underground) of this electricity using electro-magnetic superconductivity can store large amounts of electricity with almost no loss.

Wind energy can deliver clean economical electricity using a turbine. Wind turbines with advanced rotor systems are used with high wind speeds and aerodynamic controls. This must be integrated with a grid system or use battery storage.

Extensive efforts are improving batteries. Batteries from minute size to large size are an important source for storage of power.

Natural gas is sometimes called a wonder fuel. Natural gas is relatively clean, easy to transport and use, and has low levels of contaminates. As a gas turbine it is an electric generator. Better turbines with new blades and metals and high compression improve efficiency. Jet engines spin the turbines with pressurized fuel. Natural gas is used in automobiles, trucks, locomotives, and buses. Fuel cells efficiently convert natural gas to electricity

Methane produced from garbage solves garbage disposal problems and produces useable fuel.

Biomass energy uses the oldest form of energy, that is, plant sources. Living plants use photosynthesis to turn the energy of sunlight into carbohydrates. These carbohydrates are absorbed by animals and the manure can also be used to produce fuels. Both crop and forest residue and new energy crops are potential energy sources. These are renewable vegetable products. Ethanol is produced from starch from corn and grain; a by-product is animal feed.

Carbon free energy sources include hydro-power with large and small dams, and also using energy from I the tides.

Thermal power uses natural heat in rock formations deep in the earth. *A* well is drilled to the depth to reach hot dry rock. Water pumped into the well. becomes superheated. This pressurized hot water is brought to the surface so that the heat may be removed for use above ground.

Studies of nuclear waste are in progress that show possibilities of reusing and recycling nuclear waste rather than entombing the waste as a contaminate for endless time.

Transition to hydrogen power for a century. Hydrogen fusion is being studied. The fuel cell produces electricity directly from the fuel. Hydrogen when bonded with other items can be extracted. Water, H_2O, is abundant and perhaps seawater may be used with electrolysis. Hydrogen can be stored and also transferred with a distribution system. A hydrogen fuel-cell engine is in Use.

Magneto hydrodynamics suggest both more efficient motors and also miniaturization of motors. Electromagnetic field theory has achieved these possibilities.

CONCLUSION

"Environmental injustices with ecological damage and unfair benefits affect individuals, Communities, and countries. Displacement of peoples by construction projects and the dumping of hazardous waste threaten many areas. Sometimes there is the pollution of water and the poisoning of crop land. The destruction of the rain forests causes flooding and soil erosion, severe damage for the inhabitants, and contributes to global warming.

Peoples need to be empowered to defend their health and their environment." (Paraphrase: Sachs, A.)

The emergence of the new technologies offers possible solutions to many of these controversies.

The global effects resulting from new discoveries can greatly improve life for all peoples. Pollution of air, water, and food sources; global warming, and deforestation may perhaps be combated using improved technical methods.

The world needs to simultaneously consider human rights and improve the standard of living and the quality of life.

The future well being of all societies depends upon engineers and scientists as well as governments and corporations using advancements wisely for the benefit of everyone on this rapidly spinning globe.

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DIRECT CONVERSION OF SOLAR ENERGY INTO ELECTRIC POWE R

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Abstract: Among potential new sources, solar energy is extremely promising. A solar cell is a photovoltaic device that generates electric current or voltage simply when light is incident on it. Theory of photovoltaic effect predicts the characteristics of semiconductor, which would operate with optimum efficiency. Researches are going on for the use of different materials and also for better fabrication technology. The use of amorphous silicon by incorporating hydrogen, thin film solar cells, photoelectron chemical (PEC) cells and multifunction-stacked photovoltaic devices are the attempts made to increase the efficiency and reduce the cost of solar cell modules.

Keywords: Solar cell, photovoltaic effect, semiconductor p-n junction, thin film, PEC cell, multifunction.

1. INTRODUCTION

It has become apparent in past few decades that conventional energy sources are finite and are in danger of depletion, to various degrees. Renewable resources of energy will have to playa major role in future. Among new energy sources, solar energy is extremely promising. In recent years a large number of efforts have been made to utilize solar energy by various methods

An important way of utilization of solar energy is its direct conversion into electrical energy by means of photovoltaic effect. (Pulaski and Gurevich 1986). The Photovoltaic effect is generation of voltage by absorption of light. A wide variety of substances, specially semiconductors have the capacity of generating electric power at a level sufficiently good for practical applications, (Moller 1991).

2. AVAILABILITY OF SOLAR ENERGY

A vast amount of solar radiations is intercepted by earth, but this energy is diffused and at a particular location on the earth surface, the energy is received intermittently. The distribution of solar energy varies generally with Latitude. The solar energy input rate at a particular place depends upon the season of the year, the time of the day and the condition of sky. Considerable difference is observed between the winter and summer solar radiation values. Fig.1 illustrates the variation in solar radiation with the time of the day and the time of the year at latitude 43 °North for a clear day. (Sorensen, 1983). The spectral distribution of the radiation emitted from the sun follows approximately the radiation

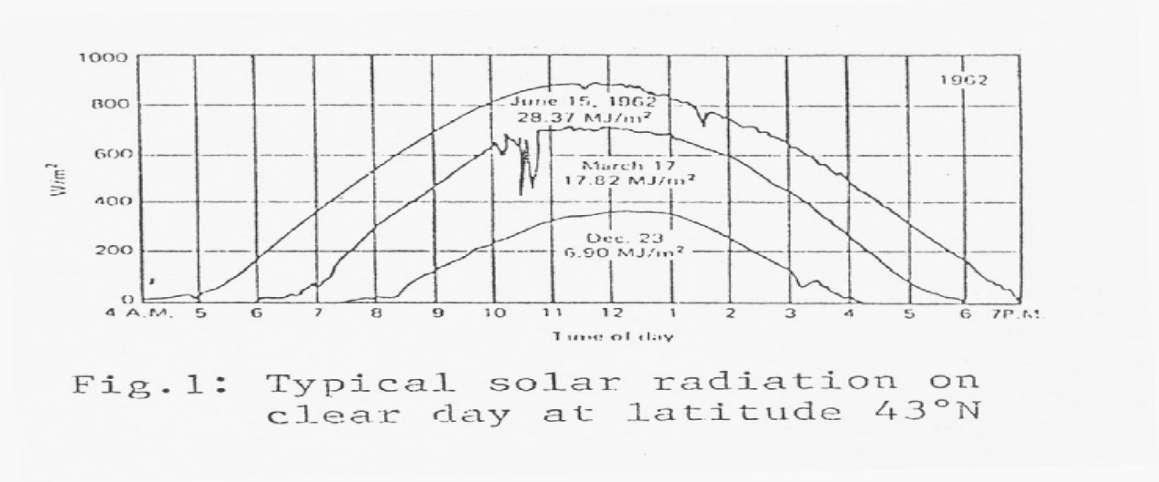


Fig.1: Typical solar radiation on clear day at latitude 43°N

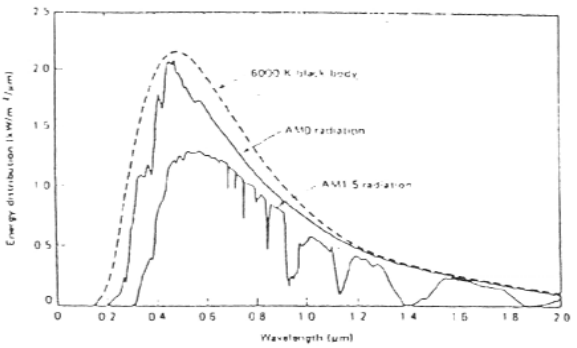


Fig. 2:Spectral distribution of sunlight

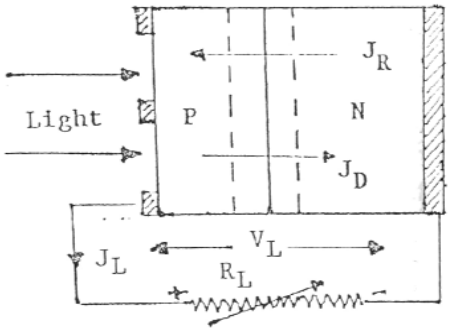


Fig.3 : Circuit diagram of solar cell.

Distribution of a black body at 60000K as can be seen from fig.2.(Moller 1991). The total energy per unit area integrated over the entire spectrum and measured outside the atmosphere perpendicular to the direction of the sunrays is essentially constant. This radiation power is referred to as the solar constant or air mass zero (AMO) radiation. Measurements taken at high attitudes have yield the current1Y accepted average value of 1.35 KW/M^2. The spectral distribution is changed considerably when the sunlight penetrates through the earth's atmosphere. Even for a clear sky the light intensity is attenuated. by at least30%becauseof scattering and absorption. The attenuation mechanisms are wavelength dependent which explains the strong absorption bands in the spectral distribution measured at the earth's surface (Fig.2) The measurement of radiant power (per unit area) is further complicated by the fact that the degree of attenuation is highly variable because of the constantly changing position of the sun and the corresponding change in the light path through the atmosphere. When sun is directly over head the corresponding radiation are called air mass one (MU) radiation. For any given angle 0) with respect to the overhead position the air mass bout takes the value AMm, in which the air mass number m=l/Cos θ). The AMI spectrum has an incident power of a 925 Kw/M^2 . The spectrum has contributions from direct and diffused (or scattered) sunlight.

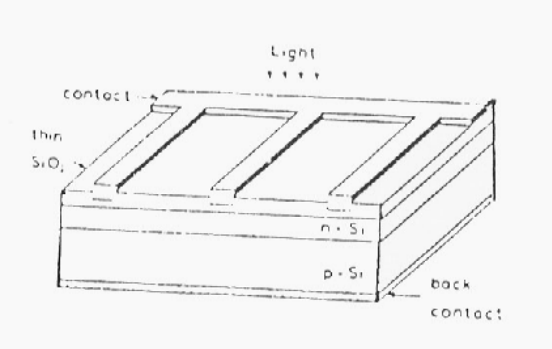
An optimized photovoltaic system has to utilize solar cells, which readjusted to the average spectral distribution of the local sunlight.

3. SOLAR CELL

Solar cell is a device, which converts light energy into electrical energy by photovoltaic effect. These can indeed supply energy to systems with power levels varying from milliwatt to megawatts. (Kotnala and Singh1986). They are also reliable, completely static and maintenance free. A photovoltaic cell is a device that generates positive and negative charges by the absorption of light, allow the transport of those charges (generally by diffusion) to a near by discontinuity in the structure oregano where a potential barrier exists, and the positive and negative charges are separated by the action of electric field, and also provide a means for collecting the separated charges and conducting them to an external circuit. Fi3.3 illustrates the essentials of photovoltaic cell. The most common charge separation mechanism is the potential barrier associated with p-n junction, hetero junction or schottky barrier.

Presently a p-n junction silicon solar cell is the most widely used and serves as a reference device for .all solar cells. It was first developed by Chaplin, Fuller and Pearson in 1954. For satellites and space vehicle flat-plate silicon solar cells are most important long duration power supply.

The typical n + on p -silicon solar cell is manufactured from boron doped p-type single crystal silicon having resistively of 10JLCm. (Size



1983). The illuminated surface of cell contains a shallow diffused 0.3 }lm deep n'-type layer doped ,vi th phosphorus. Electrical contact to cell is. Accomplished by an avaporated and solder dipped Ti/Ag contact. The front ohmic contact is in form of strip and fingers and back ohmic contact covers the entire back surface. (Fig.4) The exposed surface is coated with antireflection coating composed of SiO2 layer. The standard cell has a thickness of .3 00 μm

Fig 4: Solar cell structure.

A p-n junction has depletion region with a potential barrier caused by immobile '. ionized impurities. This potential barrier opposes the flow of majority charge carrier across the junction. When the junction is exposed to radiation of energy hV"7Eg, electron-hole pairs are generated through out the semi- conductor i. e.p-type, n-type and depletion region. The minority carriers generated in depletion region near the junction cross over the junction by diffusion. These charge carriers flow through the external resistance R L and cause potential drop across s it.\Which makes the junction forward biased and results in the flow of current in the direction oppositeto the current (J) due to radiation. The net current density in an ideal Shockley:-n junction solar cell is given by

$$J_L = J_R - J_D$$

Or

$$J_L = J_R - J_o \ (\exp qV_L/KT\text{-}l)$$

Where J1 is load current density
J_R ia photocurrent density
V_L is potential drop across load

The photocurrent density J_R is the Current due to minority ty carriers generated near the junction up to distances equal to diffusion lengths. The number of minority carriers produced within the diffusion length region L_n&Lp in p&n type semi-conductors is

$$\alpha I\ B\ (Ln+Lp)$$

Where α is absorption coefficient, I is 1tensi ty of li8ht and B is quantum yield.

If all these minority carriers cross the junction giving rise to photocurrent then

$$J_R = \alpha\ I\ Bq\ (Ln+Lp)$$

When he cell is exposed to solar radiation photons of energy less than the band gap make no contribution to cell out put.

A photon with energy greater than Eg contributes an energy Eg to the cell output and the excess energy over Eg is wasted as heat.

A standard silicon solar cell exhibits a conversion efficiency of 10. 5% under AMO (air mass zero) illumination i.e. for solar light out side the atmosphere with a light Intensity 1. 3 KW/ m^2 . An individual silicon cell with an area of 2 cm can only have 0.5 to 0.6 V of open circuit voltage and about 30 to 60 mAof short circuit current. To obtain higher power than is provided by a single cell, (Kotnala and Singh 1986) solar cells are connected in series or in parallel according to requirement of the system. Solar cell modules are made by mounting the. Solar cells on a base board and soldered. This is encapsulating with a cover of high optical transmission. The photovoltaic modules are fixed on certain support structure exposed to the sunlight. This support structure fixed with photovoltaic panels or modules is known as photovoltaic array.

The power generating capability of the solar cell can be enhanced by concentration of the incident solar radiation. A focusing type collector is employed to intercept and reflect the solar radiation to the surface of the solar cells.(Sorenson 1983). The energy input

Per unit area of cell surface is increased and consequently there is increase in the power out put. Tile increased energy input to solar cells tends to raise the cell operating temperature. In order to avoid deterioration of the cell structure the energy, absorbing component t must be cooled, typically by a circulating fluid. The heat removed in this manner can be utilized in various kinds of processes thus improving the performance of the energy conversion system. An example of a typical array when exposed at 60^0 C can deliver about 10 W at 11.5% efficiency under AM 1 condition.

4. MATERIALS FOR SOLAR CELLS

Solar cells convert radiant solar energy into electrical energy. The dominant parameters are conversion efficiency and power out put. The theory of photovoltaic effect is used to predict the characteristics of semiconductor that would operate with an optimum efficiency as photovoltaic solar energy converter. The existence of such an optimum material results from the interaction between the optical and electrical properties semiconductor. Considerable attention is devoted to the forbidden energy gap (Eg) of the semiconductor (Backus 1976). The smaller the energy gap of the semiconductor, larger the portion of solar spectrum which is utilized, but the maximum photo voltage obtainable is correspondingly low. On the other hand a larger energy gap can give a higher photo voltage and lower leakage across the junction, but a smaller portion of the solar radiation is absorbed and low short circuit current is obtained. These two offsetting effects cause peak efficiency to exists at a specific band gap value. Figure 5 shoves the ideal (theoretical) solar cell efficiency as a function of energy band gap at various temperatures. It is seen that the efficiency has a board maximum. Therefore semiconductors with band gap between 1 and 2 eV can all be considered solar cell materials, many factors reduce the efficiency SO that the efficiencies actually achieved are lower.

First solar cell was made in 195~, using singles crystal silicon and the first thin film CdS solar cells Ra made in 1960. Inspire of the unfavorable band gap of **1.1** (Which is less than the optimum) and optical absorption (Indirect band gap) for the highest photovoltaic conversion efficiency, silicon is still the most favorable candidate for the solar cells, because of well-understood techabundam Availability of starting material a~ nontoxic nature. (Moller 1991). Today the efficiency of commercial silicon solar cells is about 10 to 15% though maximum theoretical conversion efficiency with solar light on ground is nearly 23%.

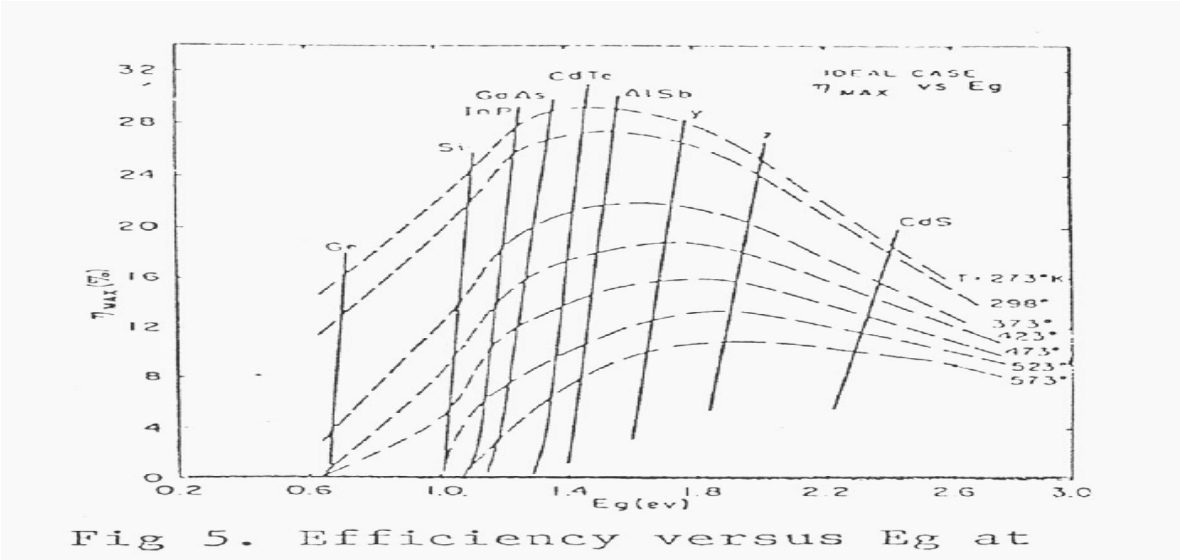


Fig 5. Efficiency versus Eg at

Fig 5. Efficiency versus Eg at various temperatures

Cadmium Sulphide Photovoltaic cell is another common solar cell in commercial use. It is actually a heterojunction cell consisting CdS and Cu S. These are thin film solar cells and their production methodsar2-amenable to mass production. II-IV compounds tend to have low lifetime and cannot be made into good p-n junction. Therefore solar cells made from these commonly involve heterojunctions. Single crystal solar cells of CdS and CdTe have efficiency

Of about 8%.,whereas the optimized efficiency of 15% is speculated.

Gallium arsenside is another material, which is favored for solar cells. It has a direct band gap. 1.4 eV, close to the optimum for maximum conversion efficiency. However, high surface recombination velocities and low minority carrier lifetime limit the efficiency of GaAs solar cells. Improvement in fabrication technology and use of GaAIAs has increased the prospects of efficient solar cells. The GaAs cell coated with TiO_2 (to reduce reflection losses) gives conversion efficiency up to 21%. GaAs solar cells are considerably more expensive than silicon solar cells because of cost of gallium. One of the advantages of GaAs is its ability to operate at higher temperatures than silicon.

Many organic compounds have also been investigated and found to have properties of interest to solar energy conversion (Chandra et al 1986). Many of them have activation energies (Eg) in the range of interest i.e. 0.5 to 2eV. Open Circuit voltages of .5 to 1 volt have been observed. However the current is too small to provide efficient energy conversion. This is largely due to high resistivity 0 f the material.

Various types of photovoltaic systems are in use (Table 1) - .

1) Homojunction
2) Hetrojunction
3) Metal - semiconductor or schottky diode.
4) Photo electrochemical solar cells.

5. RECENT ADVANCEMENT

The main problem in large-scale terrestrial use of solar cells is the cost of photovoltaic modules. It is essential that intensive research efforts should continue bringing about the cost reduction which is necessary for photovoltaic to become Competitive with other energy technologies for production of electricity. Many attempts are being made in this direction.

a) Use of amorphous silicon Attempts are being made to reduce the cost of silicon solar cells by using poly-crystalline silicon, silicon ribbon and amorphous silicon. The thin films of amorphous silicon prepared by vacuum evaporation or sputtering in an inert gas have nigh concentration of states in the energy gap due to defects (Carlson 1977). Remarkable improvement occurs by hydrogen forming an amorphous silicon alloy a-Si:H. The hydrogen atoms bond with the unpaired electrons of Si atoms and thus defect states are removed by hydrogen and so the electrical conductivity of a-Si:H. Dr0ps dramatically. The attracting properties of these materials are the band gap, (Which is adjustable from 1. 5 to 2.9 eV), the high optical absorption coefficient and the demonstrated ability to form n or p type material by doping.

b) Use of these films: Thin film provides large junction area and less amount of material is used. The recent advances in the science and technology of thin film devices show that their commercial prospects are very bright.

In thin film solar cells the active semiconductor is a polycrystalline or amorphous thin film which has been deposited on a supporting substrate like a glass, ceramic, metal, plastic or another semiconductor. Various deposition techniques such as evaporation, Chemical vapour deposition CVD) Sputtering, metal organic chemical vapour deposition MOCVD), molecular beam epitaxy (MBE), chemical beam epitaxy CBE), and metal organic source modulation epitaxy (l'10SME) are available today and offer a great flexibility to form semiconductor films of various composition$. The basic requirement is that the thickness of the film is larger than the inverse of obsorption co-efficient so that most of the light can be absorbed and smaller than the diffusion length, so that almost all light generated carriers can be collected. Thin film solar -cells are therefore mainly made from compound semiconductors with direct band gaps and high absorption coefficient. (Reddy 1993).

The first polycrystalline thin film cells were CdS/Cu_2S solar cells. The prime advantage of these is the ease of fabrication and the low possessing costs. However reliability problems virtually eliminated all work on this particular cell although efficiencies of about 10% are reported. The solar cells degraded under high humidity and at higher temperature (>60^0C) or When the load voltage exceeded. 33V. these problems could be over come with the further development of copper based ternary semiconductors. Among $CulnSe_2$." has received more attention because of its extremely high absorption coefficient and stable electro optical properties. Other advantages include band gap that is suitable for either homo junction or hetero junction device type.

c) Photo-e1ectro-chemica1 cells: In last decades the method of converting solar energy with the aid of semiconductor-electrolyte photoe1ectrochemica1 (PEC) cells has been advanced as an alternative. In PEC cells, the use is made of the interface, which forms on mere dipping the semiconductor into the electrolyte sou1ution and the SG-1iquid junction potential barrier can he easily established. Besides, polycrystalline semiconductors films can also be used without any drastic decrease in efficiency (Chandra 1984) Thus PEC cells provide an economic chemical route for trapping solar energy. It consists of a photosensitive n-or P-type semiconductor electrode and a counter electrode dipped in a suitable electrolyte. The counter electrode can also be a photosensitive p-or n-type semiconductor (SC). When the SC/e1ectrolyte Junction is illuminated by light of energy hv> E8. photons are absorbed by BC producing electron-hole pairs Because of the potential Barrie electrons and holes are separated and their recombination inhibited. The majority carriers (electrons) flow to the counter electrode through the external circuit and the minority carriers (holes) reach till surface and cause an electrochemical, reaction. In liquid junction solar' cells (L J S C) a redo electrolyte' system is employed, where The anode is, Counter balanced by the reduction at the cathode and hence! There is no change in the chemical composition of the electrolyte and light is converted to dc-electricity,

d) Use of multifunction: There has been considerable discussion of the possibility of using multifunction stacked photovoltaic device to achieve high conversion efficiency, (Gauchang and Guohua 1993/ Kuznicki 1993. Bobrenkc et al 1994). The operation of these cells involves two or more single junction photovoltaic cells having energy ga1 in the range of 2.5 to 1.0 eV. The cells are arranged so that sun 1~~ is first incident on the semiconductor with the largest energy gap. Photon,> of higher energy are absorbed by it and electrical energy is produced. The lower energy photon~ pass to the next SC with next largest energy gap and so on. The whole of spectrum of incident light may be absorbed by the different semiconductors and light energy is converted into electricity. By spectrum splitting, multi- junction stackes can be designed so that ea~ cell is optimized for a particular portion of the spectrum, thereby minimizing the high energy photo losses. This results in higher overall efficiencies. According to the data the of solar spectral irradiance under AH 1.5 this kind of photo anodes can cover about 90% of the total solar energy and the efficiency of the energy conversion is estimated to be 30%.

ACKNOWLEDGEHENT

The another acknowledges the help provided by Prof. B.P. Chandra.

Table l Materials used in various types. of Solar cells

Materials	Bandgap(ev)300^0 k (theory)	Efficiency n%(theory)
Homo junction		
Ge	0.66	-
Si	1.11	23
CdTe	1.40	25
GaAs	1.43	25
Hetero junction		
n-cds/P-Cu_2s	2.42	15-20
n-Cds/pInp	2.42	20
p-ZnTe/n-cdTe	2.25	-
p-ZnTe/n-cdSe	2.26	-
p-CulnSe_2n-cds	1.01	20
p-si/n-In_2 O_3	1.11	11
Schottky diodes		
n-GaAs/Au	1.43	20
n-Si/cr(cu)	1.11	-
p-Cu_2 o/cu	1.93	10
Photoelertrochemical cells	(for SC)	
n-Wse_2/2MKI+.02MI_2	1.35	19.8
n-GaAS/ferrocene-ferrocecumin DCL4 methanal solution	1.42	15.5
P-InP /vcl/VCL_2-HCL	1.35	13.0
Cdse_2 Te/csS+0.5M cuso4	1.47	12.7
Cdse/ferri/ferro cynide	1.7	12.4
CuInse_2/2MKI+.02Min2+.02McuI+2 MHI	1.01	12.0

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CHROMATIC ADAPTATION TESTING WITH A COMPUTER GRAPHICS SYSTEM

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Abstract: The next questions were answered with experiments using coloured test plates on the monitor:

- Whether coloured illuminance of the monitor brings colour adaptation
- Is chromatic adaptation produced by the most white part of the test field or by the average colour of the test field
- Is chromatic adaptation produced mainly by the central area of the test field or by the Average colour of the test field.

The relative intensities of the R, G. and B outputs were determined by heterochromatic photometry, using a 2° field in different colored sorround. The change of the results of photometry while the sorround Colour was altered indicated the degree of the Colour adaptation.

Keywords: Colour Vision, Chromatic Adaptation.

1. INTRODUCTION

The chromatic adaptation is an important effect in the correction of colour deficiency with correcting glasses. (Abraham and Wenzel 1988.) The chromatic adaptation is a well known phenomenon but there are some interesting questions we don't know enough. These questions are related to the location of either different coloured or different illuminated parts of the visual field. I have made experiments to answer these questions.

At our Colour Science Laboratory at Technical University Budapest, CRT displays are used in more than half of all our visual experiments because of

- The flexibility of a computer-controlled colour CRT system makes it easy to change the patterns, the colours and the illuminance of the test figures
- The characterization of the test figures is easy
- We can use a relatively simple and unexpensive

System compared to other colour measuring devices. (Arden, et al., 1988. and Fairchild and Reniff, 1955.) In this article I describe my experiments when I attempted to measure the extension of chromatic adaptation in different conditions of colour and illuminance of the visual field.

2. METHODS

Our display system consisted of a conventional (Berns, et al. 1993.) 486 PC computer and a Philips 14 A

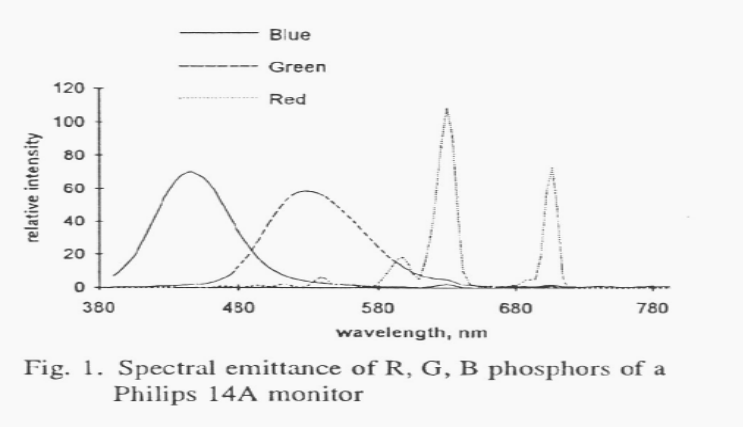

Fig. 1. Spectral emittance of R, G, B phosphors of a Philips 14A monitor

Fig. 1. Spectral emittance of R, G, B phosphors of a Philips 14A monitor

Color monitor. The chromaticity of the 3 phosphors was measured with a PRICHARD spectrophotometer (see.Fig1.)

The relationship between screen R, G and B luminance's and applied voltage is the form $L=kV^x$, where x=0.98, and k=1.lO; 1.18 and 1.08 respectively. (see: Fig. 2.)

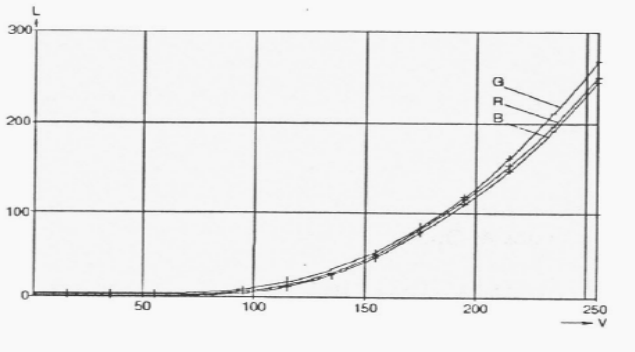

Fig.2. There relationship between screens R, G, B luminances (L) and applied voltage (V)

The source program named **SEVEN COLOURS** is written in Microsoft **PASCAL**.

The image displayed by the colour monitor can apply 7 different colours. The R, G and B luminances are changeable in a colour look up table on a part of the monitor. The length of the look up table is limited to 256 entries.

The test plates have two parts. (Nayatani aI, 1986) The test field takes place in the center of the test plate in 2° viewing field. The size of the test field is 24x24 mm, and the distance between the person tested and the colour monitor is 680 mm. (see Fig.3.)

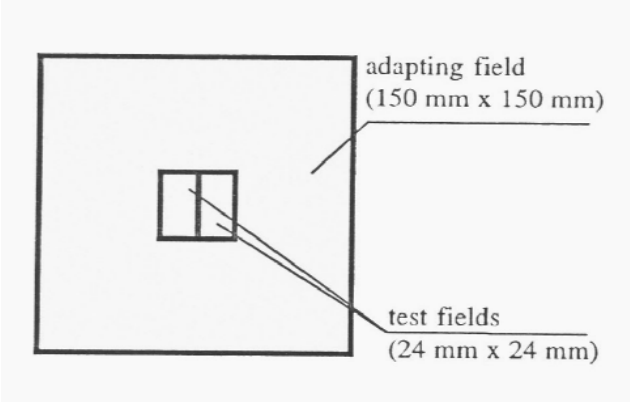

Fig.3 the test plate, and the test fields in the adapting field

The test field has two parts, which have different homogeneous colors, E.g. one part is red and the other is green, or one part is green and the other is blue.

The adaptation field takes place around the test field, and has different patterns with different colours and illuminances.

The person tested has to match the illuminance of both of the test field parts with the help of the look up table. Hence the colours of parts are different, this is similar to the heterochromatic photometry.

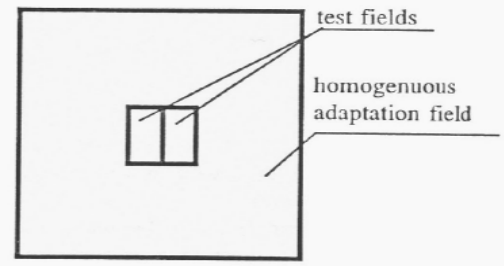

Fig. 4/a

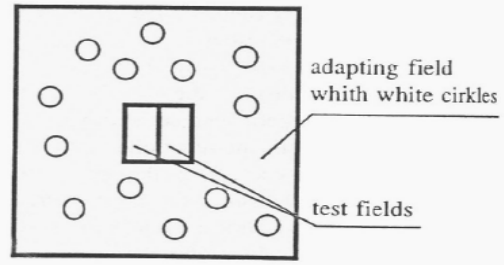

Fig. 4/b

3. SUBJECTS

Observers were students recruited with an advertise. mint. They were screened with our new pseudo. I isochromatic plates on colour monitor (Wenzel, 1996.) ~ and diagnosed with conventional small-field Rayleigh matches using a new HEIDELBERG anomaloscope. I All of the 50 persons were normal trichromats. '

4. RESULTS

The test plates of the chromatic-adaptation experiments are shown in Fig. 4, 5 and 6.

4.1. The first experiment

The first question was whether color illuminance of the, monitor brings color adaptation. Fig. 3. shows the adaptation field which was black at first then red, green and at last white.

One part of the test field was red and the other was green. The value of the red and green illumination, which seemed to be equal to the tested person, was measured.

The results showed that the illuminance of the color monitor does make chromatic adaptation. For the heterochromatic color match, the tested person needs more green with green adaptation field and more red with red adaptation field than with black adaptation test

Fig. 4. The adaptation field is homogeneous (4/a) or whith white cirkles (4fb)

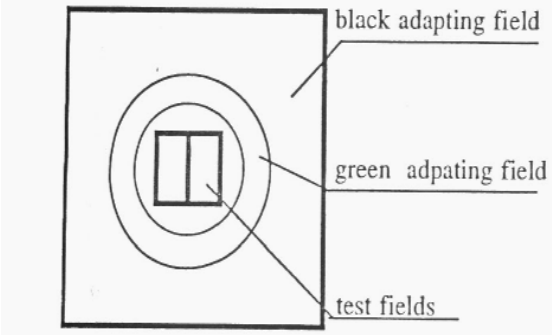

Fig.5/a

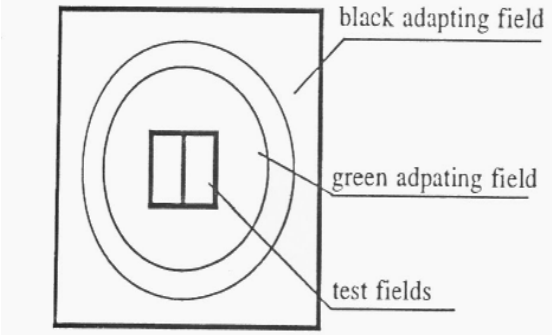

Fig. 5/b

Fig. 5. Test plates whith green adapting rings

Field. Moreover the observers need both equal red and green with white background.

4.2. The second experiment

The second question was whether chromatic adaptation is produced by the most white part of the adaptation field or by the average color of the adaptation field. Fig. 4. shows the test plates. One of them has a homogeneous adaptation field and the other has white circles in the adaptation field (Fig. 4/a) and (41b). The average colour was equal to both of them.

Applying the test plate on Fig. 4/a made the same result as in the first case applying green background, and applying the test plate on Fig. 41b. had similar result as in the first case applying white background. It shows that the chromatic adaptation is produced by the white part of the adaptation field.

4.3. The third experiment

The third question was, whether the chromatic adaptation is produced mainly by the central area of the adapting field or by the average colour of the adapting field. The Fig. 5/a and 51b. show the test plates. Both of them have a green ring on black field, but on one of the test plates the ring is nearer to the center, and on the other the ring is far from the center. The green rings have equal surfaces. (Fig. 5/a, Fig 5/b)

The results showed that the chromatic adaptation is the strongest when the adapting field is near to the centre of the viewing field.

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DEVELOPMENT IN TRAFFIC IN BOTSWANA WITH SPECIAL REGARD TO SAFETY

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ABSTRACT: Botswana gained independence on 30 September 1966 and has a democratic form of government. It has an area of approximately 582000 km2 , about the same as France, and a population of about 1.5 million. In the relatively short time since independence Botswana has risen from the ranks of one of the Africa's poorestcountries to one of the wealthiest. Per capita gross domestic product was P278 in 1973/74, PI033 for 1982/83 and P4900 for 1991/92. In 1966, there were only five kilometers of tarred roads in the entire country, but nowthe tarred road network has reached almost 3000 km. The growth is further characterized by an impressive increase in the number of registered vehicles which is growing at an average annual rate of 10 % and by the population growth of 3.5%. However, this growth is also accompanied by an alarming increase in the accident rate. The paper reports on the research findings and analysis of data on road traffic accidents, and presents recommendations for road safety improvement.

Keywords: Road-safety, traffic, accidents, road-intersections, transport, Botswana

1. ROAD ACCIDENT STATISTICS

1.1. The current system

The current system of collecting road accident statistics was set up in 1987. It is a computerized package developed by the Transport Research Laboratory, UK and adjusted to Botswana conditions by SweRoad and the Road Safety Division. The aim of the system is to provide information on the accidents, which occur throughout the country. The collection of data is the responsibility of Botswana Police. Each year the police officers of 13 Police Districtsin Botswana complete report forms known as 'Traffic Accident Report Forms" about road accidents on the public highway which include human injury or death and property damage. The data are evaluated and analyzed by the Road Safety Division of the Department of National Transport and Communications. The analysis is presented in the annual reports. The report is quite comprehensive and summarizes the road accident occurrence from different aspects such as: drivers' age, casualties of drivers, passengers or pedestrians, severity of accident, vehicle class, casualties by sex, roaduser class, police districts where casualties/ accidents occurred, location, type of intersection control, type of road surface, hour of the day, day of the week, month, light and weather conditions, collision type, vehicle maneuver, use of the seatbelts, influence of the alcohol, driving without valid driving license, etc..

1.2. An overview of the basic road accident data

The following statistics are derived from the 1993 edition of "Road Traffic Accidents", an annual publication of the Department of National Transport and Communications, Road Safety Division.

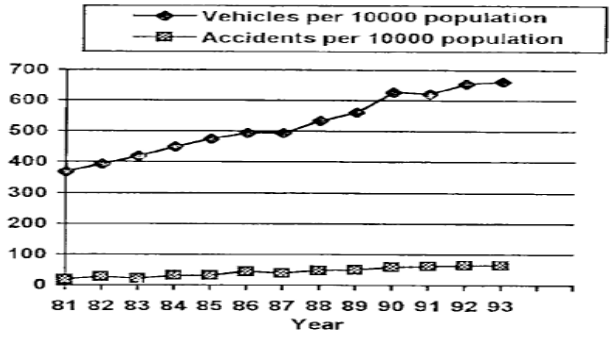

FIG.1: Growth trends in number of vehicles and number of accidents

Fig. I shows growth trends in number of registered vehicles and number of accidents per 10000 population. It shows that between 1981 and 1993 there had been a 79.7% increase in number of registered vehicles per 10000 population and 253% increase in number of accidents per 10000 populations within the same time period. This trend of accident growth rate is alarming and is the matter of concern not only of transportation professionals but the whole community.

Number of accidents according to the place of occurrence

The total number of accidents recorded in Botswana in 1993 was 9169, out of which 38.8% (3563) took place in the capital Gaborone. It corresponds well with the proportion of vehicles registered in Gaborone (40%).

Analysis of the accidents occurring in Gaborone according to the location shows that the vast majority (76.4%) were of not-junction type. The percentage of accidents occurring at intersections (23.6%) is significantly lower than that found in South Africa, where in urban areas over 40% collisions occur at intersections although the intersections constitute only a small percentage of the total length of the road network. This distribution indicates that the probable cause might be a reckless or drunken driving, over speeding and lack of proper training. This statement is supported by the fact that 51% of all accidents were single vehicle accidents.

Accidents at signalized intersections constitute 34% of accidents, which occurred at all types of intersections in Gaborone. This percentage is relatively high and engineering elements which might contribute to the collision occurrence at signalized intersections are further discussed.

Number of accidents according to severity

	Botswana	Gaborone
Total no. of accidents	3169	3563
Fatal	379(3.2%)	71(2.0%)
Serious	716(7.8%)	203(5.7%)
Minor	1815(19.8%)	637(17.9%)
Damage	6337(69.1%)	2652(74.4%)

The number of damage-only type of accidents occurring in Gaborone is more than the average for the whole country. Due to the lack of road safety knowledge and skills, Botswana looses on an average one life daily each year. In Gaborone more than one person dies every week as a result of road accident. General trends are not really that much different in different countries, so that the relationship between road fatalities, licensed motor vehicles and population can be generally expressed by the following empirical formula presented by Q' Flaherty: Fatalities = 0.0003 [(vehicles)(population)] This formula suggests that each country has an 'inbuilt' toleration level with respect to what is acceptable regarding road accidents, particularly fatalities. If this formula is applied to Botswana data, the actual number of fatalities in 1993 has been five times higher.

Number of accidents according to the driver-age characteristics

A total number of 13553 of drivers / vehicles were involved in the road accidents in 1993, i.e. every 7th registered vehicle was involved in a road accident. The drivers in the age group 25-29 have been involved in the 3118 accidents, which represent 23% (the highest number) of all accidents. The age group 25-39 has been responsible for 61.6% of all accidents. The most severe casualties of drivers (deaths and serious injuries) have been reported for the age group 20-24, i.e. the youngest drivers who most probably do not have enough driving experience.

Pedestrian casualties

Analysis of pedestrian casualty statistics shows that 32.5% are children «15 years) and only 2% are adults of retirement age (>65 years). Crossing the road forms the biggest single hazard for pedestrians, contributing to 66% of the fatalities and 71 % of casualties. The most common difficulties experienced by pedestrians include an inability to assess the speeds and distances of vehicles. Given the vulnerability of the pedestrian when involved in a conflict with a motor vehicle, a number of measures ranging from the promotion of safety education to the provision of pedestrian footways and crossings should be implemented.

Conclusion:

The above data illustrate in brief the road safety problem in Botswana. It can be said that deaths and injuries from accidents on roads have now reached very high proportions. Accidents are a major drain on the national economy. In 1993, the cost to economy of road accidents in Botswana was estimated to be about P300 million (OS$100 million). The types of activities that may be considered for road safety improvement are literally numerous. They may range from publicity campaigns aimed at influencing motorists and pedestrians for exercising more responsibility, to the installation of complex traffic control schemes

Designed for reduction of central area congestions and for improvement of traffic flow, to the road marking at junctions for ensuring a safer turning movement.

2. RESEARCH FINDINGS FOR ROAD SAFETY IMPROVEMENT

2.1. Road Safety at Signalized Intersections BEng Student Project

An integral part of the final year curriculum of the Bachelor of Civil Engineering Degree Programme at the University of Botswana is the individual project. The nature of the projects may vary depending on the special inclinations of the student, staff expertise and resources available. In general, the project may involve analysis and evaluation of an actual civil or building engineering project or an experimental investigation of a real field problem in the laboratory. One of the projects in 1995, carried out by Mr. B. Seduced under the author's guidance, dealt with the road safety in Gaborone, specifically with the occurrence of collisions at the signalized intersections. Signalized intersections with the highest occurrence of collisions and high traffic volumes were identified. The project critically evaluated the relationship between the geometric and traffic engineering elements and the collision occurrence. The site details for each intersections were obtained from the relevant authorities or from field surveys and measurements. The site details of significance were the geometric layout, road markings, traffic signal location, collision records, traffic volume counts and speed measurements.

The analysis of the data lead to the following conclusions:

- The collisions at the major at-grade intersections are slightly less severe than the national average
- Two problems, which contribute to the occurrence of, rear-end collisions were identified:
  poor visibility of traffic Signals and inadequate signal timing.

Poor visibility of traffic signals results in motorists comprehending the traffic signals and taking therequired action at a very late stage. A general observation supported by a speed measurement is that the drivers are over speeding and their responses to the traffic signals are sometimes too slow, resulting in collisions with the preceding vehicle or too sudden and the following driver is unable to take corrective action in time. The motorists need an adequatetime in which to comprehend and react to the traffic signal. The key factor is the visibility of the signal heads. In some cases the lenses are poorly illuminated and not clearly visible, particularly against the rising or setting sun. Good visibility oftraffic signals is an essential prerequisite for the safe operation of signalized intersections. Warning devices should be installed in the case of the approaching traffic signal-controlled intersection and also where the sight distance is limited..

The second factor contributing to the high occurrence of the rear-end collision was inadequate amber time and inadequate signal timings. Insufficient amber times lead to the so called "dilemma zone", within which it is impossible to safely execute either manoeuvre, either to apply the brakes in order to stop for the red signal or to attempt to clear the intersection on amber time. The dilemma zone can be eliminated by selecting an appropriate minimum duration for the amber signal phase if factors such as perception-reaction time of the driver, comfortable deceleration, width of an intersection, length of vehicle and speed are taken into account. Calculationof amber and red intervals for each approach at each intersection should be done separately and this task is currently planned to be undertaken within the framework of transportation research studies in the Department of Civil Engineering.

The geometric layout parameters of intersections were evaluated and the following observations were made:

With moderate to high right-turns volumes, opposing right-turning vehicles obstruct sight distance resulting in "right turn to front of opposing traffic" collisions. The congestions of varying degrees have occurred during peak periods. Insufficient capacity for right-turn movements leads motorists to attempt to turn where there are inadequate gaps or poor vision. If there is sufficient capacity, it is recommendable to install additional signal heads and control the right-turning separately, allowing right turns only during a protected phase. Pedestrian facilities such as sidewalks or crossings should be provided.

2.2. A Critical Survey of Drivers Training: and Its Implication for Road Safety in Gaborone

The road accident data indicate that one of the main factors of accident occurrence is the total lack of or inadequacy in drivers training. The aim of the research conducted by Oladiran, M.T. and Pheko, H.B.(1994)was to determine the level of professional training offered by the Driving school in Gaborone. The conclusion was that in Botswana there are inadequate training and licensing programs for private-vehicle drivers as well as public-service vehicle drivers. The following recommendations were made:

- The L-test procedure should be reorganized and more qualified examiners should be provided

- The instructions and facilities in the driving schools should be monitored periodically by the appropriate ministry.
- Learner drivers should be properly trained in approved or designated driving schools to maintain a uniform and high Standard of driving
- As the responsibilities to be conferred on the driving schools are immense, these schools should be upgraded, e.g. in terms of staffing, space, equipment and other resources
- The rate at which accidents occur can be controlled by improving regulatory measures including appropriate police patrol.

A training program for the vehicle inspectors has been developed within the research project. The didactic procedure has been found suitable and will be implemented shortly.

2.3. Regional Road Transport Training Initiative

All Southern African Development Community (SADC) countries are facing similar problems relating to the training and qualifications of drivers and transport operators. Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe have joined their forces in participating in the Canadian International Development Agency (CIDA)-funded project, which was launched in May 1994 by the Federation of Regional Road Freight Association as the Regional Road Transport Training Initiative. This initiative is aimed at setting common standards for training in all aspects of road transport in the SADC region. It is also intended to develop and / or strengthen national and regional training capacity. The objective of the project is to put in place a structured training and qualification system for the transportation industry throughout the region. A Plan was approved by the project working group at its meeting in Harare, in 1994.

The tasks were divided into four groups:

(i) Project management - consists of all the activities needed to plan, direct, control and fund the practical phases of the project; a group of experts has been established within each country.
(ii) Design of the system - consists of background research, preparation of the basic framework of titles, assessment and qualifications, identification! Creation of an awarding body and centers of excellence and the preparation of an accreditation system
(iii) Development of the system in each participating country; Currently the project is in this stage, the goal of which is to adapt or create training courses and materials, adapt or create assessments, create qualifications, develop awarding body and centers of excellence and initiate accreditation process
(iv) Implementation of the system is the longest and most difficult phase of the project and it will adapt training courses and materials to the individual needs of each participating country, accredit training centers, introduce training courses and materials, introduce assessment and award qualifications.

The major outcome of the project will be a framework of competency-based qualifications covering the full range of occupations in the road transport industry from manual operatives, through drivers and mechanics right up to management.

3. CONCLUSIONS

A crucial requirement for sustained economic growth is the existence of an efficient transport system. No economy can function effectively unless goods and people can be moved reliably and safely within and across its borders. In the whole Southern Africa there is an urgent need for improvement in the road transport system. This will require investment in the infrastructure of roads and bridges to ease physical problems of distributions, but there is also an urgent need to increase the efficiency of the transport operators. The road safety plays a very important role, and the research findings and recommendations should be implemented so that the improvement can be achieved in this vital sector.

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ICE PREDICTION ON ROADWAY COVERING: BOTH TRAFFIC SAFATY AND ENVIRONMENT PROBLEMS

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Abstract: The method of mathematical simulation is used to study the conditions of ice formation on road surfaces. Mathematical model of the "road-environment" system is suggested. This model is based on the logical modules describing the conditions for 'road ice formation. Simple principles for icing forecast were obtained. Practical application the results of these researches is described.

Keywords: road safety, ice formation, prediction, mathematical model

INTRODUCTION

Upgrading of road safety during the winter period at the sacrifice of keeping pavement from ice formation is one of the topical problems of ground traffic. Slipping is a dangerous phenomenon and it is the chief cause of ground traffic accidents in winter resulting in death and severe injury of people. Usually slipping on roadway coverings is eliminated by the use of anti-icer and deicer salts. However, the more efficient way is to allow no formation of an ice layer and, hence, to keep high readability and road grip of a type. The solution of the above problem is possible with the availability of a specialized road ice prediction.

The process of ice formation is very intricate, it is influenced by many weather and road factors and the degree of dependency Item these parameters we can't be explained. The problem of road ice prediction is complicated. It cannot be solved by using the conventional research methods. To solve this problem it is necessary to use the method of mathematical modeling and computing experiment.

The mathematical model based upon the calculating analysis of the pavement temperature and the logical modules describing the conditions for ice formation on a road has been developed for the investigation of the process. The model allows one to complete the calculating experiment with the use of a personal computer IBM with the followed data handling. The physic statistical dependencies for the prediction allowing one to predict the ice formation 3 - 6 hours prior to its onset have been obtained. The model enables to investigate the dynamic behavior of the "road environment" system during the formation of slipping of various types. With the availability of forecast, the anti-icer and deicer salts sowing rate may be decreased in several times, resulting in beneficial effect on the Improvement of the ecological situation within a roadside ship.

1. MATHEMATICAL MODELLING OF ROAD ICE FORMATION

1.1 *Mathematical model of "road* - environment" *system*

"Road-environment" system is a complex heat-and moisture exchange model. The law of its functioning may be represented by the operator *Fs.* This operator transforms the set of inside independent systems parameters into outside dependent variables (Sovetov and Jakovlev, 1985).

$$Y(t) = F_s[v(t),h(t),t] \quad (1)$$

Where $y(t)=\{yI(t),Y2(t),...,y,,(t)\}$ the vector of output dependent variables, F: the law of systems Functioning,

$v(t) = \{v$ I $(t), V2 (t),... , V m (t)\}$ vector of the ambient conditions effect, $h(t) = \{h(t),h2 (t),... ,h_k (t)\}$ the vector of the proper systems parameters, t - the time.

Equation (1) is a dynamic mathematical model of the system in winter period. Operator F: may be presented as logical relations describing the conditions of ice formation on road surface.

1.2. External systems parameters.

In winter roads can become slippery in a number of ways. There are seven states of road surface.

1. Dry surface.
2. Wet surface.
3. Ice-crusted. This kind of road slippery is formed when water on the surface freezes to a thin coating of ice. It is possible when the surface temperature drops below $0°$ C.
4. Hoar frost. The conditions of its formation are: clear weather, negative radiation balance (radiation loss), high humidity, surface temperature lower than $0°$ C and at the same time, lower then the dew point.
5. Freezing rain. It is formed when rain whose temperature is a little above $0°$ C falls onto a cold surface. On contact with the cold surface the rain drops are cooled and crystallized to ice.
6. Glaze. This kind of the road slippery is formed when rain is super cooling, that is the temperature of the rain drops is lower then $0°$ C and when they fall onto a surface whose temperature is about $0°$ C or lower, they freeze instantaneously to ice.
7. Hard snow. This kind of the road slippery takes place when snow on a highway surface becomes compacted by the action of traffic. Thus, the state vector is that which has all zero components except one. This coordinate is equal to I and corresponds to the state of the road surface.

I.3. Inside systems parameters.

The inside parameters were separated into two groups: meteorological conditions v(t) and road factors h(t). All weather conditions influencing the road icing are represented in table I and the road factors - in table 2.

Table I weather conditions ,influencing road icing

Vector ingredient	Parameter name	Letter designation
$V_1(t)$	Air temperature	T_a
$V_2(t)$	Atmospheric pressure	P:
$V_3(t)$	Relative humidity of the air	W
$V_4(t)$	Dew point	T_d
$V_5(t)$	Vapour pressure	E
$V_6(t)$	Precipitate	OS
$V_7(t)$	Amount of precipitation	Q
$V_8(t)$	Cloud cover	N
$V_9(t)$	Wind speed	V
$V_{10}(t)$	Wind direction	RU
$V_{11}(t)$	Variation of the atmospheric pressure	ΔP
$V_{12}(t)$	Energy balance of road surface	R_b

Parameters V_1, V_3, V_6, V_7, V_9 have direct influence on ice formation, V_2, V_{11}, V_{12} define the weather conditions as a whole and others have indirect influence and form the road surface temperature and the processes of moisture evaporation. AU this parameters may be received from meteorological reports.

Table 2 road factor, influencing ice formation

Vector ingredient	Parameter name	Latter designation
$h_1(t)$	Road construction	KD
$h_2(t)$	Longitudinal profile	I
$h_3(t)$	Route bearing	RD
$h_4(t)$	Situation in roadside strip	-
$h_5(t)$	Surface temperature	
$h_6(t)$	Thermal conductivity of road construction materials	λ
$h_7(t)$	Specific heat	C
$h_8(t)$	density	ρ
$h_9(t0$	Moisture content of material and soil	W_r
$h_{10}(t)$	Roughness of road surface	Hr
$h_{11}(t)$	Road surface color	-
$h_{12}(t)$	Amount of traffic	N_t
$h_{13}(t)$	Velocity	VI

The surface temperature is a main factor defining ice formation on road pavements. It is formed under the influence of all road parameters. However, the degree of their influence is different and unknown. The surface temperature can be received by calculation with the mathematical model.

I.4. Mathematical model for simulation surface temperature.

The method of mathematical simulation was used to determine the temperature fields in road

Construction. In order to calculate the surface temperature heat conductivity equation with II and III kind boundary conditions was solved.

Road consumption and soil half-space is a Multilayer system. Each layer has the wing heat physical properties: thermal conduction λ. and specific heat c. This meters are the functions of coordinate x, time t, temperature T, road materials density d moisture content (Wr)

the following problem has been solved to define temperature fields in road construction and surface temperature: $c\rho\ \partial T(x,t)/\partial t=\partial/\lambda\ \partial x[\partial T(x,t)/\partial x]$ (2)

Where T(x,t) is the temperature at death x in road construction at t,q is the heat flow density in road construction and on its pavement

The scheme for calculation his problem is represented in fig. I. Heat-physical properties changing from layer to layer (λI,ci, ρI) and from frozen soil (λf,cf, ρf) to thawed one(λt,ct, ρt) in the road bed. There is the phase transition with the heat liberation or heat absorption on the phase interface. System (2) can be written as:

$$\begin{aligned} &c_I\ \rho\partial T(x,t)/\partial t=\partial/\partial x[\lambda I\ \partial T(x,t)/\partial x] \quad H_{i-1}\le x<Hi\ I=1,2,3,4\\ &c_f\rho_f\ \partial T(x,t)/\partial t\partial/\partial x[\partial T(x,t)/\partial x] \quad H_4\le x<H_f\\ &c_t\rho_t\ \partial T(x,t)/\partial t\partial/\partial x[\partial T(x,t)/\partial x] \quad H_f<x\le H \end{aligned} \qquad (3)$$

and conditions on the phase interface

$$\lambda_f\ \partial T/\partial x\ \big|\ x=H_f\ -\ \lambda t\ \partial T/\partial x\ \big|\ x=H_t=Q\rho\ \partial H_f/\partial x \qquad (4)$$

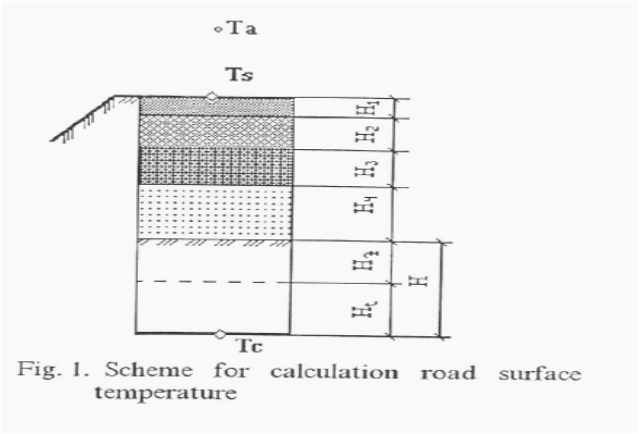

Fig. 1. Scheme for calculation road surface temperature

Where Hf=Hf(x,t) is the surface of phase transition Q is the latent heat of ice melting .model (4) is subjected to boundary and initial conditions.

There is a complex heat exchange with surrounding air on the road surface. It is defined as the boundary conditions of II and III kinds:

$$\lambda\ \partial T/\partial x+\alpha\ [T_s(t)-T_{ac}(t)]=0 \qquad (5)$$

Where T_{ac} is the "conditional" air temperature

$$T_{ac}(t)=Ta(t)+\rho sqs/\alpha s \qquad (6)$$

Ps the incident radiation absorption coefficient, qs is the intensity of heat flow,α is the heat flow depends on the energy balance at the road surface (Rb) and all its compounds may be determined by the actinometrical methods (kondratjev K.J., 1965). Formula for calculation contain such parameter as cloud cover(N),celestial altitude (I) geographical latitude, longitudinal profile(I),road bearing (RD),vapor pressure (E),road surface color and roughness of road surface(hr)

To calculate convectional heat exchange coefficient α_c the empirical formula was used (ivanov,1973)

$$\alpha_c=0.00058V^{1.15hr0}.15\ \lambda\ a/\gamma\ a^{1.15} \qquad (7)$$

Where λa is the air thermal conductivity, γa is the air kinematic viscosity.

The second boundary condition is a constant temperature on the depths of temperature oscillation damping H:

$$T(H,I)=Tc=const \qquad (8)$$

The initial temperature distribution was calculated by the formula,*al.at.,* 1971):

$$T(x,0)=T_{a.av}+T_s-T_{a.av})Rs+\Sigma\ Rx/R \qquad (9)$$

where $T_{a.av}$ is the Monty average air temperature, *Rs* the henna resistance of road surface, Σ*Rx* that of road layers higher then *x* depth, *R* is the total thermal resistance of all road layers and road bed until H depth.

1.5 Method of computation

To solve the formulated problem (3 – 9) the method of finite differences was used. Equation (2) is an equation with the discontinuous coefficients and there are special computation schemes for its solution (Beljaev and Rjadno,1982). There is a sweep method for the numerical modeling. Mesh width on time is uniform and makes up 15 minutes, and that on coordinate x is irregular, it is the least in upper layer of the road construction (0.01 m) and the biggest in the road bed (0.1 m). Tills mesh width size provides convergence of numerical solution to approximate value by virtue of its second order approximation, as well as its unconditional stability.

1.6. Computing experiment

To simulate the conditions of ice formation on a road surface the meteorological reports of Voronezh weather station over the 20-years period where used. The meteorological parameters are measured every 3 hours. To obtain intermediate information in the nodes of a mesh linear interpolation was applied.

The program complex SIGNAL for IBM computer was developed. Algorithm is realised on the language FORTRAN and it may be presented by 7 steps.

Step1. The information about road construction is introduced.
Step 2. Initial temperature distribution is calculated by formula (9).
Step 3. Daily meteorological parameters are introduced.
Step 4. Meteorological information is interpolated to the nodes of a mesh. The arrays of atmospheric precipitation and surface conditions are formed.
Step 5 . Boundary condition (5) is calculated. To obtain road surface temperature the difference equation (2) is solved.
Step 6. The conditions for ice formation in accordance with a section 1.2. are verified. If the conditions are not carried out then go to step 5.
Step 7 . The information about the date, time and type of ice formation along with road surface temperature and weather conditions on the calculation step as well as 3, 6, 9, 24 hours before is placed into the computer memory.

Steps 5-7 are to be repeated 96 times daily.
Steps 2-7 are to be repeated for every year of weather observation.

Thus, at the first stage of the computing experiment the statistical information of icing risk potential cases over the 20-year period is formed.

2. MODELS FOR SHORT-TERM ROAD ICE FORMATION FORECAST

Linear discriminate functions where calculated to forecast road ice formation. They areused in meteorology to predict the dangerous weather phenomenon. To obtain this models the results of the first stage of computing experiment are used. There are two sets of information. The first named "ice presence" includes meteorological parameters and surface temperature in the beginning of the ice formation. The second set, named "ice absence" includes the same parameters the day before. The form of the discriminant function is:

$$D(x) = alxl+a2x2+...a",xm+am+1 \qquad (10)$$

where coefficients aj are calculated from the condition of maximum difference of these sets:

$$\varphi = (X1-X2)^2 / s_x \rightarrow max \qquad (11)$$

Where Xj is the vector of average values, S" is the mean square deviation.

To raise forecast reliability "screening" procedure was used. For the selection of the significant parameters the Machalanobis distance..12 was employed (Bogatkin and Enikeeva, 1985)

$$\Delta^2=(X1-X2)^T v_m^{-1}(X1-X2) \qquad (12)$$

Where v_m^{-1} is the inverse covariance matrix.

Thus, the most significant parameters are included into forecast models. Standard computer programs of discriminant analysis were used.

3. MODELS SUFFICIENCY TEST

To verify the sufficiency of the models for simulation of the road surface temperature the field observations where carried out. During these experiments the road surface temperature was measured. These researches took place during two winter seasons. The results of the mathematical simulation were compared with the experimental data. Arithmetical mean of the absolute error is equal to 0.520 C and the upper boundary of the confidence interval for 0.9 fiducially probability is equal to 0.620 C. Therefore the mathematical model for road surface temperature simulation has reliability sufficient for the formulated problem. To estimate the reliability of the models for simulation of road surface conditions the information about surface conditions on the roads (over the 6-years period)

And on runway of civil aerodrome (for the same period) were used. .161 cases were analyzed. The mean convergence is equal to 85 % and is changed from. 79.2 % for glaze to 88.4 % for hard snow. This reliability may be sufficient for practical problems.

4. PRACTICAL APPLICATION

Mathematical treatment the results of computing experiment was made to obtain the practical references for long-term forecast and models for the short-term prediction of road icing.

4.1. Long-term forecast

The information about the number of cases of the road ice formation in winter period (common and for all types), amount of precipitation, the time of necessary conditions for icing, the rate of solid precipitation were obtained. Probability distribution functions for all these parameters ~re analyzed. This information may be used for winter maintenance organization. With its help the amount of anti-icer materials, machines and distance between the deicer materials deports may be calculated.

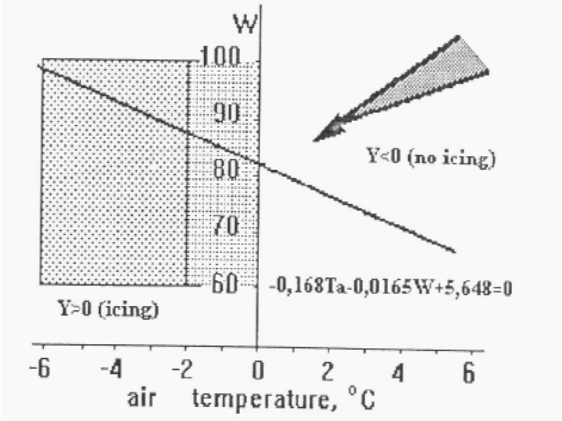

Fig. 2. Forecast of ice-crusted formation

4.2. Conditions of ice-crusted formation and its forecast

Data handing of the computing experiment makes it possible to investigate the dynamics of variation of the most significant parameters. The following meteorological and road conditions are preceded ice crusted formation.

I. The wind direction is changed to the west, north-west or n011h direction.

2. Wet surface.

3. The air temperature and relative humidity of air are reduced simultaneously. The stable reduction of these parameters takes place during 6-8 hours before the icing.

4. At the same time the atmospheric pressure is raised. The increase of this parameter takes place during9-12 hours before thrice formation, when the rain precipitation is falling.

If these conditions are taking place the measurements of air temperature and relative humidity are substituted in the discriminant function

$$y=-O.J68Ta -O.065W+5.648 \quad (13)$$

if the value of the function is negative the ice crusted formation is not expected. If the value of the function $y>O$ the icing is predicted. Tins model allows predicting the ice formation 3 hours before the process starts. The graphic interpretation of precipitation is presented on Fig. 2. Equation (l3) is a straight line on the two dimensional subspace with coordinates *(Ta, W).* This line separates the parameters' values in two classes: ice formation presence (under the straight line) and ice formation absence (above the line). In order to predict theroad icing the fixed zOl1e is used. It is presented as a rectangle with hatching and is called the working area. The boundary of this zone corresponds to upper and lower values of the confidence interval for the 0.95 fiducially probability:

$$-1.8 < Ta < 0.0; \quad 60 < W < 100 \quad (14)$$

If the anti-icer salts were used before, the air temperature range may be expanded

$$-6.0 < Ta < -0,5 \quad (15)$$

Arrow shows the direction of parameters variation.

4.3. Conditions of hoar frost formation

This kind of road icing don't forms in the moderate-continental climate.

4.4. Conditions of freezing rain formation and their forecast and glaze

These types of road icing have the same conditions of formation. They were joined in one set for prediction. The graphic interpretation of precipitation is presented on Fig. 3. The following meteorological and road conditions are preceded freezing rain and glaze formation.

I. The wind direction is changed to the south, south-east or south-west direction.

2. The air temperature and relative humidity of air are raised simultaneously after the long frost. The stable increase of these parameters takes place during 24-12 hours before the icing.

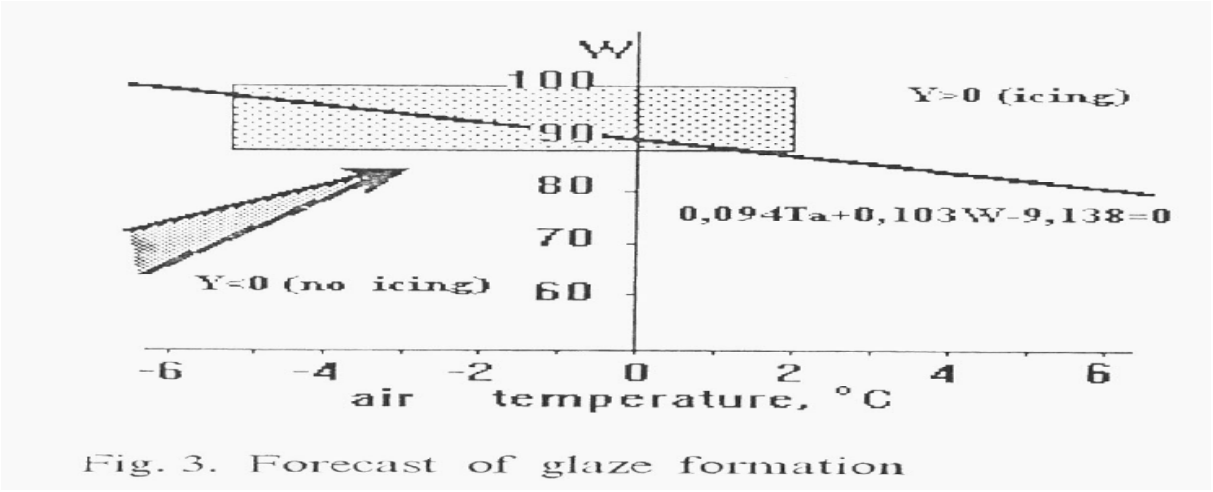

Fig. 3. Forecast of glaze formation

3. At the same time the atmospheric pressure is reduced. The reduction of this parameter takes place during 24-12 hours before the ice formation.

If these conditions are taking place the measurements of air temperature and relative humidity are substituted in the discriminate function

$$y=0.094Ta + 0.103\ W-9.138 \qquad (16)$$

If the value of the function is negative the freezing rain and glaze formation is not expected. If the value of the function $y>O$ the icing is predicted. The model allows predicting the ice formation 3 hours before the process starts. The line (l6) separates the parameters' values in two classes: ice formation presence (above the straight line) and ice formation absence (under the line). In order to predict the road icing the working zone is used. The boundary of this zone outspends to upper and lower values of the confidence interval for the 0.95 fiducially probability:

$$-5.2 < Ta < 2.0; \qquad 87 < W < 100 \qquad (17)$$

Arrow shows variation. Of parameters variation

4.4. Conditions of hard snow formation

The main condition of its formation is a snow presence on the road surface. The snow layer may compacts when the following meteorological conditions are take place:

I. The air temperature is higher then -5° C.

2. If the air temperature changes from -5° C to -100 C the snow layer may compacts when the relative humidity of air is higher then 90 %.

3. If air temperature is higher then 00 C the hard snow is fondled when the intensity of snowfall Is f>0.6 mm/h and at the same time the air temperature is reduced

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IMPACT OF CONGESTED TRAFFIC ON EMISSIONS FROM ROAD VEHICLES

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Abstract: Motor vehicles are a major source of volatile organic compounds (VOCs), carbon monoxide (CO) and nitrogen oxides (NOx) concentrations in urban air. Congestion in urban areas is increasing and emissions of VOCs and CO under congested conditions are greatly increased. The impact of these elevated levels on thecalculation of emission inventories is assessed using London, UK as an example.

Keywords: air pollution, urban, VOCs, CO, congestion, CORINAIR, COPERT

1. AIR POLLUTION AND EMISSION INVENTORIES

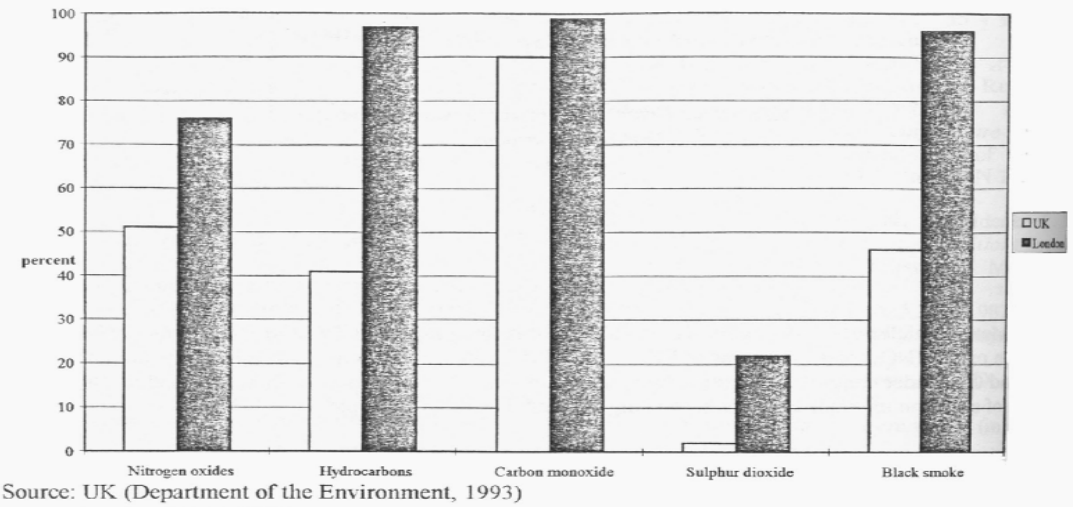
Air pollution from vehicles in urban areas is one of the fastest growing areas of concern in Europe today. The combustion of carbon-based fuels (petrol and diesel) to drive motor vehicles results in a variety of pollutants being emitted into the atmosphere. The major pollutants of concern include carbon monoxide (CO), carbon dioxide (CO2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulates. Solely, and in combination these pollutants have adverse effects on the health of the population and contribute to detrimental atmospheric changes resulting in, for example, acid rain and global warming. There are currently a number of concerns relating to the impact of pollution from traffic on health from both primary and secondary pollutants e.g. ozone (03).

An important aspect of developing abatement strategies for pollutants is to understand and quantify the source of emissions. This requires the collation of data from measurements of emissions from motor vehicles and how they vary with speed and load In depth studies of these emissions have been carried out in the UK (Eggleston, 1987) and in Europe as part of the EC CORINAIR project (Eggleston et aI, 1991). Speed/emission curves, which vary with vehicle technology, have been constructed to relate emissions (in gIkm) to average trip speed. The resultant emission factors were used to develop empirical models to estimate the levels of pollutants being emitted into the atmosphere as a result of road transport and assess the impact of abatement strategies

Empirical models that have been developed include, on a European basis, COPERT (Computer Program to calculate Emissions from Road Traffic) (Andrias et aI, 1992) for the EC CORINAIR project and on a national basis, the UK National Atmospheric Emissions Inventory (NAEI) road transport work (Eggleston, 1992). Models such as this provide the means to compare emissions from different countries. For example, in the UK road transport is responsible for 90% of CO emissions (CORINAIR, 1990) whereas in Hungary transport is only responsible for 49% (CORINAIR, 1990).

Not only are there big differences between countries but also between national emissions and emissions in urban areas. Figure 1 compares the road transport contribution to emissions in the UK as a whole and London. This clearly demonstrates how cities are major contributors.

Figure 1: Road Transport Contributions to Emissions



Source: UK (Department of the Environment, 1993)
London (Chell, 1993)

Speed profiles in urban areas are also very different from national averages. For example, the averagespeeds on Class 'A' roads on a national basis is 90 kph (Department of Transport, 1994a) whereas in Greater London it is 34 kph (Department of Transport, 1994b).

The speed distribution used within the empirical models is based on national averages. The NÆI distribution is based on four Gaussian distributions for urban, rural single carriageway, rural dual carriageway and motorway roads. The COPERT distribution is based on one single average speed, representative of each of the road types urban, rural and highway.

Congestion is also a major feature of urban areas and with respect to this, Warren Spring Laboratory (WSL) in the UK has developed a dynamometer cycle that is typical of congested driving conditions (Farrow et aI, 1993). The average speed determined by this was 6.64 kph - a good deal lower than the average urban speed

In this paper, the effect on emissions of allowing for lower urban speeds is illustrated for London, UK using COPERT as the modelling tool and CORINAlR emissions data.

1.1 COPERT Model

In addition to emission characteristics (Le. speed/emission curves), the COPERT model requires information on vehicle stock. That is the number of vehicles in the fleet and how many comply to which regulation both on gasoline and diesel vehicles. The categories into which they are split can be found in Appendix 1.

Information on traffic activity statistics is also required This is in regard to road usage including data about distances travelled and the split of vehicles between different road classes.

Emission characteristics. For the purpose of this paper emission factors derived from CORINAIR are used (see Appendix 1). These factors do not cover speeds below 10 kph but as the impact of congestion is a focus of the study is was deemed necessary to extrapolate the curves to include the congestion speed of 6.64 kph.

Vehicle stock. Using DoT statistics for London, it was calculated that the number of vehicles in Greater London represents approximately 12% of the total UK stock. Hence the 1990 vehicle stockdata (pers. com.) was scaled to represent this. Appendix 2 shows the vehicle stock file that was used.

Traffic activity statistics. The average speeds are as those used for the National Atmospheric Emissions Inventory (Eggleston, 1992) i.e. urban 20 kph; rural 60 kph; highway 115 kph, with a mileage distribution of 46% urban; 40% rural; 14% highway. As an illustration of the impact of congestion, scenarios were investigated where the urban portion was assumed to be very slow moving.

1.2 COPERT Modelling.

Within Greater London there is a mix of highways and faster routes with a more congested centre. As a preliminary investigation the impact of congestion on emissions can be illustrated by changing the urban speed from 20 kph to 6.64 kph. Thus, scenarios 1 and 2 demonstrate the sensitivity of emissions to urban speed.

Scenario **1** : Vehicle stock file as for London assuming no congestion.

This resulted in a base case emissions inventory from which changes in emissions due to other scenarios were estimated

Scenario **2**: Vehicle stock file as for London assuming all urban driving congested.

This gave an indication of how the levels of emissions change during congestion.

Together with this the impact on emissions of all gasoline vehicles being fitted with three way catalytic converters (TWCs) was investigated for both non-congested and congested conditions.

Scenario **3**: All gasoline vehicles fitted with a TWC assuming no congestion.

This scenario was used to assess the impact on emissions of fitting all gasoline vehicles with TWCs.

Scenario **4**: All gasoline vehicles fitted with a TWC assuming all urban driving congested.

The impact of congestion on emissions was assessed using this scenario.

The results reported in this paper (shown in Table 1) are based on the urban proportion of gasoline vehicles being driven under congested conditions whereas in reality only a percentage are. For example in London 24% of vehicles travel below 4 kph in the central area (Department of Transport, 1995).

2. Conclusions

AS can be seen from Table 1, reducing urban speeds to represent congestion i.e. compare columns 1 and 2, results in an increase of 120% for CO and 70% for NM-VOCs. The fitting of TWCs to all gasoline vehicles could result in a reduction of 63% for CO and 56% for NM-VOCs if there is no congestion (compare columns 1 and 3). *NOx* emissions do not vary greatly as they are dominated by higher speeds.

Clearly, congestion has a large impact on CO and VOC emissions. With current concerns about urban air quality, the introduction of TWCs is seen as a means of major improvement. However, as this paper demonstrates, if congestion is taken into account in emission inventories, the expected benefit of the TWC is significantly reduced (compare columns 1 and 4) for CO and VOCs. Also, these results do not take account of expected traffic growth, so in reality the situation could be worse.

Table 1: Results of COPERT runs

EMISSIONS (Kt.)	London Split No Congestion	London Spilt congestion	All TWC No congestion	All TWC congestion
CO	984.2	2166.4	362.6	426.0
NM-VOC	113.6	193.1	50.4	53.5
NO_x	97.8	98.3	54.8	56.4

The ratio of VOC:NOx emissions is also important, as in populated regions of Europe the photochemical production of ozone is often VOC limited (Simpson, 1992). Hence, the reduction of VOC emissions in these areas is very important. This fact is a significant feature of the modeling studies downwind of London that has been initiated by these results, using the London Plume Model of R Derwent(Hough and Derwent, 1987).

Clearly more information is required on driving patterns and emissions to further quantify the implications of congestion. This needs to allow for stop/start conditions as well as low average speeds and to include direct measurements from a representative sample of vehicles in addition to traffic census data. Other features such as cold start emissions are also being considered. A range of scenarios can then be prepared for modelling studies of photochemical ozone production downwind of cities.

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MODELLING AND SIMULATION FOR A FLY-BY-WIRE AIRCRAFT.

by
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Abstract: Contemporary high performance combat aircraft is fly-by-wire type. It is inherently unstable giving the planform designer the freedom to relax aircraft static stability. This in turn shifts the responsibility of providing adequate artificial stability to control system designers. Two primary considerations govern stability. The first is knowledge of the stability and control characteristics of the basic airframe. The other is Handling Quality and the Performance requirements of the users. This paper addresses the first consideration of knowing the flight mechanics parameters including the stability and control characteristics of the unaugumented aircraft. These enable identification of critical areas for design and assessment of the control law. At the chosen design points, the art of deriving linear models from nonlinear flight model is described. The paper concludes with a description of the Engineer in the Loop Simulator facility that enables the designed control law to be tested out prior to assessment in pilot-in-the loop Simulator.

Keywords: Flight Simulation, Modelling, Aircraft Flight, Fly-By-Wire Control, Simulators

1. INTRODUCTION

The most important preliminary task for a flight control system designer is to analyzer the stability and control characteristics of the aircraft that is to be controlled. The essence of analysis is in modelling the aircraft. The technique of modelling an unstable aircraft in the non-linear domain is much the same as that of a stable aircraft. However, the need for a large number of linear aircraft models comes at a very early stage and is indispensable in the design and development cycle of the unstable aircraft.

The generic mathematical flight model of the aircraft is highly non-linear representing all phases of flight, all flight conditions and all configurations. There exists just one model capable of simulating any manoeuvre one can conceive. The state of the art computers theoretically make it possible to derive non-linear control for a non-linear plant. Practical: considerations of controlling a highly complex statically unstable combat aircraft dictate control lawlesion to be carried out in the linear domain.

This demands linear perturbation models of the aircraft to be derived at all design points of interest. e method of recognising the points of interest for ensign is covered in detail by deriving flight mechanics parameters. At identified points, the linear perturbation models are generated. The structure of the models is described followed by a brief description of testing philosophy in a real time Engineer friendly Simulation facility.

2. THE NON-LINEAR FLIGHT MODEL

The generic non-linear flight dynamic model defamed with respect to the centre of gravity in the body axes is as in equation (1).

$$X(t) = f(x(t),x(t),u(t)) \qquad (1)$$

Where $X\Sigma$ [V, α, β, p ,q,r,Ψ, θ , φ ,X,Y,Z]
$u\Sigma$ [δe, δa, δr, δt ----------]

The sensors which sense the flight variables like accelerations, angular rates, flow variables like angle of attack, sideslip and speed are at locations often far away from the centre of gravity. Thus, for deriving linear observation models, non-linear observation equation (2) are equally important.

$$y = g(x,u,X_{pp}, Y_{pp},Z_{pp}) \qquad (2)$$

Where $y\Sigma$[X,X_1,a_x,a_y,a_z, γ, α_s,L,D----]

The equations make the assumptions that the aircraft is a rigid body flying over a flat non-rotating earth. Such a model is capable of executing any kind of manoeuvre. An example of a combat manoeuvre is shown in Figure 1. If one were to analyse the linear dynamics of the aircraft at different points in this manoeuvre, they will be showing different Characteristics. It is therefore essential to analyse the models for various types of manoeuvre states for which equilibrium can be defined. The concept of equilibrium or trim relevant to starting the design of control law is covered below.

3. EQUILIBRIUM ANALYSIS

A generalized system of the form $X = f(x, u)$ is in an equilibrium state when X is zero and the value of x is steady. For stability and control analysis, the period of interest is less than one hundred seconds. It is therefore useful to visualise a manoeuvre like a loop and freeze the flight at different intervals of time in that particular manoeuvre and study the dynamics around the frozen time interval (Figure 2). At each one of these points, the trim state and the linear Model will be different to those at other points of time. Thus a single non-linear flight model encompassing representation of flight at all points in the flight envelope can render itself into a string of state space linear models qualified by flight condition, configuration, flight state and trim type. The trim state itself can give insight into a host of well understood flight mechanics parameters. An example of a trim state information coming out of an automated linearizing software ALLS [Rekha] (Figure 3) is shown in Table 1. Aircraft manoeuvre can be as diverse as the pilot who flies it making it an infinite set. Any manoeuvre that is well understood renders itself to be mathematically defamed. Basically this means translating pilots' opinion of what constraints a manoeuvre to an Engineers' language. Some very well understood and often encountered manoeuvres are: Straight and Level pull up, Turns and Spin. The implications of the different trim constraints for these manoeuvres are as follows.

3.1 Straight and level Flight Trim

This trim option implies that for a given flight condition, the defined Mach and altitude are constants and the wings are levelled out. This when translated means satisfying the following constraint equations.

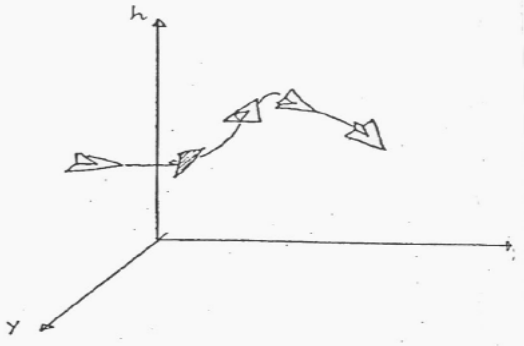


Fig.1 : Combat Maneuver

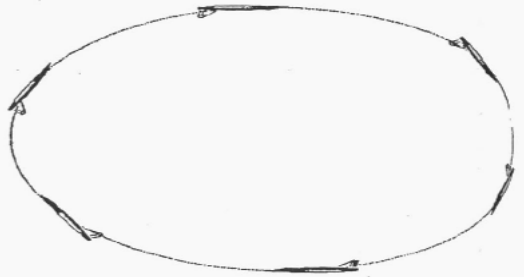


Fig.2 : A View Of A Loop Maneuver

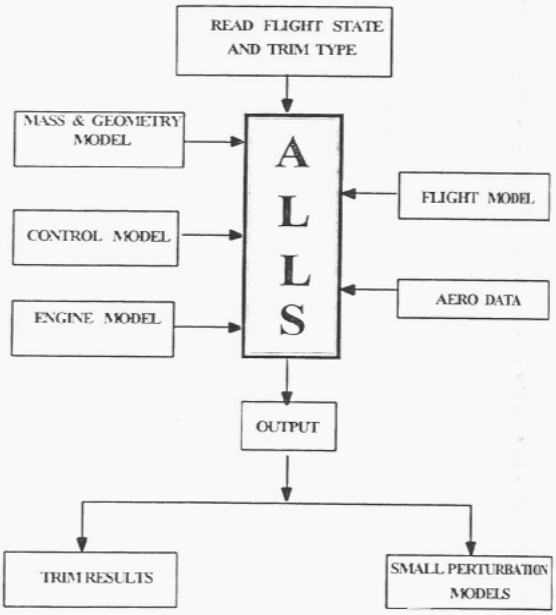


Fig. 3 BLOCK SCHEMATIC OF LINEARISING SOFTWARE

MACH		**VTRIM**	Meters/sec	**PS.**	Millibars		
ALTITUDE	Meters	**LD**		**PT-PS**	Millibars		
GAMA	Degrees	**PSIDOT**	Deg/sec	**NDOF**	5/6	**VCAS**	Knots
MASS	Kilogram	**IXX**	Kg-m*m	**IYY**	Kg-m*m	**IZZ**	Kg-m*m
WEIGHT	KILO NEWTONS	**IXY**	Kg-m*m	**IYZ**	Kg-m*m	**IZX**	Kg-m*m
CBAR	Meters	**XREF**	%CBAR	**YREF**	Meters	**ZERF**	meters
C.G	%CBAR	**DELX**	Meters	**DELY**	Meters	**DELZ**	Meters
WING AREA	Sq. Meters	**DXENG**	Meters	**SPAN**	Meters	**DZENG**	Meters
ALPHA	Degrees	**THTAD**	Degrees	**PHI**	degrees	**PSI**	degrees
BETA	degrees	**HDOT**		**RHO**	Kg-m*m*M	**QBAR**	Kilopascal
THRUST	Kilo net tons	**SIGMA**	Degrees	**LIFT**	Kilo newtons	**DAG**	Kilo newtons
CX		**CZ**		**C LIFT**		**CD**	
CI		**Cm**		**Cn**		**CY**	
UB	M/sec	**VB**	M/sec	**WB**	M/sec	**N**	
P	Deg/sec	**Q**	Deg/sec	**R**	Deg/sec		
AILERON	Degrees	**ELEVON**	Degrees	**RUDDER**	Degrees	**PLA**	Degrees
FLAP	Degree	**AIRBRAKE**	On/off	**ATMOS**	ISA/ITRA	**COMRAT**	On/off
UC	Up/down	**ANX**	G units	**ANY**	G unit	**ANZ**	G unit

Table 1. TRIM STATE INFORMATION

	CI	**Cm**	**Cn**	**CD**	**CLIFT**	**CY**
zero coeff	Cl_o	C_{mo}	C_{no}	C_{Do}	C_{Lo}	C_{yo}
p	C_{lp}	Cm_p	Cnp	CDp	CLp	Cyp
q	C_{lq}	Cm_q	Cnq	CDq	CLq	Cyq
r	C_{lr}	Cm_r	Cnr	CDr	CLr	Cyr
vel	C_{lv}	Cm_v	Cnv	CDv	CLv	Cyv
mach	C_{lm}	C_{mm}	CNm	CDm	CLm	Cym
alpha	$C_{l\alpha}$	$C_{m\alpha}$	Cnα	CDα	Clα	Cyα
beta	$C_{l\beta}$	Cm_β	Cnβ	CDβ	CLβ	Cy
altitude	C_{lh}	Cm_h	Cnh	CDh	CLh	Cyh
alpdot	$C_{l\alpha}$	Cm_α	Cnα	CDα	CLα	Cyα
btadot	Cl_β	Cm_β	Cnβ	CDβ	CLβ	Cyβ
aileron	$Cl_{\delta a}$	$Cm_{\delta a}$	Cnδa	CDδa	CLδa	$Cy_{\delta a}$
elevon	$Cl_{\delta e}$	$Cm_{\delta e}$	Cnδe	$CD_{\delta e}$	CLδe	Cyδe
rudder	$Cl_{\delta r}$	$Cm_{\delta r}$	Cnδr	CDδr	CLδr	$Cy_{\delta r}$
pla	C_{lt}	Cm_t	Cnt	CDt	CLt	Cyt
lef	$Cl_{\delta f}$	$Cm_{\delta f}$	Cnδf	CDδf	CLδf	$Cy_{\delta f}$

TABLE 2. NON-DIMENSIONAL DERIVATIVES

$$\phi = 0; p = q = r = 0 \qquad (3.1)$$

3.2 Pull- up Trim:

This trim assumes that there is no lateral motion but there is a constant pitch rate satisfying the following constraints.

$$\phi = 0; p = r = 0; q = \text{constant}; \qquad (3.2.1)$$

from $\alpha = 0$ equation and above constraints one gets

$$q = \left[mg(n - \cos(\theta - \alpha)) - F_{tz} \cos\alpha + F_{tx} \sin\alpha \right] / mV \cos\beta \qquad (3.2.2)$$

3.3 Turn Trim:

This option implies that there is no lateral acceleration - ny. Therefore

$$ny = 0; \ \phi = 0; \ \theta = 0 \qquad (3.3.1)$$

These equations along with the fact x = 0 for any equilibrium yields

$$Ps = -(\Psi \sin\gamma / \cos\beta) - q \tan\beta$$

$$Q = -(\Psi \sin^2\phi L [-\sin\gamma \sin\beta \pm (\sin^2\gamma \sin^2\beta - \sin^2\gamma \cos^2\beta / \sin^2\phi L)^{1/2}]$$

$$Rs = q/\tan\phi L \cos\beta$$

$$Ps = p\cos\alpha + r\sin\alpha$$

$$Rs = Ps = p\sin\alpha - r\cos\alpha$$

$$\phi = \tan^{-1}(-p/\Psi)$$

$$\theta = \tan^{-1}(q/r)$$

$$\Psi = \text{Tan}^{-1}(\phi L/V)$$

$$\phi_L = \pm \tan^{-1}(\sqrt{n2 - \text{Sin}2\gamma})/\cos\gamma$$

3.4 spin trim:

This trim implies satisfying the following constraints

$$\alpha \geq \alpha_s,$$

$$\omega = |\Psi|,$$

$$R = v\cos\gamma)/\omega \qquad (3.4.1\text{-}3.4.6)$$

$$P = -\Psi\sin\theta$$

$$Q = \Psi\cos\theta\sin\phi$$

$$R = \Psi\cos\theta\cos\phi$$

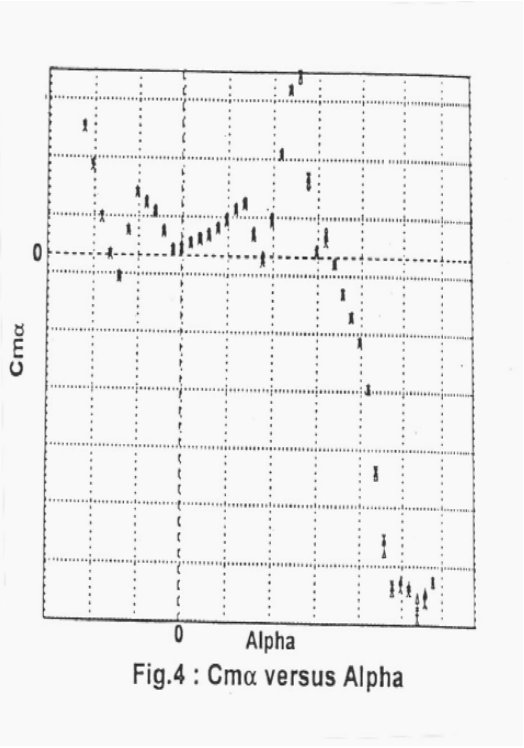


Fig.4 : Cmα versus Alpha

4.0 FLIGHT MECHANICS PARAMETERS

For a chosen trim type, the corresponding constrain equation is selected. The aircraft flight equilibrium is determined using appropriate constrained optimization algorithm. A wealth of information is obtained at trim from this automated software ALLS as in Table 2. A close scrutiny of the variables listed give insight into the parameters like the non. Dimensional derivatives, the control settings require to achieve equilibrium. These values permit other flight Mechanics parameters like LCDP, Candy to be derived. A plot of variable Cam obtained after trimming the aircraft systematically with respect to different Mach number, Angle of attack and altitude is shown in Figure 4. From this it is evident that for control law design, linear models need to be generated at close intervals where the pitch up is changing drastically. The structure of the model is detailed in the next section.

5.0 LINEAR FLIGHT MODEL AND ITS STRUCTURE

Assuming the aircraft flight is close to nominal or equilibrium conditions, the generalized system

$$Jx_n(t)=f(x_n(t),x_n(t),u_n(t)) \quad \textbf{(5.0.1)}$$

Can be represented by linear system in (i) generalized form as

$$Kx=A_0x+B_0u \quad \textbf{(5.0.1.1)}$$

$$Y=C_0x+D_0u \quad \textbf{(5.0.1.2)}$$

(ii) Standard form

$$x=A_sx+B_su \quad \text{in standard form} \quad \textbf{(5.0.2.1)}$$

$$Y=C_sx+D_su \quad \textbf{(5.0.2.2)}$$

As it is well established that for small perturbation analysis of an aircraft the longitudinal and lateral dynamics can be conveniently decoupled, the following longitudinal and lateral models are used

5.1 Longitudinal:

State equations in standard form

$$X_{ion}=A_{ion}X_{ion}+B_{ion}U_{ion}. \quad \textbf{(5.1.1)}$$

Where

$$X_{ion}=[\alpha,q,\theta v/V] \quad \textbf{(5.1.1.1)}$$

$$u_{ion}=[\delta e,\delta f,\delta t] \quad \textbf{(5.1.1.2)}$$

Observation equations

$$Y_{ion}=C_{ion}X_{ion}+D_{ion}U_{ion} \quad \textbf{(5.1.2)}$$

Where

$$Y_{ion}=[\alpha_s,q_{rs},\theta r_s,a_{nz\,rs},a_{nz},\gamma] \quad \textbf{(5.1.2.1)}$$

5.2 Lateral:

State equations

$$X_{lat}=A_{lat}X_{lat}+B_{lat}u_{lat} \quad \textbf{(5.2.1)}$$

Where

$$X_{lat}=[p,r,\beta,\varphi] \quad \textbf{(5.2.1.1)}$$

$$U_{lat}=[\delta a,\delta r] \quad \textbf{(5.2.1.2)}$$

Observation equations

$$Y_{lat}=C_{lat}X_{lat}+D_{lat}U_{lat} \quad \textbf{(5.2.2)}$$

Where

$$Y_{lat}=[p_s,r_r,\beta_{rs},a_{ny\,rs},a_{ny},\varphi_s] \quad \textbf{(5.2.2.1)}$$

Where

$$\mathbf{A_{ij}=\delta x^{\cdot}/\delta x;\quad B_{ij}=\delta x/\delta u;\quad c_{ij}=\delta y/\delta x;\quad D_{ij}=\delta y/\delta u}$$

For the same flight condition, for the following manoeuvre namely - Straight and Level, Pull up, Turn, the difference between the models lies in the values of the A,B,C and D Matrix elements. This implies that a control law designed in the linear domain, no matter what model has been taken for starting the design meets the design objectives. Which type of linear model is best to be considered for design is again dependent on the parameters which highlight the issues considered critical such as time to double, pitch recovery margin, Lateral Control Departure parameter(LCDP), control position at trim etc. This is assessed by examining the Flight Mechanics parameters obtained at the equilibrium point. For example, from the plot of LCDP vs. Candy of Figure 5, it is seen that the closed loop simulation needs to be assessed critically where it shows a tendency to depart - i.e. in the region where LCDP and Candy are negative. Such an assessment can be done ill a non-linear real time simulator platform which permits detailed study of the time history of all variables whether of the Flight model or the control model.

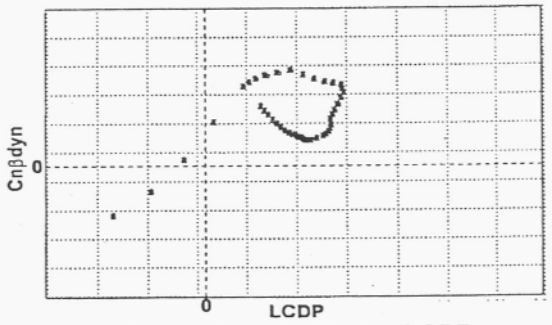


Fig.5 : Cnβdyn versus LCDP

A platform that permits batch simulation as well as real time simulation is highly desirable. A facility that is user friendly and easy to operate by designers which permits the control law designer to make quick changes and see for himself the effect of the change in an objective manner is essential. The outcome of such a need is the ELS facility at the National Aerospace Laboratories[Padma et.al].

6.0 SIMULA TION MODEL IN ELS AND ALLS

ELS is an Engineer in the Loop Simulator conceived to catalyse the design of Control Law*for* a Light Combat aircraft. The ingredients of the simulator are an Engineer's station comprising the throttle and the control stick, a data acquisition system that converts the control inputs to the digital domain, a numeric processor solving the six-degree of freedom flight equations, and a graphic processor providing the visuals. The different modules are connected via ethemet as shown in the Figure 6.

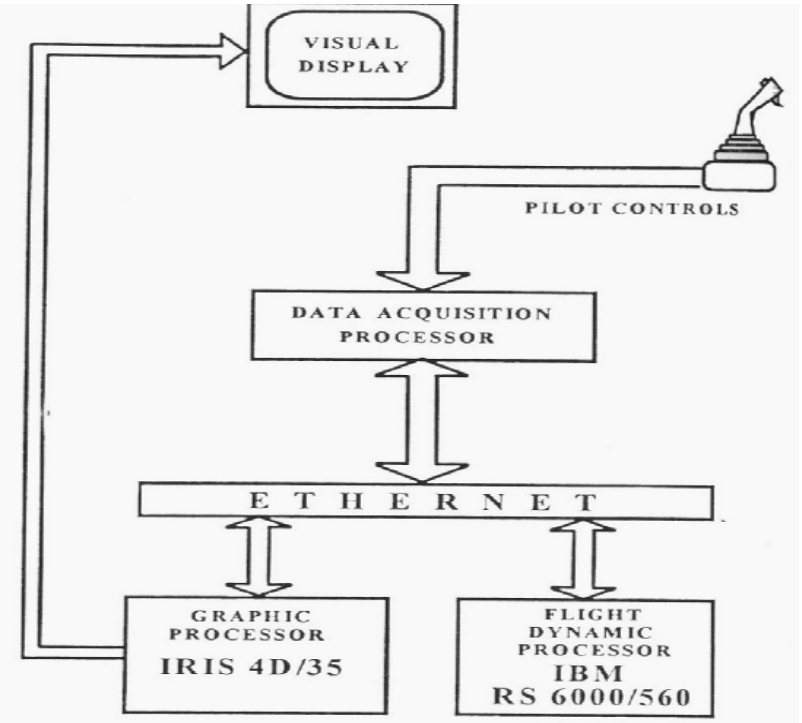


Figure 6. Engineer-in -the -Loop Simulator

The flight model itself is represented in a schematic way as in Figure 7. It comprises of various sub modules namely the engine, the actuator, the atmosphere, the aerodynamic data model, the flight model, the control model, the weight, centre of gravity and Inertia model. The linear closed loop model responses are first compared with the nonlinear closed loop model responses for small perturbation inputs to ascertain the correctness of implementation of the control law. Subsequently the law is test flown by the Test Engineer or the Design Engineer in the ELS Simulator. A comparison of open loop and closed loop response plot in Figure 8 shows the degree of controllability of the stability of a combat aircraft. The iterative procedure for testing is shown in the flow diagram(Figure 9). The analysis of the time histories of simulated controlled flight is an objective feedback that indicates whether or not the Control law design is to be refmed or to be frozen for further evaluations by flyers.

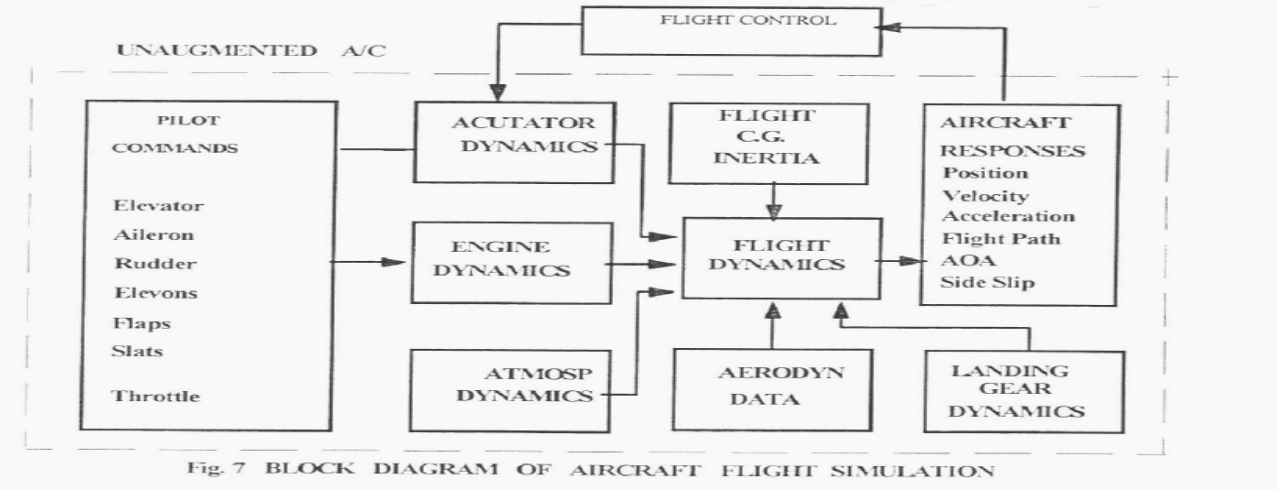
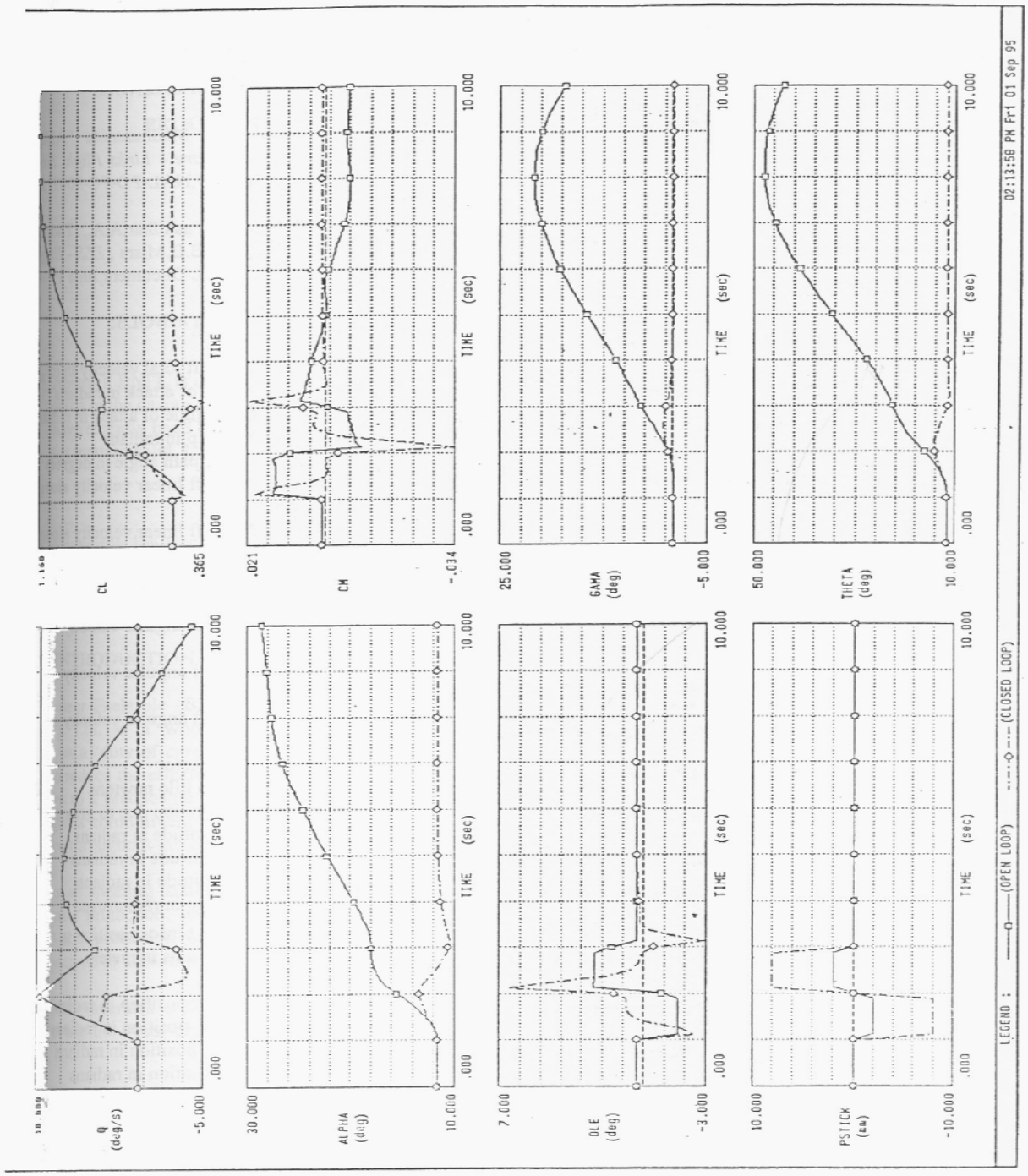


Fig. 7 BLOCK DIAGRAM OF AIRCRAFT FLIGHT SIMULATION


Q
(deg/s)
ALPHA
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OLE
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PSTICK
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CL
CM
GAMA
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TIME (sec)
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Figure 8.

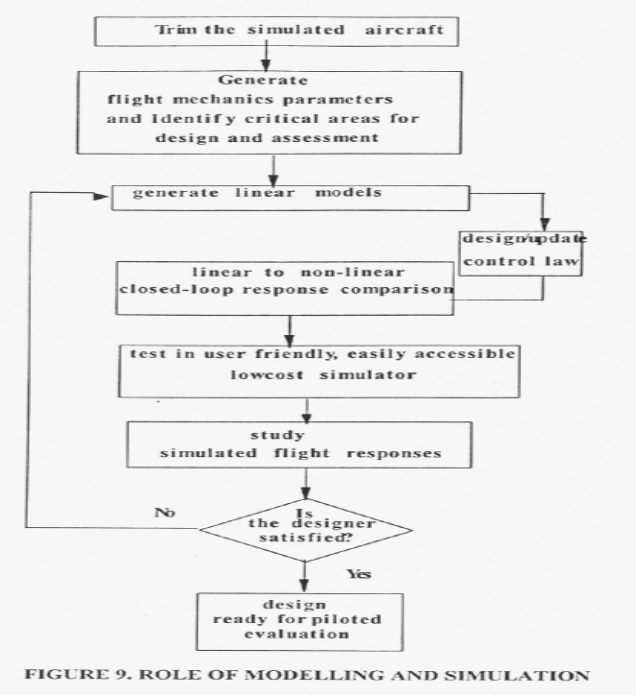

FIGURE 9. ROLE OF MODELLING AND SIMULATION

7.0 CONCLUSIONS

The role of modelling and simulation is an essential element in the Control law design process, which Is seen to be a long drawn iterative procedure. The aerodynamic data, for the flight model before the aircraft is test flown comes from the wind tunnel. Hence any mathematical model whether linear or non-linear can at best be as accurate as the wind tunnel data will permit. Therefore, the process of generating models and simulating continues even as the flight tests proceed. Any surprises coming out of the aerodynamic derivative estimates from the flight test identification methods will have to be absorbed to update the aerodynamic data and the model. Changes therefore point to going back to the first step in the iterative design procedure. Like in any good optimization procedure, the effort in the very first step is the hardest and knowledge gained during iterations helps in converging fast towards the fm& goal. A Linear model software tool like ALLS and an Engineer friendly Simulator like ELS are vital catalyzing the design of the control law of a Fly-By.! Wire aircraft.

8.0 REFERENCES

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9.0 SYMBOLS

V	Aircraft total velocity in m/s2
α	Angle of attack in radians
α s	Stall angle of attack in radians
β	Sideslip in radians
γ`	Flight path angle in degrees
U body axis in m/s	Aircraft linear velocity along x
V body axis in m/s	Aircraft linear velocity along y
W body axis in m/s	Aircraft linear velocity along w
P body axis in rad/s	Aircraft linear velocity along x
Q body axis in rad/s	Aircraft linear velocity along y
R body axis in rad/s	Aircraft linear velocity along w
N	Load factor
M	Mass in koil newtons
Q	Acceleration due to gravity in m/s2
Ψ	Yaw attitude in radians
θ	Pitch attitude in radians
φ	Roll attitude in radians
ω	Spin rate in radians/SEC
Ipp	Pilot or sensor position w.r.t.c.g.along I-axis in meter I=x,y,z
δe	Elevator position in radians
δa	Aileron position in radians
δr	rudder position in radians
δf	Flap position in radians
δt	Throttle position in degrees
Mach	Mach number
CXi	Non-dimensional aerodynamic
Coefficient	X-l,m,n,LIFT,D,Y I=p,q,r, α , β , δe, δa, δr, δf, δt,M,h

PROCESS TECHNIQUES USED BY BNFL TO PROTECT THE ENVIRONMENT.

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Abstract: BNFL is committed to reducing discharges from its facilities. This paper outlines some of the design techniques employed by the company and describes two plants that have recently been brought on line to reduce radiological discharges to the sea. Techniques for treating solid, liquid and gaseous wastes are briefly described.

Keywords: Ion Exchange, Ultra filter, Waste Treatment.

1. INTRODUCTION

British Nuclear Fuels pIc (BNFL), of which BNFL Engineering Ltd. is a wholly owned subsidiary, acknowledges a 'duty of care' for the environment, and aims to reduce the effects of its activities on the environment to a practicable minimum. To this end it encourages a commitment to good environmental performance throughout the organisation.

In addition to meeting statutory requirements for environmental protection, the health and safety of the public and protection of the environment are primary concerns to al1 within BNFL.

The Company operates a Code of Practice based upon achieving the "best practicable environmental option".

The company policy predates the latest legislation and thus no change in direction was needed to comply with the new laws.

The aim of this paper is to describe the techniques used at the design stage, particularly by the Process Engineers, to minimise the effect of any process on the environment and to give some examples of plants operating today that make positive contributions to reducing discharges of radioactive materials to the environment.

2. DESIGN TECHNIQUES.

The first step in any project is 'Optioneering'. This, as the name implies, entails identifying all the various options for achieving the end result and may identify R&D requirements. The engineers will develop the most promising options to a stage that enables outline costs to be assigned. For example, Process Diagrams will be drawn with preliminary sizing of equipment and process conditions assessed. This will lead to choice of materials of construction and ventilation requirements and an assessment of waste arisings. The perceived hazards would be identified and a preliminary safety assessment carried out if necessary.

Another technique used within BNFL Engineering Ltd is 'Value Engineering' which examines a proposal and using structured discussion identifies the most beneficial way forward. This is aimed at ensuring that the project members understand all aspects of a proposal, so that unnecessary work is avoided and that the design effort is focused on the important issues.

Both 'Optioneering' and 'Value Engineering' make use of multi-disciplined groups.

The Design Engineers then develop the process so that HAZOPI studies can begin. By using standard guide words the potential hazards, both conventional and radiological, can be identified and the relevant disciplines actioned to find a solution that satisfies the HAZOP team.

At the detailed design stage, the designers include recycles and process steps to minimise the waste produced and the impact on the environment, by efficient use of resources including power and reagents. HAZOP 2 studies are then carried out that look in detail at the proposed design. Experts from the environmental protection and safety departments are included on the panel of both HAZOP teams. If necessary, they carry out risk assessments that ultimately lead to the categorization of the protection systems included in the plant design.

Continuous design review ensures that minimisation of waste is ensured. The designers are also required to consider decommissioning of the plant, as this can influence the chosen layout or process step.

3. WASTE MANAGEMENT

Over the years BNFL has built up an impressive level of expertise in designing, constructing, operating and maintaining the complex and technically advanced operational plants which ensure an efficient and effective fuel cycle service. In addition BNFL Engineering Ltd has extensive experience of dealing with an issue that all process industries have to face i.e. Waste Management.

Of the £5.5 billion the Company is investing in new plant and equipment until the end of the century, about £1.7 billion is being channelled into waste management plants at BNFL's largest site, Sellafield, in West Cumbria.

There are three types of waste that inevitably arise out of man's activities, these are:

- LIQUID WASTE
- SOLID WASTE
- AERIAL EFFLUENT

The following sections outline some of the improvements that have been made recently by BNFL to reduce the impact on the environment of the wastes arising from the Sellafield site.

3.1 Liquid Waste.

Low-level liquid waste, once treated and monitored is suitable for discharge to the Irish Sea. BNFL has dramatically reduced its discharges in recent years by bringing into operation a series of effluent treatment plants. The main ones use three different principles which are illustrated in the following plants:

. The Salt Evaporator
. The Enhanced Actinide Removal Plant (EARP)
. The Site Ion Exchange Effluent Plant (SIXEP)

The Salt evaporator plant has helped to reduce total alpha and beta discharges by more than half. It concentrates alpha, beta and gamma activity in salt bearing streams from Sellafield's reprocessing plant by evaporation. The concentrates are treated in the Enhanced Actinide Removal Plant. There, the alpha and beta content is reduced by flocculation and the resulting floc is encapsulated and stored as intermediate level waste.

The Site Ion Exchange Effluent Plant is designed to remove sludge and soluble caesium and strontium from cooling pond water in which irradiated nuclear fuel elements have been stored.

The plant has dramatically reduced discharges of short-lived beta activity to sea. Caesium activity, for example, has been reduced one thousand-fold. It concentrates activity contained in 30,000 cubic metres of liquid effluent into just one cubic metre of solid ion-exchange medium, which is then encapsulated in cement.

3.2 Solid Waste

The encapsulated waste from these and other plants are at present stored on site. The siting and construction of a long-term repository for intermediate-level waste in the UK is an issue being addressed at the moment. One of two sites identified in the UK is Sellafield where a detailed geological investigation is being undertaken.

Because of its minimal radioactive content, low-level solid waste is disposed of in shallow land burial sites. The waste consists of paper, plastic sheeting and containers, towels, protective clothing and scrap metal, much of which is disposed of merely because it has been in a radioactive operating area.

Initiatives have been implemented in the company to minimise the volume of solid waste. The need to reduce waste has been identified and a period of education. of the total workforce has begun including, among other things, the introduction of new working practices to ensure correct segregation

of waste at source. There are also compaction systems be brought on line that will dramatically reduce the volume of this waste, so that the life of ling site will be extended into the 21 st century

3.3 Aerial effluent

Designers are concerned with a range of gaseous discharges e.g. building ventilation air, active lent extracts, and process vessel and, air and gases. Specifically off-gas treatment systems designed by Engineering Ltd include:

- Electrostatic precipitators
- Wet scrubbers
- Chemical clean-up systems
- Packed beds
- High efficiency particulate filters

The containment needs of each building or plant are individual. BNFL Engineering Ltd are able to design a system with a particular process in mind that he safety of plant operators and minimizes effluent discharges to the environment

4. PLANT DESCRIPTIONS

4.1 site Ion Exchange Effluent plant.

As the name implies the SIXEP treatment process is I ion-exchange. An atom in solution electrically charged and *is* called an ion. Make up the microstructure of crystalline i. Some materials are able to extract IS from solutions passed through them and e them into their microstructure in place of ions which had previously formed part of their lattice. Such materials can be naturally materials known as zeolites or especially red materials.

A well known example of ion exchange is water The calcium or magnesium ions in lake the water hard. They are removed in water softening process by passing through a zeolite, typically in exchange for sodium ions from its crystal lattice.

In SIXEP it is caesium and strontium ions that are removed by a zeolite called clinoptilolite – a naturally occurring alumino-silicate selected following extensive tests. The ion exchange is shows schematically below'

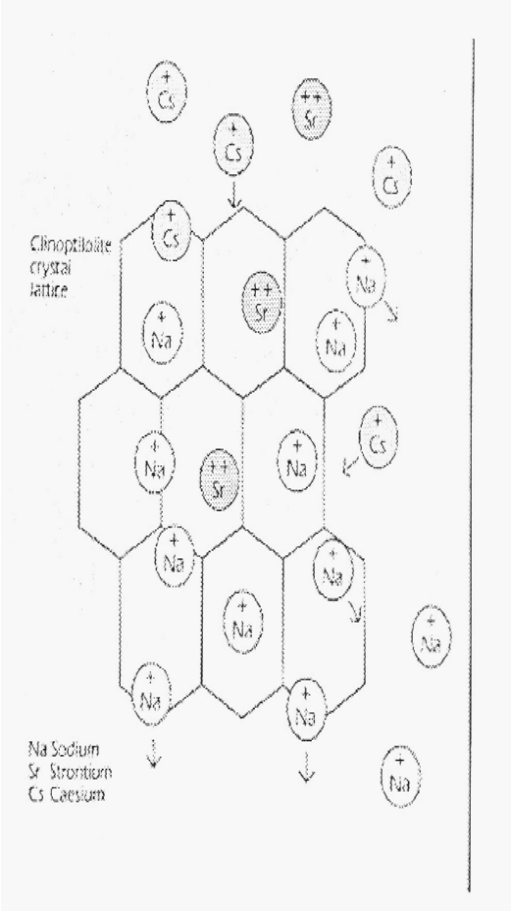


Fig.1 ION EXCHANGE PROCESS

Clinoptilolite in a granular form is loaded into vessels in the Chemical Preparation area where it is washed and skimmed to remove fine particulates before being transferred hydraulically to the main treatment part of the plant.

Before the contaminated water is fed to the ion exchange columns it is conditioned by passing through sand bed filters and a carbonating tower. The sand bed *filters* have *two* purposes *viz:* to remove particulate matter which has come from the fuel storage ponds and would otherwise rapidly block the ion-exchange medium, and to remove any magnesium solids which would go into solution and compete with the caesium and strontium for the ion exchange. The filters are back washed at regular intervals and the accumulated sludge is stored in large tanks. In order to maximise the efficiency of the sand bed filters in terms of actual percentage solids removed and in terms of quantity of liquor treated between backwashes, a programme of development was carried out that led to the use of a polyelectrolyte and the control of the feed temperature.

The water in Magnox fuel storage ponds is alkaline to slow down corrosion of the fuel cladding material. If clinoptilolite is subjected to alkaline conditions for prolonged periods it tends to deteriorate and the beds would become blocked. A carbonating tower bubbles carbon dioxide through the feed stream *to* return it to a near neutral condition.

After the carbonating tower, the water is pumped under pressure through two vessels in series, each of which contains a bed of clinoptilolite. As the water passes through the column, the clinoptilolite absorbs the caesium and strontium. After about three months, when up to 80 million gallons of water have passed through the bed, it begins to saturate and the second bed takes over as the main removal mechanism. The first bed is then discharged and refilled. In order to minimise the volume of spent ion exchange arisings (and therefore minimise solid waste) work was done to optimise a system of column reversal such that each charge of clinoptilolite is used first in the trail position, followed by use in the lead column.

It had been demonstrated that a few percent of spent ion exchanger remaining in the column after transfer had a marked effect on the decontamination factor in that vessel. This led to the need for design and development work that produced a design that leaves no more than 0.1 % of the material behind.

The plant includes facilities for sampling the process stream at various points, including the final discharge to sea. This not only confirms the satisfactory operation of the ion exchange process but also measures the small quantities of radioactivity remaining in the discharges to sea.

4.2 The Enhanced Actinide Removal Plant

The Enhanced Actinide Removal Plant has been designed to remove alpha and beta activity from effluents resulting from future and historical reprocessing operations.

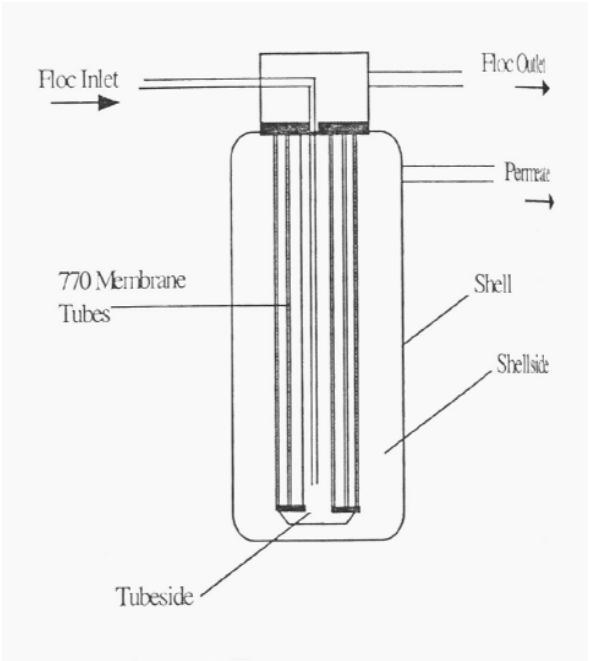
These consist of:

- Low volume medium active concentrate streams arising from current production.
- Low volume historical medium active concentrates stored on site
- High volume low active bulk effluent streams

These streams are acidic and contain significant amounts of iron in solution.

The process involves adding pre-treated sodium hydroxide to the iron bearing acidic stream resulting in the formation of a ferric floc. The majority of the alpha activity co-precipitates with the floc leaving a purified liquor. The addition of specific chemicals at the precipitation stage significantly improves the beta activity removal.

The ferric floc, containing most of the activity must now be separated from the liquor to produce a solid waste suitable for encapsulation in cement. The remaining aqueous permeate is subsequently discharged to sea. The dewatering stage is achieved by ultrafiltration.



Ultra filtration works on the principle of the floc bearing stream being continuously recirculated under pressure through porous parallel tubes, causing a flow of permeate outwards through the tube membranes. These tubes are housed in ultrafilter modules, schematically shown below. The feed recirculates through a series of ultrafilters until the desired degree of dewatering has been achieved.

The high volume bulk effluent operates with two stages of ultrafiltration. The primary ultrafilters, operating continuously, produce an intermediate stage floc and most of the permeate. The process is then completed by the secondary ultrafilters operating on a semi-batch basis to produce and discharge the floc product at the correct specification for encapsulation.

The medium active concentrate stream, due to its low volume, requires only one set of ultrafilters.

The permeate produced in the dewatering stages is sentenced on a batch basis to ensure t hat it meets the discharge criteria before being discharged to sea. Any batches that fail to meet the discharge requirements are recycled within the plant

FIG 2. EARP ULTRAFILTER

5. CONCLUSION

From this paper one can see that at an stages in the life of a plant BNFL and BNFL Engineering Ltd as one of its subsidiaries are committed to ensuring that its personnel are encouraged to minimise the effect on the environment of the operation of its plants.

This process starts at the pre-design stage, where every option is fully explored and the relative merits of each one are examined. Various design techniques are then employed that lead to a fully justified design. Research and development work is carried out to support the design and during operation the process is optimised to operate as efficiently as possible.

Decommissioning is not forgotten, in fact the means of de-commissioning the plant is taken in to account at the design stage.

The two plants described are capable of treating the effluent from historic plants as well as existing facilities, thus fulfilling the declared aim of achieving the "best practicable environmental option."

INTERACTIVE POLLUTION MAPPING ON THE INTERNET: MAKING SENSE OF ENVIRONMENTAL INFORMATION

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Abstract: Information can be managed in such a way that it plays a strategic role in achieving an information intensive organisation's objectives. Providing information about the environment will increase public awareness of environmental issues and empower individuals to help to protect their own environment. Advanced information technology can be used to encourage informed debate about environmental issues. In particular, the use of database and communication technologies can be used to present information to the daily increasing audience who have access to the Internet. The application of information technology to the task of making information about chemical releases into the environment in the UK available to a wide audience in an understandable form is presented to illustrate the argument.

Keywords: environmental information, World Wide Web, pollution data, managing information. Information technology.

1. INTRODUCTION

Any organisation whose operations are information intensive must be continually monitoring and evaluating developments in information technology as part of its strategy to maintain a competitive edge and achieve its objectives efficiently and effectively. Increasingly the idea is becoming established that information is not only vital to *support* an organisation's activities but that it is also a key determinant of what an organisation's activities *call be.* In this paper we report one area of our work which demonstrates that exploitation of advances in information technology can present new possibilities for creating and achieving an organisation's strategic objectives.

Friends of the Earth (FOE) is one of the UK's leading environmental campaigning organisations and is a member of the Friends of the Earth International Network which co-ordinates over 50 international groups. In the United Kingdom, one of FOE's primary activities is to research and disseminate accurate and reliable information about environmental threats and alternative, sustainable lifestyles. Informing government. the media. other non-governmental organisations and specialists

bodies and the general public. In the summer of 1995 a two-year collaborative project began between Friends of the Earth and the Department of Computer Science at University College London to investigate and establish innovative ways of using information technology to manage the information which is vital to FOE's successful operation. This paper reports on one area where this collaboration has initially made an impact.

The growth 0f Internet sites and services continues exponentially. In particular, the development of the World Wide Web (WWW) service has hugely eased the means by which information can be presented, linked to other related sources of information, and accessed by non-technical computer users. The number and range of organisations who are setting up WWW sites to conduct their business and to make their services known to the rapidly expanding audience accessible through this medium is growing on a daily basis. Friends of the Earth was one of the first non-governmental environmental campaigning groups in the world to establish a presence on the Internet when it set up FOE net! in May 1994. One of FOE's strategic objectives is to remain at the leading edge in developing and exploiting new forms of information technology to achieve its aims in helping to protect the environment. FOE views the Internet as an important core medium for environmental campaigning rather than as a currently fashionable sideline. FOE net not only presents a unique opportunity to disseminate information to a huge audience about rapidly changing situations but also to engage in two way communication. Interactive information sources provide a means for individual visitors to the Internet site to enter actively into the debate about environmental issues as well as supporting communication among FOE groups throughout the UK.

2. MANAGING INFORMATION EFFECTIVELY

The view that information is an important resource for an organisation is now well established and over the last twenty to thirty years techniques, technology and practices have been evolving to manage information electronically. There is an inherent danger in the "information as resource" perspective which is that information will be confined to be viewed as a kind of passive commodity to be acquired and used to support the operational activities of the organisation to which it belongs. Over the last decade in particular the passive. supportive view of information has gradually been replaced as the role of information has moved up the decision making hierarchy from the operational level. Through management control. to the level of supporting strategic decision making. Since the overall purpose of strategy is to guide and direct development and change in an organisation it follows that as information can be of strategic importance to an organisation. the managing of information should properly be viewed as a branch of management dealing with the exploitation of information for organisational objectives.

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[1]FOEnet is :It http://wwwJoe.co.uk

Advanced information technology provides the support platform for the exploitation of information. The main properties of advanced information technology which affect organisations are those for facilitating communication (rapidly, easily, reliably, cheaply. across large distances. among selected large or small groups and among individuals) and those for assisting with decision making e.g. storing huge amounts of data automatically, retrieving data selectively, combining and reorganising data, making inferences, running simulations. presenting information in a variety of understandable forms and structures. Facilitating communication and aiding decision making in these ways increases the availability of information. Some of the consequences of this increased availability will be intended and planned effects. but others. which cannot be predicted in advance. will arise inevitably. Thus use of advanced information technology not only increases the effectiveness and efficiency of an organisation when applied appropriately (the "information as resource" view) but is also likely to affect the organisation's nature and objectives (what it knows, what it can do. how it is organised).

3. THE ROLE OF PUBLIC AWARENESS IN EFFECTING ENVIRONMENTAL CHANGE

Friends of the Earth campaigns for the basic rights people need to protect their environment - the right to know, the right to act and the right to seek redress. The necessity of free access to information was internationally recognised in Principle 10 of the Rio Declaration of the United Nations Conference on Environment and Development. which stated "Environmental issues are best handled with the participation of all concerned citizens ... each individual shall have appropriate access to information concerning the environment ... and the opportunity to participate in the decision making process". This clearly links the need for effective public participation with the accessibility of environmental information.

In the European Union access to information had already been formalized under the "Freedom of Access to Information on the Environment" Directive 90/313/EEC which sets a minimum uniform standard of openness for environmental

information across Europe. In the same year a UK government White Paper2 stated, "if people are given the facts, they are best placed to make their own consumer decisions and to exert pressure for change as consumers, investors, lobbyists and electors", thus advocating a government policy of openness and transparency. The European Environmental Information Directive was implemented in the UK under the 1992 Environmental Information Regulations.

In the United States there has been far more progress in making environmental information available to the public than in the UK. For instance, the annual compilation of a Toxics Release Inventory (TRI) has been a powerful, motive force behind companies' performance in reducing polluting emissions. League tables of the most polluting companies' are published along with maps of where they are and lists of pollutants they have released. Anxious to get out of the "Top Ten of Polluting Companies" and reduce their vulnerability to attack from aggrieved local communities, firms have taken positive steps to reduce pollution. William Reilly, when head of the United States Environmental Protection Agency, said that the TRI had "far exceeded our expectations as a tool for improving environmental management"[3].

Despite wide recognition that the public *should* have access to environmental information there are still many reasons why public access is limited. To ensure that information is *truly accessible* sources should be conveniently located, user friendly, not excessively expensive, organised so that they can be accessed in a variety of meaningful ways, and they should besupported with aids for interpretation and understanding.

Making data available is not the same as making it sensible, understandable and valuable for informed decision making. We illustrate this claim using for our example the Chemical Release Inventory (CRI), a public register of factories monitored in the UK by the Government's Environment Agency and contrast its qualities as an information resource with the mapping interface created by FOE for accessing the CRI data.

4. THE CHEMICAL RELEASE INVENTORY

The transformation of the inventory of chemical releases as formally published by the government of

[2] Government White Paper "This Common Inheritance - Britain's Environmental Strategy, HMSO, 1990.
[3] US EPA Toxics Release Inventory (TRI) Data Conference. March 29-31. 1993.

the United Kingdom into an on-line information resource illustrates how a large volume of complexly structured data can be brought to life and become *useful* information, and how it can 'come to make sense through being presented in a meaningful and accessible manner in a form which assists understanding and further analysis via a variety of appropriate interfaces.

The CRI is a database of chemical emissions recorded by the UK Government's Environment Agency (formerly Her Majesty's Inspectorate of Pollution). It contains records of the emissions of notifiable substances from those major industrial processes which are subject to government regulation. Set up under the Environmental Protection Act in 1990, the CRI is a public register to improve access to environmental information and to assess compliance with environmental quality objectives. The register is published by the Government as an annual, 500 page report which consists of tables of aggregated data. No explanation of the data is provided and individual companies cannot be identified. The data can also be accessed by ,visiting a regional office of the Environment Agency to view data about individual companies. A charge is made for any data printed and this facility is only available if a formal prior arrangement has been agreed.

Although this data is notionally publicly available, in practice, until now, it has rarely been referred to for four main reasons: firstly simply because it is not widely known to be available for public reference; secondly because the cost of purchasing a copy of the data tends be discouraging for all but a very few specialised readers[4]; thirdly due to the formidable and inherently inflexible form in which it is presented (a very substantial paper based catalogue of figures) which is hard to interpret; and fourthly because the way the data is organised is on the basis of aggregate emissions associated with areas of local government and this makes analyses on other bases a difficult and very time consuming task.

There are other reasons why this data is not as useful and as widely used as it might be. These can be viewed as being related to the main reasons for lack of use of the data already mentioned. Two of the most important of these secondary reasons concern (lack of) timeliness and accuracy. The process employed for collecting. Collating and publishing returns from factories required to report to the pollution inspectorate is not geared towards making the data publicly available rapidly. Since the data is not made much use of publicly. Until now there has been little demand for data to be up to date. A similar circular argument can be used to account for

[4] Currently the cost is about 35 pounds sterling.

The poor levels of accuracy and completeness in the data. Whilst data is collected but little used its accuracy mirrors its value, it is poor. Once data becomes an important source for constructing information attention is quickly drawn to its shortcomings and these need to be addressed if analyses of any value and quality are to emerge. These' arguments suggest that more intensive use of the data is likely to lead to pressures for its quality (timeliness, accuracy, completeness) to improve.

In an attempt to increase interest in the publics right to environmental information Friends of the Earthlaunched a "Right to Know" campaign in October 1995. A strategic component of this campaign was the publication of the Chemical Release Inventory as an information resource accessible on the World Wide Web. The Web-based CRI is a mapping interface to the Government's register of chemical releases. Information about the industrial sites which the Government monitors is stored in a database, which is dynamically linked to the map interface whenever a visitor to the WWW site requests information. In this way updating of the data is simplified and any request for data automatically results in the most up to date information being presented.

Once a user enters the CRI site5 background information about the CRI and the Environment Agency can easily (and optionally) be accessed along with information, which highlights the problems with the data (known inaccuracies and incompleteness). The mapping interface is designed to make the data accessible, meaningful, relevant, and easy to use. The user is offered the choice of selecting an area of interest either from a national map of England and Wales or by entering a postcode. Either option results in the generation of a 50 km2 map centred on the selection which has marked upon it all industrial sites within the map area displayed along with location information such as urban areas and roads (figure 1).

Any industrial site shown on the map can be selected for further exploration (the user clicks directly on the site on the map), this initiates an appropriated linked query to the database of chemical release data resulting in the display, in tabular form, of emission data for each relevant factory (figure 2).

The Web-based CRI has been constructed using a mixture of software as no single "off-the-shelf' software product was available which satisfied the requirements. The system makes use of many different components of information technology including database and communications technology. Hypertext browsers. and geographical information Systems and it links geographical data sources with the chemical release data to provide the information resource.

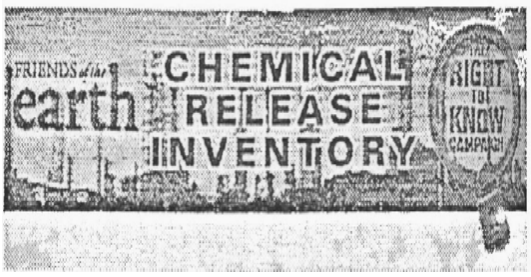
5 http://www.foe.co.uk/cr

Conceptually the system can be described quite simply as follows: a large image is created a using simple algebra as a "cookie cutter" to pull out the selected (map) area based on the centre grid coordinate of the selection or postcode. The database is search for all factories within the area and these are displayed on the map dynamically i.e. they are not pre-coded in the map data. These factories then provide the direct link to the database. Triggering a query to the database to pull out the relevant information once a factory has been selected. Aim displaying emissions recorded for it as a table.

Fig. I Screen image of the map-based interface to the CRI

The mapping interface is easy to use and makes an exciting. Interactive interface to the data, which is intended to attract new users to look at aim to analyze the data. Prior familiarly with computers is not required to use the interlace since it has been designed to positively encourage people to look at and explore the data. A member of the public can enter a specific postcode and have a map generated

Which is centred on his or her own home area, thus information is presented in a focused form which is immediatcly relevant to the enquirer without any need to sift through tables of figures and scientific jargon. By making the CRI available on the WWW information is accessible at any time to anyone who has a connection to the Internet. With the increase in Internet connections at universities, libraries, post offices. book shops and "Cyber Cafes" more and more people are becoming able to see and use the information.



Chemical Release Inventory for UML LTD
Alternative selection:

Year medium

Selections: Year All Medium All

Medium: water
No recorded for this medium
Medium: Air

Year	Substance	Annual limit	Release	Addition release	Unit of measure
1992	CARBON MONOXIDE	220	346	0	Tonnes
1992	NITROGEN OXIDES(AS NO 2)	1.1	0.86	0	Thousand tones
1992	PARTICULARS	20	300	0	Tannes
1992	SULPHUR DIOXIDE	4.1	3.023	0	Thousand tannes
1993	CARBON MONOXIDE	220	0	0	Tones
1993	NITROGEN OXIDES(AS NO 2)	1.1	0.6502	0	Thousand tones
1993	PARTICULAR	20	122.7	0	Tonnes
1993	SULPHUR DIOXIDE	220	2.067	0	Thousand Tonnes
1994	CARBON MONOXIDE	220	0	0	Tonnes
1994	NITROGEN OXIDES (ASNO 2)	1.1	0.698	0	Thousand Tonnes
1994	PARTICULAR	20	87.68	0	Tonnes
1994	SULPHUR DIOXIDE	4.1	1.864	0	Thousand Tonnes

Medium: land

Year	Substance	Annual limit	release	Additional releasse	Unit of measure
1992	NP-SOLIDS NOS-TO LAND	5.55	6	0	Thousand tones
1993	NP-SOLIDS NOS-TO LAND	5.55	5.688	0	Thousand tones
1994	NP-SOLIDS NOS-TO LAND	5.55	8.212	0	Thousand tonnes

Fig.2 screen display of CRI data for selected factory

During the first seven days of the Web-based CRT's operation there were 60.000 accesses to FOE net and over 3.500 queries to the CRI database about individual factories. At the time of writing there have been over 16,000 queries to the CRI database. This makes an interesting comparison with the number of visits to the Government's Environment Agency regio nal offices made by the public which were recently reported to be 760 for a whole year6. Figure 3 shows the impact of the launch of the CRI data on the Internet on the number of visits to FOE net. Use of the Internet means that it is possible not only to present information in an understandable form to enquirers on the basis of their interaction with the resource's interface but that it is also possible for users of the data to communicate with its providers. Future work to offer alternative means for users of the CRI to analyze the CRI database will be based on their own suggestions, which are invited electronically to all visitors to the FOE CRI site.

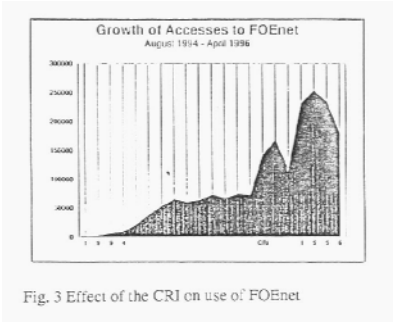


Fig. 3 Effect of the CRI on use of FOEnet

5. CONCLUSIONS

Information can be of strategic importance to an organisation provided that the management of information as an organisational resource is understood and prioritised within the organisation. The use of advanced information technology can increases the effectiveness of an organisation when applied appropriately. These observations apply equally to organisations whose interests lie in protecting the environment. The increased availability of information which appropriate use of information technology can provide can help an organisation to achieve its goals with more effectiveness in direct ways. Evidence from the United States suggests that making information about the release of pollutants widely available encourages more environmentally conscious behaviour through a variety of direct and indirect pressures. Global declarations. and national and international community legislation about access to information about the environment has led to minor improvements in access to environmental information.. Making data available is not the same

[6] HMIP Annual Reports 1994/5. HMSO. 1995.

As making it sensible, understandable and valuable for informed participation in decision-making. FOE has set a new standard for the provision of environmental information to the general public, by turning complicated Government statistics into meaningful, relevant and easy to use information. Appropriate use of information technology can play an important part in tackling many of the shortcomings of less advanced means of presenting data. Some of the consequences of the increased availability of information cannot be predicted in advance, these unforeseeable consequences are inevitable as new ways of making sense of the data emerge.

ACKNOWLEDGEMENTS

Many members of staff and volunteers at FOE played a part in the development of the Chemical Release Inventory including Peter Phillip, Richard Weatherly, Mary Taylor, Tom Broxton. David Canines, Simon Redding and Leslie Saint James. Joanne Miller assembled and tested many of the mapping and database retrieval components on which the Inventory is based with the help of FOE staff during her time as a MSc student at DCL. The CRI Web-site is dedicated to Andrew Lees, the late campaigns director of Friends of the Earth, whose commitment to justice and the environment, combined with a vision that information technology would be useful, made it possible.

DEVELOPMENT AND ROLE OF WOMEN IN TECHNOLOGY! ENGINEERING BASED INDUSTRIES

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This paper explores some of the challenges, opportunities and initiatives being adopted in the UK toencourage more women into technology and engineering based careers. It is essential that bright young women are encouraged to study mathematics and science in school and that teacher are made aware of the career opportunities for their students in industry. Industry needs to recruit the highest calibre individuals in order to meet the challenges of global competition. Industry must adopt more positive policies to recruit quality women as technicians and engineers and retain those women by introducing family friendly policies.

Introduction

The Engineering Employers' Federation was originally founded in 1897 in the UK to act as the national collective bargaining medium for engineering employers in the UK when wage negotiations for both professionalstaff and manual workers were conducted at a national level. Since the end of national collective bargaining in 1989, the EEF has pursued a much more publicly fronted role and has brought to the forefront its expertise in areas such as economics, training, health, safety and environmental issues. Previously given EEF's national bargaining role there had been a desire to keep a low profile on the national representational stage, as it was viewed by member companies as being incongruous with EEF's national bargaining role.

Currently the EEF is the largest employers sector organisation in the UK and represents the interests of over 5000 engineering and manufacturing companies ranging from the large aerospace and defence manufacturers to small, metal-fabrication companies employing 100 people. EEF's main headquarters **in** London provide the centres of excellence in economics, employment policy, European affairs, employee and industrial relations expertise, health, safety and environment, education and training. The EEF runs one of the busiest employment law practices dealing with industrial tribunal appeal cases both in the UK and the European Court of Justice on behalf of our member companies. EEF also publishes a large stable of publications to provide practical advice and guidance for its member companies. Those policy areas are the primary responsibility of the Deputy Director General of the EEF. The EEF services the needs of its member companies through a network of 13 local associations offices throughout the UK who provide handson, direct professional services to its member companies. These services include employee relations, best practice techniques, including world class manufacturing benchmarking, industrial relations advice and guidance, health and safety and environmental audits, economic engineering trends information to name but a few of the services provided.

The EEF is an apolitical organisation and is a well-regarded national lobbying and representational organisation for the engineering and manufacturing sectors. A large part of the role of Deputy Director General is to maintain close contact with government ministers and senior civil servants on a day-to-day basis both in the UK and in Europe representing engineering companies' interests. However, the biggest cultural shock for the organisation has

Undoubtedly been the appointment in 1993 of its first female director in 99 years of its existence, and being a lawyer, it must have been initially viewed by some engineers as more of a quantum leap into the dark, than a quantum leap forward.

Position of Women

A conference concentrating on women in technology and engineering gives opportunities for wide ranging debate and discussion on the issues which are affecting women worldwide who wish to pursue a career in engineering. Many of the issues are transnational and the commonality of perceived problems seem to differ little whether you work in the eastern or western hemispheres of the globe.

There is little doubt that, if countries and companies are to become more competitive, science and technology must play an increasingly important role in achieving that end. In view of the relatively low numbers of women currently working in scientific research and technology there is undoubtedly cause for considerable concern. If we look at the progress which women made in the European Union between 1972 and 1982 they in fact recorded more progress in that decade than in the two previous centuries since the French Revolution and the First Declaration of the Rights of Women!

But it is also true that there has been terrible stagnation since the mid-1980s. Researchers have claimed three reasons for this stagnation. Firstly, media fatigue. The issue of feminism and women's interests are not fashionable any more. It has been taken over by the ecologists and the global environment debate. Secondly the demise of the Women's Movement which had such a wide following in the late '60s and throughout the '70s. Women have, in the European Union, achieved universal sufferage, equal employment rights in legislation at least, so what is there left to fight for? Also the very feministic stance of the Women's Movement does not appeal to many working women in the 1990s. And thirdly, the impact of the recession in the European Union where jobs have been reduced and women's opportunities have been curtailed due to companies' low recruitment figures and redundancies have reduced job opportunities.

However it does seem that many of these suggested arguments do not provide sufficient credible justification for the low numbers of women entering science and engineering training. There is a need to explore some of the areas that require tobe addressed more comprehensively and where there is a demanding role for all women already working in engineering and technology sectors to lend their support.

Children in the home

The problem starts right at the beginning in many western countries where children are colour coded at birth. This of course has no reference to the colour of a child's skin - boys are dressed in blue and given train sets and fire engines and girls are dressed in pink and given dolls and baking sets. The first lesson in stereotyping has begun and in most cases it is women who place these markers in the ground as mothers.

Parents have a tremendously important role to play with teachers at this stage i~ ensuring that both genders are given exposure to the world of technology. The interchange of toys between genders - baking sets for the boys, food technology in its early stages and boxes of lego and building bricks for the early structural engineers amongst the girls would help to break down some of these barriers. It is worth noting that no less than 50% of educational development takes place in the first five years of life. Those early learning experiences are critical in establishing awareness of how things work and simple moving mechanisms can be explored and experimented with to gain first hand experience.

Influencing schools

The whole profile of a career in technology needs to be raised. If employers are to attract the brightest and best into industry then it must be an appealing place to work in. The need for more influence by the engineering industry in schools particularly at primary school level is absolutely critical. In addition the method by which engineering subjects are taught in school must have an emphasis on modem application of engineering and science and their importance in the wealth creation of any country's economy.

Primary schools afford employers the greatest opportunity for influencing young minds. It is an area where finally industry, particularly in the United Kingdom, has started to waken up to. The need to ensure that science and mathematics are being taught in interesting, challenging and project-orientated styles which both girls and boys can find stimulating has never been more critical.

Early introduction to computers as learning aids is important. In the United States, the Clinton administration has embarked on a high profile campaign to connect every classroom in every school to the new information super highways by the year 2000. It has placed at the top of its policy agenda the goal of enlisting equitable and life-long access to learning technologies for all Americans. Visits to science and technology centres and museums as part of weekend and holiday trips ensure that technology is associated with leisure and fun and not just with mandatory schoolwork.

Recent research in secondary schools has demonstrated a marked improvement in the numbers of girls who opt for science and maths in single-sex schools as opposed to mixed sex schools. For the students in single-sex schools there is no

Monopolisation of the computers and other equipment whereas in mixed sex schools girls find they receive less attention from teachers and spend less time on the equipment. In the 1995 GCSE (General Certificate of secondary Education) results (examinations taken on a national level by 16 year olds in England and Wales) demonstrate clearly that girls are stealing a march on boys in maths and science examination passes, particularly where the girls have attended single sex schools. A few mixed comprehensive schools have now decided to expand their plans to conduct separate class work for boys and girls in an effort to improve exam pass rates. Commentators and employers watch with interest to see how this experiment develops as many are convinced that girls will continue to fare! letter in a segregated environment.

Industry Initiatives

Industry needs to expand and encourage the envelopment of work placements for students and teachers to help counteract cultural bias against a career in engineering and technology. It may be time consuming to have a student placement in a busy operational environment but employers have to make the time available. They have to make the effort. They cannot simply always blame the teaching staff for their lack of knowledge of industrial and technical environments if employers are not prepared to give up ilie necessary time to try to bring the world of industry alongside the world of education when influencing young people's choice of career development. The role iliac teachers play in influencing young minds is very significant and ensuring they know what industry has to offer young people in career opportunities is paramount.

In 1994 the EEF launched its School Liaison Award scheme to motivate its member companies to work with schools on technology projects in order to increase awareness amongst young people of the tremendous challenge and excitement in pursuing a career in technology. It provided an opportunity to bring out the best calibre staff that employers actually have working in the engineering industry to assist with the projects. They are industry's greatest ambassadors to sell a career in engineering and technology. They are actually doing it!

Unless an increase in the numbers of young women who have the necessary qualifications to enter higher education to pursue engineering degrees can be achieved then it will not be possible to improve the development and role of women in technology. Today in the UK there are still 10 times as many men as women entering higher education in engineering and technology and twice as many men read for a degree in the physical sciences. These ratios are reversed in biological sciences and subjects allied to medicine. In medicine and chemistry, the numbers of men are only very marginally higher. We have a long way ahead of us if we are to achieve critical mass to move some of .he Mountains that lie ahead after graduation day.

One of the most popular projects in the UK is the WISE campaign (Women in Science and Engineering). The scheme was launched fourteen years ago by the Engineering Council and the Equal Opportunities Commission to change the attitudes of young people, parents, teachers and the general public about the suitability of engineering as a career for girls. The campaign has been wide ranging including publications, posters, careers advisory services. However one of the most innovative parts of the campaign was the setting up of the first WISE bus as a mobile teaching exhibition centre. Groups of 14/15 year schoolgirls spend time on the bus when it visits their school with women tutors, providing hands on experience of new technologies. The programme has been a huge success with five buses on the road currently. The running and equipping of the buses have been achieved through sponsorship by industry in the UK.

The EEF has just completed a new pilot scheme with WISE to promote a three-day pilot scheme for 12/13-year-old girls to participate in an engineering activity programme as a taster prior to choosing their curriculum subjects for study at GCSE level. The EEF is particularly interested in attracting girls who would wish to aim for technician level via the new modem apprenticeship scheme, which has been developed in the UK by employers in conjunction with the Confederation of Shipbuilding and Engineering Unions and the Engineering Training Authority (EnTra). The pilot was run in March and April 1996 and has involved three EEF regional associations. Initial feedback indicates that it has been hugely successful. Girls participating in the pilot scheme have been captivated by the exciting challenge that a career in engineering through a modem apprenticeship could afford to them. To convert even a small percentage Item opting to take engineering rather than hairdressing or secretarial services will be considered a major achievement increasing our female technician numbers in the UK. Currently the EEF is evaluating the full results of the pilot scheme with WISE and is hoping to take the scheme nationwide next year.

The Engineering Training Authority also runs the Insight programme annually which affords girls aged 17 the opportunity to spend one week in industry as part of their final year at school. During this highly participative course the girls are given engineering projects to work on and spend time on work shadow placements in industry. In recent years up to 65% of girls taking part in the programme have subsequently opted for engineering careers.

Graduate recruitment

Graduate recruitment into industry is the next area to tackle. Company literature needs to feature women in the organisation and a clear indication of the number of women employees already in the company and the

Types of jobs they are holding down. It gives the message that there are people in engineering roles already in the company. The company is clearly telling young women that it can offer them a career and that there are already women in the company enjoying good career development. The message is clear from this type of company. It is saying "come and join us". Even better than photographic material is being able to send women engineers to careers exhibitions or company open days where young women undergraduates can actually have an opportunity to discuss on a one-to-one basis career opportunities and be inspired to join a particular company based on an actual live role model.

Given the ever more competitive world that most companies operate in the persistent problem of securing a supply 'of good-quality graduates has meant that companies simply cannot afford to disregard the growing numbers of women with technical degrees. If a company is looking for first-class engineers then it is a foolish company, which only takes from the top quartile of 50% of the population when they could make their selection from the top quartile of 100% of the population. The economic and intellectual arguments will always win over positive discrimination. The Department of Trade and Industry (DTi) in conjunction with Opportunity 2000 (an initiative in the UK based on the business case for equality of opportunity rather than on social or ethical reasons) published in October 1995 a new document entitled 'Making the Most' featuring case studies of companies who have promoted women into technical and scientific roles and will act as good promotional material for equal opportunities. The EEF is co-sponsoring this year with Opportunity 2000 and the DTi a follow on project concentrating on highlighting best practice case studies of small and medium sized companies who have demonstrated best practice in developing family friendly policies to encourage women into their businesses.

In the workplace

Once into the company a woman will begin the unending journey to establish herself at every stage of her career progression. Women have to be strong and inwardly tough if they are going to survive. Not only will a woman be faced with the technical challenges of her job and in fact these challenges will pale into insignificance on occasions when she has to deal with the challenges of climbing the company ladder and combatting decades of male prejudice and discrimination against women.

If a woman is successful and receives promotion she may well find herself in charge of men who are possibly much older than herself. It is then that she will find that the old adage that men are happy to work with women and for women to be promoted provided they do not have to work for them will come home in a big way. The only way to overcome these barriers of discrimination is to prove that you can do the job and do it better than they can and given women's exceptional talents in teambuilding skills, this should not be too hard to achieve! Professionalism and team building are the best tools in any job. No amount of female haranguing is going to get one anywhere in the higher echelons of industry and at times one has to simply rise above it all.

Challenge of isolation

One must keep things in perspective - remember that it may also be a challenging situation for a young man in a promoted position but unquestionably a woman will stand in a far more lonely spot than any man. Female colleagues are thin on the ground and corporate loneliness for many women is often the biggest challenge that faces women in industry. It is often sited as the most frequent reason for women quitting male-dominated environments. A woman will need technical expertise, determination, but above all, she will need courage to weather those moments of isolation.

A woman will also find that she is excluded from many activities, which are male-orientated in the workplace. Going to the bar after work or joining in a game of golf even if she wished to do so is not always open to a woman. Women are effectively denied admission to the Men's Club even if they wanted to join.

Networking

That is why professional support networks for women are so important and whilst one may not have an immediate colleague in the same department or indeed company, through networking women can achieve a measure of support for each other. In the UK the Women's Engineering Society (WES) is one organisation, which has sought to tackle this problem by encouraging the formation of networks of women working as engineers and technicians. The society, which celebrated its 75th anniversary in 1994, has as one of its broad aims the provision of a network facility for women engineers and engineering students at any stage of their career. The society produces a journal, 'The Woman Engineer', and encourages women to set up their own local groups as forums for support and discussion. The EEF are strong Supporters of the WES and have given funding towards its Foundation to assist highflying engineers to return to the work place following career breaks.

Many large companies have their own internal women's networking groups who can often liaise closely with colleagues in other companies and campaign on a range of equal opportunities issues including maternity provision and childcare. Success is of course variable. Good examples in the UK are the Women in Lucas Project operated by Lucas Industries plc and the Shell UK Exploration and Production WINGS network which encompasses women working offshore as well as onshore.

Promotion opportunities

The key to progress lies in getting women promoted from the junior positions and into supervisory/ Management positions. However, the siege mentality ~ men in middle and junior management is Definitely blocking progress towards sexual equality. How many women have had a helpful senior manager Acting as a mentor but their immediate boss was a total restriction often brought about by fear of his own Shortcomings and inabilities? Consequently if: companies do not have many women in promoted positions this inevitably leads to far too few in the lpper and senior levels of management, particularly in: he boardroom. It is only when significant numbers of women are recruited into an organisation that one can really begin to realise measurable levels of increased influence and change of cultural attitudes towards women. The operation of a successful Equal Opportunities Policy within a company is dependent on managers to promote it and encourage others to fulfil list aims. A written policy statement is not worth the lapper it is written on if it is not practiced. It must bemain Board responsibility and there must be a champion of Equal Opportunities on each Company board.

Style of management

It is not only male attitudes that work against women in industry. The perceived view of management in general is of a very traditional, very full-time job. lost organisations expect their managers to work long ours, to travel and to give total commitment to the ~b. Many management jobs still appear to be designed [round the assumption that the managers will have a full-time spouse to shoulder domestic responsibilities, perception still shared by many male managers themselves.

Not nearly enough has been done to encourage engineering employers to consider providing flexible working arrangements and career breaks for women ho wish to have children. The retention of these 'highly skilled women is crucial - their loss from the workforce permanently is a serious loss in terms of the Financial investment in their training and expertise.

As far back as 1990 the EEF issued advice to all its ember companies in a publication entitled "Fewer young Recruits - How to Mitigate the Commercial effects" an action checklist which encourages 'Employers to "organize career breaks - help women to: tom to work after having children, be flexible Create opportunities for part time working and flexible hours." The career break scheme was seen as a way of retaining skilled women employees as well as attracting ore women into engineering companies.

To overcome the problems of losing touch with technical developments whilst on the career break, the [chime placed great emphasis on regular updating Courses and refresher training on return to the company. Support for more flexible working practices has also come from some of the professional engineering institutes and from unions representing engineering employees. However, equal opportunity initiatives which do not address the wider workplace culture can only have a limited impact if that culture is premised Example, career breaks, an individual woman may believe that she will be disadvantaged unless such opportunities are also taken up by men.

Lack of confidence

Women in general suffer from lack of confidence - men seldom question their abilities even if they should. Men question when they will get promotion, women question will they get promotion. Women still tend to be clustered in the lower levels of management and there is little evidence that they are breaking through what is commonly called the glass ceiling to take the top jobs. Women currently make up less than I % of the Chief Executives of companies in the UK. A survey carried out by Ash bridge Management College for Opportunity 2000, found that 59 companies in the top 200 companies had women on the board compared with 21 four years ago. but of the 59 appointments,80% were non-executive. The lack of progress in appointing female executive directors must be a cause for concern.

In a 1994 survey the Institute of Management in the UK reported that the proportion of women at virtually every level of management had fallen for the first time in 21 years. The percentage of women managers had grown from 1.8% in 1974 to 10.2% in 1993 but had fallen to 9.5% in 1994. However this trend has been counteracted by the results of the same survey carried out in the subsequent two years, which shows increases to 10.7% in 1995 and 12.6% in 1996. It is interesting also to note that Opportunity 2000 companies show greater levels of women at senior levels with published figures sitting at 16%.

Women from ethnic minorities are however progressing significantly less well than other women managers. In Opportunity 2000 organisations black and Asian women managers currently comprise only around two percent of all managers. It is interesting to note that research carried out by NB Selection reported that women have a greater chance of being appointed to key management positions than men once they have made it on to a short list. The gap is even bigger for those moving from the written application to the interview stage. There, 22% of women compared with 10% of men are successful. While significantly fewer women applied for the positions the results were certainly encouraging.

Women are often better qualified for jobs they apply for but their reluctance to apply for positions only where they meet all the requirements holds them back while men tend to be less discriminating. If a woman meets 75% of the job description, then she should apply for the job! If she meets 100% of the job specification where is the challenge in the job? This is one of the key pointers to women's potential failure to reach the top jobs - more confidence and courage are needed to make the difference.

Technology career ladder

Women, particularly those in technology-orientated functions often become side streamed and steered into the expert routes. The route to the top is nearly always through general management operations-type roles. There has been wide spread recognition of the lack of opportunities for scientists and engineers to progress on the basis of their technical skills. Engineers with scarce skills have had to leave these skills behind in the pursuit of career development.

It is important for companies to create technical career ladders equivalent to managerial ones. However generally the managerial route is still seen by employees as offering greater opportunities of getting to the top. Technical ladders tend to be narrower and shorter than managerial ones, offering promotion to only a small number of specialists. Technical positions often attract lower salary levels than general management positions so if a pot of gold is one's long term aim beware the poverty pitfall! To be the company expert is to sideline one's own chances of getting to the top. If a woman wants to get to the top she cannot remain in a backroom job where she will produce the research and background on projects which others will build their careers upon.

Equal pay

Equal pay is still a problem in many sectors of industry in the UK in spite of legislation being around for nearly 20 years. Figures for 1995 published by the Equal Opportunities Commission show that female managers and administrators working full time in industry earn only two thirds of the average weekly earnings of male managers. At the lowest management level, women's salaries are 90% of men's but female directors earn only 77% of the average salaries of male directors. Industrial Tribunals in the UK deal with increasing numbers of equal value claims each year- women clearly whether in management positions or on the shop floor are not prepared to allow the situation to continue and are pursuing issues for themselves.

Maternity benefits

Maternity rights or lack of them in some companies give great cause for concern. Many large companies have developed good maternity leave packages and part time and job sharing schemes for women who wish to return after having given birth but who do not wish a full time job. However, many government policies do not encourage employers in this respect and in many European countries including the UK the lack of provision of child care facilities puts enormous strains on working mothers. Much more needs to be done by way of providing support mechanisms for women to maintain their careers in industry if they are also expected to be wives and mothers at the same time. Many women have made the conscious decision not to marry and/or not to have children as they feel they are unable to give the dedication and time that is required to succeed in carrying out either of those roles effectively. Many however have managed to combine successfully a senior management position with a busy family life.

Mentoring

Wherever women are working, and in whichever field of engineering or technology they are making a contribution, it is simply imperative to get more women to take up the opportunities of a career in engineering and from those increased numbers a solid quality base can be established to promote the best. For those women already in technological or engineering based jobs they must take up the challenge of mentoring a junior colleague. One owes it to ones gender to provide support to others particularly those first entering industry. Individual successful women may have got where they are apparently by their own efforts but they need to reflect on how much better industry would be with a few more women like themselves around.

EEF is working hard to get the message across to engineering companies. Industry needs more women and the economic arguments for recruiting them are positive for the bottom line corporate costs. It is worth repeating again, why should a company select its future human resources from 50% of the population when it can select from the top quartile of 100%. The engineering industry needs quality not quotas and employers must work harder to get more young women to opt to train in the engineering and technological fields to meet the challenges in terms of technology development and global competitiveness.

WOMEN IN THE HONG KONG CONSTRUCTION INDUSTRY

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ABSTRACT

Women in the Hong Kong construction industry have long been under represented with statistic showing the percentages of male and female participants at 94% and 6% respectively. However, the number of female enrolled in the construction related fields is steadily increasing in Hong Kong with architectural and surveying courses gaining preference. With a higher level of education attainment and couple with low fertility rates and late marriage age, women now have a better chance to enter and sustain their participation in the workforce.

The construction industry is one of the catalysts of the economy and to meet the future need for professional in the industry, the industry must find ways both to attract and to retain people other than male staff. This paper is aimed to provide an insight in the professional women in the Hong Kong construction industry and to identify factors that influence their participation. Key issues such as how well are women integrated in the workplace in the construction industry, what are their career prospects, what barriers or discriminations do they face and the effect of family responsibilities on their career preferences are explored in the local context.

Keywords: construction industry, women participation, integration, and barriers

INTRODUCTION

Professional and technical fields, especially in the construction industry are often overlooked by women. Women in the Hong Kong construction industry is of no exception and statistic has show that the percentage of male and female participation to be 94 % and 6 % respectively (Annual Digest of Statistic 1993). In Hong Kong, women entered the workforce in the large numbers during the rapid industrialization of Hong Kong's economy in the late 1960s and early 1970s. By 1993, women accounted for 46.5% of the total workforce with the highest labour participation rate in the 20-24 (79.1%), 25-29 (79.8 %) and 30-34 *(62.0%*) age groups (Annual Digest of Statistics 1994). There is a tendency for women in Hong Kong to delay marriage with the median ages for women in first marriage were 22.9 in 1971 and 26.2 in 1991 and women are also giving birth to their first child at an increasing older age, 23.4 in 1971 compared with 27.9 in 1991(Westwood et aI, 1994). This trend of later marriage and childbirth indicates that more women appear to be more willing and able to pursue jobs and careers before entering marriage and childbirth.

PARTICIPA TION IN THE CONSTRUCTION INDUSTRY

Hong Kong's higher education institutions have adopted a policy for equality for students of both sexes.

In a study by Liu & Ng (\ 994) ,the number of women enrolling in construction related courses is increasing with certain courses such as architecture and surveying achieving over 30 % of female students. The figures in the construction education front in Hong Kong seems to reflect that more females are willing to embark on a career in the construction industry that has long portrayed an image that the nature of the work requires male dominance and the work is considered too physically demanding and unfeminine for women.

With increasing women participating in the Hong Kong construction industry, there is a need to understand the opportunities for women in this field and to address issues such as the integration of women into the workplace, the career prospect, barriers and problems encountered in the industry. A survey was conducted to explore these issues and to examine how women view their role in the construction industry. Understanding these issues and problems will help women in the construction industry, now and in the future, to cope with their problems and to help the industry to attract and retain women in the construction industry.

THE SURVEY

The survey sample of women was selected from membership lists from the four major professional institutions in Hong Kong construction industry, namely Hong Kong Institute of Architects, Hong Kong Institute of Surveyors, Hong Kong Institute of Engineers and Chartered Institute of Builders (HK Branch).

These local professional bodies's membership lists made no reference to gender and considerable research was required to identify the relevant sample and as such there is some limitation to the survey sample.

A total of 75 questionnaires were sent and the response rate was 46 %. Whilst the total sample size may not be large enough to allow for statistical analysis, it is possible to gain general impressions on perceptions of women as professionals in the construction industry.

PROFILE OF THE RESPONDENTS

Figure 1 shows the distribution of positions held by the respondent of the survey. It is noted that a majority (63%) of the respondents are professional staff while 17 % holds management positions.

Figure 1: Position of Female Respondent

POSITIONS	%
Professional	67
Senior level management	6
Middle level management	11
Technical	11
Teaching	5

Professional: Individual responsible for the specific work or project of an organisation, but not responsible for the decision making inside the organisation

Senior management: The principle decision making executive and administrator-who coordinates and directs the activities of an organisation

Middle management: Executive and head of functional department inside an organisation

Technical: Individual responsible for the specific task, reporting to a professional staff

The age of the respondents are from 25 to 39 with 39 % for25-30 age group, 39 % for 31-35 age group and 22 % for 36-40 age group. It is worth noting that most of the respondents are of the age where they graduated from their construction courses in the mid eighties and early nineties and belongs to the most active working groups. 51 % of the respondents are married while 49 % are still single.

Educational Preference

55 % of the respondents indicate that the reason for selecting a construction related course in their tertiary educationwas due to personal interest while 33 % were due to the possible prospect in the industry. 12 % entered into construction courses due to encouragement of friends and family. The vast interest in construction industry was prompted by the massive development that dominated Hong Kong's scene during the 80s and the 90s. It is encouraging to note that interest is one of the main 'reason for selecting a construction related course by the respondents. It would seem to suggest that females are not deter by the challenges posed in a male dominated industry.

Comparison with Male Counterparts

The female respondents in this survey seem to have m unanimous view regarding their career prospect. laborite feel disadvantaged when compared to their male counterparts. Most of them feel that they have lot gained more facial rewards, nor have better Opportunities to be promoted and get more challenging assignments as their counterparts (Fig. 2)

One area in which they perceive as having advantage Over male staff is to be representative in dealing with Ether people or professionals in the industry which re mostly males. This seems to derive from cultural attitude where the preference for women to represent1e companies, is to take advantage of the culture of offer treatment towards women rather than a perception that women are better in-their profession. there currently exist no equal pay legislation in fang Kong and it was only until 1981 that the Hong long government introduced equal eligibility for fringe benefits for married men and women employed in the civil service. While there is no conclusive research in Hong Kong that has shown discriminatory practices against females in the employment aspect, the higher percentage (75.8 %) of men in managerial and administrative posts compared with that of females serves to suggest that maybe women are deprived of promotional opportunities (Green Paper 1993).

Figure 2 Comparisons to Male Counterparts

Item	Agree %	Disagree %	Neutral %
Item a	18	49	28
Item b	11	34	55
Item c	16	34	50
Item d	29	11	55
Item e	5	51	44

Item a: *I have been more successful in my profession*
Item b: *I have had better opportunities for promotion*
Item c: *I have had more opportunities for getting challenging assignments*
Item d: *I am often trusted to represent my organisation externally*
Item e: *I have gained more financial rewards*

When asked of their abilities in comparison with male counterparts, 63 % of the respondents feel that they performed much better than males in communication and interpersonal skills. These views are reinforced in a survey done by Toothy and Whittaker (1993) whereby women are thought to be less confrontational; resulting in better conflict resolution and possess good communication skills. In terms of supervisory and technical skills, over 80 % of the respondents believe that that they are at least capable of an average performance when compared to men.

Overall, the respondents feel confident that they possess the equivalent skills as men in pursuing a construction related career.

Comparison with Females in Other Professions

When asked to compare against females in other professions, most of the respondents feel that they fared much better in all aspects (Ref. Fig. 3).

Figure 3 Comparison to females in other profession

Item	Agree %	Disagree %	Neutral %
Item a	47	11	42
Item b	30	35	35
Item c	53	11	36
Item d	53	21	26
Item e	45	18	37

Item a: *I have been more successful in my profession*

Item b: *I have had better opportunities for promotion*

Item c: *I have had more opportunities for getting challenging assignment*

Item d: *I am often trusted to represent my organisation externally*

Item e: *I have gained more financial rewards*

Nevertheless, when it comes to issue on opportunities for promotion; the respondent's views are rather mixed. It would suggest that while they may get. More challenging and financial rewards than women in other professions, they still consider that the chances for females to advance to higher levels of management may not be any better than their counterparts. In an article on women quantity surveyor in the UK, the majority of women in senior positions either work overseas or own their own practices (Building Economics 1994). It does seem to suggest that women professional have to gain promotional prospect through their willingness to assert themselves, probably more than their male counterparts to take on plenty of onshore and off shore projects in their career.

Barrier and Discrimination

It is interesting to note that none of the respondents are currently working in a construction firm or based on site works. 42 % of the respondents are presently working in government agencies; 53 % in private consultancy firms and the remaining 5 % in educational institutions.

When asked about experiences working on sites, 42 % of the respondents have had experienced working on construction sites and majority of those who worked on sites seemed to think that experience on sites are crucial in the career path for construction professionals. As for those who have had no experience working on sites, only 25 % agreed that site experience is crucial. The respondents generally look at the construction career as being divided into two main categories, office work and site work. Even though many of the respondents acknowledge the importance of site experience; they still consider in that in office work, they would have equal opportunities to progress in their career.

Several reasons were cited by the respondents as main barriers to their advancement of career on site such as low level of acceptance of male subordinates on site, difficulty to gain credibility from male counterparts and contractor and the harsh environment of the construction sites. In a research by Toothy & Whittaker (1993), women face more difficulty in gaining credibility on sites where the field staff or contractors tend to be of lower educational level. These problems would seem to arise due to "negative attitudes of men at all level" and "pressure on women to conform to gender stereotype" (Bakos 1992).

Effect of Family

Survey questions concerning the impact of family responsibility indicated that 95 % of the married respondents have greater amount of housework responsibilities than their spouses. Only 5 % state that they share an equal load with their spouse. 36 % of the respondents have children and they all rely on servants in the caring of the children. This extra familial help usually releases the working women from doing physical housework but she still has have to assume a coordinator role; assigning tasks for the domestic; organizing daily activities to satisfy the family's physical needs.

Greenglass (\ 985) pointed out that working females frequently experience more difficulties than males in balancing the various demands in their life because employed women are often expected to fulfill both homemaker and career roles. These dual sets of demands are often a source of pressure on the working women as most respondents feel that they have to take on less responsibility and less demanding assignment in order to adequately cope with both their career and families. It was shown that professional women who make their families as important as their careers; earn less and tend to be in lower positions for longer periods (Gibb-Clark 1991), Family responsibilities are seen to have an influence on job performance and opportunities for advancement. Female professionals in the construction industry face a tough acceptance of their roles where traditional sex role stereotypes held by men may at times preclude their accepting pregnancy and motherhood in women who have also made a career commitment

Should women be encouraged to participate in the construction industry?

Most of the respondents are of the opinion that more women should be encouraged to enter a career in the construction industry. They feel that women should ~ be discriminated against in any profession. As correspondents states:

"The construction industry would benefit with more females as they possess a distinct strength and sensitivityin dealing with certain problems in the industry."

However, majority of the respondents believe that it would be better if females limit themselves to construction career that is office based in order to I have equal or even better opportunities to progress in their career.

Many of the respondents indicated that the industry Need to raise awareness amongst the females of the various aspect of career opportunities in the industry and to dispel the gender stereotyping that the industry is only for males. One of the way to achieve this is to disseminate correct information about the careers to the students in schools prior to entering tertiary! Institutions and also to inform the general public that career in the construction industry is not gender based.

CONCLUSION

Although there are increasing number of female professionals in the construction industry, survey responses clearly indicate that female professionals perceive themselves as not on par as their male. Counterparts. A discriminatory attitude toward female occurs most frequently in site works and there is difficulty in gaining credibility with male subordinates. All in all, the respondents affirm they do not have any doubt regarding their abilities to, handle work as any male colleagues but are hinder by gender expectation that is foster by the society.

Additionally, women are expected to playa dual role homemakers and paid works. These dual burdens often resulted in affecting the opportunities for females to advance in their career especially in a male dominated industry. In spite of such limitation, lost of the respondents feel positively enough of the Industry to encourage more female entrants. The construction industry is one of the catalysts of the Economy in Hong Kong, and with its growth, more and more professionals will be needed. It is no doubt one of the promising fields for women who are prepared to break through the existing barrier.

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WOMEN IN COMPUTER TECHNOLOGY IN HONG KONG UNIVERSITIES

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Abstract: Over the past four years, the number of women enrolled in computer technology courses offered by universities in Hong Kong has not kept pace with the rapidly expanding demand for computer professionals. In fact, women studying or working in the field of IT are significantly underrepresented in universities and industries. Why are there so few women attracted to the field of great promise? Based on a questionnaire survey conducted at Hong Kong's two universities, this exploratory study will attempt to find possible reasons. The women students' motives for choosing computer science as a major field of study will also be examined.

Keywords: women, computing, career, computer science, gender, education

1. INTRODUCTION

With the fast growth in the information technology (IT) industry during the past decade, more and more female university graduates have entered the industry to begin their professional careers. However, the IT industry is still dominated by men, especially at the management level. In her paper on "Women and Computing", Karen Frenkel reported that although women represented nearly 50% of all professionals in the US, they constituted only 30% in the IT industry (Frenkel, 1990). In Hong Kong, a similar situation prevails. According to the government report on "Equal Opportunities for Women and Men" published in 1993, 49% of Hong Kong's inhabitants were women, yet they accounted for only 32% of all professionals. And, according to a recent survey, women constituted about 30% of IT professionals in Hong Kong (Fukuda, 1994).

Studies in the US have shown that educational and recreational software are generally designed to appeal to boys. The themes of computer games are predominantly war, destruction, crimes, and traditionally male-oriented sports and hobbies (pearl, et aI., 1990). Therefore, it is hardly surprising that computers and careers in IT are widely perceived as a domain belonging to males. Furthermore, the choice of subjects to study at secondary schools has a strong effect on selecting computer studies as a major at universities. In Hong Kong, largely under the influence of family and society, secondary school girls tend to stay away from the "science stream", preferring the "arts stream". Considering that one of the requirements

For admissions to Computing Studies program at the university level is "c" or above grade in a Mathematics subject of HKCEE (equivalent to UK "0" level examination), it is understandable that there are very few female applicants to the program. In fact, about 75% of the first year students enrolled in the computing studies program at the two universities surveyed in this study are male, with 64% of them having taken computer courses at secondary schools.

As shown in Table 1, female students majoring in computing studies are clearly under-represented at the two universities. And, over the past four years, their numbers have averaged at just around 27% of the total enrollment. Moreover, at the postgraduate level, the number declines sharply to about 4%. Although this might be explained by the not-so positive experience during undergraduate studies, the main reason for such a drop could well be dfficulties involved in balancing career, study and, in some cases, family responsibilities. The low representation of women, especially at the advanced level, raises a disturbing possibility that few women graduates would enter academia, thus perpetuating the trend of non-existent role models for female students

Table 1: Enrollment in Computing Studies as a Major Field of Study

	University A			University B			
Year	All	Total no. of female	In %	All	Total no. of females	In %	Av. of two universities
95/96	126	40	32%	100	17	17%	25%
94/95	114	32	28%	93	34	37%	33%
93/94	102	34	33%	74	19	26%	30%
92/93	91	21	23%	91	17	19%	21%

2. THE SURVEY

There are seven government-funded tertiary institutions in Hong Kong, and all offer computing studies or IT as a major field of study. In order to explore the background, motivation, and experience of female students in computing studies, a questionnaire survey was conducted at two of these universities. Both universities require students to participate in the Industrial Placement Program during their third year of study. Therefore, the participants in the survey consisted of the first, second, and fourth year students, both females and males. A total of 615 questionnaires were distributed, and 389 returned questionnaires were deemed valid and useful - the successful response rate of 63%. Of the total valid returns, 112 were from females and 277 were from males. And, more than 90% of the students surveyed own personal computers at home.

The survey has revealed that there is a significant difference in the students' perception of difficulty in studying computer science subjects, depending on the year of study. The fourth year students, after a year's working experience in industry, generally regarded the subjects less difficult than the first and second year students did. Only 6% of these final year students considered them "very difficult", 45% "difficult", and 43% "not too difficult". In fact, 6% regarded the subjects as "relatively easy". On the other hand, 3 % of the first year students considered them "relatively easy", with 23% saying "very difficult", 47% "difficult" and 25% "not too difficult"

. The number of hours the students spent on computers increases as they advance from one year to another year of study. While only about 30% of the first year students, both females and males, spend20 hours or more per week on computers, the figure goes up to above 64% in the second year and 77% in the fourth and final year. This is partly due to the fact that the final year students are required to do an independent project involving a substantialamount of work at the computer terminals. However, our survey also revealed one striking difference between female and male students, in regard to the nature of computer usage (see Table 2). Whereas our female respondents use the computer mainly for doing coursework assignment, their male counterparts are more inclined to use the computer for playing games or browsing through the Internet. This confirms a recent study finding that young women generally do not use computers for entertainment, and they prefer pursuing other

Leisure interests, which involve. More interpersonal relationships (Oectering and Behnke, 1995).

Table 2: Nature of Computer Usage. By Sex

	Female	Male
Games	7%	16%
Internet	8%	14%
E-mail	12%	10%
Course work	70%	56%

Having also noted that most females surveyed would use the computer, only if necessary, they were asked to rank the reasons for choosing computing studies as their major field of study (see Table 3). It is interesting to note that although the majority gave a high ranking to "interest in computers", a rather significant number of them simply attributed their choice of computing studies to "easier admission requirements". Due to political and economic uncertainties hanging over the transfer of sovereignty to China on July 1, 1997, the students and their parent's alike hold a rather pragmatic view about university education. As a result, to many of them, getting into a university is much more important than what you study. Nevertheless, an alarmingly large number (59%) indicated that given the choice, they would transfer to a different major field of study, with 66% opting for business management.

Table 3: Reasons for Majoring in Computing Studies ("Females")

Reason	Average score
Interest in computer	2.17
Promotional prospects	2.77
Good starting pay	3.03
Easier admission requirements	3.18
Influence by friends	3.78
Parental pressure	5.08

Note: Respondents were asked the reasons for choosing a job from 1 to 6, "1" as the most important, and "6" as the least important.

Table 4: Reasons for Choosing a Job ("Females")

Reason	Average score
Challenge and job satisfaction	2.73
Compensation package	3.39
Good working environment	3.14
Promotional prospects	3.69
Job security and stability	4.74
Opportunity to move into management	5.17

Note: Respondents were asked the reasons for choosing a major from 1 to 6, "I" as the most important, and "6" as the least important.

Our female respondents were also asked to rank the reasons for choosing a particular job after graduation (See Table 4). A recent study on job expectations of IT professionals, both females and males, in Hong Kong indicated that "compensation package" was the most important reason for changing jobs, followed by "promotion prospects" (Burn, 1994). However, the present survey presented a different picture. While "compensation package", together with" good working environment", were still

Considered fairly important factors in choosing a job, the most important factor turned out to be "challenge and job satisfaction". Yet, the lowest ranking given to "opportunity to move into management" would suggest a lack of career ambition among female students in computing studies.

3. CONCLUSION

In spite of the rapidly rising demand for more computer professionals, women actually engaged in the field of IT are significantly under-represented in both industries and universities. As recently as 1990, only 13% of Ph.D. degrees went to women in the US (Spertus, 1991). In Hong Kong, at least in the two universities where this study was conducted, not a single Ph.D. has ever been conferred to any woman. Why are there so few women attracted to pursue study and work in the computer field? The problem begins long before they get into the universities. Though many have the potential to do well, the invisible pressure often put by family and society tend to discourage secondary school girls from taking science subjects. And, the recreational and educational software developed and marketed today have little appeal to young girls. As a result, studies and careers in computing studies are widely perceived as domains belonging to males. Even among the female students majoring in computing studies at universities, there are many who have chosen the field of study as an easy way just to get into the universities.

This study has indicated that female students have very little ambition to move into management; and, in fact, they attach a rather low importance to "promotion prospects" as a reason for choosing a job after graduation. The survey has also found that the majority of them are genuinely. Interested in studying computing studies, and consider "challenge and job satisfaction" as the most important factor in searching for a job. This might be explained by the fact that in Hong Kong, women are generally not expected to be the main breadwinner for their families and, therefore, have less pressure to pursue only monetary rewards that usually come with promotions to higher management positions. In fact, "job security and stability" was regarded by our female respondents as the second least important reason for choosing a job.

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THE CHANGES IN MANUFACTURING MANAGEMENT AND THE OPPORTUNITIES FOR WOMEN

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Project Engineer Reyrolle Projects Limited

Abstract*:* The number of women employed in industry through this century follows different patterns depending on the social and economic needs of the times. Due to the fact that the population of women in the workforce constitutes a vital part for the well being of the UK contemporary economy, initiatives have been taken to involve women in all aspects of work. In this paper we shall investigate why the number of women in manufacturing management positions is so limited, and what the Rolls-Royce recruitment, training, and development policy will do to encourage women to break into this line of work.

1. INTRODUCTION

In the past, manufacturing was male dominated at all levels. During the first and second world wars women were employed in the factories as semi-skilled and skilled labour on a temporary basis. At the end of both wars they were encouraged to leave their wartime employment in order to give their jobs back to the men who returned. However, due to economic necessity women were still required in clerical, unskilled, and part-time employment. The status and pay of these jobs was poor and this contributed to the "inferior" image of women in these occupations.

Since then, and especially in the last two decades, many things have changed. In the 1950s women comprised less than one third of the labour force (White *et al.,* 1992); in 1994 women represent 44.8% (11.3m). Twenty percent of women employees are in management positions (28% of men), and eighteen percent (13% of men) in supervisory positions (Employment Gazette, 1994). Eleven percent of women employees work in manufacturing which represents 30% of all employees in manufacturing (Employment Gazette, 1994). Women have started to break into non-traditional jobs. The numbers are not overwhelming but their presence is noticeable. Many companies, like Reyrolle Limited (part of Rolls-Royce Industrial Power Group), have realised this shift of mix in the workforce and have started to adopt policies which will enable women to fulfill their career aspirations, and motivate them to follow non traditional careers.

2. CHANGES IN MANUFACTURING

Manufacturing has experienced significant changes in the last two decades. International competition has become so intense that in order to survive manufacturers realised that the traditional practices were no longer adequate to enable them to compete in the world market. New organisations have evolved which are flexible, customer oriented, and focus on people issues, teamwork, training and development. Factories are not the dirty and noisy places that they used to be. This is due to a number of reason; advances in technology (CAD, CNC machines, robots, conveyor lines etc.), health and safety requirements, and total quality management.

The biggest challenge which manufacturers are facing today is having to change and improve their practices and products in order to stay in the world market. In order to meet this challenge focus has been placed on the recruitment of graduates from engineering and science who will bring new ideas and forward thinking into the organisation, thus

Combining the best of the old and new worlds. These graduates will constitute the majority of the senior managers of the future. The future looks quite promising for young people, both men and women, coming out of the universities who have decided to follow a career in manufacturing.

The style of management and organisational structures are the areas which have been most affected by these changes. The levels of hierarchy have been reduced, organisations have become more linear and management style has become synergetic rather than autocratic. Emphasis is placed on teamwork, communication, training, and leadership. The managers of today are leaders, leading by giving direction, building teams, and inspiring others by word and example. Instead of being controllers, they are policy makers, planners and co-coordinators. These are the essential qualities of a modem manager. Their objective is to establish self-managing, and self-regulatory teams. They have to articulate the vision of the future, display energy, confidence and total commitment. They are resource providers, trainers, developers, and motivators. They are part of the team and do not stand above it. The modem manager does not tell people how to do things, but what has to be done. In this way people get involved, and are committed to the day to day objectives. The team makes the decisions, the leader's role is to co-ordinate the team and make sure that feedback is given, and ideas are heard and evaluated.

3. EMPLOYMENT CHARACTERISTICS

While the changes in manufacturing were taking place, and specifically over the last ten years the number of women going into engineering and science increased by 41 %. The number of men increased by 20% (Higher Education Statistics Agency (HESA)). It was identified in a survey conducted by the Department of Employment that highly qualified men and women are equally likely to be found in the top three occupational groups. These occupational groups are: a) Managers and administrators, b) Professional Occupations and c) Associated Professional and technical occupations. Looking at these groups individually it was identified that in group a) the proportion of men in corporate position is greater to that of women with equivalent qualifications. In group b) women were substantially less likely to be in the science and engineering professions compared to men. In group c) there is a greater number of women than men both with higher academic qualifications, suggesting that women are confined to these lower status jobs within these occupational fields.

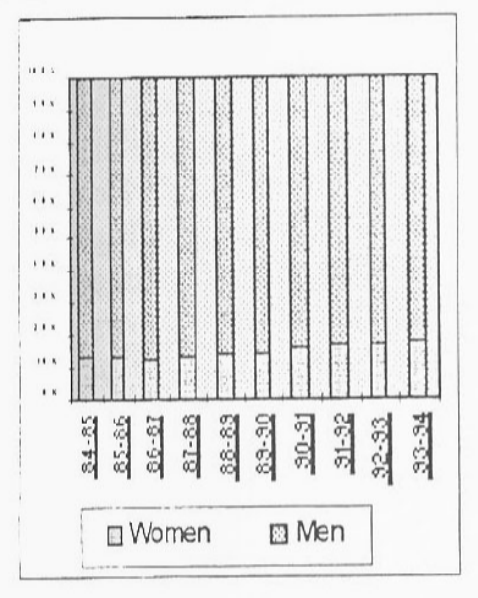
It has been established that the number of women entering non traditional occupations is limited (White *et aI.,* 1992; Carter and Kirkup, 1990; Still, 1994, 1992). This is due to the influences originating from home, school, environment and media exposure. In order to overcome these obstacles a joint effort from industry, government and education should be instigated. Career information from industry should be channeled directly into educational establishments giving a broad and accurate description of the opportunities available.

4. WHY ARE THERE SO FEW WOMEN IN SENIOR MANUFACTURING MANAGEMENT?

In order to answer this question it is important to understand the route people followed in the past to reach senior management positions. A number of senior managers from Reyrolle Limited were interviewed for this purpose. The majority of the managers (male) had completed some kind of apprenticeship either as fitters or as technical apprentices. They were usually promoted on a performance basis, and their progression was relatively slow. The age profile for a manager was around 40-50. The slow progression was due to the management profile, which required the manager not only to understand but possess knowledge and training on most details of the jobs that his subordinates carried out. Promotion depended on good performance in the manual tasks and experience in the workplace. This enhanced the development of functional and technical oriented organisations. The managers were the autocrats who ruled over their subordinates.

Returning to the original question, the number of women applying for apprenticeships in the past was very limited, or non-existent. The women who did work in industry were usually unskilled or semi-skilled, thus reinforcing the image that they were not technical experts. Additionally the number of women going into engineering and science was very small. The majority of the women until the end of the 60s chose medical-associated, teaching, clerical and service sector occupations. This coincides with the information obtained from the interviews from senior managers who had a degree and had not encountered any women engineers or scientists during the early years of their careers. What was noticeable was that the age profile of the senior managers with a degree was lower than the ones without., which let us come to the conclusion that their academic qualification enabled them to move up the ladder faster. The majority of managers who were in the 25-35 age group either had a post -graduate degree or were planning to undertake one. The same applied to their female counterparts.

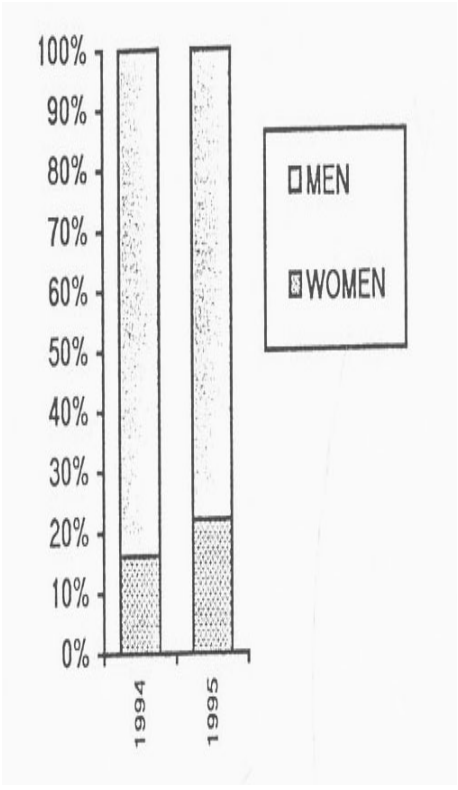
The age profile of the women managers will were interviewed was lower than both categories of men, which supports the belief that the mix has started to change. They all obtained university degrees, in either engineering, science or business studies, by studying on a part time basis while they were already working in industry, or full time.



The belief highlighted by the people interviewed was that the number of women engineers/scientists applying for the graduate positions is limited. The statistics issued by HESA support this theory ***(Figure* 1)**

Figure 1. The percentages of women and men engineers/scientists whose first destination is manufacturing from 1984 to 1994.

The good news about the information in ***Figure* 1**, is that the percentage of women going into manufacturing is increasing. The percentage of graduates applying for graduate positions at Rolls-Royce Industrial Power Group for 1994 and 1995 are displayed in ***Figure* 2**. Of the total number of graduates employed in 1994 and 1995 13% were women.



Although the percentage of women of the total number of graduates going into manufacturing has increased, the representation of women is still low. This limited representation of women can be justified by two assumptions a) women do not go into engineering and science, or b) women do not go into manufacturing. women do not go into engineering and science or A further investigation of the actual numbers of women engineers/scientists going into universities, graduating and entering industry/manufacturing was required **(Figure 3).**

***Figure* 2**. Percentage of Men and Women applying to Rolls-Royce Industrial Power Group.

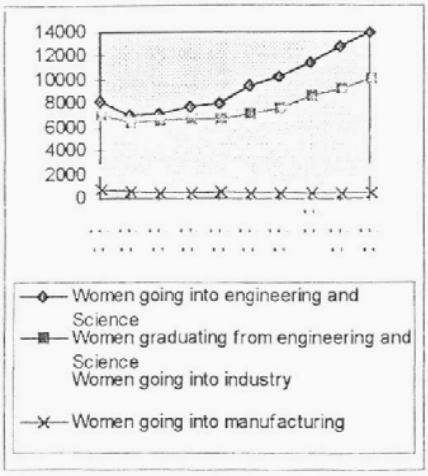


Figure 3. The number of women going into engineering and science, graduating, going into industry and manufacturing.

It is evident from ***Figure* 3**, that although the number of women engineers/scientists has increased over the past ten year, the number of women entering manufacturing/industry has remained relatively constant throughout this time. The uniformity of the numbers of women entering manufacturing/industry was unexpected especially when the number of women graduates was increasing. Due to this uniformity it was felt necessary to investigate the number of men choosing industry/manufacturing as their first destination ***(Figure* 4**).
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The information in ***Figure* 4**, shows that it is not the number of women engineers/scientists causing the increase but it is the reduction in their male counterparts.

Many researchers argue that even today people believe that engineering is not the place for women (Carter and Kirkup, 1990). The dominant influencing factors are culture, and lack of relevant career information. Reyrolle Limited participates in a number of programmes and has adopted policies in order to encourage pupils, students, engineers and scientists to get involved in industry. The activities are initiated by local schools, universities, institutions, and the company itself There are three main groups that are being tackled, 12-13 year olds, school leavers, undergraduate and postgraduate students. Events such as open days, and "Take your daughter to work" days are aimed at girls at the age of 12 and 13 when they are about to choose their school subjects. Women and men engineers employed by Reyrolle Limited also participate in programmes where they visit schools and talk to pupils about the different opportunities available in manufacturing. These programmes cover pupils about to choose their subjects and those about to leave school. Other activities the company organises with local schools include work placements for students during their holidays and visits from the schools to the workplace. It is not only the pupils that are involved but the teachers are also given the chance to shadow managers working at the company. Reenrolled Limited has formed partnerships with several universities in the UK in order to sponsor undergraduate and postgraduate students. Additionally, career fairs and career opportunities advertisements are organised with various universities across the UK.

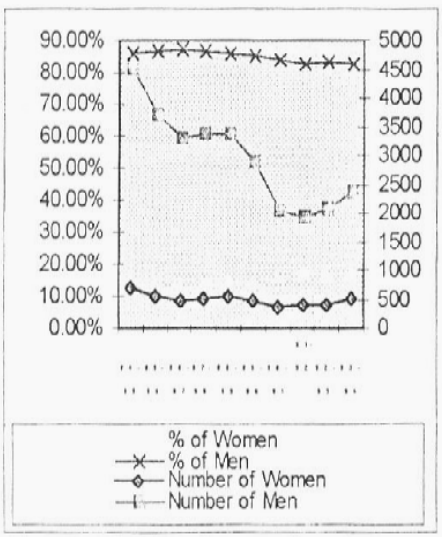

Figure 4. Number of men and women entering manufacturing versus the percentage.

Once the graduates are recruited they go through a two-year training course, which is accredited by the Institute of Electrical Engineers, Institute of Mechanical Engineers and Chartered Institute of Management Accountants. This training covers the majority of activities within the company i.e. production, engineering, purchasing, design, accounting, sales, marketing, project engineering and installation. At the end of their training they are given their first appointment. Their progress is monitored by the training department during their training

Period, and afterwards their supervisor through the company appraisal system. Every employee has the chance to discuss with his or her supervisor their progress, any problems, and talk about their future development. A plan of action for each employee and supervisor is devised which includes all necessary training that may be required in order to enable the individual to gain the knowledge and experience that will enable them to fulfill his/her career aspirations. It is the responsibility of both parties to ensure that training and other plans materialize. There are opportunities for all employees to undertake, on a part time basis, further education courses such as Higher Education Support In Industry, Integrated Graduate Development Scheme, Rolls-Royce: MEA and Warwick University Integrated Management Development Scheme. In addition, some graduates are encouraged to do PhD degrees. Diplomas and degrees undertaken by employees within their agreed training plan are sponsored by the company and the student is allowed time off depending on the requirements of their work, course or research.

It is evident that there is a comprehensive and integrated strategy at Rolls Royce regarding recruitment, training and development for both women and men.

As the company has invested heavily in its graduate intake it was thought necessary to encourage women to return to work after childbirth. The company supports women through an enhanced maternity package, which also includes contributions towards childcare. There are initiatives at a number of sites for the creation of crèche facilities. Flexible hours of work have also been adopted for women with children. It is left to the women to come to an agreement with their managers.

5. CONCLUSIONS

Based on the figures obtained from HESA it is evident that women are moving into non-traditional areas of education. The neA1 step is for them to consider non-traditional careers in industry and manufacturing. In order for this to happen industry has to playa major part in motivating young engineers to enter industry and manufacturing. Reenrolled Limited does this at present with their sponsorships, vocational employment opportunities, career fairs and advertisements. However, it is equally important to change the existing low status of a career in industry and manufacturing in Britain. This, however, is a national issue and involves the need to develop an interest in science and engineering at an earlier stage. In order to do this school career advisors, and media should be given up to date information directly from industry. This would help to develop a positive attitude towards engineering/science as a profession. This positive image will encourage women to consider a career as a professional engineer/scientist within industry.

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HOW WOMAN DEVELOP HER CAREER IN S CIENCE AND ENGINEERING?

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Abstract: With a view of encouraging women to develop their careers in science and technology, a survey was conducted about the attitudes and opinions of 2000 educators and researchers. Although the majority of respondents expressed gender equality in theory for the opportunity of scientific career development, male respondents tended to accept the present severe situation of discrimination over women's employment opportunities, in contrast to that of female respondents. Most of respondents were aware of the recent trend of youth, not only girls, losing interest in science. However 60% of respondents replied that their own children like science. More children from the homes of female respondents liked science or engineering. Psychological effects of young women due to career breaks for marriage or childbirth were investigated.

Keywords: Women, Youth, Career, Science, Engineering, Survey, Education

1. INTRODUCTION

Over the past 30 years, many women received higher education in the fields of science and technology. However these women leave their jobs within a few years due to married or childbirth. Once women take a career Break, few of them could get their former work again.

In addition, there is a recent trend that youth not only girls, are less interested in science and technology, and are not making their careers in these fields. This suggests that in 20 years time, there may Widower engineers in Japan. Therefore an investigation was conducted on the present Iquation and measures to improve these problems were discussed.

2. DISTRIBUTION OF QUESTIONNAIREAND PROFILES OF RESPONDENTS

The questionnaire included 50 questions with 340 possible choices altogether and consisted of 5 parts, i.e., 1) is the attitude of youth towards to science and technology? Then the remaining 4 parts are the roles necessary to encourage scientific interests to youth, especially for girls. That is, 2) Role of home, 3) Role of schools, 4) Role of the society. And 5) Role of female scientists and engineers. At the end of questionnaire, additional free comments are asked. 20% of the respondents wrote useful opinions.

As shown in Table 1, the investigation is based on a survey of 2000 scientists and engineers. They are graduates of faculties

Of science or technology of 4 year university or higher. Questionnaires were distributed to 1000 science teachers of high, junior-high and primary schools. The schools were chosen roughly evenly geographically and evenly between public and private establishments.

800 replies were received within the dead line. As seen in Table 1, 530 from female respondents of whom 23% are unemployed. 270 males replied. They were mostly school teachers.

Table 1. Distribution of Questionnaire and Profiles of Respondents

*Distibutin of questionnaire:
Total: 2000 graduates of science or technology of 4year-university
1000;science teachers of prim., junor-high, high school,
550; science professionals of univ., college, and laboratories.
450;women graduates currently unemployed

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*Profile of respondents: total: 800(for statistical use)
Women 530(66$), men 270(34$),
Average profile: Married with two children,
Present profession: Educators (women 64$, men90$)
Researchers (women 13$, men 10$)
Unemployed (women 24$, men$)
Present occupation: Administrators (women10$, men 4$)
Non Administrators (women 90$, men 96$)

Specialized field	Math	Phys	Chem.	Bio	Engi	Life	Other
Women ($)	7	12	27	21	9	14	11
Men ($)	3	27	20	28	9	3	11

Combined fields= math. incl. info. Science; phys. incl. Geophys.; bio. incl. agri; life incl. med.& pharm,

3. TRENDS OF YOUTH IN SCIENCE AND TECHNOLOGY

The first question was" Are you aware of the recent trend of youths losing interest in science? ". On average, 74% respondents expressed awareness of such loss. Then the question goes on "When do youths start losing interest in science? As shown in Fig.1, 25% of them said that 'they start

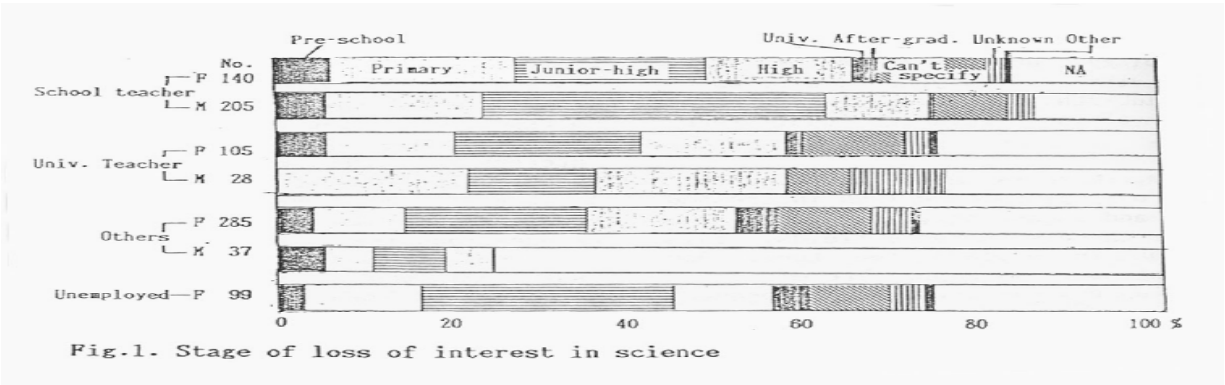

Fig.1. Stage of loss of interest in science

At junior-high school age, and 15% at high school another 15% at primary school and respondents said it at pre-school next question was "Why young students Interest in science?" The biggest answered was 'Cream teaching for matriculation' and followed by 'less practical experiments in science'. Many respondents that youths tend to avoid enter universities of science or technology where study awaits.

4. HOW TO FAHILIARIZE CHILDREN WITH NATURE OR SCIENCE AT HOKE?

Roles of mother and father for children at n respect to influencing attitudes of en towards nature and science are ant. Then" Do parents provide opportunities for children to "feel close nature or science?" 60% of parents answered yes, no difference in the replies between mothers and fathers. Further" Do parents to children environmental pollution at with actual examples?" Although no 'difference in the attitude of fathers mothers, a slight difference was that *i.e.* father) respondents tend to teach really rather than with actual example

Next question was, do (did) your children like (liked) science at junior-high and high school? The answer was jimmied to first and second children. As shown in Fig. 2a, 6Q.r of respondents said that their children like (liked) science at junior-high school and 50% said that their children liked science at high school stage. An interesting result was that more children at home of female respondents liked science. That is, 64% of children of female respondents like science ageist 44% children of male respondents.

Question goes on that" What's the reason for children liking science?" As depicted in Fig 2b the highest score was in 40% of respondents who answered 'because of home Environment'. Remember that all respondents are either educators or researchers of science and technology or some unemployed female science and technology- graduates. This implies that the role of women at home is also very important. Also, the role of father to children can not be overlooked. In the present society, effort is rather oriented to easy accesses to high-tech appliances to all level of people. This resulted so called 'Black box engineering'. Anyone can operates complicated appliances by touching a button without knowing the mechanism of the appliances. So, "Do you know the mechanism of high-tech appliances in your home?

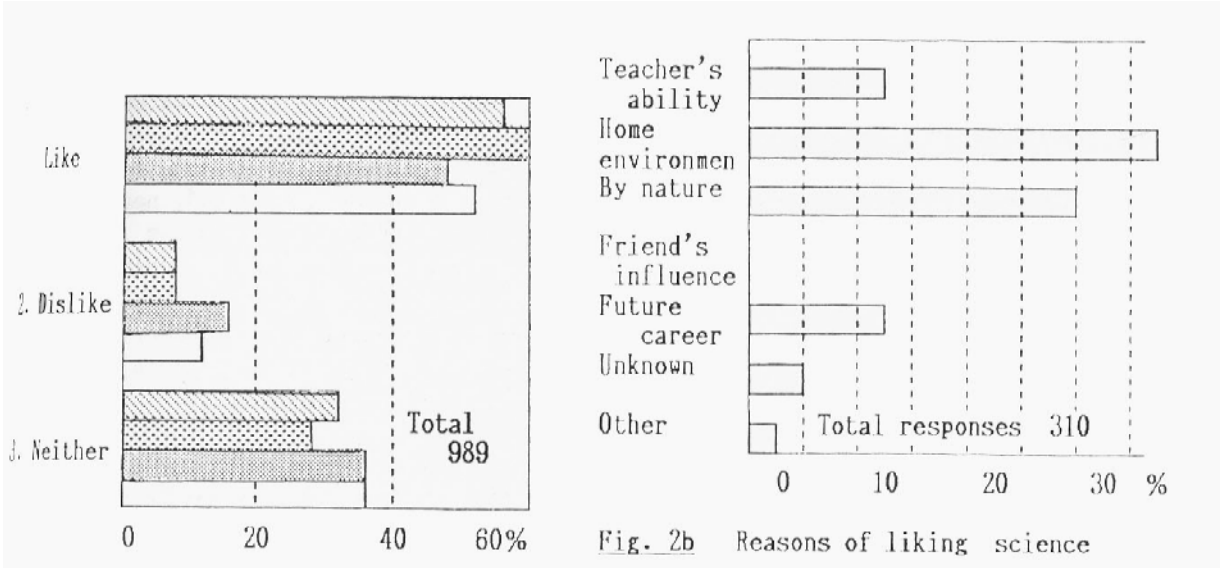

Fig. 2a Do your children like science ?
At Junior(1st child, 2nd child), At High(1st Child, 2nd Child)

Fig. 2b Reasons of liking science

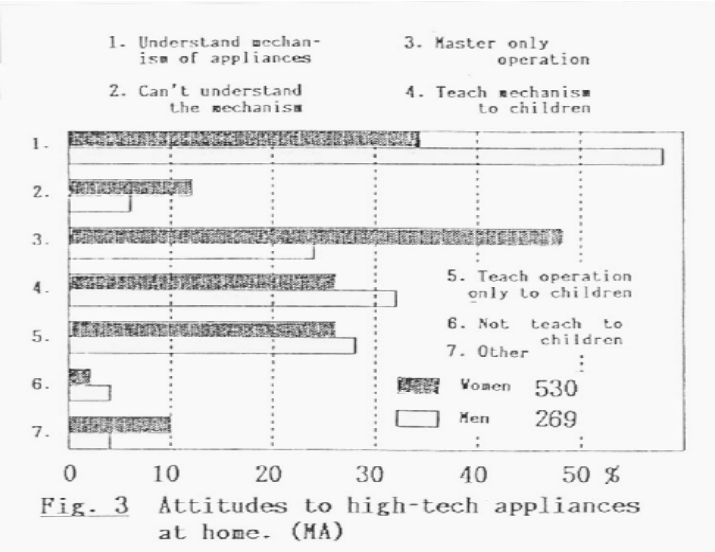

Fig. 3 Attitudes to high-tech appliances at home. (MA)

The result is seen in Fig. 3, 60% of male respondents say' yes' against 34% of female. On the other hand, 48% of female respondents say that 'only mastering how to operate it' as compared to 26% of male respondents do so. It is disappointing with the women's attitudes. However it is realized that this may be due to the difference in the profession of female and male respondents. Women work more in the field of life science while men are involved more in engineering. In addition to that some female respondents have not worked for a long time after their career break. Further investigation is needed. Another guest ion is "Why young students lost interesting science?". The biggest reason answered was' Cream teaching for matriculation' and followed by 'less practical experiments in science subjects". Many respondents felt that youths tend to avoid entering to universities of science or technology where hard study awaits.

5. DOES SCHOOL DISCOURAGE CHILDREN'SINTEREST IN SCIENCE?

For sometime in Japan, it is said that children start academic competitions from kindergarten. The competition never stops although many people criticize this situation. Most school teachers complain that they can't take time for experiment during teaching because so much knowledge has to be creamed into students for matriculation To demonstrate practical experiment during class, a teacher muse take some time in advance to prepare or adjust equipments or material to use for the experiment.

Students, at the stage of junior-high or high school age, feel a lot of pressure from their lessons. Many students dropout or lose interest from science subjects. Relatively few male students take physics or chemist course at high school and very few girls take such subjects. Referring to the recent statistics of female members of the Socialites of Physics and Chemistry of U.K. and USN. The proportion of female members in Chemistry society is 5.7%, as compared to 10.8%, and 25% of U.K. and USA respectively. For physics, 2.0%, 7.3% and 18% in order of Japan, U.K. and USA respectively.

6. WHAT IS THE EMPLOYMENT STATE FOR WOMEN SCIENTISTS AND ENGINEERS?

Due to a prolonged economical depression in Japan, many companies do not employ women. Thus the awareness and attitudes of people on this matter are critical. Although the majority of respondents replied' gender equality' for education and career opponents, some male respondents accept this severe employment situation for female graduates. As seen in Fig 4. Nearly 80% of female respondents, regardless of their occupations, said' it is a discrimination against women'. On the other hand, only5 of male respondents said' discrimination'. These male respondents are mainly schoolteachers or administrators.

There are some reasons why companies do not employ women: Because the majority of women leave employment after 2 - 5 years .of work, just about the time when they get used to the work. Their reason for leaving job is mainly either marriage or childbirth.

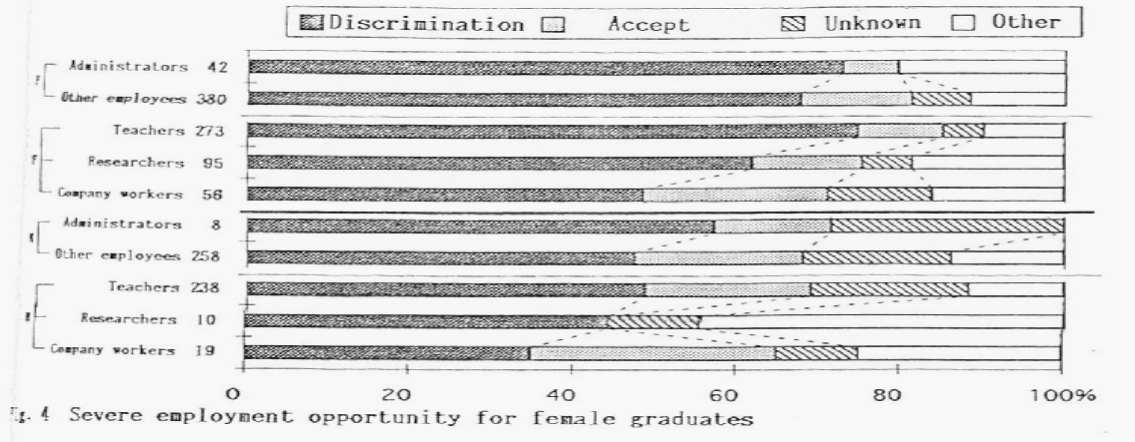

Fig. 4 Severe employment opportunity for female graduates

Fig.5a shows the length of employed work of 10len before break. Over 70% of women employees worked less than 10 years in which Harked less than 5 years. We asked furrier" What was the reason for quitting the job? As seen in Fig.5b the major reason was I~ for childbirth followed by 36% for marriage. The large number. of resignation ofl0ung women will be due to fewer facilities for childcare within their reach, but also I.e. feel some young women lackthe professional consciousness.

7. HOW TO ENCOURAGE GIRLS TO DEVELOP A CAREER IN SCIENCE AND TECHNOLOGY?

Fig. 5a Employed dulation

To attract girls for careers in science and technology is rather complicated. As pointed at earlier, many youths, not only girls, seem to have lost passion or curiosity for true, science or technology, However the fact that few girls making their careers in science or engineering is a chronic phenomenon in Japan. In addition to that, as described in the previous section, many women quit the job within several years. Therefore the result is that there are very few women scientists and engineers working for a long period.

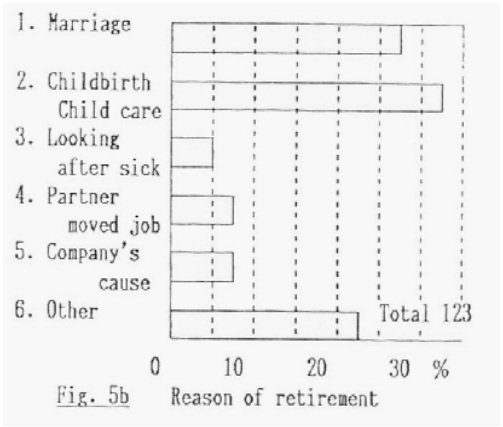

Fig. 5b Reason of retirement

The psychological effects were observed when women resigned from their jobs and are compared to those of now. As seen in fig6 about 40%of the resigned women felt a positive feeling such as happy or free at the time of resigned. But those positive feeling became less as time passed. The fee ling depends on the length of work engaged. Women who worked longer feel more negative suffering such as restlessness, loneliness, regret, or chagrin.

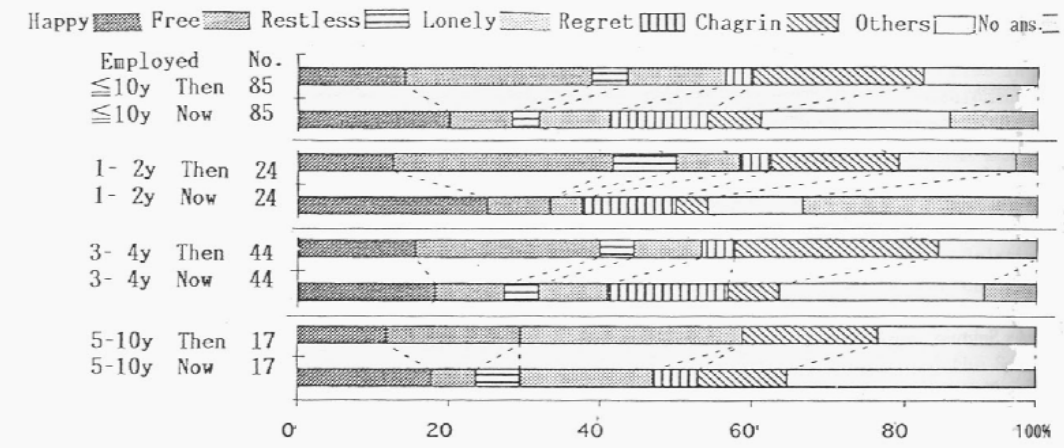

Fig. 6 Psychological effects of career breaks

Finally, a question "How can we increase women in science and technology?" was put. The replies from female respondents are very positive, such as that they like to give interesting lectures to girls, or guide youths to science museums etc. many people suggested utilizing mass media to enlighten youths about science.

The other suggestion was to raise the salaries of engineers and scientists to a level of clerical employees. One interesting suggestion is that' A discovery or invention made in science and in technology by women will not be discriminated by gender.

8. CONCLUSIONS

1) From the present survey, it is seen that there are no obvious prejudice in the respondents for a girl's career in science and technology. However there are subtle Prejudices on women employment opportunities by male respondents. The subtle and subliminal mind of mentors may affect youth's future course.

2) However, young people are showing dis. interest in science may be only a part of the trends of our present society. Many respondents felt that recent youth take an easy-going attitude to life. So one has to think what will be a good relation between science and human beings.

3) Improvement must be made on the child care facilities together with a social guarantee scheme of paid parental leave. Also affirmative action on employment should be reinforced

Many respondents wrote additional free comments together with the set questions. Out of 880 replies received, 160 respondents wrote their opinions on various topics. The contents have many implications. We are now investigating them.

The end.

"WOMEN IN SCIENCES"

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Abstract: Polish women scientists, especially married and bringing-up children attain the highest scientific degrees and positions quite rarely. The principal reason for the sex inequality in Poland is a deeply rooted and popular among Polish women a classic model of a women position in society. The other one, so called "Internal Immigration" is a direct consequence of present socio-economic transformation, which causes that women leave universities for a well-paid job in private sectors. The lack of perspective discourages also real enthusiasts who can not conduct expensive researches and resign from scientific work. A shining example for all women may be a great personality of Polish scientist, professor B.J. Trzebiatowska who also worked in difficult times and during her life published more than 600 scientific articles in general, women scientists require more help from both family and society in order to attain a state of reconciliation between family and professional duties.

Keywords: women scientists, Poland, classic model, inequality, internal immigration, post communist countries,Socio-economic transformation.

1. INTRODUCTION

In the first part of this communication some ideas based on the social status of women scientists that result from the present situation in Poland are reported. They may be referred to women in other countries as well.

Nextly, there are searched the reasons of the occupational inequality between men and women and some statistics is given to illustrate the situation in which women scientists find themselves in the Poland of today.

Finally in the honour of professor Boguslawa Jezowska - Trzebiatowska (BJT), the eminent Polish scientist and esteemed woman who was the organizer and first director of the Faculty of chemistry of Wroclaw University (where the author work) A few facts from her interesting biography are mentioned.

2. HISTORICAL ASPECT

Collection of materials for this communication has been started by looking through "Nobel Prize List"(Bonin, et al.,1989) in Physics and Chemistry, two scientifically difficult and rather "masculine" disciplines. As one might have forseen, amongst more than hundred names there are only a few women including Maria - Curie Sklodowska who has been awarded the Nobel Prize twice.

After having looked into another book entitled "Creators of Chemistry" (Litynjecki, 1979) sceptisism of the author has even increased. in that book appear the names of pioneers like Democrit from Abdera, Lavoisier, Avogadro, Nobel to Linnus Pauling and other contemporary chemists but once again only M. Curie and her daughter Irene joliot

Curie were mentioned in. In "The Ancient Engineers" (Colley, 1963), only the names of Assyrian Quinn Semiramid and Alexandria Quinn Cleopatra were noticed there. Both of queens were educated In dIe manner of their times what was Exceptionally rare phenomenon in that epoque. From "Doctors Honoris Causal of University of Wroclaw "(Ziolkowski, 1993), it results that even nowadays it is very difficult for women to attain an eminent place in science. In the period of fifty years, more than hundred honorable degrees were awarded to the scientists for their unusual achievements in Science or in Art. Among these hundred names there are only two women...

Why is this so? As it appears from another work (Iwaszczyszyn and Konecka, 1986) among all full professors in Poland there are only 7% of women? Where such a shocking inequality originates from?

3. CLASSIC MODEL

In Poland as underlined by some sociologists (Reszke, 1991), a lack of equality between men and women is clearly observed in many spheres of life. At the root of the problem lie quite different methods of socialization for the two sexes, restricting the independence of young girls more than that of boys. Girl's feature is not so directly considered to be related with her professional work, as does it boy's future. Besides, the influence of the family and the accepted standards and norms affect the socialization of the young Polish women. Historically, in Polish society a traditional rather then a liberal model of a woman and her 'role as a "wife", "mother" or "housewife" is obligatory. Her occupational work is merely treated as a means of increasing the family budget Such stereotype ideasstill prevail and professionally or publicly active woman unfortunately does not receive a suitable encouragement neither from the men's side nor from women in general.. In Poland all professions are still divided into those which are "feminine" or "masculine". In science the women participation is about 35% however about half of them, they are foreign languages lectors who can not be promoted any further.

4. STATISTICS

As it was found in the book of Iwaszczyszyn and Konecka (1986) that in the years of 1982/1983 The Committee on Researches and Prognosis, called "Poland 2000" sent to Polish women scientists a special inquiry in order to learn their opinions on some problems. From the inquiry it results that about 38% of them work in the natural and social sciences, 43% in medical and agricultural sciences, and only 19% in technical sciences. As far as their civil status was concerned, of the Polish women in science about 61 % are married, 15% divorced or in separation, 16% are single women, and 8% widows; 33% of them have only one child, 30% have two children and less than 5% have three or more children, while 31 % have no children at all. Concluding, we notice that the majority of women working in science are married and have a small number of children. Science requires a lot of time and devotion....

How the married women manage all their family and professional duties? About 57% of the women bringing up their children are helped by mother, mother in low or baby sitter. Only 11 % enjoy their husband or partner's help. Characteristic for Polish women scientists is that among them there is a lack of the highest-level managers like Department Heads, Rectors etc. The highest managing position occupied by them in science are Directorship of an Institute or Clinic. Only 14% of women scientists think highly of their own scientific achiements and claim that they have made significant contribution to the science. A different opinion is held by 65% who maintain that although they achieved many good results, they did not reach what they might have done. Dissatisfaction with their scientific activity appears in about 15%, while about 7% claims that achieve scientific success is not the most important thing for them. For the majority of women, apparently, it is important to have a happy family life and they try to keep equilibrium between their profession and their private life. Thus we see that the principal reason for the sex inequality in Poland is a direct consequence of a traditional vision of a women position in society. This is a very deeply rooted and popular model among Polish women. The conflict between the roles of the wife and employee is the case that married women reach relatively rarely the highest qualifications. But in the other hand, 70% those women who reach these high level (scientific titles and degrees, high professional positions), in spite of the fact of being married and having children, continue their occupational work. It appears to show that furthering women's education is a strong stimulus for the reconciliation of the family and professional duties. The great majority of Polish married women scientists have very little time left for themselves. As it is noticed by Titkow and Domanski (1995) "they are charged with practically all family duties and are responsible for building and maintaining the relationship and the family. The man's duty is only to provide for the family and to abstain from certain behaviour like physical abuse, alcoholism or adultery". A Polish woman who is single has a slightly better possibility for a successful scientific canter. She may reach scientific degrees significantly more quickly than her married

Collogues. It is obvious that the sex segregation can disappear only in countries where governments realize a full employment policy and where kindergartens and the nurseries are available for the childrenof the workingwomen.

5. "WAITING FOR GODOT"

In Poland and other post-communist countries further inequality is observed. In such sectors of the social economy like Science, Education and Health Service, a significant disproportion exists between the high professional qualifications required from the ernploees and the meagre possibilities to give them adequate wages. Incomes in these sectors are amongst the lowest, even though the social standing is high. Such sectors as Science or Education are crucial for the prestige of the state, but the financial outlay for them is a miserably 10w.Becouse of this many scientists resign from their work. In the period between 1981-1991 about ten thousands of scientists, among them a considerable fraction of women left Poland emigrating to USA, Canada or to Western Europe. Since 1991, every year at least 200 scientists emigrated to the West. In recent years despite of eminent changes inthe country the number has gone up to 220 per year. In fact the Polish scientific community faces a great crisis. The scientists emigrate because they are badly paid. According to the European Institute for Regional and Local Development (pawelek, 1995) those loses may be irrecoverable. One aspect though is cheerful; about 87% of scientists who have recently emigrated still work in science. Another serious problem which occurs in Poland in the period of transformation from the communist to the market: economy is that young people abandon their studies or the work at the. University for a well paid job in he private sectors. This so called" internal immigration "attracts more than 1000 young people per year. The universities lose mainly economists, mathematicians, chemists, and management and: computer science experts. The number of Polish women in science is still decreasing. Medical Academies do not know how to stop the out- flow of Pharmacists (mainly women) who leave them to work in private drugstores or to become the representive of a Western Pharmaceutical company. The worst thing is that Universities also lose real enthusiasts who are discouraged by low salaries but mainly by the impossibility of Inducting expensive researches.

Quoting the words f one "Warsaw's Voice" corumnist E. Pawelek (1995) "Waiting for an improvement resembles Samuel Beckett's "Waiting for Godot". As scientists y-the disastrous results of neglecting science in) poland will show up in the next 5 to 10 years.

6. PROFESSOR B. JEZOWSKA - TRZEBIATOWSKA

In this context there is a need to recall a great personality, the Polish chemist professor Boguslawa Jezowska-Trzebiatowska (BIT) who died at the age of 80 years, a few years ago. She may be a very good example of a woman activity and scientific achievements for all women. She was born in 1908 near Lvov (today Ukraine). Her father was doctor of Physics and his daughter continued family tradition beginning her studies at Technical University of Lvov in 1926 as the first women student in its history. She graduated in 1932 and obtained her PhD in 1935. Then she began her scientific career in the field of Coordination Chemistry. Unfortunately, due to the World War II she could not continue her researches for more than 5 years. In 1945 like hundreds a thousands of other Polish people she had to leave her place of life. and moved together with her husband to Wroclaw' i.e. from the Eastern to Western part of Poland. Together with them, many other eminent Polish scientists from Lvov also arrived in Wroclaw. Once in Wroclaw, she immediately started to organize the Wroclaw scientific center setting up the Department of Inorganic and Analytical Chemistry at Technical University and then at Wroclaw University (Ziolkowski, 1988). In 1954 she becameprofessor of chemistry at the University of Wroclaw where she was appointed to prof.emeritus in 1979. Since 1967 she was a Member of the Polish Academy of Sciences. Prof. BJT remarkably accomplished the foundation of several scientific institutions. She created the Institute of Chemistry at the University of Wroclaw and a modern laboratory in the Institute of Low-Temperatures and Structure Research of the Polish Academy of Sciences in Wroclaw. Both of these are now leading centers of scientific investigation and education in this city. She has trained many generations of students, coworkers and colleagues. From her 70 doctors, 28 became associate or professors and 11 are now full professors working in Poland or in foreign laboratories. As it is warmly written by one of her coworkers (Ratajczak, 1994) "Her example of enthusiasm for science, direct and clear insight, unremitting effort and phenomenal mastery of details have inspired and shaped many lives". Her lectures were a pleasure to hear because of the excellent chemistry, but also because of her excitement and enthusiasm for the research in which she was involved with her coworkers at the Institute in Wroclaw. She was a kind; understanding person, always open to people and sensitive to their problems. Shedid not have children her own but treated her coworkers and students as the best of mothers.

Professor BIT excelled in the broadness of her research activities. And during her long scientific

Career she published more than 600 articles as the main author or together with her younger collegues. As a tribute to her unusual scientific achievements she was a' member of many Polish and foreign scientific associations. As a perfect organizer she arranged numerous national and international conferenceson different aspects of chemistry and she participated in many international meetings all over the world. One has to admire and respect her achievements, the achievements of a "weak " woman. Professor Boguslawa Jezowska- Trzebiatowska is a shining example for all women scientists.

7. FUTURE?

It seems that in Poland, the number of women working in science will decrease in the future. Owing to the fundamental socio-economic changes which occur presently in Poland, the tradition and stereotype patterns to which Polish women were subjected for centuries may be changed in a decade or two. A growing number of active businesswomen, owners of private firms economy encourage other women to reach higher professional positions and to think about themselves in categories of individual needs and ambitions.

8. CONCLUSION

Women need to work and they may to work extremely creatively. As Simon de Beauvoir says [Beauvoir, 1991) - "Mainly due to the professional work women are able to decrease the distance separating themfrom men, and nothing else is able to guarantee them real freedom". It is all-true but on the other hand women have to require more help from both the family and society in order to attain a state of reconciliation between family and professional duties.Scientific work, as it appears, requires a special psychical and physical predisposition and does not like to share its rights with other obligations in life. Women, especially married, who are bringing-up their children have many such obligations and hence their path towards the high scientific degrees and professional positions is an arduous one. It is strewn with many thorns and only a small fraction of them have a chance to attain the highest scientific distinctions.

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Redesign of an Engineering Curriculum Informed by the Women-in-Engineering Program

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Abstract

This paper presents the initial findings of an engineering curriculum transformation project, which has been initiated at the university of Maryland through the support of the A. James Clark School of Engineering's Women in Engineering Program (WIE) and the University of Maryland Center for Teaching Excellence (CTE). Nine School of Engineering faculty and 6 Undergraduate Teaching Fellows participated for one semester in workshops, seminars, group discussions, and personal experiences of the faculty/fellow team. In the following semester the modification of 6 school of engineering courses were implemented. The 6 courses chosen for this study ranged from freshman co senior level. This paper reports on two courses as typical of the outcomes.

Introduction

Today there exists a challenge to incorporate new and improved teaching practices, which will be more appealing to a diverse engineering student body throughout the engineering curriculum. It is generally believed that application of modified teaching paradigms will lead to increased recruitment and retention among women and underrepresented ethnic groups in engineering, and this is desirable for increasing diversity in the engineering workforce. We present an overview discussion of specific women elated issues important to the transformation of engineering curricula, and we report initial results of student surveys on teaching preferences and effectiveness. The issues which we identify have been determined through a semester long workshop series exposing engineering faculty to contemporary issues and ideas related [Q women in science and engineering. Our recommended guidelines for curriculum transformation support a more humanistic approach in teaching and a continuation of effort chat will lead to greater diversity. These are suggested as a means to insure greater satisfaction and enthusiasm for all students. Initial survey results for a freshman level engineering population have confirmed chat diversity in terms of gender and ethnicity are desirable for all students. However, the level of importance is greater for women students.

Engineering Curriculum Transformation Project

An engineering curriculum transformation project has been initiated at the University of Maryland through the support of the A. James Clark School of Engineering's Women in Engineering Program (WI E) and the Universityof Maryland Center for Teaching Excellence (CTE). The project included a semester long series of workshops and seminars featuring experts in the field of women in science and engineering. Additionally, a parallel series of guided, small group discussions was facilitated under the direction of Dr. Deborah Rosen felt, Professor of Women's Studies and Director of the campus curriculum transformation project. The workshop participants included 9 school of engineering faculty and 6 Undergraduate Teaching Fellows who were women. Each faculty member (or faculty pair) was assigned an undergraduate teaching fellow, and based on information gained through the workshops, seminars, group discussions, and personal experiences of the faculty/fellow team, modifications or6 school of engineering courses were implemented. The 6 courses chosen for this study ranged from freshman to senior level.

The participating faculty group created a list of specific women-related issues that were deemed important in realization of the project goals. The issues generally revolved around a theme of inclusion: regard for the relevance of course material to topics of interest for all student populations represented,

Regard for the level of competence of all student populations represented, education of students and faculty in basic human interaction skills. And ongoing evaluation of teaching effectiveness and student satisfaction [1,2,3,6] the recommendations are as follows:

1. Provide Context to the including historical. Social. Relevance and application.
2 Promote the contributions of women and ethnically underrepresented scientists and engineers.
3. Use diverse teaching methods including visual. verbal and other multimedia techniques.
4. Create and apply a variety of teaching analogies. Including a mix of gender-neutral analogies. Analogies relating or a typically female experience, and analogies relating to a epically male experience.
5. Include group assignments and group activities in student responsibilities.
6. Selection criteria for members women a group should not be random and should be based on the needs of the student as well as me needs of me problem.
7. Provide training in basic interpersonal skills. Including diversity training, group dynamics and conflict resolution for faculty and students.
8. Include freshman and sophomore level courses mar provide encouragement for students.
9. Develop workshops. Seminars or short courses, which provide remedial, level instruction in laboratory and comparer skills.
10. Maintain an on-going critique of reaching effectiveness rough student-student and student-faculty interactions.

These recommendations should be regarded as a set of guidelines, which may be applied in developing a curriculum, which is more appealing for all students. However, many of me issues outlined are particularly important for women students and also for students from underrepresented ethnic groups in engineering. This has been confirmed through external studies of women and underrepresented groups in general science fields'. However. we are now conducting strudel surveys and focus group interviews [Q gauge the validity of these statements for engineering students. Initial results of written surveys for a freshman class and a junior class selected for participation in the curriculum transformation project are presented below.

ENES 100 - Freshman Introduction to Design

The ENES 100 engineering design course was implemented through the Engineering Coalition of schools for Excellence in Education and Leadership (ECSEL). The course. is designed to provide a complete product development experience. Including product design. Construction and evaluation for first year engineering smelts. Along win basic engineering skills me course provides opportunities for development of writer and oral. Presentation skills. and ream work skills. The ENES 100 course is considered a contemporary model for Introduction of design-oriented classes early in the engineering curriculum. The students are separated into teams of 6 and :Ire given a product specification. The students must men design a product mat will meet the design. Specifications.

This course has been chosen for me ECTP program because it offsets an opportunity to positively influence and educate first year engineering students in group dynamics and team working skills. Initiation of team activities early in the curriculum will establish an appreciation of the advantages mat come only rough collaboration. and me our come of this should be better preparedness for me team Orientation of a real wood work place. The curriculum transformation modifications which have been applied [0 miss course relate directly to items I, 6 and 7 from me list given above. The modifications were as follows:

1. Additional criterion was placed on the product specification to add a useful context to the project goals.
6. A modified set of criteria was used in the selection of team members
7. A workshop on group dynamics was held

ENME 342 and 343 Introduction to Fluid Mechanics and Fluid Mechanics Laboratory

Introduction to Fluid Mechanics (ENME 342) and Fluid Mechanics Laboratory (ENME 343) are required courses in the Mechanical Engineering curriculum. ENME 342 has typically been taught as a lecture course in which a professor. in a class of 35 45. will present the material and gated through homework. Quizzes. And tests. ENME 343 was a 1credir laboratory course in which me students performed 6 prepared labs and men wrote reports on the labs. The interactions win rte Teaching Assistant was limited to the time associated win the labs. Taught as separate as courses, They are intended to integrate the theoretical lectures in ENME 342 with the hands-on experience in me laboratory with prepared labs. These two courses were chosen for the ECTP project because they are upper level

Undergraduate course[5] which all students are required (0 rake and which historically have received lower man average ratings from the students, due co the difficulty of the material and the teaching Pedagogies. Even though the department has inversed resource co improve both courses and to integrate the labs in ENME 343 with the lecture in ENME 342, me intentions has been thwarted by the fact: that almost 40% of the students take the Jabs at a later dace (due to too many time-consuming labs in the junior year).

The redesign of the courses begins with listing the two courses as one, making it impossible to rake the labs separately. Secondly, the course is structured as 2 1-1/4 hour lectures and a two-hour studio. The studios are designed to give a varied experience of group problem solving, expanded discussion of the lecture material, laboratories, and a group project. The students are divided into groups, by the student's choice, although subtle care was taken to insure that there were no groups with just one female. The hands-on aspect of the course was changed from 6 equal sized laboratories to 4 labs ranging from a one day event with just a short one page write up co a semester long project for each group of students. The other major alteration focused on the student Teaching Assistant interaction. The TAs are now assigned co groups of students to support the students in the labs, lectures, homework and tests, rather than just the labs. This requires another level of personal interaction between the students and Teaching Assistant. The curriculum transformation modifications that have been applied co this course relate directly co items 3, 4, 5, 10, and I. The modifications were as follows:

1. Principles and subject areas were introduced through real-life demonstrations and examples and then connected co the fundamentals that they would be learning.
3. Subject matter was introduced in many forms including videos, group projects, sample problems, and student presentations.
4. A specific effort was made co find examples, which would interest the spectrum of students in the class.
5. Groups were established to perform semester. long projects and to work together in the studio and' on class assignments.
10. Various forms of student feedback were employed including manure minders, student interviews, semester questionnaire, and a final survey.

EN ME 100 Freshman to Design Introduction Specifics

MODIFICATION OF PRODUCTR SPECIFICATIONS

The product specifications assigned to each of the ENES 100 sections included design and construction of a vehicle which could capture the energy created bay 15 mph wind source and carry a 40 lb. payload a minimum distance of 30 feet in a reasonable time frame. Several size constraints were also placed on the final product. In addition to the standard specifications, the students were given several incentives for constructing a product that would be useful for human entertainment. For example, bonus points were given for carrying a payload more in line with the weight of an adult. Additionally, incentive points were available to the team, which constructed a vehicle judged visually most appealing by a group of 4th grade students.

OBSERVATIONS

Incorporation of the design modifications greatly increased the level of enthusiasm of each of the teams. Product designs were generally dominated by The drive to improve payload capabilities, and to develop a product theme that would appeal to children. Special product features such as bicycle style hand braking systems, additional safety equipped co protect young riders and decorative pictures and illustrations were included on various designs. At the conclusion of the semester, a few teams donated their designs to local high school and community centers. However, when questioned about the usefulness of the project:, most students did no t recognize a practical use for the vehicles.

CRITERION FOR TEAM MEMBER ASSIGNMENTS

The criterion used in making team selections included three components as follows:

1. Each team must have at least one member with a reliable car.
2 No team will have only one female or African descent member.
3. No team will have subsets of member's who describe themselves as being friends.

Using this criterion, women students were assigned co three of the five teams in the class. One team had three women members, two teams had two women members and two teams had no women members. One of the seven initially enrolled women students subsequently dropped the class. This student had been assigned co the team combining three women students. There were four students of African descent, and none of these students dropped the class. Of the six women students completing the Class, one was of African descent and one of Hispanic descent.

OBSERVATIONS

One of the more interesting topics of debate during me curriculum transformation project group discussions involved faculty prerogative in selection of individuals to be grouped for a group assignment.

In spite of empirical evidence, which supports the stipulation that women students cynically experience frustration and dissatisfaction when isolated in team situations:[2,3,6], many of me participating faculty felt strongly mat creating a false environment by increasing the presence of underrepresented students should nor be pursued. The educational experience gained from a more realistic environment is of more value and would be more appreciated following graduation. A few faculty members fat mar miss was not as critical for particularly lower level students.

In past offerings of me ENES 100 class. Gender and ethnicity have not been considered in making team selections. For those past cases, it has been observed mat women students (when isolated) often complain of nor being taken serious for analytical activities. Also. It has been observed that women students become frustrated when team members are reluctant to complete assigned tasks in a timely manner. Moreover, male students often complain of women team mates who are overly concerned with completing tasks on time and maintaining adherence to a planned schedule of activities. Using me criteria of no isolated women students, and no isolated African descent students, this type of situation was not observed by the instructor or teaching fellow. Also, meoverall morale and cohesiveness of each of me teams was much improved over past experiences for the same instructor.

GROUP DYNAMICS WORKSHOP

The group dynamics workshop was hosted by Ms. Symone Colquitt, a volunteer elementary school parent who has gained experience in coaching team design projects by managing a group of six. 4m grade students in me construction of a barratry-powered vehicle. The activity was par of a national competition tided "Odyssey of the Minds". The workshop involved a short introduction outlining effective team characteristics followed by a series of brainstorming activities. Finally. a hands on activity mat required brainstorming, group decision making and allocation of tasks was performed. The workshop was held early in the semester, bur was not done prior to me first group homework assignment.

During the workshop, brainstorming activities were assessed by judges who determined the level of creativity in responses of individual team members to a general question. Bonus points were awarded to teams whenever particularly creative responses were given by one of the team members. However, pregame comments given by the workshop facilitator placed a clear emphasis on achieving a large quantity of responses, and on withholding judgment of responses by team members.

OBSERVATIONS

A few general observations noted from the workshop included the following:

1. Almost all of the students spent an inordinate amount of time concentrating on the judge's assessment of responses given by team members. .
2. A few male students openly challenged the worth of emphasizing quantity of responses over the quality of responses with n the context of a brainstorming activity.
3. Evidence of team camaraderie developed as me activity progressed.

In addition to me observed improvement in team satisfaction for women students, me team dynamics for me overall class was also greedy improved over past experiences. All of me teams demonstrated an ability to resolve conflict with out intervention on me par of me instructor or me teaching fellow. This has previously not occurred. Also, when students were questioned about me number of teammates they respected, the average response was 4.8 for women students and 4.1 for men students.

ASSESSMENT AND EVALUATION

As a means of evaluating me effectiveness of the modified team selection criteria and me group dynamics workshop, and also to begin compilation of data on effective teaching practices and methods, two surveys were written and distributed to the students. The surveys were written wind the assistance of faculty and graduate students in the department of psychology and me ENES 100 instructor and teaching fellow. The first survey was distributed after completion of approximately 40% of the semester and the second survey was distributed after completion of approximately 90% of the semester. The first survey was completed by 19 male and 7 female students. and me second survey was completed by 18 male students and 5 female Students. Additionally, a third survey was distributed by the WIE office after completion of approximately 60% of the semester. A few statistically significant trends for the population sampled have been identified.

SURVEY RESULTS

The surveys were structured so mat students were asked to quantify how well may agreed win a statement on a scale from 1 to 5. 1 is strongly disagreeing, 5 is strongly agree and 3 is neutral. The statistically significant results are listed and discussed below.

1. All students prefer an comically diverse environment for academic work. However, this is more true for women students (avg.=4.6 in survey 1, avg.=5.0 in survey 2) than for men students (avg.=4.1 in survey 1. avg.=3.6 in survey 2).
2. All students prefer a gender mixed environment for academic work. This is more true for women students (avg.=4.6 in survey 1. avg.=5.0 in survey 2) than for men students (avg.=4.2 in survey 1. avg.=4.2 in survey 2).

3. Men students agreed that it is important co use examples and give assignments, which are inclusive of different groups of people in terms of gender and ethnicity (avg.=4.5 in WIE survey). Men are more or less neutral (avg. =3.3 in WIE survey).
4 .Men students tend to agree that team meetings improved following the group dynamics workshop (avg.=3.8 in survey 1). Women students were neutral (avg.=3.1 in survey 1).
5. Men students tended to strongly agree that team meetings improved over the course of the semester (avg.=4.6 in survey 2). Men students tended to agree with this statement also, but less strongly (avg.=3.7 in survey 2).
6. The initial survey. White students were neutral when asked if team meetings had improved following the group dynamics workshop (average=3.1). Other students tended to agree with the statement (average=3.9)
7. Though the teaching fellow was not overly utilized, white students were slightly more likely co approach the teaching fellow for assistance (avg. #visits= 1.6) than other students (avg. #Visits= 1.1).

Other statistically significant results indicate that men students consistently disagreed that gender or ethnicity will affect an instructor's teaching approach or the student's ability co learn. Women students strongly disagreed with statements co this effect. Also. all students disagreed that teaching methods and examples presented in class prepared them for completion of the class project or enhanced their conceptual understanding of the material. Lastly, all students felt their team exhibited positive characteristics. Men students tended co agree with these statements, and women students tended co strongly agree

ENME 342 and 343 Introduction to Fluid Mechanics Details

This class was comprised of 28 smelts - 21 male and 7 female, with more than half of the class being seniors. Two surveys were conducted - one at the mid-term in a survey created by the instructors and one at the end of the semester in one administered by the WIE program. The surveys were structured so that students were asked to quantify how well they agreed with a statement on a scale from 1 to 5. 1 is strongly disagree, 5 is strongly agree and 3 is neutral.

Forming of Studios and Groups

The studios were designed co provide an opportunity for the students to work on more difficult problems associated with the lecture material, do hands-on experimentation co further understand the concepts and co do a semester long project. Furthermore it allowed the professor co have a more personal interaction with the students beyond what could be experienced in the lecture format.

Observation

The students reported getting value out of the studio experience. In the midterm survey 20 students (71 %) chose to comment that they thought the studios were a valuable learning cool. The final survey results confirmed the previous findings with the class approving of group study for understanding lectures (4.09) and the studios (3.73) . but showed lithe differences between men and women (3.81 for men and 3.50 for women).

Semester Project

Years ago a bridge in the Washington State Narrows collapsed.d9:' co vibrations caused by the air flow. The groups were given a semester project of designing a rod, which would vibrate at a velocity specific co their group: land then co designs a change of design that would remove the vibration. The students had co periodically rum in pans of what would become their final report to demonstrate the progress they needed co be having co fulfill the project. All the groups would test their design in the wind runnel co see if their calculations were accurate.

Observation

After a slow Stan all of the groups demonstrated an interest: land a responsibility of getting their design co work. A5 with a Manufacturing with Polymers course offered here, the students demonstrated :In ability co understand and show interest in the difficult and subdue concepts that were pan of the project. Even when their understanding of the lectures had that "undergraduate air" about it, their comprehension of the project was at a very deep level.

Survey Results

Beyond the other resoles reported the other significant resoles were in the area of gender! Ethnic biases. Although the class felt that there were gender biases in engineering (3.52), they felt it was nearly absent in the class (1.57). Interestingly. the male response was higher (1.71) than the females (1.17). The results were similar for racial ethnic biases where the class thought that in the field their were biases (3.26), whereas in the class they were insignificant (1.70) Again, the females (1.33) showed a Stronger response than the males (1.82). The same survey was done in a fluids class, which was taught the old *way.* are females in that class showed a higher concern 2.29) when compared co our class. Given that one of

The intention of the program was to make an environment conducive for women and minor ides these results show success in that area.

One other goal in this program was to enhance women's interest in remaining in engineering. The survey showed that, even though the environment was conducive (which was also trepanned by the female response (3.83) to the encouragement to participate in class (as compared to 3.43 for the other class), their interest in pursuing engineering was not enhanced (3.00).

CONCLUSIONS

A curriculum transformation project in engineering has been initiated which will seek to improve the attractiveness and appeal of the engineering curriculum for women and ethnically underrepresented students in engineering. Group of 9 engineering faculty have convened and identified specific woman-related issues that should impact realization of the project goals. The issues identified revolve around the theme of humanization of the engineering curriculum through a philosophy of inclusion. education of students and faculty in basic human interaction skills; negated for the relevance of course materials to topics and applications of interest to all student populations represented, regard for the initial level of competence of all student populations represented. and ongoing evaluation of teaching effectiveness and student enthusiasm. Initial results from student surveys indicate women students place more emphasis on team oriented activities, and while all students tend to prefer diverse academic environments in terms of gender and ethnicity, these issues are more important for women students. We also have observed that control of academic environments based on the needs of the participating students is more likely to result in increased levels of satisfaction and enthusiasm for women Students Specifically. Avoiding isolation of women students for group assignments and group interactions is recommended. Finally, conventional methods used in teaching engineering principles and concepts do not meet- the needs of students in general. Regardless of gender.

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BIOGRAPHIES

Dr. Patricia F. Mead is an Assistant Professor of Mechanical Engineering here at the University of Maryland. She received her Ph.D. in electrical engineering from the University of Maryland, College Park in 1994. Since her faculty appointment in the fall of 1994, Dr. Mead has worked to developed a program of research addressing issues in packaging and reliability of opt electronic devices and systems; including semiconductor lasers and fiber optic assemblies, fiber optic sensors with medical and manufacturing applications, and science and engineering curriculum Reform.

David Bigio has been engaged in the field of polymer processing for over 13 years. He received his Ph.D. from M.LT. in 1986. Since joining the faculty of the University of Maryland at College Park. he has established the Polymer Processing Laboratory which is engaged in research dedicated to the quantification of mixing as a basis for

Extruder performance evaluation. Dr. Bigio has been involved with curricula development for the past three years. He has spearheaded the redesign of a number of core engineering courses, including the Engineering Project, Fluid. Dynamics and capstone Engineering Design courses. Furthermore, he has been involved in the creation of Manufacturing with Polymers course. This course, as developed over the lasttwo semesters by a cross disciplinary group of faculty from Mechanical, Chemical and Materials Engineering Departments, involves developing, in collaboration with local industrial partners, a specific problem in polymer manufacturing which can be handled in a single semester by upper-level undergraduates working in teams of 2-4 students. He is also the Chair of the Teaching Excellence committee for the School of Engineering. Dr. Bigio is the Education Chair for the Extrusion Division of the SPE and of the Baltimore Washington Section

Elizabeth Rosenfeld is the undergraduate teaching fellow assisting Dr. Patricia Mead in the A.J. Clark School of Engineering's Curriculum Transformation Project. She is working towards a second bachelor’s degree at U11CP in Mechanical Engineering. Prior to her career change, Ms. Rosenfeld was the Assistant Program Director at New Rochelle. Hospital Medical Center's Cardiac Rehabilitation' Center (New York). She received her first bachelor's degree in Hebraic Studies from Rutgers College, NJ and a Master's degree in Exercise Science from Queens College, NY.

CROSS-CULTURAL & CHILLY CLIMATE ISSUES FOR WOMEN IN ENGI NEERING

Susan Cavin, Ph.D. & Amy Siskind, Ph.D.

P.O.W.E.R (positive Opportunities for Women Engineers' Retention)
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Abstract: Sexist and racist jokes are part of campus sub-culture at five New Jersey colleges surveyed, especially on suburban campuses, more than urban. Faculty perceptions of the classroom vary more by gender, nationality, ethnicity and departmental division than by race. Classroom sex ratios, more than any variable studied,polarize faculty by gender, race, nationality, and ethnicity. Male professors do not think the high male: low female student sex ratios of engineering classrooms matter much. Women professors do. White Euro-Americans think they matter more than international professors of color, especially Asian. The engineering/science classroom is still a gendered space.

Keywords: Gender, Hate Speech, Engineering Sex Ratios, and Nationality

In the spring semester of 1995, 614 faculty surveys were collected for a National Science Foundation grant called P.O.W.E.R. (Positive Opportunities for Women Engineers' Retention) at : the New Jersey Institute of Technology (N.J. 1. T.) And four community colleges which historically transfer students to N.J.I.T. Hudson County College in Jersey City and N.J.l. T. in Newark arc urban campuses in the New York metropolitan area, while the other three county coIIeges (Middlesex, Ocean, and Brook dale) are located on suburban campuses in central New Jersey. The P.O. W.E.R. study primarily focused on faculty attitudes toward women in engineering, science and technology. However, humanities and social sciences faculty were also surveyed to test conventional stereotypes about how "liberal" the liberal arts really are compared to engineering and science. Additionally, race, ethnicity, and nationality were studied in relation to faculty attitudes toward women students and faculty. Classroom issues and campus climate, particularly hate speech, were analyzed.

1. METHOD

The P.O.W.E.R. questionnaire was designed (Fall 1994) by reviewing other university faculty surveys in order to build on previous research, then culled down to the three most relevant surveys to fit a state engineering institute: a) Dr. Sue Rosser's survey on classroom climate targeted at the University of South Carolina science faculty; b) Ball State University's questions on faculty collegiality; and c) Northwestern University's campus climate questions on racism and sexism. Twenty-eight faculty interviews were conducted at all 5 New Jersey colleges (Fall 1994) along with 3 faculty focus groups (an all male group; an all female group; and a mixed gender faculty group) at Middlesex County College, to hone survey questions. The faculty survey was protested at Brook dale Community Colege (January 1995), then administered to the entire full-time and a sample of part-time Faculty in Engineering/Science/Math/Humanities/Social Sciences at the other four colleges at their first

faculty meeting of the Spring semester.[1] The faculty surveyed are broken down by college in this way: [2]

Tablet. Faculty Breakdown by College.

N.J.I.T	**166**	**(27%)**
Brook date	**161**	**(26%)**
Ocean	**161**	**(26%)**
Hudson	**50**	**(8%)**
Total	**614**	

2. CAMPUS CLIMATE RESULTS **(n=614)**

The following campus climate trends were reported by faculty at all five colleges surveyed:

2.1 Urbanity & Hate Speech.

Increased Urbanity = Less Hate Speech against u.s. Minorities (Women, Blacks. Jews & Gays).

Less hate speech (warmer climate) is reported on urban campuses while more hate speech (chillier climate) is reported on suburban campuses by faculty in New Jersey. The majority (about 2/3) of Suburban college faculty report occasionally

[1] The POWER survey was administered (January March 1995) by the POWER PI and POWER Faculty mentor: at Middlesex by Engineering Technology /Physics Professor Josephine Lamela and Math Professor Lucy Gullo; at Hudson County College by the Coordinator of Engineering Science, Professor Mojdeh Tbatbatbaie; and at Ocean County College by Math Professor Judy Lenk. At N.J.I.T. it was administered at Engineering Departmental meetings in February and March 1995 by the POWER PI, Dr. Roxanne Hiltz, and Dr. Judy Valyo with the help of Engineering Department chairs. The survey was administered by Associate Dean Anne Wiley to the College of Science and Liberal Arts at N.J.I.T. by campus mail.

[2] **N.J.I.T. Faculty Sample:** The N.J.I.T. Faculty sample consists of 166 male and female professors, from the Newark College of Engineering and College of Science & Liberal Arts (CSLA). Most of the faculty sample were full timers in Engineering or Math/Science, but for comparative pareses, a small number of social science and humanities faculty and part-timers at N.J.I.T. were also surveyed. N.J.I.T. only had 6 full time women engineering professors during the spring of 1995.

Hearing sexist language, sexist and racist jokes whereas the majority (about 3/5) of urban college faculty report never hearing racist or sexist speech by faculty/stem administrators. Consistently throughout the study, more faculty at suburban schools report chilly climate incidents of all degrees, ranging from hate speech to violent action, than faculty at urban campuses. In fact, the farther south geographically one goes away from New York into New Jersey, the percentage of faculty reporting hate speech against American women, racial minorities, Jews, and gays increases.

Urbanity & Nationality: Suburban College Faculty Report More Students Make "Derogatory Remarks About Someone's Nationality" Than Faculty; Whereas Urban College Faculty Report The Reverse. Urban faculties in New Jersey hear more derogatory remarks about one's nationality made by faculty than students. This trend may be explained by a larger international population of both professors and students at urban schools in the New York metropolitan area than in the suburbs. Nationality is more an issue at urban colleges among faculty than the suburban colleges, though it is not irrelevant there either.

Homophobia. Two New Jersey trends: Homophobic remarks arc marc common among students than faculty; but are far more common among both professors and students in New Jersey suburbs than in the cities of Newark and Jersey City. More students are overheard making antigay remarks than faculty at all colleges studied. This may correlate with age. Faculty/staff/administrators occasionally make anti-gay remarks overheard by nearly half the faculty at suburban colleges compared to less than one third of urban faculty.

2.2. Sexist & Racist Jokes

Faculty/Staff/Administrators Are Just As Likely As Students To Be Overheard Telling Sexist And Racist Jokes And Using Sexist Language At All Colleges Studied Faculty report little difference among faculty/staff/administrators & students regarding overhearing racist and sexist jokes. However, at all five schools, sexist language and sexist jokes are heard by more faculty than racist jokes. Racist and sexist jokes are pervasive in New Jersey colleges surveyed in 1995. Sexist language and jokes are reported by

The majority (2/3) of all suburban college faculty and by about 2/5 of urban college faculty and thus constitute part of core college sub-culture in New Jersey.

2.3. Student Violence

Faculty Witness Students Threatening & Using More Violence Than Faculty.

At all colleges surveyed, more faculties report occasionally witnessing students threaten violence and use physical violence than faculty/ staff! Administrators. The occasional incidence of faculty observed student physical violence varies by college campus: ranging from 11% to 33% of faculty, depending on the college. There is no clear pattern of student violence based on the urban-suburban continuum, which defies conventional stereotyping about the violence of inner city life.

2.4. Gender & Hate Speech.

Gender makes little difference in Faculty Reports of Sexist Speech on Campus. Men were equally as likely as women to report overhearing sexist language or sexist jokes on campus. This implies that sexist jokes are told in front of women as well as men. Gender made little difference in faculty reports of all forms of chilly climate issues except in two areas: racist jokes and stalking.

Gender Affects Faculty Reports of Racist Jokes The majority of male faculty at all 5 Colleges surveyed report hearing racist jokes on their campus while the majority of female faculty (55%) have not heard racist jokes. Interpretation: This may mean that man tell each other racist jokes more than women do to each other. Perhaps more importantly, it appears that men do not tell racist jokes in the presence of women faculty as Often as they do in the presence of male faculty on these 5 New Jersey campuses.

Gender Affects Faculty Reports of Stalking incidents. No male faculty report knowledge of my stalking incident where the perpetrator is 'acuity/staff! Administrator. Only female faculty 10. All reports of stalking by 'acuity/staff/administrators thus come from female acuity. However, male faculties are aware of student stalking incidents.

3. GENDER AFFECTS NJ1T FACULTY PERCEPTIONS OF THE CLASSROOM

Looking at the engineering/science classroom, some interesting gender differences emerge among N.J.I.T. faculty around the various topics of sex ratios, women graduate students and male students. The majority of N.J.I.T. Male professors answer differently from the majority of female professors regarding these variables:

3.1. Female Graduate Students Have A Difficult Time

The majority of N.J.I.T. male professors surveyed (52%) disagree, while the majority of female professors (52%) agree, "I think that female graduate students have a more difficult time than male graduate students."

3.2. Student sex ratios affect classroom dynamics

An overwhelming majority (70%) of women professors agree while 40% of N.J.I.T. male professors (the mode) disagree that "The ratio of male to female students affects classroom dynamics. "

3.3. whether male stateless talk more in class

The majority of N.J.I.T. male professors (56%) disagree, while the majority of female professors (58%) agree "Male students are more active in responding to questions than females."

3.4. whether sex discrimination charges are unfounded

Sixty three percent of women disagree that "Charges of sex discrimination are frequently unfounded," while 61 % of N.J.I. T. male professors, say they have no opinion on this subject.

3.5. Men comfortable with women bosses

The majority (76%) of women professors disagree that "Most men would be comfortable working for a woman boss" while the mode (46%) of N.J.I.T. male professors say they have no opinion on this subject.

3.6. Socializing with colleagues advances career

The mode (44%) of women professors agrees that "Social interactions with my colleagues have been important to my career advancement" while the mode of male professors (39%) disagree. More minority professors believe that socializing with

Colleagues help career advancement than white professors do. This suggests that white men either do not see or believe that "the old boy network" operates as much as women and minorities.

4. MALE & FEMALE PROFESSORS AGREE ON F ACUL TY-STUDENT RELATIONS

The gender of a professor made little or no difference in their answers to most survey questions. Engineering and science professors surveyed in New Jersey generally agree on far more faculty-student issues than they disagree. The majority of both female and male professors agree on the following classroom issues:

4.1. Most professors comfortable with graduate students.

The majority of N.J.I.T. male professors (72%) disagree that "I am uncomfortable when meeting graduate students of the opposite sex because of the possibility of charges of sexual harassment." So do an overwhelming 94% of women professors.

4.2. Women students don't contradict professors

The majority of men (60%) and the majority of women (75%) professors disagree that "Female students in my classes contradict me."

However, when we ask whether male students contradict N.J.I.T. professors, we find an interesting phenomenon. The percentage of male professors holds steady around 3/5; the majority of male professors (59%) say that male students do not contradict them. Yet the percentage of women professors drops almost 30 percentage points between the two questions: from 75% of women professors who said women students do not contradict them to 48% who said men students do not contradict them. Also, one quarter (26%) of women processor say their male students do contradict them in class. While gender makes little difference regarding faculty perception of women students challenging professors in the classroom, gender may affect faculty perceptions of male students.

4.3. Male students do not challenge most professors' classroom authority.

While the majority of both N.J. I.T. male (79%) and women professors (56%) disagree that "Male students regularly challenge my authority in the classroom," many more males feel this way than women. Also, a quarter of women professors (28%) say male students *do* challenge their authority in class. Male professors may experience male students' classroom talk differently. This phenomenon needs more research.

4.4. Professor's classroom questions.

Ninety one percent of women and 81% of men agree with the statement: "I ask male students the same types of questions I ask of females."

4.5. Women rarely appear in my textbooks.

The majority of women professors (55%) and the mode of men (46%) agree, "Women rarely appear in the textbooks I use." Over a quarter of men (27%) disagree, however.

4.6. Most faculty support university childcare.

Sixty six percent of men and 85% of women agree that "The University should provide quality, low-cost child care for both faculty and students." While the majority of bottle sexes favor university-supported childcare, many more women do so than men.

5. NATIONALITY AFFECTS N.J.I.T. FACULTY PERCEPTIONS

Only N.J.I. T. data on nationality is presented here. The ratio of American to international professors at N.J.I. T. is more evenly divided than at the other colleges: 97 American and 73 international faculty respondents at N.J.I.T.

Demographically, about 3/4 (72%) of the N.J.I.T. Faculty respondents are white. However, only 52% of them arc born in the USA; 16% arc European, 20% born in Asia, and 6% in the Middle East. No African-American professors completed a questionnaire at N.J.I.T Less than a handful of Black Caribbean's (2%) and Hispanic (1%) professors did. The vast majority of people of color arc Asian (21%), predominantly Indian and Chances, and 4% Middle Eastern (e.g., Iranian, Turkish, Egyptian). The rest did not static their nationality. Faculty responses to these questions differ only slightly by nationality:

5.1. Whether student sex ratios affect classroom dynamics.

Almost half of American faculty (48%) agree that sex ratios affect classroom dynamics compared to only a third of international faculty.

5.2. Whether the curriculum is gender-biased

The majority of all nationalities at N.J.I.T. disagree that the curriculum is gender biased, but many more internationals (79%) than Americans (58%) disagree.

5.3. Whether families suffer when mothers work full-time.

More internationals (42%) agree that children will suffer in families where the mother works full-time than Americans (20%). In fact, 56% of Americans disagree that children suffer when mothers work full time.

5.4. Whether they sacrifice family needs to job needs.

Far more internationals (46%) than Americans (29%) state that they often sacrifice the needs of their family to the needs of their career. In fact, about 2/5 of Americans say they do not sacrifice their families for the job.

5.5. Whether social interactions with colleagues affect career advancement.

More internationals (41 %) than Americans (23 %) agree that social interactions have been important to their career advancement in fact, 4.7% Of Americans disagree. This question also provoked a similar response from women and racial minorities who believe that socializing with colleagues is valuable to career advancement, while white men generally do not.

5.6. Whether men would be uncomfortable working for women bosses.

Most Americans (52%) disagree that "most men would be comfortable working for a woman boss" while 58% of internationals say they have no opinion. These responses could mean that more Americans are willing to talk about the discomfort of having a female superior, while internationals would rather avoid the issue. Or docs it mean that more internationals would feel more comfortable working for a female boss? More research is needed to answer these questions.

In sum, international faculty at N.J.I.T. differ from American faculty regarding: the impact of Sex ratios on classroom dynamics, the impact of working mothers on families, the acceptability of sacrificing family needs to job needs, the importance of social interaction with colleagues to career advancement, and male discomfort with female superiors. When nationality is analyzed by ethnicity, the findings get more interesting. Generally, it appears that more Euro-American faculty at N.J.I.T. pause to consider gender and race issues raised by American social movements than Asian, Middle Eastern and Indian professors, who tend to dismiss these issues. More Asian and Middle Eastern professors believe that mothers who work full-time harm their children. Also, Asian and Middle Eastern professors were more reluctant to discuss their feelings about working for a female superior on this questionnaire.

6. DEPARTMENTAL DIVISION AFFECTS FACULTY PERCEPTIONS

When respondents are broken down by departmental division (engineering/ technology, science/math, social science, and humanities) at all five colleges, their responses differ greatly in the following ways:

6.1. Whether gender affects pedagogy

Notably higher percentages of engineering/tech (51 %) and sdcncclmat11 (44%) faculty disagree t1mt "the gender of the professor makes a diligence in how a subject is taught." than social science (23%) and humanities (34%) faculty.

6.2. Impact of male/female ratio on classroom dynamics

Many more engineering/techs (46%) faculty disagree that sex ratios affect classroom dynamic than faculty in any other division. However, 43% of the science/math faculties agree, along with 52% of social science, and 55% of humanities faculty agree that sex ratios affect classroom dynamics. Interestingly enough, faculty in the "soft sciences" where sex ratios are near equal believe that sex ratios make the most difference. Faculty in the "hard sciences" with higher male-lower female sex ratios, do not see sex ratios as important to classroom dynamics.

6.3. Women rarely appear in textbooks.

The majority of engineering/tech faculty respondents (55%) agree that "women rarely appear in the textbooks I use," while 40% in science/math, 42% in social science, and 60% in

Humanities disagree. Clearly, women appear much less in engineering/tech textbooks than in textbooks in any other division.

6.4. Racial bias in textbooks.

The majority of engineering/tech faculty *disagree* (52%) that "I consider possible racial bias in a text as one of the factors in selecting a text," while the majority of social science (51%) and humanities (55%) *agree.* Science/math faculty were more split between 34% disagreeing and 25% agreeing The majority of engineering/technology professors do not see racial bias as an important factor in text selection. This could be interpreted two ways: either they believe there is no racial bias in their textbooks or they may not feel it important to eliminate racial bias from their texts Humanities and social science respondents clearly believe that there may be some racial bias in their texts, and that it is important for them to take this into account. This divisional difference is striking.

6.5. Do departments try to hire female faculty?

More than any other division, the majority of engineering/tech faculty (56%) agree that their department makes a concerted effort to increase the number of women faculty, but that there are not enough qualified applicants. Only 23% of science/math faculty agree. On the other hand, 39% of both social science and humanities faculty disagree that their departments make good faith efforts to hire women.

6.6. Whether they sacrifice family needs to job needs.

Most professors in the science/math (50%), social science (53%), and humanities (53%) divisions disagree that they often sacrifice family needs for career," whereas only one-third of engineering tech respondents disagree. This may be because there is a higher number of women in the no engineering disciplines. Engineering Technology faculty say they are more likely to sacrifice family needs to the demands of their jobs. But is that because they are predominantly males in the engineering division? Specifically, is this more a phenomenon of gender than of departmental division. In summary, departmental division makes a notable difference in faculty responses to certain gender and race related questions. More than any other discipline, Engineering Technology faculty are more likely to dismiss questions about whether gender affects classroom dynamics, the hiring of female faculty, and whether their textbooks are racially biased.

7. ARE PROFESSORS GENDER BLIND?

The POWER data suggests the possibility that there may be certain behaviors/sul.1jects where one is gender blind: E.g., men may not notice that other men are doing all or most of the talking. Male professors do not notice the often-cited observation in the women's literature on classroom climatic (Sandlcr, 1982; Rosser, 1990) that male students talk more in class (Zimmerman, 1975; Thorne, 1979). This suggests the possibility that there may be certain behaviors/subjects where one is gender blind: e.g., men may not notice that other men are doing all or most of the talking. However, men may notice when women are doing all the talking. Perhaps male professors, blinded by their gender, realty cannot see when other man, in this case students, dominate classroom talk. African American studies literature has long pointed out that member of dominant groups, i.e., whites are often unaware when they dominate discussions where minority group members are present (Rothenberg, 1988). Minority groups are painfully award of the dominant group. Unfortunately, the reverse is not true.

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SEX CULTURE OF FEMALE STUDENTS IN HONG KONG

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ABSTRACT

A study by the Family Planning Association in Hong Kong showed that one in five babies born in the territory were that result of unplanned pregnancies. The outcome of the study reflected that the public in general is very uninformed about sexual matters and is ignorant on the use of contraception. This magnitude of ignorance is particularly alarming given that Hong Kong is considered a well developed country with an educational and economic achievements that parallel to any country in the west.

The Chinese traditional view of sex as a taboo subject and the mounting uncertainty of the future due to the handover of Hong Kong to China in 1997 are cited as the reasons of the sexual repression in Hong Kong. However, the young people in Hong Kong is heavily influenced by the liberal western media and there is a tendency of them being caught in a vacuum of sexual confusion of knowing a little but not enough for their own protection. This paper will look at the social factors affecting the level of sexual awareness amongst the female students in the tertiary institutions in Hong Kong and examine the female students' perception of their role in gender equality.

Keywords: sexual attitude, awareness, gender role, perception

INTRODUCTION

In Hong Kong, women make up just under half of the population (49 %) and 57 % of the women were in the 15-49 age group (Annual Digest of Statistic 1992). Nearly 78 % of all the women in Hong Kong have received some form of education at primary level and above. With the changing demographic, economic and social trends in Hong Kong over the past decades, the status of women has undergone important changes. However, studies by the Family Planning Association reflected that the public in general is uninformed on sexual matters and traditional sexual attitudes were still found to be prevalent amongst females. It was found that not only did men uphold the sexual inequality between genders; women also imposed restriction on themselves (Family Planning Association 1987).

According to surveys conducted by the Family Planning Association for the past ten years (1981, 1986, 1991), young people in Hong Kong have increased in sexual permissiveness but their knowledge in this matter seems to be reducing. One important factor contributing to this may be due to the gap between main culture and sub-culture, i.e., between the traditional societal moral standard standards towards sex and the youngsters' conceptual permissiveness (Yeung 1994). Though Hong Kong is a modem society, the Chinese traditional view of sex as a taboo subject is still retained within the community, which restrained the discussion of sexual matters openly.

However, with increasing opportunities for the attainment of knowledge amongst females in Hong Kong, there is a need to investigate how these social factors influence the sexual awareness amongst female students and to examine how females perceive their role in gender equality. Understanding these issues may help to address the problems faced by young females in coping with their sexuality. A study was carried out of which a total of 100 questionnaires were sent to female students in the City University of Hong Kong and the response rate was 65 %. The age of the respondents are from 18-20 (65 %) and 21-23 (35 %) and majority (60 %) indicate that they do not possess any particular religious belief while the remaining state Christianity and Buddhism as their religions.

THE ANALYSIS

Sex Education Background

42 % of the respondents state that they have attended sex education classes during their secondary education while 58 % state that either they have not attended such education or their secondary schools did not offer such classes to them. When asked if the sex education had been helpful in their understanding of sexual matters, the view from the respondents that had attended such course are rather mixed. 48 % of the respondents agree that it had been helpful while 52 % disagree. The reasons given for disagreement were that the information provided in the sex education was too general and the teachers did not discuss sexual matters openly. However, all the respondents agree that sex-education should be taught in secondary schools which seem to indicate that the students feel the need for some legitimate venue to obtain knowledge on sexual matters.

In the past, the idea to include sex education in school curriculum was quite controversial and the term 'sex education' is rarely found in the regular timetables but is hidden under titles such as Health Education, Family Education and the like. It was said that sex education should be affective education which aims at self empowerment where individuals by understanding the consequence of their actions can take responsibility for controlling their own lives, and enhancing their self esteem (Went 1985). Perhaps, if sex educations Programme in schools are planned with such objective in mind, it will be more conducive for the students to attend.

Sexual Awareness

When the respondents were asked if they possess enough knowledge on sexual matters to help them deal with a relationship, 68 % state yes while 32 % state no. It is surprising to note that the majority of the respondents who said yes are from the groups, which have not attended sex education in their secondary schools. When the students were asked of the main source of information on sexual matters, the following results were obtained.

Figure 1 Source of Information on Sexual Matters

Source	%
Mass media	60
Peer group	22
School	10
Parents	8
	100

Yeung (1994) remark that schools and families should be the proper channel where young people receive the required knowledge. However, schools in Hong Kong generally lack comprehensive strategies

In the implementation of sex education and most parents tend to avoid teaching their children on sexual matters which caused the youngsters to seek other channel of information. As indicated by the outcome of this survey, mass media and peer group playa much larger role as the sources of information. Liberal media from the west and from other countries such as Japan are easily available in Hong Kong and since majority of these media are commercially oriented, some news items or articles are sensationalized to attract the market. As for peer group, Csikszentmihalyi et al (1984) show that adolescent spend roughly twice the amount of time with peers than with their parents. Peer groups become the main audience for young people in case of emotional disturbance and these young people exchange knowledge of sexual matters via friends.

The respondents indicate a liberal view in their attitudes towards sexual experience before marriage. 68 % of the respondents disagree that females and males should not have sexual experience before marriage, which reflect the departure from the traditional perception of non premarital sex amongst the young females.

82 % of the respondents had dating experience and more than half (51 %) think that the suitable age for dating in girls is 16-18 years while 45 % indicate 1921 years and the remaining indicate above 21 years of age. The most common reason for dating given by the respondents is that" dating is common" while" dating to find long life partners" rank second with "can't refuse" rank third. In a survey carried out by the Family Planning Association (1991)amongst youngster in secondary schools, it was discovered that the average age for first dating experience was 13.7 years and the two reasons cited for dating were that "dating is common" and "can't refuse".

It would seem that young females in this survey feel that an older age for dating is more suitable and even though they still think dating is common, there is an emphasis now in looking for a more lasting relationship where dating is akin to courtship.
On the matter of sexual knowledge, the respondents were asked to state whether a number of statements on sexual matters was true or false (refer to Figure 2)

Figure 2 Percentage distributions of correct answers to statements on sexual matters

Statements	correct answer %	Don't know %
a	68	10
b	48	25
c	75	10
d	100	-

a: Pregnancy is not possible in first intercourse
b: Chance of pregnancy is low for sexual intercourse at 2 weeks before menstruation
c: Birth control pill is the only method of contraceptive for females
d: Multiple sexual partner will increase the chance of getting AIDS

Unexpectedly, only about half of the female students knew that the chance of pregnancy is high if sex takes place about two weeks before menstruation while a quarter did not know the answer. All the students have answered correctly for the statement on AIDS, which may be due to the continuous mass media health educaion campaign on AIDS. The percentages of "don't know" appeared to be small for statements on the possibility of pregnancy in fusty intercourse and contraceptive, but coupled with the percentages for those who answered incorrectly, the figures represented approximately a third of those who is ignorant of the actual facts.

Perception on Gender Roles

Gender roles constitute an integral part of identity and defame the social behaviour of women and men in a society. Cheung et al (1991) remark that gender stereotypic roles are foster through the conservative cultural forces of the family. In traditional Chinese society, women basically have to serve an instrumental and supportive role in managing home and supplying male heirs (Koo 1985). In the survey carried out, the female students were asked if they were expected to help out in the domestic housework and a majority of 82% said yes and the range of percentage of distribution of housework for daughters in the family is 20-30% while the range for sons in the family is 5-10%. Most of the respondents indicate that biggest proportion of the housework fall to the mother with 70-100% while the father's proportion is 5-15%.

The outcome of these distributions of housework is not surprising as stereotypic gender role often cast the provider role with the father and the homemaker role with the mother. Such division of household labour was also prevalent in families where the mothers work full time (Lau & Wan 1987).

On gender issues, the respondents were asked to state whether they agree or disagree on some of the statements on gender roles and perception (refer Figure 3).

Figure 3 Statements on gender role and perception

Statements	Agree %	Disagree %	Neutral %
a	45	40	15
b	48	40	12
c	52	28	20
d	25	55	20
e	40	40	20
f	36	20	44

a: Achievement of a successful career is more important to males than females
b: Higher education attainment is more important in males than females
c: Qualities such gentleness and obedience are important characteristics of females
d: Men are the breadwinners while women are the homemakers
e: A successful woman is one who is independent and devoted to her career
f: Being a female is more advantageous in this decade

The respondents views are rather mixed on issues in gender equality where a slightly higher percentage agree that a successful career and a higher educational attainment is more important to males than females.

Lam (1982) find that parents' perceptions of educational level attained by sons and daughters were different where majority of the parents wished for higher educational attainment for sons and parents tend to respect the interest and ability of their sons in choosing a future career than their daughters. Family provides the first socializing experience for an individual in the shaping of gender role and parents' aspirations may have influenced the perception of the young people.

More than half of the respondents agree that qualities such as gentleness and obedience are important characteristics of females. A descriptive study by Cheung (1979) on the life histories of 36 aged Chinese women shows that the self-perception of the women were greatly affected by the cultural prescriptions of the women's role. In gender socialization, girls are encouraged to be nurturing, to subordinate, to value attachment to others while boys are encouraged to be independent, adventurous, aggressive, dominant etc. The gender division of labour between the parents also help to reinforce the gender role conception- daughters learn Item their mothers what they will grow up to be and sons learn what to expect Item their wives (Richardson 1988). However, 55% of the respondents disagree that males are the breadwinners and women are the homemakers while 25% agree. In Hong Kong, women accounted for 46.5% of the total workforce and they have made significant representational gains in the occupational categories of "professionals, technical and related" and administrative and managerial". This, amongst other things, reflect the increased the educational attainment of women. By 1991, females represented over 20% of the people in the managerial category and over 30 % in the professional category=a high proportion comparatively in Asia (Westwood et al 1994). This reflect the opportunities that are available to the women in Hong Kong in the pursuant of careers and more females are having a better choice in choosing their career path. The mixed view of the respondents on the perception of a successful woman maybe due to the dual demands on, women in today's modem society where a woman is expected to perform the roles of homemaker and employed worker. More than a third of the females agree that it is more advantageous being a female in this decade which reflect the opportunities that are available in Hong Kong for the cultivation of one's interest in all aspects regardless of gender.

CONCLUSION

In Hong Kong, although both sexes have equal chances in education and career opportunities, there is still a strong male-oriented tendency in respect of socio-cultural traditions and sexuality. The masculine and feminine characters are socially and culturally constructed with parenting, families, schools, the media, etc, playing crucial roles. In general, the gender roles as prescribed by our society produces female character to value attachment and relationship, to be caring and nurturing, empathetic, in short to be the caretaker and provider of emotional needs for the family. Sexuality is to a great extent, based on how one view the role of oneself and one's male/female counterpart in the society. Even though Hong Kong is considered a well-developed country with an educational and economic achievement that parallel to any country in the west, some conservative concepts of Chinese society are still retained. In particular, sex still remains a taboo at schools and in families. The female students in the survey have highlighted the inadequacy of the sex education programme in schools and they indicate the main sources of

information on sexual matters are obtained through a and peer groups which may account for the liberal views display by them on some attars. However, surveys have shown that young pole in Hong Kong are still ignorant in many aspects of sexual matters and perhaps, if the Young people are given correct knowledge which are complete and handy as well as to understand the importance of social responsibility that comes with sexual relationship, they could be assisted to analyze and solve sex-related problems positively.

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Changes in the Role of Women in Hungary During the 50 Years

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Abstract: After 1945 in Hungary an increasing number of women were involved in full-time employment partly due to political reasons and partly owing to the expansive economic growth. Thus, as a consequence of the underdevelopment of the infrastructure necessary to the smooth, untroubled life of families, serious social tensions have emerged. Divorces have grown by leaps and bounds and the organization of every-day life has become almost impossible even in the remaining families. Women were burdened by weights both in the primary and secondary economy that have resulted inevitably in their mental and physical deterioration. Our lecture outlines the conditions of the current, post communist society.

Keywords: two-earners-model, unemployment growth, traditional family, countries in transition

Passing through social and political transition, the countries of Central and Eastern Europe, including Hungary, are coping with severe economic constraints. These adversely affect the enforcement of economic, social and cultural rights, the effective recognition of women's rights, and the development of an attitude conductive to the full acknowledgement of female equality.

The past 50 years, which is subject to the overview, has seen substantial changes worldwide. They include the collapse of the communist party-states of Central and Eastern Europe in 1989-90, and their move away from socialist planned economies towards the establishment of modem market economies and parlimentary democracies.

Under state-socialism, the "equality of women" existed for a long time as an unquestionable political objective. It was primarily based on the right to a gainful occupation as the most important criterion. The question of how important the roles ideology, the vast labour-demand generated by extensive industrialization, and the political endeavor to maximize control over the individual and minims wages through the "two-earners-model", played as underlying motives is currently subject to debate. When and how much women needed an opportunity to work and when and to what extent is was inflicted upon them by the state is another issue under discussion at present. It is likely that there were innumerable factors, named and unnamed, that contributed to the final result. Elements of imposition, such as an increased workload on women and weakening domestic functions, undeniably had a legate impact. That continued discrimination against women manifested itself in the structure of female employment and in wages lower than those of men is fact. Their involvement in economic activities did help improve tulle tenancies position of families and In most cases work outside the domestic setting meant an enrichment of women's lives as well as alleviating to a great extent female poverty. In secondary and higher education the proportion of women did reach, or /by rising over 50% / even exceeded their actual proportion.

The countries in transition have been surprisingly quick to establish political structures typical of modern democracies /fundamentals of multi-party system, free elections, the rule of law/. With that, political and civil rights, which previously existed "de jure", have become a reality. Factors which primarily influence the status of women are related to ideology, the economy, and party politics. Economic decline in Eastern Europe has reached critical proportions. In the majority of these countries, the rate of output loss and unemployment growth is higher than during the Great Depression in 1929-31. There is mounting inflationary pressure. By now Hungary has reached a point where the two

earners-modal is no longer prevalent. In more than 50% of families there are now single or noearners at all. As a result of economic decline about two thirds of the population have been exposed to falling living standards. The afflicted the worst include the unemployed, families with children on their own. the objective deterioration of the general situation is being accompanied by a heightened sence of insecurity.

Apart from religion, Hungary's first freely elected government restored the traditional family with the mother caring for hearth and home as the centerpiece of its values as opposed tothe ideological pressure in the 1950's for female employment. The already wide range of maternity benefits were further expanded while, with previous state prevalence gone, there was a substantial decrease in subsidies for childcare institution. About haf the crèches were closed. Although there was a limited reduction in nursery capacity families were changed more for meals both here and in schools. The economic stabilization measures which the current socialist-lieberal government is forced to take are not expected to yield improvement in any areas.

Of Hungary's population of 10,3millon there are 5,4 million women and 4,9 million men. According to the 1990 census 85,9%of families were full families, 12% of couple-based families had the wife as active earner. In 80% of single-parent families it was the mother who lived with the child. In 1990, in 26,5% of all households women acted as principal earners.

From 1996 the female retirement age is 62 years, before 1996 is was 55 years. The level of women's general educational background reaches and, in young age groups, even exceeds that of men's. Girls typically choose grammar school/ two third of grammar school student are girls/. There is market segregation by gender of various occupation, e.g., girls prevail in health care and in secondary commercial studies, whilst boys dominate heavy industry and construction occupations. This is not a consequence of institutionalized discrimination. Rather it is a matter of parents and children's preference. in the 1993/94 academic year,52% of university and college students were females. The percentage of female students significantly varies by faculty. In medical schools female student continue to outnumber males. The situation is rather similar at the faculties of low women also dominate special education /98%/, primary school teacher training /90/,and secondary school teachertraining/66%/.

Among women in managerial positions or coming from families of intellectuals, the percentage of those remaining in this segment of society has been steadily rising, which id not the case with man. The reason for continued increase is that in 1992 42% of the daughters of men in managerial positions or working as intellectuals became managers or intellectuals themselves, versus 28% in 1973. The small business sector provides live hood for women to a growing extent. Recent years have seen a substantial decline in female employment in the case of both active-aged women and those outside the age employability.

Summary

Between 1945 and 1980 the extensively developing economy raised women up to work without considering what kind of social work would suffer /here I mean bringing up children and taking care of the elderly/. For a period of time it was compensated by the lifestyle in which different generations lived together, but later on by the breaking up of this, these tasks become uncared.

In the 60's the increasing economical prosperity built up the nursery school system, schools colleges and maternity benefit. However, in the late 70's the serious political and aconomical crisis sould be felt, and with this the system of social allowances also faced a crisis. The crisis still continues, that manifests itself in the disintegration of free educational and health system, and in the reduction of allowances and grants. This particularly effects Hungarian families since inflation this year is 22%. After the 90's the input of women's work into the economical sphere has increased the burden of our society by depriving us of rights and advantages. Most of all the burden of intellectual women affects their career badly. The prospective time to escape from it is hardly predictable. In the new economic sphere it would be very important to establish a real stability in the social and legal security of women.

WOMEN IN AGRICULTURE PRODUCTION

L. Batmunch

MONGOLIA

The final paper has not arrived in time. The author will distribute her paper on the spot.

WOMEN IN ENGINEERING IN CANADA: WHERE DO WE GO FROM HERE?

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ABSTRACT

Enrolments of women in engineering have increased steadily for the past decade. Other obstacles are impeding further progress. Humanizing the engineering ClUliculul11, the culture and the teaching style would create an environment where more women, with the proper background and competence would choose these programs, instead of entering the more liberal professions. The creation of an environment fine from sexism, double standards, harassment, and the inclusion of multidisciplinary fields that are of interest to women would do much to successfully achieve gender balance in this field. The participation of women in the governance of the profession and theofficering of flexible work options in the workplace would contribute positively to the retention of women in this profession.

KEYWORDS: Enrolment, Retention, Mentoring, Workplace Issues, Governance of the Profession, and Women in Engineering

1. INTRODUCTION

In Canada, women represent fifty-two percent of the population, yet are under-represented in some fields, most notably in Engineering. Other professions such as medicine, law, dentistry, and veterinary medicine have reachedand maintained gender-balanced enrolments for years. This points clearly to the existence of more subtle and coverlid obstacles in Engineering and the Physical Sciences.

A notable increase has occulted in the past decade: the national average enrolment of women in undergraduate and graduate programs has increased from around 12 percent in 1988 to just under 20 percent in 1995. However, there is a considerable discrepancy between various universities in the enrolment pattern. The propulsion of women varies from under 10 percent to 43 percent in the undergraduate programs across the country. The number of women faculty remains dismally low, at 5 percent in two-thirds of engineering schools and none in the remaining third. Case studies of institutions with the highest enrolments at the undergraduate level are presented at the end of this paper.

It is possible that a ceiling will be reached at 20 percent in some of the Faculties and Schools of Engineering \\here curriculum content, teaching style and the climate issues have not been addressed and modified from the traditional andocentric perspective to one that reflects woman's interests and needs. Some of the unfortunate incidents relating to sexism in the workplace or in academia can also be a dependent to young women who would have considered this career. A paradigm shin in the cult me, cubiculum and teaching style in engineering education is needed. At the same time, industry must adjust to the needs of dual career couples by offering employees flexible work options, if they wish to attract and retain quali1ied and skilled people.

3. BACKGROUND

A national Chair in women in engineering has been created at the University of New Brunswick, in 1989, 1inancially supplied by a large corporation (Nortel) and the Natural Sciences and Engineering Research Council (NSERC). The mandate of the Chair is to encourage an increase in the emancipation of women in the engineering profession, at all levels and across the country. In the process of studying the factors limiting women's participation in engineering, the Chair Holder was greatly assisted by the creation of a national committee, in February 1990. The mandate of the CCWE (Canadian Committee on Women in Engineering) was to examine obstacles and identify successful strategies to increase the emancipation of women in Engineering. The committee was composed of 19 members, representing the major organisations connected to these issues, with regional, bilingual and gender balance. The author chaired the committee, which released its report "More

Than Just Numbers" in April 1992 (CCWE, 1992).

The committee's work addressed issues at all levels of career development: the K-12 education programs, including parental and societal influences: the post secondary education, the workplace, and the professional and technical societies. In the process of developing its report, the CCWE held six public forums across the country and received more than two hundred personal testimonies and briefs from individuals and groups. The CCWE contracted a research project on "best practices" carried-out in seven universities and six workplaces. Prior to releasing its report, the CCWE held a national conference in May I 99 I to review a set of draft recommendations, with 250 participants. This was followed by an endorsement meeting in September of the san1e yam', with the major stakeholders, to ensure a 'buy in' approach. That last event concluded the committee's work. The major stakeholders agreed, at the time, to hold an update conference three years later (in 1995) to assess progress. Future directions would be guided by the discussions at the new conference through workshops and plenary sessions (Update Conference, 1995). In the interim, the Government of Cm1ada, under the auspices of the National Advisory Board on Science and Teleology (NABST), developed a second report, extending the CCWE work to cover the fields of science and tec1mology, released by the Prime Minister of Canada on March 8. (NABST, 1993)

1.1 Issues at The Pre-University Level

The results of studies indicated that the social barriers limiting the participation of young women in nontraditional education programs start as early as birth and continue at all levels of the education system, perpetuating the myth that the physical sciences, mathematics, and engineering, are fields of study for men. Thus, by the graduation year in high school, a small number of women are left in the pool of candidates qualified to enter into an Engineering Program (Peltz, 1990: McDill 1991: Frize, 1993: Sadker, et. al, 1994).

Another obstacle is the low number of \\omen profiled in textbooks and of women teaching science and mathematics at junior and high school levels. For engineering, this lack is even more serious, as the few \\'omen science teachers are usually in biology or chemistry, and more rarely in physics. Faculties of Education, responsible for training and educating the next generation of teachers, could do much to provide them with gender sensitization so that they will be more aware of how to encourage both girls and boys to develop their lull potential, by challenging them, suppor1ing them and selecting textbooks that breakdown the stereotypes of gender roles. Guidm1cc counselors must provide broader career infom1ation to students and free of gender bias. They shouldmake a greater effort in identifying the skills and interest of young people, especially where nontraditional careers arc concerned (for e:\ample, nursing for boys and engineering for girls).

1.2 Strategies for Change

Workshops for parent and career counselors, textbooks portraying women and men in active and sharing roles, are all detective strategies. Some schools are using a cooperative laming environment in their classes. (Brooks, 1986): others have developed chemistry and physics classes *for* girls-only classes and a content and teaching style that incur) orates experiences and interests of girls (Rogers, 1988). Videos have been created on careers in Science (S.C.W.I.S.T.), and careers in Engineering (Frize, et. al, 1992) showing how engineers and scientists apply their knowledge to the benefit of humankind, solve problems, and design the world we live in. A non-traditional career day at a junior and senior high' schools has been organised by various universities and colleges in Canada. Some programs involve young women students only, with role models selected from the fields of engineering and the physical sciences, with a hand<;-on workshop. In other places, male nurses, ballet dancers and caregivers are invited to join women engineers, geologists, cementers, and firefighters, to do the workshops with boys ~and girls. (Yukon, 1996). These strategies cm1 be very successful in breaking down the stereotypes and making careers more visible and appealing to young people. Mentor and job-shadowing programs, where young women meet women who are working in non-traditional occupations, can create the long-te1111 supp011 needed to continue to eliminate the barriers.

1.3 Issues at The University Level

Once women choose engineering as a field of study, their experience can very from class to class and from university to university. Retention can be linked with having access to women role models (women teaching in the classroom and available to provide advice and counseling). There are some programs with no women faculty, or where women are sectional lecturers and all the tenure-track or tenured positions are held by men. Exit interviews with women students have shown that some land the climate too hostile and they transfer to other Faculties where they perceive the climate as more friendly. Some blatant sexist acts are still committed by engineering students and by some professors, and these come to light from time to time. In the past few years, these acts have taken the from of articles in the student press, bad jokes, and sexist symbols being displayed to represent the student group (association). Some professors ignore the women in their class and devote more of their attention to the men

The existence of double standards is another major problem. Stereotypes shape our perceptions about what each sex can and should do. They can have a major impact on the career progression and success of many women. These stereotypes can affect the success rate of women in competitions for scholarships, fellowships, grants, jobs, promotions, research grants, and being nominated and seceded to win prizes and awards. The systemic bias that exits against groups such as women and visible minorities can only be eradicated through education and sensitization programs, and through a balanced representation in committees that select the winners of scholarships, of awards; and committees that recommend the hiring, the promotion or tenure of faculty, for e:-;ample. (McKee & Sheriffs, 1957).

Multidisciplinary programs and research proposals are still looked upon by the most conservative groups of our profession as not mainstream and as such, may be devalued by the "hard engineering" factions. Yet, the multidisciplinary approach will allow engineering to crunch large, difficult problems, emit the solutions and probably make them more societal relevant. Women seem to enjoy multidisciplinary courses and fields, especially if they have a link to the real world and to societal realities. The myths that propagate a masculine view of excellence may be prejudicial to women's success and to their integration into these fields. This not only applies to m)'1hs concel11ing merit, awards and appointments, but to the value of intellectual work, and success in seeking funding (Caplan, 1992). Humanizing the course content would certainly contribute to enhancing women's interest in these fields. In fact, this may e:-;plain pm11y why women are so interested in a career in medicine. These factors also work against some of the men whose research interests and methods lie outside the currently narrowly defined 'excellence in engineering scholarship', or what is called 'mainstream research'.

1.4 Strategies at the University Level: Climate/culture

Universities should encourage the use of gender-inclusive language and instructors should be encouraged to find ways to in1prove the climate in the classrooms. Adding a few questions on the student opinion surveys regarding the language used in class, and whether the instructor tiled examples that are inclusive of the diverse groups in the class, would be infol111ative about the level of progress achieved in each of the classes. The distribution of a booklet on gender-inclusive language to each instructor (Ontario Women's Directorate, 1993) and making gender-sensitivity training available to faculty, staff and graduate assistants, would give a clear message about expectations from the university administration, on these issues, and help to create a more woman-friendly environment.

Retention can also be increased by providing senior student') as mentors to the first and second year students. Offering tutoring to students who are having finicality in one or two particular courses can also increase the retention rate and build the students' confidence. Creating an atmosphere where there is respect and tolerance for diversity may be the most important factor in supp0I1ing and encouraging students to successfully complete their degree. Finally, tracking students' pelfol111anCe, especially for those who are bordering on failure, would help to catch problems before they become in" eversible.

Special effigies should be made to attract and fund women students to enter graduate programs; they form the pool for future women faculty. Letters can be sent to women undergraduate students with high marks, asking them whether they have considered graduate school. Women faculty needs to be proactively sought and hired. The goal should be based on the availability of women in the pool of doctoral students. It is frequent to observe that even where affirmative action policies exist, the policy is often ignored or paid lip service.

Institutions of higher leal11ing will only successfully demonstrate that they care about these issues when they also identify and hire women in senior academic administrative positions. Institutions that hire women at those senior levels and supp0I1 them while in those positions, bentest from a diverse perspective and leadership style. However, few institutions have learned yet to appreciate this deterrence and some of the women hired at those levels have a very difficult task. In many places, the extort on gender-balance is limited to the undergraduate level, where the increased number of students affect in the funding level positively.

HIGH ENROLMENT OF WOMEN IN ENGINEERING PROGRAMS

Strategies that world!

Case Study I (The University of Gulp School of Engineering)

An interview with the Director of the School (Dr. Otto Lambert) and of his Special Assistant (Janet Diesel) revealed some interesting facts about the success of this particular School in reaching a gender balance. The Current proportion of women enrolled in Engineering at the University of Guelph is the highest in Canada: both the first year and the overall average enrolment of women in the Engineering programs is 43 percent; there are 35 percent women at the Master's level and 19 percent in the doctoral program. Just fewer than 17 percent of the faculty are women. The total enrolment in the program last year 520 students at the undergraduate level and 86 at thepost-graduate level.

At Guelph, there have been several women in the engineering classes for at least twenty years. The curriculum content seems to have a lot to do with the level of their success and this is even more evident today, where the enrolment of women is almost at par with that of the men. Around twenty years ago, women were mostly enrolled in Biological Engineering. Since 1988/89, the School has offered five programs: Biological Engineering, Engineering Systems and Computing, Water resource Engineering, Environmental Engineering and Food Engineering. The latter program will no longer be offered as a major as of September '96 due to low enrolments.

In Canada, all engineering programs must be accredited in order for the degree to be recognized by the profession. The Canadian Engineering Accreditation Board (CEAB), for much of its early work, was traditional in its view of Engineering Education, and it took a considerable effort on the part of Guelph to sensitize the Board to the fact that non-traditional programs are appropriate engineering disciplines. All of Guelph's Engineering Programs are fully accredited. It is interesting to note that several of these programs are part of emerging engineering fields and there are many opportunities for engineers with a multidisciplinary education. From the gender equal enrolment levels in medicine and biology, it is clear that women are attracted to the Life Sciences, and merging these fields with the problem-solving aspects of engineering makes these programs very popular with women.

In 1986, the School hired a part-time engineer to act as a role model for students and to help with recruitment and retention issues. As Special Advisor, Janet Diesel has been a great source of inspiration for young women in high schools and for the undergraduate students at the University. She is responsible for the liaison activities with the local schools and also provides supplier in all aspects of academic advising, including admissions, student progress, providing education and career information, and some personal counseling.

Guelph gets a different mix of students than the larger Schools in Ontario. They attract the type of student who want to enroll in a smaller university, and probably those who would want to live-in on the campus. A place in residence is guaranteed to all new students. The students often comment on the 'family' atmosphere the School provides. They also mention how the faculty are close to them, where an 'open access' policy is part of the culture.

A personal contact is made to encourage each of the students who meet the requirements for graduate studies. Help is also provided for students to find a summer job and to apply for NSERC Scholarships. As far as teaching style is concerned, some of the faculty at Guelph are experimenting with problem-based leall1ing and with the cooperative style of leall1ing. The faculty is fairly young and enthusiastic. These new methods have their drawbacks but also promise interesting results. With time, some of the drawbacks have become better understood. These new techniques can prove to be excellent, and patience and imagination will provide an exciting and highly ef1ective educational experience for the students.

Some of the comments made by the students about the program are telling the story about what the University of Guelph is to them: Student A: "I saw women in the Engineering building at Guelph. I never saw any at (...two other Universities)." Student B: Men here are concell1ed about ensuring faill1ess in meeting women's needs." Student C: "I saw what women in Engineering at (...University) went through. Women are suppressed there, ... if they want to fit in, they have to do what the guys want, n. you have to fit in." Student D: "We all help each other through the program. There is a tremendous atmosphere of cooperation amongst the students".

Case Study 2 (The Faculty of Applied Science at Queen's University)

At the University of Queen's, an interview with the Dean (Dr. Carl Hamacher) and the special Advisor (Margaret Kuiper) has provided several successful strategies that have led to an enrolment of women reaching 28 percent in the past few years. The enrolment of women in their graduate programs combined have reached I 9 percent, and 6.5 percent of faculty are women. Queen's University has hired a part-time assistant in the Dean's office since 1988. Some of her functions and role have had a very positive in.t1uence of the increasing proportion of women student's. The position has always been held by a woman engineer, and in addition to being a role model for the students; she also leads many activities both in the community and within the Faculty in promoting a wide range of issues associated with women in engineering.

Dean Haymaker has observed that the culture in the Faculty began to change when the proportion of women became higher than 25 percent. There seemed less clustering by gender and women mixed with men for most academic and social activities. The executive of the Engineering Undergraduate Society (EUS) began to have a much more gender-balanced representation. But there are still some activities centered on women's needs. Every summer, the Advisor sends a welcoming letter to each woman admitted in the programs, outlining the various supposing activites offered. Each of these students also receives a telephone call to make sure that their questions are answered before arriving on the campus. The advisor also organizes a series of informal

Evenings to encourage women to pursue a graduate degree. These usually consist in a panel discussion, specific to the various engineering disciplines, followed by a question and answer period. Because of the high number of women participating in this event, three such dinners are organised every year. The event does not seem to have created a negative reaction from the male students. All students, in parallel with this activity, are invited to attend sessions on Graduate School while in their final year of the undergraduate program. With the women, more effort is needed to address their concerns about balancing family and career and they may need a little more encouragement to consider graduate school, as they may not have had as much one-on-one encouragement at the undergraduate level. In general, women respond better to a small group gathering about these questions than in general meetings with all students,

Another first at Queen's is the Science Quest Project: an engineering and science camp for really young people from grades five to eight (ages 10 to 15). Many other universities have followed this example and there are cuttingly around eighteen similar camps in Canada. The Queen's students rearming the program have shared their expertise with other groups who are now also running very successful camps, including the Worlds Unbound Camp at the University of New Brunswick, where the enrolment of girls has been, in its past three years, slightly higher than the enrolment of boys. The UNB Camp is bilingual, offering weeks in English and some in French, while alsorotating some of its camps in various regions of the province.

At Queen's, the Engineering Undergraduate Society (EUS), has created a committee called "The Equality Issues Committee" (EIC). The committee and its executive address issues of recruitment and of retention of women in the Faculty. The students work closely with the Dean's Advisor on these issues and have organised, for five consecutive years, a very successful conference on women in engineering. Every year, there is a good mix of high school students (women) and engineering students (both male and female); other engineering students come item other universities, both from Ontario and loom other provinces. Women from industry are invited as speakers and for round table discussions. The issues are discussed openly and frankly, in a collegial atmosphere. The Gender Equality Committee has also successfully cal Tied out another project: it was the development of a "Gender Inclusive Language Pamphlet."

The healthy discussions that occur between the students and the Dean's office on issues of concern to women students, and the new ideas and activities that the Equality Issues committee generates, are to creating a positive environment for all students. The proactive and visible support from the Dean onthese questions also makes a difference in the level of success achieved. The Dean at Queen’s does not foresee any reason why enrolments of women in their engineering program should decrease by any significant amount, but thinks that they must continue toactively promote the value and qualities of an engineering education to both women and men.

Finally, Queen's has observed Memorial Services on December 6 (anniversary of the Massacre of the women students at Ecole Polytechnique in Montreal), and has cancelled most academic activities on that day. The Senate has recently extended the cancellation of academic activities on December 6 for another five years. The mark of respect given to this National Day of Mourning by Queen's is well appreciated!

5. CONCLUSION

The 'enrolment of women in Engineering programs in Canada has almost doubled in the past five years. Some educators believe that a ceiling has been reached and that nothing more can be done. The two case studies rep0l1ed here and the high enrolment in the University of New Bnll1swick Saint John Campus (over 30 percent in each of the past three years) have shown that, beyond recruitment strategies, much can be done in the area of retention, teaching style and cubiculum to remove the remaining obstaclesto a natural fit between women and engineering. Unfortunately, some educator’s continue to think in terms of changing women to fit the Current engineering culture, rather than asking themselves, what would make engineering of greater interest to women, with a view that their participation would enrich the field, not impoverish it. It is not infrequent to hear people say, well if women don't want to enter into engineering, that's their problem. These same people view engineering in a very traditional way, and consider multidisciplinary programs with some prejudice and Suspicion.

Key strategies that work to create a friendly envirOlill1ent for all students, in my opinion, hinge on hiring a woman as a Special Advisor (role model), with an accompanying visible support from the Dean and the Department Heads. Retention strategies are even more important than recruitment ones, as they ensure that people who meet the requirements of the course end up with a degree and self confidence, and are ready to enter the engineering workplace as professional, respectful colleagues, valuing diversity and new emerging fields and ideas. Hopefully, these engineers of tomorrow will ensure that we design a healthy world for future generations.

In the profile of the two universities we have just seen, it seems that the dollars spent to support an "advisor"

Position have really paid off both in enrolments and in retention of students, and' particularly successful with women students. Other factors I believe arc: the calculus and small-school environment at Guelph has created a culture where it seems women and men enjoy to learn how to become engineers. On the other hand, Queen's, as a larger school, has developed ways to communicate with its women students when they first apply and the students themselves are addressing the issue of equality in a dialogue which will benefit everyone in the end. Both approaches have worked. Both universities have hired women professors in a higher proportion than the national average.

Now, how we apply these good ideas to our own setting is the important question. Many of the strategies used at these two institutions could work successfully elsewhere. Students have a choice and they will choose to study and pay their fees to the university that will best meet their needs. Universities, for their part, are going to see enrolments going dowdy unless they are the place of choice for many students. So it makes sense economically to "become a woman-friendly university", which in fact should make the environment friendly for everyone. Many of our Faculties and Schools in Canada have found some interesting ways to create a friendly environment. Institutions that celebrate diversity should be the most successful ones at the turn of the century.

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A SURVEY OF WOMEN AND MEN ENGINEERS I N THE UNITED STATES

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Abstract: In June of 1993, the Society of Women Engineers published the first report on its National Survey of Women and Men Engineers. The survey questioned about 1000 men and 1000 women engineers, drawn from the membership of 22 U.S. engineering societies, on issues of ethnicity, education, family status, job experience, career progression, salary, predominance appraisal, satisfaction, accomplishments and obstacles. The results quantify differences between male and female engineers and describe the state of the engineering profession in the United States. Two recurring themes show up in the survey data. One is the high level of uncertainty and change in many engineering workplaces. The other is that young women engineers in their twenties start out on parity with their lane counterparts in both salary and other descriptors, while older women engineers in the survey data set report very different experiences.

Keywords: gender differences, survey, United States, equity, career satisfaction, advancement opportunities, obstacles, engineers

INTRODUCTION

In 1993, the Society of Women Engineers (SWE) completed a survey of 2000 male and female engineers selected from the members of 22 U.S. engineering societies Significant findings were published in a 40 page report, available from SWE beadquarters.1 Thus paper presents background on the Survey and highlights of the findings, focusing on career advancement, job satisfaction, and salarycomparisons.

BACKGROUND

In the 1970s and early 1980s, the Society of Women Engineers did what many organizations do,that is survey its membership and publish descriptive reports. SWE published several reports called" A Profile of the Woman Engineer", containing information on SWE members including age, marital and family status, education, geographic distribution, type of employer, and salary. The work of collecting and analyzing the data and publishing the report was all done by volunteers. In the late 1980s, the Society decided to take the Profile project a step further and attempt to collect data on women engineers who were not members of SWE and to attempt to compare data on women engineers with information about the engineering workplace as a whole, that is with men engineers. SWE contacted the Engineering Manpower Commission (now known as the Engineering Workforce Commission) of the American Association of Engineering Societies (AAES), and with their encouragement developed a questionnaireand conducted a pilot test of the survey. 2

SWE contracted with the AAES for national implementation of the survey. Members ofengineering societies were selected as the easiest and most cost effective pool of potential survey

respondents. Approximately 500,000 engineers belong to one or more of the 22 societies participating in the study, representing about one third of the total number of engineers in the U.S., so any compromise in the representative ness of the data due to restricting the sample to society members is believed to be small. Mailings were sent out to over 3000 engineers across the country, with two follow up mailings to improve the response rate. Tile final response rate was 55%, somewhat short of the goal, but good enough to provide a margin of error in the data analysis of plus or minus 3 %.

The sample is stratified by specialty in order to obtain sufficient data on many of the smaller engineering disciplines. During the data analysis, weighting factors were applied based on the actual distribution of engineers across gender and discipline according to data maintained by the Engineering Workforce Commission. Figure 1 shows the number of male and female respondents to the survey, and Figure 2 shows the percentage of male and female engineers in the United States.

FINDINGS

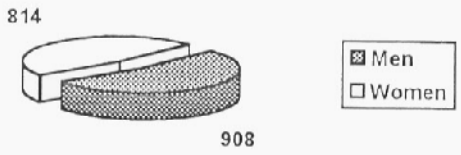


Figure 1. Gender of Survey Respondents

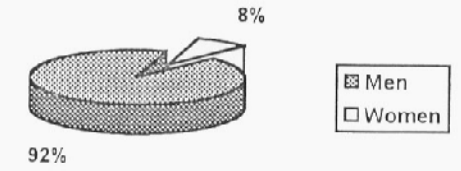


Figure 2. Gender of U. S. Engineers

The SWE survey collected data on demographics, family status, and motivations to enter the profession, education, employment history, performance assessment, salary, career progression, and job satisfaction. Thus paper presents highlights of the findings, including an overview of education, professional registration, and member of employers, and a more in depth look at the data on salary, management participation, career obstacles, and discrimination.

Education

The engineers who responded to the survey are a lushly educated group, with forty-four percent of the weighted sample having advanced degrees. Women are slightly more likely then men to have a non-engineering bachelor's degree. Women are slightly less likely than men to have an advanced degree (38 % vs. 45 %), but this is an artifact of age. For engineer's wider 40 years old, women are actually more likely than men to have an advanced degree (27% of women vs. 17% of men). About 14% of the male respondents have PhD's compared with only about 6% of the women.

Professional Registration

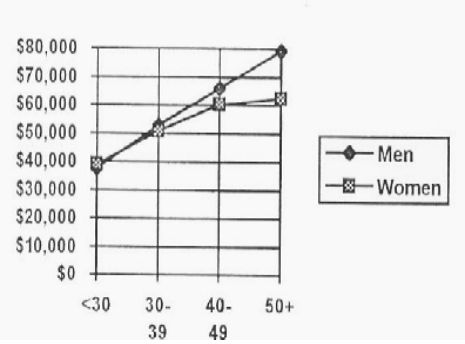
Across the board, regardless of discipline, type of employer, or age, men are much more likely than women to pursue and obtain registration as professional engineers (40% of men vs. 14% of women). Broken down by technical specialty, even in the civil and environmental areas, where career advancement often requires the P.E. license, a laugher percentage of men are registered (82 % vs. 51 %). Tile reasons for tills discrepancy are unknown, but worthy of further investigation. In tile U.S. 's changing engineering marketplace, with cutbacks in defense spending and restructuring of the manufacturing sector, professional registration can be a valuablecredential in an engineer's job search.

Average Number of Employers

The difference between male and female engineers in number of employersis slight. Regardless of gender, the typical mature engineer has worked for four different employers over the course of his or her career. It will be interesting to track changes in thus statistic as a result of the current restructuring of tile engineering workplace. An engineer entering the workforce today is much less likely to spend his or her career with a single employer than in the past.

Organization Shakeups in Last 5 Years

SWE asked its survey respondents tile same question asked of all U.S. adults by the National Opinion Research Center's General Social Survey. Thus finding is one of the most striking of SWE' s study. Fully three times as many engineers experienced major reorganizations in their employers during the last five years as did the general population (60% of enquirers vs. 21 % of tile general population). Thus comes as no surprise to many engineers, and



Graphically demonstrates the changes going on in today's engineering workplace.

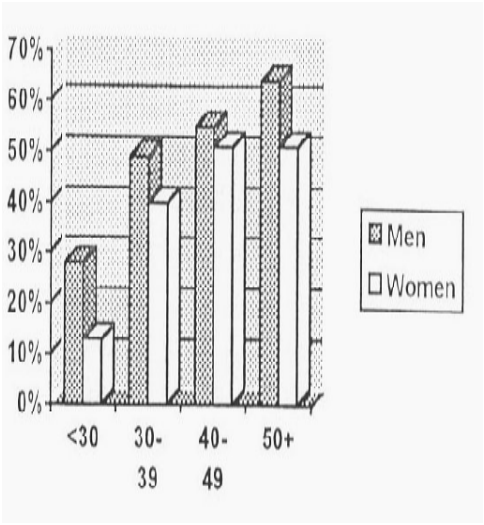
Average Annual Salary

According to the College Placement Council, entry level salary offers for women engineers are as good or better than those offered to men. SWE's data confirm that finding, but show that before engineers enter their thirties the men pull ahead in base salary and continue pull farther ahead for the rest of their careers. The graphic shown in Figure 3 was used on the cover of the survey report.

Figure 3. Average Annual Salary of Engineers by Age and Gender

Satisfaction with Salary Compensation

The SWE survey collected satisfaction data on twelve aspects of the engineers' current jobs, on a scale ranging from plus two for "very satisfied" to minus two for "very dissatisfied", with zero being neutral. A plot of satisfaction with salary by age and gender is particularly interesting when compared with the actual salary data above. Women engineers in each age decade are more satisfied with their salaries than their male colleagues, even though for the most part they are earning less.



Participation in Management

Fifty one percent of the men in the SWE survey feel they are a part of management, while only 32 % of the women do. Figure 4 shows that this difference holds true across age groups, and it is also consistent regardless of size of employer, so it is not purely a result of the fact that the average male engineer is nine years older than the average female engineer. The survey also asked how many layers of management between the engineer and the top of their organization, and the responses confirm tills result.

Once engineers become managers, tile differences between lane and finale rnanagers are slight. They both manage, on average, twelve other people, seven of whom are engineers. The male and female engineering managers in SWE's study earn comparable salaries through their mid -forties, with the salary curve diverging only for engineers over 50 years of age.

Figure 4 Percentage of Engineers who are Managers

Satisfaction with Advancement Opportunities

When asked how satisfied they are with advancement opportunities in their current job, men and women both start their careers with a somewhat optimistic outlook. As they progress through there twenties and thirties, reality sets in and their assessment becomes more neutral. In their forties, however, men's outlook becomes more positive for the refrained of their career, while the women's outlook levels off.

Satisfaction with Career Prospects

When asked about satisfaction with career prospects in the context of their overall engineering careers (not just their current position), the engineers are a little more positive, but tile trend across the age groups is similar. Younger engineers start their careers while a positive outlook, becoming less optimistic as they grow older. As they mature, the outlook becomes more positive again, but older women are considerably less satisfied tI1aI1 older men.

Greatest Career Obstacle

The survey instrument included an open ended question asking respondents to describe their greatest obstacle to career advancement. About 80% of tile women and 70% of the men responded to tills question. Their answers can be grouped into five major categories: the economy, personal issues, management, and discrimination and work/family conflict.

Men in all age groups. Cited the economy as their greatest career obstacle. Women also were conceded about economic conditions, but other types of obstacles were more important for women in most age groups. This category includes comments about the lack of promotion Opportunities in organizations that are experiencing downsizing and layoffs and references to cutbacks in defense spending as well as general comments about economic conditions.

The category of personal issues includes things that lie individual has some control over, such as the need for specialized training, an advice degree, or preference for a different type of job. This was the most frequently cited category for women under 30, and the second most frequently cited category for men under 40.

Comments about management include complaints that upper management is only interested in short term profits will no Long-term perspective and that the organization was managed by accountability and lawyers wilting technical understanding as well as comments about the incompetence of their immediate supervisor. These Comments were more frequently lade by men that by women.

Discrimination was cited as one of the top three obstacles by women in all age groups, becoming a more impunity factor for older women. Comments referring to the "glass calling" were included in this category.

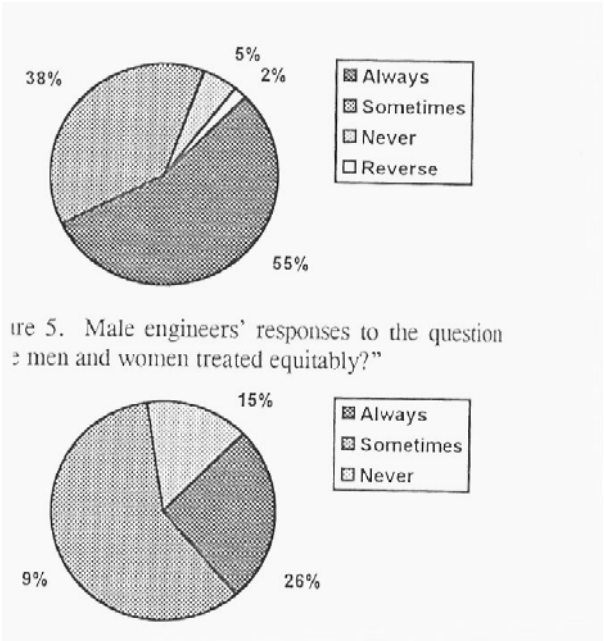
Work and family issues become the most frequently cited obstacle to career advisement for women in their flirtiest. This category includes the need to spend more time with children and comments about lie need to relocate to accommodate a spouse's career.

Equitable Treatment

The survey results show a big difference in perception between men and women regarding equitable treatment. More tl1an twice as many men as women feel that lie sexes are always fairly treated. three times as many women as men feel that there are consistent inequities. Over eighty percent of tile men say they have no personal awareness of incidents where people have been "overlooked", but 58 % of lie women engineers say they are aware of such incidents will respect to women. Figures 5 and 6 illustrate tile responses of men and women to this question.

Twenty-eight percent of respondents are aware of inequities affecting ethnic minorities. 65 % of tile non-minority men say people are always treated equitably on tl1e job, but only 44 % of tl1e minority men agree. 37% of the non-planarity women and 32% of the minority women agree that people are always treated equitably.

Satisfaction with Equitable Treatment



ure 5. Male engineers' responses to the question
e men and women treated equitably?"

This disconnect is echoed in tile satisfaction data. When asked how satisfied tl1ey are will lie equitable treatment of people in linear current jobs, boil men ailed women are simulate positive, will tile men being more approval the all lie women, becoming more so wily age. Women tend to become less satisfied with lie equitable treatment of people as lie get older, perhaps as they encounter the "glass ceiling".

CONCLUSIONS

In summary, tile SWE survey collected a wide railed of information on tile career experience of women ailed men engineers. Some of tile most significant findings relate to tl1e light level of uncertainty in tile U.S. engineering workplace for boil women and men, ailed as illustrated by the salary graph, women tend to start out in tile workforce at parity will men or better, but as they progress tollbooth their careers tile men catch up and continue to pull ahead.

Figure 6.Female engineers' responses to the question "are men and women treated equitably?"

NEXT STEPS

The survey report presents only tile most significant findings of tile study. Additional dialysis of tile salary ailed satisfaction data by engineering specialty and type of employer is unrolling. We have pains to analyze tile

Data on Asian Americans in more detail. Many opportunities remain for more in depth analysis.

SWE plans to repeat the data collection on a periodic basis in order to track changes in the engineering workforce as women continue to increase their participation in the profession. Additional funding is being sought for these continuing studies.

SWE is using the findings of the survey to increase corporate awareness of obstacles to women engineers in the workforce and to set priorities for career development and work/family programs for its members.

ACKNOWLEDGEMENTS

SWE would like to thank the Conoco Corporation, General Electric Foundation, General Motors Foundation, and the Alfred P. Sloan Foundation for financial support of the survey project. The cooperation of the 22 participating engineering societies was essential in getting access to a nationwide pool of engineers of various disciplines. Richard Ellis, the director of research for the Engineering Workforce Commission at AAES provided technical direction and data analysis. The project was initiated by Patricia Eng, who chaired the SWE Statistics Committee from 1988 to 1991 and conducted the pilot survey. The national survey was implemented under the guidance of Shelley Wolff, chair of the Statistics Committee from 1991 through 1993.

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WOMAN IN GEORGIA

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Abstract: Historical position of the women in Georgia, their devotion to the family and motherland, their self-sacrifice are described. A woman's position and women organisations are also given in the article.

Keywords: Georgia, women, history, position, activities, Abkhazia, women organisations.

Purpose of the paper to acquaint the world's women with Georgian women with their position and activities in their historical development.

A woman has been a slave, a serf, a housemaid and a hired worker for different epochs. But at the same time she was a queen, an angel and even a divinity.

It is soud that the level of the nation is characterized by the juridical position of a woman.

In the oldest religions imaginations a woman is worshipped. The sun's divinity is a woman "The sun is my mother and the moon is my father".

The condition of mother is particular in historical Georgia. Mother isn't only the parent for the Georgians. The Georgian for mother is " deda". So the Georgians call their native language - "deda ena", the capital "deda Kalaki", the pain post of the ploughman - "gutnis deda".

If you come to Georgia you will see the silvery statue of a woman, which seems to soar over the city in the gleaming blue sky. This statue by the well-known sculptor E. Amashukeli can be seen from almost allover the city. It has become the symbol of our capital Tbilisi, "Mother Georgia". The statue holds in one hand a bared sword again enemies, and in the other a bowl, the symbol of plenty for friends. (G. Melikishvili, 1988)

Georgian Woman's beastly, intelligence, faithfulness and people's respectful attitude to woman are known all over the world. Everyone knows an ancient Greek legend about the Argonauts' campaign in Kolkheti

For the purpose of getting the Golden Fleece there. It is not by chance that Medea the beautiful and intelligent daughter of Kolkheti King played the great part in getting the Golden Fleece. Wouldn't have been to return the Golden Fleece to his home landfill Medea hadn't helped him. Kolkhi Medea is the symbol of wisdom, love envy.

According to the Christian legends the Georgian people were christened by young, virtions woman Nino by nane. And the first Georgian who folk Christianity was the woman, the queen of Kartli-Nana. The name of St. Nino is connected with conception of truth, kindness, and miraculous power. Woman's authority has been also strengthority in Georgia because Georgian land has been recognised as St. Mariams lot.

Woman's authority has been relegated to the background by all religions and also by Christianity. According all religions a woman must have been submissive to a man but there. Were some executions in Georgia.

In the first literary monument written in the 5th century is described the torment of Shushanik. She is wholly devoted to Christianity. She is the woman with strong character. Without hesitation she sacrifices her calm, careless privileged life and takes Christianity. The struggle for Christianity was the struggle for Georgians. Shushanik predicted the idea of equality between man and woman. She thought of such equality in another universe where wouldn't be difference between man and woman and everybody would be equal before Jesus Christ.

The attitude to a woman is much more elevated in Georgia than in the west and the cast. This has been proved by Georgian poet of the XII century - Shota Rustaveli in his aphorism "The lion's whelp is a lion, be it mailer female". These worlds were told in Executioners were surrounding Queen the 12th century when Georgia was being ruled by Queen Tamar. Shota Rustaveli dedicated his poem to her.

The glorious period of historical and cultural renaissance in Georgia was the period of king David and his great grand daughter Queen Tamar. She was a true follower of the political activity of David the Builder. Her rule was the summit of development of feudal Georgia then a mighty state stretching from the Black to the Caspian Sea, from the North Caucasus to Persian Azerbaijan an Erasure. Foreign trade especially with the countries of the North and South Caucasus as well as with the Mediterranean states and the fast flourishes. The ties with the Russian lands ore consolidated. Queen Tamar completed king David the builder's struggle for liberation, strength and unity.

Georgia occupation the greatest territory during her reign. Her beauty, wisdom, gentleness and kindness were known all over the world. She prohibited execution and whipping and this wonderful woman with the sword in her hand fought against the enemies together with her countrymen.

Queen Tamar was crowned in the age of 18 reigned 25 years and died in the age 43. Her name became idolised for Georgia. The Georgian state flag was named "Tamariani".

The name of another Queen Ketevan is identified with nobleness and courage in Georgian history. She is said to have angel's beauty and spiritual strength.

Shah of Persia fell in love with Queen Ketevan. She had to choose the wag of life which world brings her wealth and glory or the way of forwent. She expressed her will shortly and calmly, "I won't sacrifice my soul for saving my body. Body is the earth and will fun in the earth but my belief and Georgia are immortal".

Ketevan dressed in white garments. The fire was burning in the middle of the square. Queen Ketevan was standing bravely. She wasn't crying. She wasn't groaning. She was only praying and pressing the earth of her homeland to her heart. She was praying in whisper. "Christ", "Mariam", "Georgia". Shah flew into a rage. She suffered a defeat as king and as a man. He decided to punish whole Georgia by executing Queen Ketevan. But in vain. The Georgians thought otherwise. Queen Ketevan's self-sacrifice strengthened their knightly Val our. She put the philosophers' ideas upside down. According to them a woman does everything only by emotion and not by principles or mind. Ketevan's heroism is the reason of principles and thinking and not emotions. Queen Ketevan has become a symbol of Georgia. (G. Melikishvili, 1988)

Georgian history is the history of Georgian People's struggle against enemies. The Arabs, the Mongols, the Turhs, the Persians and the Somalis have passed over the long-suffering Georgian land with five and sword. They ruled here for centuries destroying and devastating the Georgian land.

Georgian woman's purity, gentleness and beauty are known all over the world. When loan Meunargia, one of the famous scientists, visited well - known French writer Victor Hugo and told him fat he was from Georgia, Hugo asked immediately "Jon are from the country of beautiful woman aren't you?

The great merit of Georgian woman is to keep the mother language, to take constant care of fearing and writing in Georgian language. The three main things for the Georgians are: Motherland, language and Belief. The historians have written the legendary heroism of nine brothers Kherkheulidze. Their mother was with them on the field of the battle. When one of bar of the chess-players among women of other sons was wounded she handed the flag to the second one. And when all the sons were killed on the field of the battle poor woman killed two Persians. She was fighting bravely and was also killed there.

How can it be explained that Georgian woman, has such a great part in cultural process? Of course all the woman of different nationalities are similar and Georgian woman are not privileged. But in spite of the similarity if Georgian woman are still seemed more distend beacons of their high nature the cans of this of this was their historical life which had been specific and quite different from the women of other nations. Georgia's historical life plays great in this. A woman was bringing up the young generation and looking after the farming. She had to bring up the young generation with Christian spirit. It meant to be irreducible to other religions belief. The foreign in vaders did their best to spread their belief with fire and sword in Georgia. The struggle for Christianity meant the struggle for preservation of nationality. All these have grown woman's authority. So Georgian woman took part in defending our country's culture and traditions both in body and in deed.

A lot of bloody years have passed through suffering Georgia. But there were short periods when peace was established, sword was scabbard and the country began to restore. Such peaceful years were from the thirties to the eighties.

Many women - scientists have achieved a position in life. According to the statistic facts in 1897 Georgian women by their erudition were higher than the women living in former Soviet Union (except Baltics). And we have absolutely good results now. Georgian women have made their ways in all fields. As for the Georgian chessplayas their talent is know all over the world. None

Nations have gained such achievements. We remind you their names: Nona Gaprindashvili, Maia Chiburdanidze.

Nuch has been written about Georgian phenomenon. It is said that Georgian women are gifted with particular capacity in chess. Traditions an Culture of the nation play great part in our chess-player's Achievements. Chess has been playing in Georgia for 12-13 centuries. A woman took a set of chessmen in dowry for merly in Georgia. King Vakhtang the 6th gave a set of chessmen and the book "The Knight In The Panthere's Skin" to his daughter Tamar in dowry as the proof intelligence and erudition.

About Georgian woman's beauty, erudition, delicacy, faithfulness are written a lot and we can speak endlessly about her too. But her great love towards the homeland is the main character of hers.

Georgian woman can sacrifice her life for her motherland in case of need. It was so in the past and it is the same nowadays. In 1989 when our homeland's unity was in danger, the Georgian women together with the men rose to the defense of their country. Famous Georgian women-scientists, writers, students, workers were taking part in the struggle against anti-Georgian meetings in Abkhasia.

21 participants were killed on April 9, 1989, fighting for the freedom and nationality, among them were 17 women. After that bloody April it's difficult to believe that we have endured so much misfortune, so many tears, earthquakes, the civil and patriotic wars. The war began in Abkhazia. The war which took a lot of people's lives away, which destroyed the most beautiful part of Georgia. (G. Gvertsiteli, 1990)

According to Georgian's custom it was conflicts, to take an active part in the process enough to drop the woman's mantilla between the fighting man that they separated immediately. Mother's mantilla was the sacred thing for Georgian men. So Georgian women decided to go to the field of battle and stand among the Abkhazians and the Georgians and fought for peace.

On September 22, 1993, 7 million women left Tbilisi for Sukumi. They started saving lives and still the tragedy had happened. 300 000 people were withdrawn from their motherland. 300 000 homeless became refugees on their native land. A new type of woman appeared (not only a woman). The woman who looks with envy at everything. It's very difficult to make her believe.

The' conditions of refugees are unbearable. It's very difficult to feel yourself as a full-blooded person living in the hotels, offices and not having even minimum of household implements. In spite of all these they hope for the best. They are sure that the day will come and they'll go back to their territory, which was watered by their sweat and blood. It's very difficult to imagine that the woman-scientist, doctor of agriculture, the author of some books, refugee Margarita Mchedlidze, who is about 80 manages to continue her scientific work. She has just published one more new book.

The organisation" the refugees From Abkhazia For Freedom And Peace" was created 2 months ago. The main aim of it is to develop peaceful movement and help the refugees to return to their native land.

The similar organisation "Georgian Woman For Peace And Life" was created in Georgia 3 years ago. It is led by Nanuli Tsagareishvili-Shevardnadze, the wife of the head of the government. The organisation has aimed serious purposes and tasks. Their aims are to study the historical and ethnical causes of psychological and social conflicts, to look for the ways of avoiding the possible

Of the organising the defence of the mothers and children, health and charities.

Not one of the famous women takes part in the political, social and public activities. The question how to overcome the political and economical problems is vital nowadays in Georgia.

Georgian woman is accustomed to the struggle. She has been a woman and a man, father at the same time. This is our fate and as a heavy cross we must carry it to the and.

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WOMEN ENGINEERS IN FRANCE: EDUCATION AND CAREER

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Abstract: The number of women Engineers has steadily increased since the French engineering schools accepted women. Nevertheless, strong prejudices must still be fought in order to attract more girls in schools towards technical and scientific careers. We now find women Engineers in all sectors of the economy, but they are still facing inequalities in terms of salary or position in companies.

Keywords: women, engineer, education, engineering, engineering schools, career

1. INTRODUCTION

Engineers exert a key role in the French economy. They hold vital technical knowledge in key industries. Moreover, they are found at top managerial positions and enjoy a high social status.

The first engineering school, Ecole Polytechnique, was opened in 1794. Like all engineering schools created in the 19th century, it was for male students only. Women were only accepted for the first time in an engineering school in 1917. The proportion of women. has since increased significantly amongst the population of Engineers.

It now appears useful to make a gender comparison of the education and careers of French Engineers. In this respect, valuable data is obtained through the F ASFID surveys (Federation des Associations et Societes Franchises d'Ingenieurs Diplomes) completed in 1990 and 1993 on the population of Engineers and the conclusions made by the AFFI (Association des Femmes-Ingenieurs). It should be emphasized though that these surveys were based on the response of approximately 10 % to 20 % of all French Engineers. In certain instances, depending on the issues considered, the number of women Engineers is too low to provide statistically significant results.

2. WOMEN IN FRENCH ENGINEERING SCHOOLS

Engineering titles are presently delivered by 191 accredited establishments throughout including the famous « Grandes ecoles d'Ingenieurs ».

The title of Engineer usually implies a 5-year curriculum after the baccalaureat, including 2 years of preparatory cycle in schools or at university, followed by 3 years in an Engineering school. Figure 1 hereafter shows the correspondance between the various educational programs in the USA, Great-Britain and France.

Fig. 1. Comparison of educational systems in Engineering

FRANCE	UK	USA
Baccalaureat	A-levels	High school diploma
Preparatory Cycle	Undergraduate Studies B.Sc B.Eng.	Undergraduate Studies Junior Senior B.S
Engineering school	Postgraduate Stadius M.sc	Postgraduate studies M.S

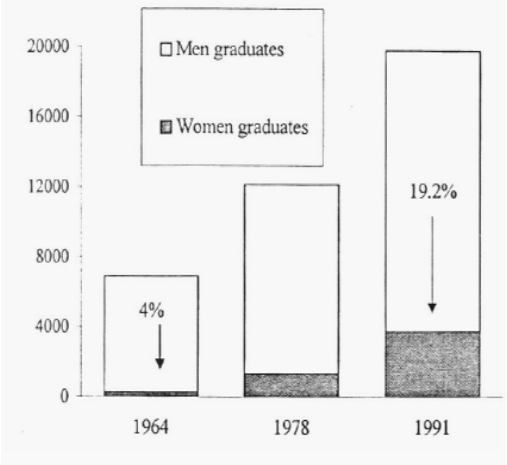

Fig.2. Women graduates as part of the engineering titles delivered.

17935 titles have been delivered in 1991. 19.2 % of them were granted to women, which means a steady increase in the last decades, as shown in figure 2.

Four arguments may explain this trend:

- The engineering schools were only progressively opened to women. Today, no discrimination is made towards female entry in any school.
- Since the end of the Second World War, the chronic need for more Engineers in the French economy resulted in increased recruitments and facilitated female intake into engineering schools.
- The broader spectrum of subjects offered in schools has undoubtedly contributed to attract young women towards Engineering. Today, they are present in 99% of all schools, but with strong discrepancies according to the specialty. They clearly favor biotechnologies, computing and chemistry, but are underrepresented in schools delivering a specialized curriculum in mechanics & metallurgy, electrical engineering, electronics & telecommunications, as well as civil engineering to a lesser extent.
- The last generations of women have been striving in greater numbers to achieve a professional career.

Nevertheless, some recent facts may cast a shadow over this trend. Inthe last three years at least, the output of new engineers has been in excess of the need in a declining industry. Unemployment is now affecting a rising number of junior or experienced engineers, and competition is growing among new graduates in search of their first job. Girls might be pressurized not to compete in this field, as our society still gives increased importance to the professional status of the man in the household.

Although every year more women are choosing engineering careers, this increase is significantly Slower than in other fields, such as medicine, law or economic sciences. The reason is to be found before the engineering schools, at the secondary school, where prejudices deterring girls from the technical sections are still strong.Although girls prove more successful at school at an early stage, only slightly more than 30% attend the C-section leading to a math's & physics baccalaureate. This section is traditionally chosen by the most brilliant pupils and is deemed to offer the best opportunities for a future career. As a consequence, female students following a technological curriculum after the baccalaureate has stabilized around 30%, whilst it developed significantly in law, medicine and economic sciences from 30 to 50% between 1970 and 1990.

Of course, some factors could help to overcome this problem. We have already mentioned the development of new engineering specialities and branches. It can also be emphasized that companies presently require multi-skilled engineers: sales engineers, financial controllers knowledgeable in manufacturing processes, environmental engineers etc...Engineering schools should thus be persuaded to propose a combined curriculum involving engineering techniques along with another vocational subject (for example sales, marketing, toxicology, law, business etc..) in order to produce well trained, high quality engineers responding to the needs of modem companies. This type of education would certainly prove more attractive to women.

3. CAREER OF WOMEN ENGINEERS

In 1993, 280,000 French Engineers were employed, of which 8% were female, i.e. more than 21,000 women Engineers. Although steadily increasing, the current number of women Engineers indicates that they are still under-represented in regard to the ratio of women at top managerial positions (31 %) or in the general working population (44%) (see figure 3).

Women Engineers are young. Some 70% of them are under 35, against 43% of all Engineers. Their dedication to the profession is obvious, for more than 90% of them are employed.

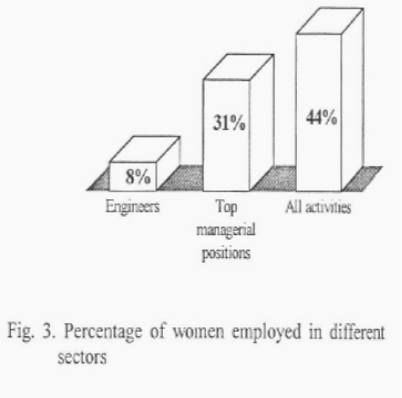

Fig. 3. Percentage of women employed in different sectors

3.1 Broader involvement in economic sectors

Women Engineers are found in all economic sectors, though with some discrepancies. Unfortunately, it is not possible to indicate the distribution in all economic sectors because the FASFID survey presented a too small sample size in some of them. Women Engineers are mainly employed in services industries (banking, trade, insurance, consultancy), electronics and electrical engineering, as well as defense. They are increasingly found in food industries and the Para chemical and pharmaceutical industries. They are still noticeably under-represented in civil engineering, metallurgy, mechanics and mining companies.

Worth commenting on is the continuous defection of women Engineers from education and research institutions. This was once the only sector that women Engineers could enter without upsetting the established social order, still employing 45% of women Engineers in 1969, but less than 10% in 1993. A reason has already been put forward: women nowadays find more opportunities and acceptance in other sectors. They are now able to choose their career according to their own preference, and are less restricted by shortsighted social considerations.

3.2 Activities pursued by women Engineers

A review of the activity pursued by the Engineer in the workplace also provides interesting data. Women are concentrated in three main types of activity: computing, consultancy, training and research (R&D, testing). It should be noted that compared to 1983, they get less involved in consultancy, but more in training and teaching, as well as activities related to quality. Women Engineers low and decreasing involvement in production activities attests to their difficulty in being accepted in this field, along with the decline of this sector. Moreover, woman's relatively low involvement in so called multidisciplinary activities compared to men is worrying, for this is involves mostly company administration and management.

3.3 Disappointing hierarchical position

A comprehensive review of the hierarchical position is made difficult due to the low number of women Engineers of certain age categories who answered the enquiry. Nevertheless, an analysis restricted to the lowest age categories suggests a trend that is not favorable to women. The figures taken for Engineers below 35 years old demonstrate that a majority of women Engineers are not progressing to managerial positions in a similar way to men (see figure 4). This situation has only slightly improved in the last decade and is still far from satisfactory (see figure 5). Female discrimination is probably at its greatest in this area. It is a widespread idea that responsibilities require more availability and more working hours, which appears difficult to balance with family life. This is used as a pretext to hinder female access to managerial positions, since the female role in the family is widely and certainly wrongly considered as more important. As a consequence, it is often believed that marriage is detrimental to the careers of female Engineers, whilst it is the reverse for males. The higher rates of unmarried and divorced women Engineers compared to men further substantiate this assumption.

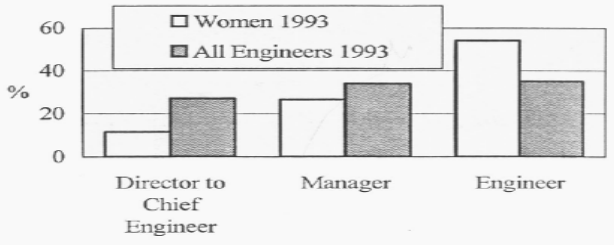

Fig. 4. Hierarchical position for Engineers between 30 and 35 years old - 1993 enquiry

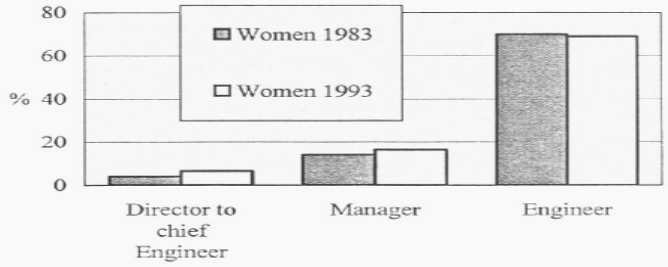

Fig. 5. Hierarchical position of women Engineers in 1993 compared to 1983

3.4-Narrowing pay gap

Young Engineers are paid according to the school they come from; gender has no negative influence for women at this stage.

Although it has been alleged that at equal position, age and sector, female Engineers are paid only 4% less than males on average, significant discrepancies can be witnessed in certain instances:

- The pay gap is widening with age - up to 25% (see figure 6)
- The pay gap is broader for managerial positions compared to basic Engineers (see figure 7)

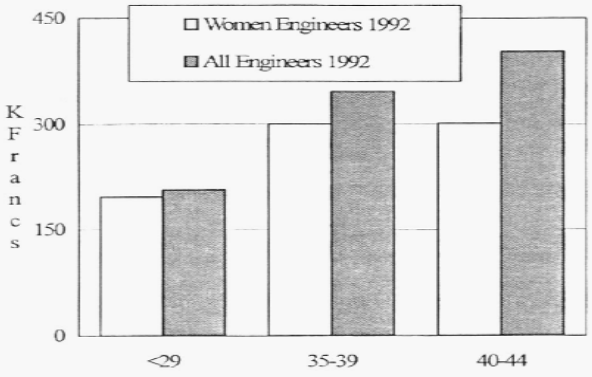

Fig. 6. Average salary of Engineers versus age (in thousand French Francs)

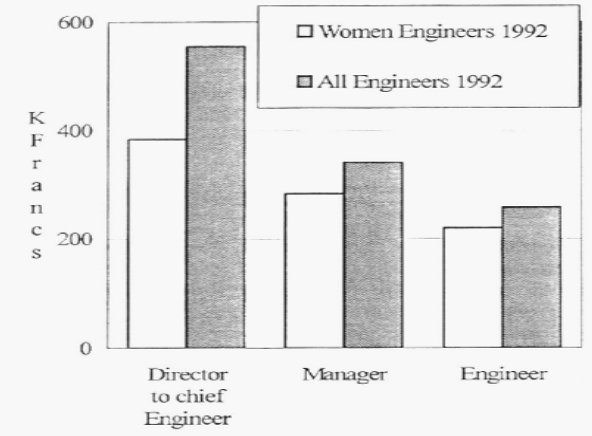

Fig. 7. Average salary versus hierarchical position (in thousand French Francs)

3.5 Engineers are satisfied

80% of engineers, female and male alike declare themselves satisfied with their professional situation.

Their prime concern is the lack of career prospects. In second position comes the risk of unemployment. It should be emphasized that women are less preoccupied by their pay and level of responsibility than man, although it is with these issues that are especially at disadvantage. A lower salary and a lesser chance of promotion for women are perceived as long established facts, which women accept as a basic rule of the game when they decide for this career.

4. MORE WOMEN ENGINEERS FOR THE FUTURE

The opening up of the French engineering schools to women has been a decisive step enabling women to choose and succeed in technical and scientific careers.

As a consequence, women have penetrated industries and services in ever-greater numbers at positions that once were considered to require typical masculine qualities. Their capabilities today are no longer in question, although they are still facing some restrictions or hidden discrimination in specific industries, for promotion and equal salary.

Informing and attracting girls towards the engineering profession at an early stage in secondary schools is essential. Numerous women Engineers in various sectors of activity can now be used as role models for this purpose. The successful involvement of women in Engineering has nowadays clearly abolished the outdated argument that technical subjects are not suitable for women.

The changing industrial environment requires new types of Engineers, pluridisciplinary and not only knowledgeable in a technical speciality. This opens new opportunities to women, and they can certainly offer particular talents and qualities in this respect.

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THE SWISS ASSOCIATION OF WOMEN ENGINEERS (SVIN/ ASFI)

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Key words: situation of women engineers in Switzerland

The Swiss Association of Women Engineers was founded September 1991 at the initiative of the "Group of Engineers for Tomorrow's Switzerland" (INGCR).

The main objective of this association, which today consists of about 150 women engineers of various disciplines, is to increase the attraction of engineering, as a whole, to women. Moreover, the goal of the association is to represent the interests of women engineers in public.

The association is a platform for discussions, permits the exchange of experiences and allows for the creation of a network between women engineers. These objectives are attained by publishing current information and by organising symposia, workshops and seminars. Nevertheless, the present situation reveals that, in spite of various SVIN activities, the proportion of women in technical professions is still very low in Switzerland. The percentage of graduated women engineers, for example, is stagnant at about 4%.

Why is this so? Which factors lead to this statistic? Which of the projects undertaken in the past 5 years have been a success, which ones must be reconsidered?

It is time for the Swiss Association of Women Engineers to evaluate its work and to assess its objectives as well as the scope of its activities. We will highlight the areas in which an organisation like SVIN can perform successfully and find possible new ways to influence the advancement and support of women engineers in Switzerland.

CHEMICALS AT HOME AND IN OUR LIVES: A WOMEN'S PROJECT

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Abstract: APQUA (Learning about Chemicals, its Uses and Applications) is an educational project on science and societal issues. It designs material for schools, workplaces and the community. The present communication explains the main objectives and concerns of the global project and emphasizes the specific community program characteristics. It goes deeply into Chemicals at Home and in Our Lives: the one year project APQUA developed for the Catalan Woman's Institute. Their material, contents, methodology and evaluation are presented and discussed.

Keywords: science education, chemicals, societal issues, community program, woman's education.

1. APQUA PROJECT: AN INTRODUCTION

APQUA (Learning about Chemicals, its Uses and Applications) is an educational project developed in Tarragona under a collaboration agreement between SEPUP (Science Education for Public Understanding Program) of the University of California at Berkeley (Their and Nagle, 1994), and the Department of Chemical Engineering of the University Rovira i Virgili, in Tarragona.

APQUA provides schools, the community and workplace groups with educational experiences focusing on chemicals, and chemical processes, and on the risk that their use means to people and the environment.

The main goals of APQUA, according to their authors, are (Abello, 1995):

- To develop greater awareness, knowledge, and understanding about chemicals and their interaction with our lives,
- To promote the use of scientific principles, processes, and evidence in public decision making,
- To provide people the necessary knowledge so that individuals can more effectively make their own decisions and actively participate as a members of a free and democratic society,
- To achieve that people learn to obtain information about chemicals.

By means of these aims, APQUA contributes to improve the quality of science education in Spain and also in Europe (APQUA, 1993a).

APQUA believes that understanding chemicals and how they interact with people and the environment is essential to informed citizens in our society. It is not productive for a society to have its populace react solely on an emotional basis (Gavalda *et al.,* 1992).

Rather than anxiously demand answers, it is essential that:

- People learn to ask pertinent questions, obtain evidence, and use it as the basis for decision making,
- People are able to listen to, recollect and consider any opinion (open-minded),

- People question their own ideas and preconceptions about chemicals and their uses,
- People understand the limitations associated with scientific evidence,
- People understand the nature of scientific inquiry in order to participate in formulating effective chemical-related policies.

APQUA is helping to meet the society's educational needs on science and technology through the design of instructional strategies and materials, which highlight chemical concepts and processes associated with current social issues. It is their specific approach in science education (Thier, 1985). It provides educational activities that deal with science related issues of present concern to the public, without taking an advocacy position. APQUA is an issue-oriented science project. APQUA, like the SEPUP project, does not teach people what decisions to make. Instead, it facilitates understanding of the available evidence so that people can come to their own conclusions about the issues (Thier and Nagle, 1994).

APQUA presents three different educational programs:
- The school program, directed to 10-16 years old student,
- The workplace program, used to cover industrial educational needs for employees in the field of environmental and risk awareness, and
- The community program, developed for use with all kinds of organised social collectives.

2. APQUA IN THE COMMUNITY

APQUA has been developing the educational material *Living with chemicals* for use with the community, since 1989 (APQUA, 1991).

Living with chemicals includes setting up workshops aimed at community groups such as women clubs and leagues, social workers, labour unions, neighborhood associations, federations of elderly people, recreational centres and parent-teacher associations, to make them aware of the chemical related choices we each make every day.

The designed activities utilize inquiry-based problem solving approaches to learning, in which the importance of rational discussion, and evidence based decision-making, is emphasized.

Topics include: chemicals in our life, hazardous wastes at home and how to dispose of them correctly, ground water contamination, toxicology and thresholds, decision making and risks, food additives, transport of hazardous materials, and smoking and our health.

The *Living with chemicals* program is applied in the Tarragona area (in the north-east of Spain) under the sponsorship of the Chemical Industry Association of Tarragona. Nowadays, Tarragona has one of the largest and most important petrochemical industrial estates in southern Europe. The program has been working since 1989 with 57 different community groups and with an average of 26 workshops per year. The average participation per workshop is 27, which represents a public incidence of 700 people per year. The program has been also implemented in other areas, by means of several administrative findings, reaching one thousand people more, through 30 workshops carried out at twelve different municipalities of Catalonia (Abello, 1995).

The APQUA community program has contributed to reinforce the relationship between the Community, Industry, and the University, three worlds often too distant in our present society. The continuous interest shown by community groups is the best indication of the acceptance of the program. At the present time, the Department of Chemical Engineering of the University Rovira i Virgili is working on the evaluation of the impact of the program in the community groups of Tarragona.

3. CHEMICALS AT HOME AND IN OUR LIVES

Most of the community groups interested in APQUA are women's clubs and leagues. They represent the 30% of the community groups APQUA has been working with. For that special interest, APQUA developed the specific one-year project *Chemicals at home and in our lives,* sponsored by the Catalan Woman's Institute (APQUA, 1993b).

The project consisted of:
- Developing a leader's guide with a set of four activities adapted especially from the APQUA community program,
- Carrying out eight training leaders sessions to introduce the project and the leader's guide to women's clubs from Barcelona and Lleida,
- Developing two informative booklets about the topics shown in the leader's guide.

3.1 The leader's guide

The leader's guide, *Chemicals at home and in our lives,* is aimed at the person who has to present the APQUA activities to the women clubs, and to carry out with the workshops. It explains how to fulfill the activities, how to give information, the necessary material, etc. Special care was taken not to use sexist language and wording.

The four activities in the guide are about: chemicals

And their interaction with people and with the environment, hazardous wastes at home, risks of living, and making decisions. Due to the fact that everything is made up of chemical products, and that these form a more and tore dominating part of our existence, it is important that we are informed about the nature of their risks, as well as the nature of these products and chemical processes and their interaction with us.

What is a Chemical?. Participants respond to questions on a chemical survey form, which contains both information and attitude-based questions. After they have finished answering the questions, they compile and compare their individual responses to see how attitudes and information interact when answering questions about chemicals.

Hazardous Wastes at Home. Participants review a list of products commonly found at home and select the disposal methods they think are appropriate for them. Through discussion they realise that many of these substances require special handling when it comes to their disposal. Participants explore the current and hypothetical public policy regarding hazardous waste disposal, and discuss their possible effects on themselves and on the community.

Making Decisions. Participants read a short story about a hypothetical epidemic in their community. Using the hypothetical evidence, they are asked to choose between two available high-risk options. After reacting to the story, participants discuss about what reasons affect their personal decisions.

Risks: The Game of Live. Participants evaluate a list of twenty common risky activities. They compare risks and select those they think are the highest and lowest. Then, they compare their selections with available evidence. Participants distinguish the risks they must accept without choice from the risks they voluntarily choose. Through discussion, participants learn more about their own risk behavior and risk assessment in general.

The four activities are designed to actively involve the participants and to offer them opportunities to use and apply a lot of different intellectual and social processes and skills such as observing, classifying, hypothesising, judging, gathering evidence, organising and analyzing data, reading tables, using ratios and proportions, estimating probabilities, drawing conclusions, making decisions, etc.

As to knowledge, these materials deal with concepts, and facts such as, chemicals, risks and benefits of chemical use, the mass media influence on public perceptions, difference between evidence and life style, hazardous waste, use and disposal of household products, potential hazards of improperly discarded substances, risk, risk comparison, risks we choose and risks we have no choke about, risk management, etc.

The attitudes and behaviours emphasised are: curiosity and reflection, active participation, critical thinking, discussing opinions, making tradeoffs, tolerance of ambiguity, communication and sharing, pleasure in understanding, and openness to new and different opinions.

All these contents worked in the APQUA activities are focused to help people to better understand the roles of science and technology in their personal lives, and to develop the knowledge and judgement necessary to make effective evidence-based decisions about science-related public issues, as responsible members of a democratic society.

3.2 The training leaders sessions

The APQUA sessions were followed by over 50 leaders from 18 different women's clubs, who were trained in a series of four seminars by APQUA staff, in Lleida and Barcelona. They were introduced to the project and how to use the guide.

Each seminar was about each activity and their workshop. The APQUA activities utilised open question framing and problem solving approaches to learning, in which the importance of both, to debate possible answers, and to make decisions based on evidence were emphasized. Each activity was designed to take no more than an hour and a half.

The activities' global objective was to make known the methods used to collect and process information, so that everyone could actively participate in making decisions on questions related to chemicals which were interesting for them, for their family, and for the community.

3.3 The informative booklets

The two informative booklets developed examine the safety and risk involved in the decision-making we have to do with regard to the use of chemicals each day. Both of them will soon be published and divulged by the Wastes' Council of Catalonia and the Dept. of Chemical Engineering of the University Rovira i Virgili. They deal with the same activities, but in a concise and integrated way.

Chemicals at home. What is a chemical? Are chemicals hazardous? Which are their potential hazards? When do chemicals become wastes? How to produce less hazardous wastes? What could you do, like a responsible citizen? Where could you get

More information?

Every decision involves a risk. When do you make decisions? How do you make decisions? What does risk mean? How to classify risks? Which is your perception about risks? How to quantify risks? What is risk assessment? Who manages the risk? Where could you get more information?

3.4 The workshops' evaluation

At the end of each set of four seminars, participants filled out an evaluation fun, which was analysed by both, the APQUA staff and the Catalan Woman's Institute. The participants rated each workshop from 1 to 10 points. The number of recollected questionnaires represents 76% of the total participation. The global mean for each individual workshop was between 6 (0"=2) and 9 (0"=1). The mean of the results for the whole seminars was 7 (0"=2) in Lleida and 9 (0"=1) in Barcelona.

The participators highlighted the following as the program's positive aspects: it favors the thinking process, shows the chemical world in another viewpoint, makes us aware about risks, provides opportunities to share and compare opinions and information with other people, and facilitates the possibility of making friends.

The negative aspects emphasised were: it makes too many questions and gives too few concrete answers, it makes us aware of our lack of knowledge and understanding about a lot of current situations, and it was too short.

The main participants' observations and suggestions were: to repeat the seminars and extend them with new topics, and to spread the program to the entire population.

All these results and comments certify the success of the program, the accomplishment of APQUA's objectives and the social lack of knowledge and understanding about science-related current issues. But, on the other hand, it was evident that the main aim of the *Chemicals at home and in our lives* program was not achieved. The participants, as leaders of a women's clubs, were able to explain and describe the program to their colleagues and family, but they didn't feel capable to implement the program in their clubs. In their opinion, the workshop has to be carried out by technical or recognised people, to be credible.

It is obvious that people still think they are not able to get information, discuss, and decide about science based social issues concerning them. They are not aware enough of, as members of a democratic society, that they have the right and the responsibility to give their opinion and decide about' science-related public policy issues which can affect their live and welfare.

4. CONCLUSION

The current society must resolve its lack of social knowledge, understanding, and awareness about science and technology, and their incidence in the present and future population. The APQUA project is helping to meet this educational need through the design of issue-oriented-science instructional strategies and material, about chemical concepts and processes.

But it is not enough to educate the rising generations. Currently, people have to deal with public decisions concerning their life and the life of their descendants. Then, they have to be aware of their personal and social responsibilities. They need to learn to gather information, understand available scientific evidence and its limitations, assess risks and benefits, and make evidence-based, rather than purely emotional, decisions.

To this effect, it is obvious that the women's clubs and leagues, as active community groups, are very good collectives who focus on science-educational efforts. The current role of women in our society and specifically in family groups can lead them to make a significant contribution towards improving the public understanding of science and its ability to cope with the demands that a scientific and technologically domineering society places on it. The APQUA community program is working to achieve that.

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RESEARCH INDUSTRY INTERACTION FOR EFFECTIVE TECHNOLOGY TRANSFER.

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Abstract: Competency of scientist, readiness of inventions for exploitation in field, with their technological, social and scientific merits are the important criteria for effective transfer of technology. A proper interaction between research and industry is called for. The same has been discussed in the paper with special reference to Indian scenario.

Keywords: Industry, interaction, technology, transfer.

1. INTRODUCTION

The beginning of organized industrial research in India took place in early 1940 with the erection of Board of Scientific and Industrial Research Council of Scientific and Industrial Research (CSIR) is the prime scientific body which carrier out R&D activities in almost all the emerging areas of physical, chemical, biological and mathematical sciences. CSIR is expected to beat the center to meet the new challenges imposed by the inflow of a variety of new technologies into the country due to liberalization of import and export modalities and reduction of tariffs. The Indian industry stands to gain by utilizing the expertise of CSIR in the evaluation of new technologies.

2. CRITERIA FOR RESEARCH

Two types of criteria are to be applied while a research proposal is assessed for transfer of technology. Internal criteria are generated within the scientific field itself and answer the question how well is the science done? External criteria regenerated outside the scientific field and answer the question, why pursue the particular science? The two internal criteria of utmost importance are whether the field is ready for exploitation and whether the scientists working are really competent. The three external criteria are technological merit, social merit and scientific merit (Weinberg). Thus if a given technological end is desirable, the scientific research needed to achieve it should be supported. The most frequently cited single index of the scientific activity of any country is the percentage of gross national product (GNP) allocated to research Table 1 indicates that this allocation varies between 0.6 and 3.4% of GNP for developed countries (Freeman). Whereas countries of the third world are frequently. Struggling to achieve 0.3% of their more slender GNP.

Table 1: Allocation of Resources in Developed Countries

Country	Percentage of GNP allocated to research	Percapita expenditure on research (Dollar)
USA	3.4	110.5
France	1.6	27.1
Germany	1.4	24.6
Italy	0.6	5.7
Japan	1.4	9.3
U.K	2.3	39.8
Belgium	1.0	14.7
Canada	1.1	22.5
Norway	0.7	11.5
Netherlands	1.9	27.2
Sweden	1.5	33.5

3. INDIAN SCENARIO

In India, with a long tradition of mathematics and astronomy, the technology is not science based in the way that in the industrialized west contemporary research continuously informs and transforms technology. India spends about0.8% of GNP on science and technology research. Despite an approximate 60-fold growth in the number of R&D units from eleven in the pre-independence days, the perceived impact of the incident is not evident. India has the third largest scientific and technical manpower of nearly three million and occupies the tenth position in terms of industrial base. Thus India has the required skill base, necessary to carry out technological innovations. However a monopoly exists over the latest technology and the technology made available through technology transfer has a high economic and political price associated with it. Consequently energy and pollution intensive industries earlier imported, now require thorough replacement or improvement to convert them into energy efficient manufacturing processes with the effluents and emissions meeting the stringent standards set by the regulatory agencies. High technology enables a country to produce at cost effective rates and allows the introduction of new products in the market whereas technological obsolescence leads to rapid loss of markets (Kumar)

4. RESEARCH-INDUSTRY INTERACTION

Technological change follows an exponential growth pattern. Moreover indigenous transfer of technology from research to industry, supplemented with adaptation and modification would help to reduce the technology gap for the development of appropriate technology for self reliance (Zhenkang). The issues related to research industry interaction have to be addressed against the foregoing backdrop. Presently the value of services and goods produced in the country based on CSIR know how is estimated to be Rs. 1200 crore per annum. Quality improvement programmes need to be pursued on a large scale for better achievements. For this purpose modern management related programmes have to be stressed and information accessibility made simpler. The industry pulse has to be sensed for economically viable technology transfer.

5. CONCLUSIONS

Conscientious efforts are necessary on the part of research organisations to upgrade the indigenous technologies so as to stand in competition with the imported technologies. A proper interaction between research and industry is called for. Corporate structure of the CSIR, meaningful interaction with the industry, involving the user agencies from the inception of R&D programme, periodical review and mid course corrections, removal of bottlenecks and minimising the bureaucratic controls, introduction of marketing and management techniques, transparency in evaluation and recognition of merit, innovative human resource management and shredding of unproductive and outdated technologies are a few steps advocated to meet the new challenges.

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AN INNOVATIVE APPROACH TO TECHNOLOGY TRANSFER BUSINESS INCUBATORS

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Abstract: Through their tax dollars, citizens of the United States fund research and development of technology in many areas. Some of this R&D has narrow application but some also has commercial application. The United States Government has developed a number of innovative methods of transferring technology from government laboratories and uses to the commercial arena. This paper describes one of those approaches as it is being implemented at Kennedy Space Center: the technology-based business incubator.

Keywords: technology, research and development, commercialization, government, technology transfer, incubator

1. BACKGROUND

An engineer or scientist with a good technical idea often meets obstacles in developing the technology into a viable, marketable product, not because of deficiencies in the technical side of the but rather because of lack of understanding or appreciation of the business side required for a successful commercialization. Technical people often do not understand all the business aspects that must be addressed by an entrepreneur. A common statistic in the United States is that 80% of new businesses will fail within their first five (5) years, typically because of business factors.

Business incubators are a fairly recent phenomenon in the United States. Incubators, as the agricultural root of the name implies, help nurture start-up businesses and ease them past their first few critical years of existence and help them grow into independent organizations. Companies that actively participate in an incubator typically experience a reverse of the failure factor described above, in that 80% of these companies are found to be successful after five (5) years.

2. INCUBATORS

There is a broad range of types of incubators. Some are for-profit organizations that primarily provide rental space with limited business support services. Others, many of which are not-for-profit incubators, provide more direct support to their tenants in terms of business and technical support provided. Regardless of the type of incubator, however, the major reason for the success of entrepreneurs and start-up companies in incubators is they are not only provided with low-cost rental space and access to reasonably priced business services, but they are also given the mentoring and

Business advice that helps them over the obstacles experienced by almost all new companies.

Because start-up companies are so small, they usually cannot afford full-time assistance on their staffs to cover various administrative support functions. Incubators can provide these types of business services, which are also shared with other tenant companies in the incubator. For example, most incubators will have a receptionist whose services are part of the tenants' rent. Tenants pay for special services, such as copying and faxing, on a use basis. This means they do not have to invest in the equipment or the staff for these functions. Since capitalization is a significant issue for start-up companies, it is critical that they do not have to expend funds they do not have a major need for. This becomes even more important for specialized support that can be expensive, such as graphics, that is needed only periodically by a company.

3. FLORIDA/NASA BUSINESS INCUBATION CENTER

The Florida/NASA Business Incubation Center is a business incubator serving the location needs of early-stage technology-based small business formation, growth, and success. The Incubator's mission is to increase the number of successful technology-based small companies originating in, developing in, or relocating to Brevard County in the State of Florida. It is being set up as a non-profit corporation. Currently, it is managed by an Executive Director, with policy decisions made by an Executive Committee made up of representatives from the three Incubator partners.

The Incubator is opening its doors for the first tenants to occupy office space in early June 1996. Several companies have been approved as tenants and marketing efforts are continuing to fill the available space in the Incubator with qualified technology-based companies. A formal opening of the Incubator is planned for July 1996, with government, business and local officials being invited to celebrate the opening.

3.1 Incubator Partners

Three partners co-sponsor the Incubator. The National Aeronautics and Space Administration (NASA) is the federal agency charged with administering the civilian space program in the United States. The NASA Kennedy Space Center, located in Brevard County, in central Florida, is the field organization that is implementing the Incubator program for NASA. NASA will provide some technical expertise to the Incubator tenants through its Outreach Program. Also, on a noninterference basis, NASA will allow tenant access to some of its specialized facilities as part of its support for the Incubator. .

The State of Florida is another partner, through its Technological Research and Development Authority (TRDA). TRDA was chartered in 1987 by the Florida Legislature to sponsor programs that significantly benefit Florida education, space research, and economic development. NASA and TRDA have teamed previously on several projects that meet the goals of both organizations. The Incubator is just the latest collaboration between the two organizations.

The third partner in the incubator program is Breyard Community College (BCC). The Incubator is physically located on BCC's Titusville, FL campus. The College is providing the facility as well as the maintenance, security, etc. that goes along with the facility. In addition, BCC is allowing the Incubator tenants access to some of the College's laboratories and shops, on a non-interference basis.

Although NASA sponsors or co-sponsors several other incubators at other field centers throughout the country, the partnership in the Florida/NASA Business Incubation Center is unique in the involvement of a federal agency, a state agency and a community college.

3.2 Incubator Facility

As mentioned earlier, the Florida/NASA Business Incubation Center is located on BCC Titusville campus. It is a 10,000 square-foot facility available for short-term leasing. Offices range in size from 110 square feet and come furnished. Flexible space suitable for prototype development and light manufacturing is also available, depending upon tenant needs.

3.3 Tenant Services

Tenants have ready access to a variety of support services to help them in their business operation. Some of these, such as the receptionist and access to conference rooms, are included in the rent. Other services, such as copying and faxing, are readily available onsite for a nominal charge.

Other services that can only be provided outside the Incubator facility will be arranged for by the Incubator staff and charged to the tenant. All offices are wired for both voice and data lines. Internet access is provided for all tenants through the College's network. A library of current technical journals and business publications is located within the Incubator. In addition, the College provides access to its library facilities for other tenant needs.

3.4 Incubator Staff

Probably the most important service provided to tenants in the Incubator is the management oversight and support provided by the Incubator staff and the volunteer mentors and advisors. The Executive Director is the primary focus of this support. A new tenant in the Incubator is encouraged to have a detailed business plan written before it comes into the Incubator. However, if a plan has not yet been prepared, which is common for start-up companies, one of the terms of the tenant's lease agreement is that one be written within 90 days of entering the Incubator. The Executive Director will help the company write its plan and review the final product, with assistance from a network of mentors and advisors from the local business community.

The Incubator is establishing a series of monthly seminars with topics that are directly related to small businesses and the special problems they face. These are organized by the Incubator staff, and will sometimes be presented by them. The shorter seminars (1-2 hours) are held in the evening, while the longer ones planned (4-8 hours) will be conducted on weekends to allow maximum participation among the tenants.

3.5 Off-Site Clients

Not all start-up companies can be accommodated in the Incubator facility itself, sometimes because the company already has too many employees or requires manufacturing facilities not available in the Incubator, or because they are already established in locations that are not in easy commuting distance to the Incubator facility in Titusville. However, many of these companies would like to participate in some of the activities of the Incubator, such as the networking among the tenants, the monthly seminars, and access to the incubator facilities and the special facilities at BCC and NASA. For an annual fee, technology based companies can become clients of the Incubator and have access to the Incubator's shared common areas, such as its conference rooms and library, and the activities listed above. Already, companies from other parts of Brevard County and some from outside the County have expressed interest in becoming clients.

4. CONCLUSION

Through offering affordable space and shared office equipment and services, the Florida/NASA Business Incubation Center will make it possible to reduce many of the costs associated with establishing and operating a business. Support facilities and programs to train and nurture the new entrepreneurs in the establishment and operation of their companies will help new technology-based ventures to have the best possible chance of success.

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FOREIGN STUDENTS IN JAPAN

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Abstracts: Japanese Higher Education system is overviewed and discussed about its bright and dark sides. In 1994, the number of foreign students had surpassed 50,000 for the first time. This represents half of the plan to have 100,000 foreign students in Japan by the year 2000. In the University of Tokyo more than 1,800 foreign students are studying from 60 countries. The situation of those foreign students in Japan is introduced.

Keywords: Japanese Higher Education System, Foreign Students In Japan

1. JAPANESE EDUCATION SYSTEM

The modem system of formal education in Japan was inaugurated in 1872. In 1947, the Fundamental Law of Education and the School Education Law were enacted. Under these laws a formal educational system (a 6-3-3-4 system) was established on the principle of equal educational opportunity.

By product of Japan's economic success, Japanese education achieves a much higher level, 95% of students will graduate from high school. Table 1 shows number of institutions, students and teachers at the Japanese educations.

The Japanese educational system is higely centralized, fosters uniformity of standards and achievement, and emphasizes the mastery of school curriculum.

Under this sysytem, serious academic development is stressed from early age; the intensity of schooling is maintained at a high level and increases in the high school years; the competitive high school and university entrance examinations, incentive and urgency for Japanese children to study and learn the school curriculum to the best of their ability; and effort and perseverance are viewed as more important then innate ability or aptitude for school achievement

Table 1. School Statistics in Japan

Type of inst.	Institutions	Students	Teachers
Kindergartens	14,901	1,852,183	103,014
Elementary	24,635	8,582,871	434,945
Lower 2nd	11,289	4,681,166	273,527
Upper 2nd	5,497	4,862,725	282,085
Schools for the handicapped	968	87,219	51,117
Universitiers	552	2,481,805	134,849
Junior colleges	593	520,638	20,964
Colleges of technology	62	55,938	4,265
Special training college	3,437	837,102	36,073
Others	2,934	339,063	17,148
TOTAL	64,868	24,300,710	1,357,987

2. FOREIGN STUDENTS IN JAPAN

The acceptance of students from other countries plays a great role in improving the level of educational and research standards both in Japan and in the other countries concerned. It also serves to increase mutual understanding and friendship between the Japanese and other peoples. The acceptance of students from developing countries is extremely significant in that Japan's cooperation with these countries contributes to the development of skilled manpower.

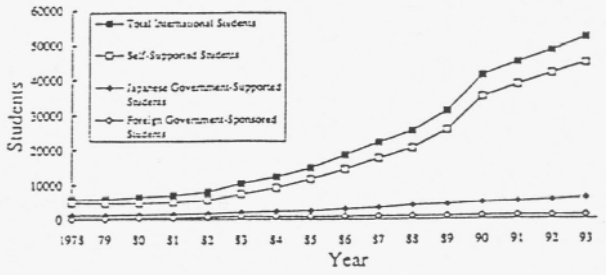

Fig. 1. Development of Foreign Students in Japan.
– ■ – : Total foreign students, – □ –: Self–supported students, – ◆ –: Japanese government supported students, – ◇ –: Foreign government sponsored students

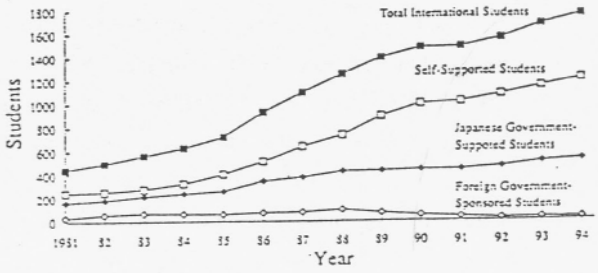

Fig. 2. Number of Foreign Students at the University of Tokyo
(The symbol is the same as in Fig.1.)

2-1 The Number of Foreign Students

During recent years, the number of foreign students studying in Japan has been increasing rapidly. As of May 1, 1994, approximately 54,000 foreign students from 135 countries were studying at Japanese universities and colleges.

Japanese Government has a plan to increase the number of foreign students in Japan to 100,000 by the beginning of the 21st century.

First figure shows the number of foreign students in Japan in fiscal years. Foreign students are classified into three categories, that is, self-supported students, Japanese government supported students (Monbusho students) and foreign government sponsored students. Almost 80% of foreign students are self-supported students.

Second Figure shows the number of foreign students in the University of Tokyo in fiscal years. The University of Tokyo is the oldest national university in Japan. It offers courses in essentially all academic disciplines at both undergraduate and graduate levels and provides research facilitates for those disciplines.

In 1995, more than 1,800 foreign students from 60 countries are studying at the University of Tokyo.

2 - 2 Circumstances for Foreign Students

The major problem for foreign students in Japan is summarized

Finances:

Circumstances for foreign students are quite different between self-supported students and Monbusho students, who get a scholarship of about $1,855 per month. Monbusho students enjoy their research and also Japanese lives.

Though 20 percent of Self-supported students can get private organizations' scholarship, other 80 percent of self-supported students have to work by themselves.

To study in Japan, especially in Tokyo, where every prices are expensive, self-supported students find it difficult to keep body and soul.

Japanese Government permits for foreign students to work 4 hours a day.

Housing:

The housing situation in Japan is not satisfactory. The University of Tokyo has two International Lodges and International Students Hall. However, accommodation cannot be offered to all students, and many foreign students have to rent apartments or private students houses. Table 2 shows the situation of housing for foreign students in Japan as of May 1993.

Table 2. Housing for Foreign Students in Japan

No. of students*(%)	Housing
11,653 (22.2%)	International lodges of universities public service
5,467 (10.4%)	Government related lodge
40.753 (77.8%)	Apartments or private student houses

*: Total number of foreign students is 52,405

Japanese Language:

Japanese language is very difficult because its grammar is absolutely different from other language. The University of Tokyo has the intensive course of Japanese language for six months against foreign students after their arrival to Japan. But this period is not often adequate for people with different language background.

In recent years the number of Japanese going to the United States has exploded, while the flow in the other direction has stagnated. Thus the exchange field has begun to resemble that of the bilateral trade and investment imbalances in the number of student exchanges. The explanations for the low numbers are familiar: language difficulties, finances, lack of accommodations, credit transfer issues, and the like. Japan appears to be taking toward a more pro-active stance on cultural and educational exchanges.

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ACCESS BY INTERNATIONAL EDUCATORS TOT HE RESOURCES OF NASA ON SPACE TOPICS

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Abstract: Educators and scientists tl1foughout the world may access tl1e information and media resources of the National Aeronautics and Space Agency of tl1e USA through two main systems: the NASA Educators' Resource Centers and tl1e NASA Central Operation of Resources for Educators. Materials and metl10ds for such acces are described.

Keywords: space, space education, NASA, space flight, space living, space station, space shuttle, astronauts

NASA, the National Aeronautics and Space Agency of the United States, has extensive materials in many media available to educators throughout the world. This paper will describe in detail the materials, provide some samples, and give information about the different ways in which educators (and researchers, too) can access these materials. In many cases, a simple letter making a request for a specific kind of information is adequate; in other cases, more sophisticated metalloids of communication can be used to access and retrieve information.

The materials available include such topics as the Shuttle, repairing the Hubble Telescope in space, living in space, various science experiments carried out in space by both Shuttle Astronauts and unmanned satellites. Some discussion will be included on joint space activities between the US and other countries. Opportunities will be provided for participants to examine materials and make requests for items, which appear valuable to them.

Educators', who wish to simply review what materials are available at the Kennedy Space Center Educators' Resource Center, or any of the twelve other similar centers, are welcome to walk in at any time the centers are open. When educators plan to visit the centers, they should call al1ead and make reservations if they wish to use the audio, photographic, video or computer equipment to make copies on their own blanks of the hundreds of items available. These materials include videocassettes, slides, computer software, lesson plans, and historical publications. Printed materials may be copied free of charges. Every educator who visits such a center receives a packet of public domain information related to a variety of space related topics.

To obtain an Educational Materials Catalog of items available world wide, educators or scientists should contact NASA-CORE Lorain County JVS, 15181Route 58 Sound, Oberlin Ohio, USA, phone 216-7741051-ext. 293, fax 216-774-2144. For a small fee plus mailing charges, any items may be ordered. Examples of catalog items include: video cassettes 1/2" VHS or 3/4" UMATIC (Toys in Space or Living in Space), slide programs (Space StationFreedom witl1 international partners), filmstrip programs (Principles of Rocketry or Astronomy/Planets), computer software (Astrografix -- data base, games, graphics), CD-ROMs/laserdiscs (a 3-week module on space borne imaging radar for junior/senior high students including CR-ROM, teacher's resource guide and educational videotapes).

The assistance of Steve Dutczak, Chief, Education Services Branch, NASA, and Janet O'Sullivan, Carolyn Swain and Carmen Jarvis of the NASA Educators' Resource Center, all atKennedy Space Center, Florida, launching site of tl1e Space Shuttle, is gratefully acknowledged..

A NEW APPROACH TO TEACHING SCIENCE IN THE USA-- THE STATE WIDE SYSTEMIC INITIATIVE PROGRAMS

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Abstract: Under the Statewide Systemic Initiative programs, states and local groups work in partnerships with the National Science Foundation to develop a wide variety of strategies to reform the entire educational infrastructures. Teacher preparation and enhancement, urban and rural collaborative and regional centers for minorities are some of these initiatives.

Keywords: teacher preparation, teacher enhancement, education collaborative, partnerships

The Statewide Systemic Initiative (SSI) program of the National Science Foundation of the USA, begun in 1990, fosters far-reaching change and improvement in mathematics, science and technology education. The underlying premise is that, to attain world class standards, the United States must replace isolated and piecemeal reform efforts will more ambitious, coordinated, and coherent approaches to reform the infrastructure, capabilities and activities of the system so that all students receive high-quality science and mathematics education.

Working in partnership will the National Science Foundation through cooperative agreements, the SSI program represents a strategy to develop excellence in mathematics and science education by strengthening the states' infrastructures though alignment of state policies and resources. This requires the collaboration of educators at all levels, business and industry, parents, policy makers and the community at large.

The SSI program covers not only the basic initiatives will the individual states but also several other programs such as the Collaborative for Excellence in Teacher Preparation, the Urban Systemic Initiatives, the Rural Systemic Initiatives, and Local Systemic Change Through Teacher Enhancement, and the Comprehensive Regional Centers for Minorities.

The overall collection of SSI programs presents activities from preschool through graduate school that are having impacts beyond a single location, either though widespread coordination or though the development of program's that are continuing to have widespread influence.

These programs offer may suggestions for educational reform that will have applications in many countries and should be especially interesting to women engineers and scientists who seek to improve both science education and the participation of women in science.

This paper will present the latest information available at the time of presentation about the various programs and their results. Additional information about the SSI program is available from the Education and Human Resources Directorate, National Science Foundation, 4210 Wilson Blvd., Arlington V A 22230 USA, phone 1-703-306-1602.

EDUCATION OF BIOMEDICAL ENGINEERING AT KANDO KALMAN TECHNICAL COLLEGE

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Abstract: The lecture outlines the aims of the biomedical education at the KANDO KALMAN TECHNICAL COLLEGE, and the role of the R&D Workstation - realised in the framework of an OMFB project - in the biomedical education.

Keywords: education, Biomedical Engineering, R&D Workstation.

1. BIOMEDICAL EDUCATION AT THE KANDO KALMAN TECHNICAL COLLEGE

Biomedical Engineering is being educated at the Kand6 Kalman Technical College since 197 2. The students attend the lectures and laboratory practice of biomedical systems and equipment during two (5. 6.) semesters. The final degree is the Electrical Engineering, which corresponds to the BSc.

There are the following compulsory subjects:

- Biomedical equipment
- Biomedical laboratory practice
- Digital radiography
- Hospital technology

The students are obligated to chose one of the following subjects every semester:

- Metrology of biological signals
- Biomedical information systems
- Applied medical imaging
- Special biomedical instruments

In the sixth semester the students have to make a final paper.

Our aim is to introduce the students to the:

- Hospital technology including organisational questions,
- General aspects of biomedical instrumentation and information systems,
- Constructing, functioning, testing and the quality management of the most important biomedical instruments.

The best students work successfully in. Scientific Student- Teams, they can get a foreign scholarship or continue their studies at the Technical University. The graduates have good chances of getting a job in hospitals, factories or servicing.

2. PROFESSIONAL CREATIV WORKSHOP

In the framework of a project titled "Installation of a **PROFESSIONAL CREATIVE WORKSHOP** ", which was supported by the OMFB it has been managed to established an European level laboratory environment. At that R&D work places:

- Both the teachers and the students can practice up-to-date professional job,
- The students can make be able to get redy to operate and service the most modern equipment,
- The teachers have the possibility to make their R&D project on a high level, they can introduce to that the gifted students too.

The realised workshops:

- **XILINX** development system,
- **ASHLING CTS 51** single-chip in- circuit emulator,
- **DSP** applied techniques,
- **WAYNE-KERR** in-circuit tester,
- **SUN SPARC**station **IPXI9**.

Novell NetWare and Unix network were installed for the connected **PC**-s

The students can work with these systems in the 5th - 6th semester. The workshops are installed in the Biomedical Engineering Laboratory of the Department for Instrumentation and Automatisation.

Helped by these systems the students can be introduced to the constructing, testing and the quality management of the most important biomedical equipment. The gifted students can make high-level scientific students -team work using it.

SCIENCE AND ENGINEERING EDUCATION: CASE STUDIES OF TRANSFORMING THE UNIVERSITY CURRICULUM TO FEMALE-FRIENDLY AND COMMUNITY -CENTERED APPROACHES

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The goal of the Urban Environmental Health Initiative is to link Boston University's School of Public Health with the surrounding low-income yet resilient neighborhoods of the city of Boston through project-based teaching, community service, and collaborative research on issues of health and environment undertaken in partnership with community-based organizations. I will present examples of collaborative classroom projects and research on issues of primary prevention of lead poisoning; asthma and indoor air quality in public housing; the environmental health agenda of urban health centers; and community gardening in inner cities.