



American Society for Quality Control

P.O. BOX 444, POINTE CLAIRE — DORVAL H9R 4P3

0401

OCTOBER

MONTREAL SECTION

MARCH 1987

OFFICERS - 1986 - 1987

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Mechanical Dept
Quality Assurance
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CHAIRMAN'S MESSAGE

February 25, 1987

Dear Members,

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At its last meeting, the Executive committee unanimously voted to go ahead to organize a one day Quality Forum in October. It will be a special event this year because in addition to the Section Quebecoise and A Q Q, we may be joined by two other societies, Society of Reliability Engineers and I E E E. The Quebec Govern ment also adopted last year a motion proclaiming OCTOBER as the Quality Month in Quebec.

A committee under the chairmanship of David Tozer will be set up soon to organize the Forum. We need a lot of help from you, any way you can. If you know someone who would like to make a presentation, or during your routine work, you may come across suppliers who are willing to advertise in the Forum transactions publication, or suppliers who would be interested to exhibit at the Forum, we would be pleased to hear from you. D.Tozer's phone number is 694 2830.

The end of our term is coming and it's time to prepare for the election of next year's Executive committee members. We will be asking for nominations and if you are interested and do not know what is the involvement, give me a call, I'll be glad to tell you.

As usual, a meeting will be held in Ottawa and has been scheduled for April 29, 1987. The Ottawa meeting will be at Spar Aerospace Ltd, Satellite and Aerospace Systems division, a tour of their facility and an overview of their Quality system will be on the agenda. Bus transportation will be made available free to members. Reserve your place early, call Gerry Heimann at 935 1186.

SECTION MANAGEMENT AWARD:

Len Berth, Eng.
Quality Management Consulting
110 Grassmere Ave.
Pointe Claire, Que.
H9R 2Y8

LETTERS TO THE EDITOR

Most of you did not notice that a number of errors had intentionally(??) been put into the Newsletter. I wanted to see if you would find them. That's right, last month's Newsletter was the FEBRUARY issue...not January.

By the way, the " " issue of the Newsletter was the JANUARY issue and it invited you to a visit to CIRCOCRAFT for January 1987 not 1986. I apologize to all those who went to borrow Micheal J. Fox's Dolorian in order to go "Back to the Future" to attend that meeting. As you can read further on, the visit at Circocraft was very interesting.

CONGRATULATIONS to George ANDREWS for pointing this out. He wins the booby prize, an all expense paid trip to the coffee machine. What's that George? You don't drink coffee?

Oh well ! !

QUALITY VIDEO

Last year's Quality Month campaign included a video, made by Westinghouse and donated to the ASQC, titled "QUALITY OF AMERICA". It is a twenty minute tape available in VHS format from Charles CHEUN. Please contact him if you wish to view it.

WORLD CLASS QUALITY

By the time you read this it will probably be too late for you to attend the TORONTO Section of the ASQC's FORUM 33. It is being held in Toronto on February 28, at the Royal York. The guset speaker will be Mr AG Warner, Vice-President and General Manufacturing Manager of GENERAL MOTORS CANADA.

Sorry! I print what I know about. If you know of activities that would interest the membership
TELL ME ! ! ! !

Send all comments and articles to:

JP AMIEL, BOX 94
c/o CANDIAN MARCONI COMPANY
2442 Trenton Ave
MONTREAL H3P 1Y9

514-341-7630 Ex 4845

INSPECTOR WANTED

FOR IN-PROCESS MULTI-LAYER PWB

** PART-TIME OR FULL-TIME **

FOR INFORMATION, CALL COLLECT

QUALITEST
Mr Urban ELLIS
(201) 792-2400

Notre client, un grand fabricant de matériel roulant de haute qualité réputé de par le monde, est installé dans la région de Montréal et emploie près de 800 personnes. Sa récente expansion, de même qu'une promotion interne, l'amènent présentement à rechercher les personnes suivantes:

Directeur de l'assurance-qualité

Appuyée par une équipe de 20 personnes dont 15 inspecteurs en assurance-qualité, la personne retenue sera responsable de la qualité des produits, et ce, de leur provenance des fournisseurs à leur expédition aux clients. Elle gèrera l'assurance-qualité en combinant les techniques administratives modernes à son jugement, et en tenant compte de la réalité d'une grande usine produisant massivement. Elle sera également appelée à faire affaire avec les autres installations de l'entreprise en Amérique du Nord.

Pour ce faire, vous devez être diplômé en génie et avoir de quatre à cinq années d'expérience dans une entreprise de montage à la chaîne. Il vous faut également avoir des qualités de chef et d'innovateur qui sauront susciter la productivité et l'attitude positive de vos collègues.

QUALITY ASSURANCE MANAGER WANTED

There is an opening for a bilingual QA Manager in a heavy equipment manufacturer of 800 employees.

Salary, based on experience is \$39-45000 a year.

Contact Ms Barbara JUDE at (514) 935-9810.

GW GRIFFITH WRAY & ASSOC.
CONSEILLERS EN GESTION

1411, rue du Fort, bureau 806, Montréal (Québec) H3H 2N6 (514) 935-8810

CF18 Update

2 February 1987

On 21 January 1987 a joint meeting of the IEEE, Society of Reliability Engineering, American Society for Quality Control and the Canadian Aeronautic and Space Institute was held at the Holiday Inn Seville. The topic of the meeting was the CF18 program. The presentation was made by General M. Ramsbottom.

We were initially introduced to the aircraft requirements for the Canadian Armed Forces. The aircraft selection process was described along with the length of time the program is to last; the aircraft is expected to serve Canada for at least twenty years. After looking at the requirements of the Armed Forces the CF18 was the aircraft chosen to best fit the role designated to be the selection team.

Among the aircraft's strong points were: ease of maintenance, reliability, good handling and strong acceleration, heavy payload, supplier support, and air-frame strength.

There have been some problems with the aircraft. These are being looked after by the manufacturer and the Armed Forces. The most publicized problem is the cracks on the tail of the aircraft. Aircraft manoeuvrability is restricted because of these problems.

One of the important parts of the CF18 program is the industrial spin-off. MacDonell-Douglas agreed to establish plants in Canada to manufacture various component for the CF18 or other aircraft. This program has been very successful at creating many jobs in the Canadian aerospace industry. An example is the General Electric plant to manufacture engines at Bromont.

The off base repair contract has been won by Canadair, thereby improving the employment picture in the Montréal area.

There were many questions from the floor about the program and the maintenance contract.

The evening was interesting for all of those who attended.



David Tozer



HELP HELP HELP HELP HELP HELP HELP HELP HELP HELP HELP HELP HELP HELP HELP

o We are looking for companies to sponsor the publishing of the Newsletter. We'll be glad to PROMINENTLY state the fact that you or your company has sponsored the Newsletter.

ADS, YOU SAY ? ?

Yes, we will publish ads in our Newsletter.
Contact our PUBLICITY man, David Tozer at 695-2028.

EXECUTIVE COMMITTEE MEETINGS

HIGHLIGHTS OF THE JANUARY 19, 1987 EXECUTIVE MEETING

The Section is looking for a means to finance the monthly Newsletter. Without a doubt this years' Newsletter is the best ever! The increased content however has also resulted in increased mailing costs. Sponsors are needed.

David Tozer is putting together a committee for Quality Month. Members are invited to participate.

We are on the right track! The Section has accumulated 2,521 points for the 1st Quarter towards the 1986-1987 Section Management Awards Competition (The Sadoris Award). Our goal this year is 10,000 points.

D. Deslauriers
Secretary

The executive committee meetings are open to all members. To attend a meeting, contact the Secretary, Debbie Deslauriers, at 744-1511 ext. 3246, for details of the upcoming meeting. We urge you, as a member, to participate in the activities of your Section.

EXECUTIVE COMMITTEE NOMINATIONS

If you're looking for a great non-paying job, here is your opportunity. The Montreal Section is looking for Section Officers or assistants for the 1987-88 season. Contact Charles CHEUN at (514) 395-7243 or drop him a line at:

+-----+
| CP RAIL |
| Mechanical Department |
| Quality Assurance |
| Rm 600, Windsor Station |
| Montreal, H3C 3E4 |
+-----+

Don't forget that we are interested in starting sub-sections. We need coordinators for that.

MEMBERSHIP:

Welcome to the following new members:

Lucio D'ALESSANDRO Bev A HAMER Thomas M KOLESSAR
ROLLS ROYCE CANADA BRISTOL AEROSPACE Ltd AVERTS LABORATORIES
Montreal, Quebec Sanford, Manitoba Rouses Point, New York

To obtain more information or an application form, just contact George Andrews at (514)341-7630 ext. 4629.

Total Montreal section membership is 334.

Congratulations to André DI SANZA who has obtained his re-certification as Certified Quality Engineer. I understand that André was recently promoted to Quality Engineering Manager at CANADAIR. All the best from all of us.

SUBJECT: ASQC KITCHENER QUALITY CONFERENCE

The Automotive Division together with Kitchener Section of ASQC and University of Waterloo is sponsoring a Quality and Productivity Conference. Our main effort is to present some of the latest State-of-Art Quality and Productivity improvement methods.

It is my personal feeling that presentations contain many of the key ingredients necessary for survival of our industries in this new era of international competition.

I am requesting your support for our conference by informing your membership as follows:

- Publicize our conference in your next newsletter.
- Announce a notice of our conference in your February and March meetings.

Your support is required to make this a successful conference in our most critical first year.

If we can succeed, it will assist us in making this an annual event which will be increasingly important for the survival and competitive development of our industries.

For any additional information, please call me at (519) 894-1000

Sincerely yours,

Rory S. Brooke

Harry G. Brooke
Q.A. Manager - Budd Canada Inc.
Regional Councillor - ASQC Automotive Division, Canadian Region

VISIT TO CIRCOCRAFT

C L E A N ! ! !

That sums up very well what all 26 persons saw at the Circocraft plant at Pointe Claire. This plant manufactures thick film hybrid circuits and multi-layer printed wiring boards.

This plant was rebuilt inside-out so as to create the special "Class 10000" and "Class 1000" clean rooms. These rooms have glass floor-to-ceiling walls looking into the reception area. This makes for a most interesting view of the production area for visitors to Circocraft.

We were received with a small buffet overlooking the laser trimming and masking areas (inside the clean rooms). The group was then split-up, shown a videotape presentation on the company and was able to tour the facilities including the clean-rooms. For those, we all dressed up in special disposable paper gowns, put on hair nets (because of my beard (I even had to put on a beard net), took an air shower(?) and walked through the rooms.

All the production area floors in the micro-circuit plant are made especially to protect the Static Sensitive devices being inserted automatically. Actually, they are so small I thought they were giuing bread crumbs onto the boards.

We also took a look at the PWBS area where multi-layer printed wiring boards are made.

Documents at Circocraft are prepared on a Xerox computer system which has graphics capabilities. Illustrations and document updates are thus quite simplified.

All in all, an enjoyable tour. Thanks to Messrs L. Mink, VP Hybrid Microelectronic Division and A. Gouder, Quality Assurance Manager, as well as their staff for making this visit a success.

JP AWIEL





KITCHENER SECTION OF THE AMERICAN SOCIETY FOR QUALITY CONTROL

KITCHENER, ONTARIO

IF YOU WANT TO BE THE BEST...

MANUFACTURING AND QUALITY TECHNOLOGY EXHIBITION

WE TAKE THIS OPPORTUNITY TO INVITE YOU AND YOUR STAFF TO OUR FIFTH MANUFACTURING AND QUALITY CONTROL EXHIBITION TO BE HELD APRIL 7 & 8, 1987, AT BINGEMAN PARK, KITCHENER, ONTARIO.

SHOW HOURS: APRIL 7, 1987 ----10.00am--6.30pm
APRIL 8, 1987 ---- 9.00am--5.00pm

THE OBJECTIVE OF THIS EXHIBITION IS TO INFORM ENGINEERING, MAINTENANCE, MANUFACTURING, INSPECTION AND QUALITY ASSURANCE PROFESSIONALS OF THE LATEST DEVELOPMENTS IN MEASUREMENT TECHNOLOGY AND QUALITY SERVICES SUCH AS TRAINING AND CONSULTING.

ABOUT THE EXHIBITION

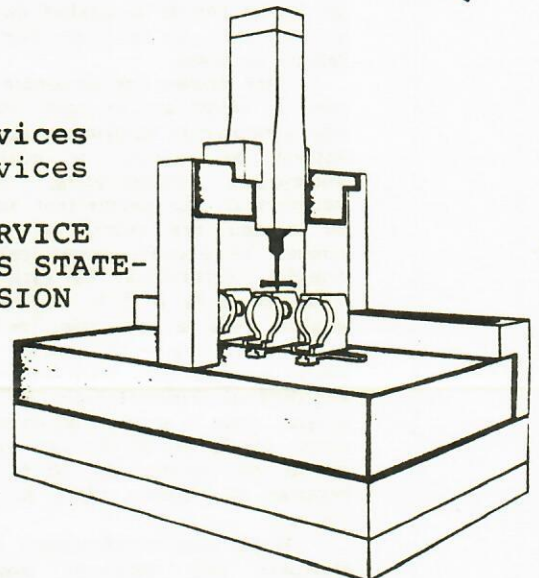
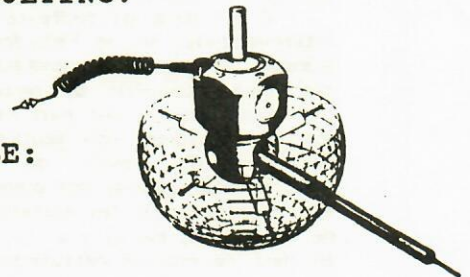
SOME OF THE TYPICAL AREAS EXHIBITED WILL BE:

- . Dimensional Measuring Equipment
- . Laboratory Equipment and Supplies
- . Electronic Test Equipment
- . Calibration and Measurement Services
- . Automated Inspection Equipment
- . Data Processing Hardware and Software
- . Non-destructive Test Equipment and Services
- . Consulting, Educational & Training Services

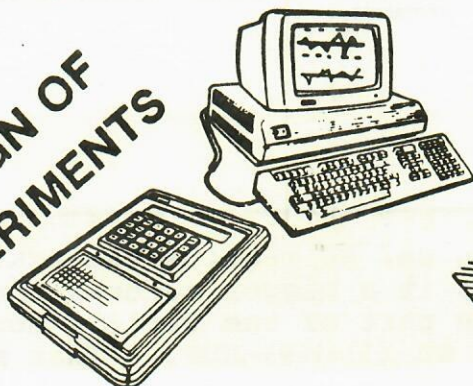
PRODUCTS FROM LEADING MANUFACTURERS AND SERVICE ORGANIZATIONS WILL BE DEMONSTRATED IN THIS STATE-OF-ART MULTI-MILLION \$ EXHIBITION. ADMISSION FEE TO EXHIBITION IS \$5.00.

FOR ADDITIONAL INFORMATION CONTACT:

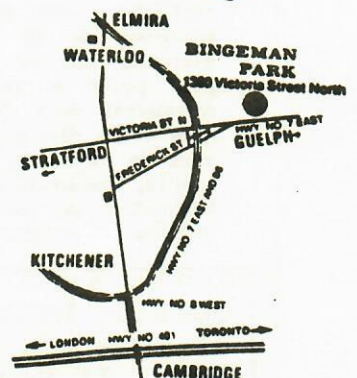
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Hobart Brothers of Canada (519)537-6291
JOHN TELLIAN - EXHIBITION ARRANGEMENTS
Bingeman Park Ltd. (519)744-1555
HARRY SCANLAN - PUBLICITY & ADVERTISING
Mitutoyo Canada Ltd. (416)821-1261



**DESIGN OF
EXPERIMENTS**



SPC





NATIONAL QUALITY MONTH • OCTOBER

Well its done !! The Provincial government, on the recommendation of M. Daniel Johnson, unanimously approved a motion to recognize October as QUALITY MONTH in Quebec. This was passed in the Débats de l'Assemblée nationale of the 28 October 1986.

M. Johnson introduced his motion as follows:

M. Johnson (Vaudreuil-Soulanges): Merci, M. le Président. Je remercie tous les collègues en cette Chambre de me donner l'occasion, en quelques minutes, de souligner combien important doit être le souci, pour toutes les entreprises québécoises, tous les Québécois, tous les organismes gouvernementaux, de faire en sorte que les biens et services produits ou distribués par l'ensemble des entreprises québécoises soient des biens et des services de qualité.

C'est dans un contexte de concurrence internationale, M. le Président, que je vous adresse la parole aujourd'hui. Nous savons que pour conquérir de nouveaux créneaux, pour nous assurer une part non seulement du marché canadien, non seulement du marché nord-américain, mais de l'ensemble du marché international des biens et services, il est important que les entreprises se soucient de la qualité, car il y a un coût qu'on paie, en part de marché décroissante, lorsqu'on ne se soucie pas de la qualité dans la prestation de services ou la production et la distribution de biens.

Des études ont démontré - c'est ce qui met le doigt sur le point important - que nos concurrents asiatiques, par exemple, ont atteint des niveaux de qualité dans leurs entreprises industrielles, manufacturières notamment, qui permettent une concurrence au niveau des coûts, au niveau du prix auquel ils peuvent livrer ces biens sur le marché international. On estime à 5 % ou à 7 %, de 5 % à 7 %, le coût de la non-qualité dans la production de biens dans les pays asiatiques - on parle notamment du Japon - alors que, pour l'ensemble des pays occidentaux industrialisés, ce coût de non-qualité dans la production de biens se chiffre entre 15 % et 25 %. On estime qu'il est même de l'ordre de 30 %, pour ce qui regarde le Québec, dans la production de biens.

Il est donc extrêmement important, afin d'assurer une meilleure position concurrentielle à nos entreprises, que nous nous soucions de la qualité. Les gestes, par exemple, que le gouvernement du Québec peut poser et doit continuer à poser se retrouvent dans des secteurs industriels où nous avons déjà eu l'occasion depuis plusieurs mois de parler de qualité, de contrôle de la qualité, notamment dans le secteur de la fabrication des pièces d'automobiles. Il y a certains programmes gouvernementaux,

comme celui de l'aide à la concrétisation de projets industriels, qui comportent des volets de qualité. Dans les programmes administrés auprès des entreprises par les directions régionales du MIC, il y a dans le programme désigné sous l'étiquette PRO-PME un volet qui privilégie une action particulière quant à la gestion de la qualité dans nos entreprises, ceci mis à part la documentation écrite, les documents audiovisuels, les séminaires et les colloques que le gouvernement, dans ses différentes instances, livre à l'ensemble des entreprises québécoises pour bien les sensibiliser à cette dimension de la qualité dans la production de biens et services au Québec.

Des économies importantes peuvent être réalisées mais d'abord, et je dirais avant tout, une nouvelle attitude de nos créateurs d'emplois, de nos entreprises, de quelque taille qu'elles soient, d'assurer une qualité optimale, maximale dans la production de biens et services, nous assurerait une part du marché croissante et, donc, une prospérité accrue. De nombreux organismes se soucient justement de cette dimension de la qualité dans la vie des entreprises, notamment - et j'aimerais souligner leur travail - l'Association québécoise de la qualité qui regroupe environ 600 membres, la section québécoise de la Société américaine de contrôle de la qualité qui, quant à elle, compte plus de 1000 membres, et évidemment, l'Association des chefs maîtres dont l'objectif est d'assurer par des communications constantes entre autres, cette recherche de la qualité dans la production québécoise.

Il est donc important que nous mettions en oeuvre des programmes d'amélioration de la qualité dans nos entreprises et que le gouvernement du Québec et l'Assemblée nationale du Québec, dans son ensemble, sensibilisent l'ensemble des entreprises québécoises à cette recherche constante de la qualité qui se traduit en fin de compte par une recherche constante et une atteinte de l'excellence que nous désirons tous citer en exemple à tous nos concitoyens. Je vous remercie.

Quality Month will soon be upon us. We require the assistance of some willing persons to make it a bigger success than last year. If you want to help or be part of the Quality Month Committee, contact David TOZER at (514)695-2028. That applies to those outside Montreal also.

Brainstorming's Begun For NQM 1987

Already ahead of where they were last year at this time, plans for National Quality Month 1987 are well underway. With the leadership of ASQC President-Elect J. Douglas Eking (Xerox), the guidance of Vice President, Section Affairs George Vorhauer (Eastman Kodak), and NQM Ad Hoc Committee Chairman Alan Key (Philip Crosby Associates), focus groups were nominated and formed. Consisting of 20-30 members, these focus groups met throughout January to critique past campaigns, suggest possible themes and promotional strategies, and act as a general sounding board to fine tune the campaign. The three regional committee chairmen, Paul Moser (Avon, East Coast) Mike Thomas (McDonnell Douglas, West Coast), and James McLinn (private consultant, Midwest) are coordinating resources and centralizing input. A strong, well-organized campaign is thus in the works. Make your ideas a part of the excitement. Paul Moser can be contacted at: (212) 546-6022; Mike Thomas at (714) 896-2672; and James McLinn at (612) 824-7312. Any further information can be obtained by calling George Vorhauer at (716) 588-3905 or Lynn Kallas, ASQC senior public relations coordinator at (414) 272-8575. Updates of the focus group meetings will be found in future issues of *On Q*.

■ The answer will be in the premier issue of *The Quality Review* scheduled for release in mid-March. *The Quality Review* is ASQC's new quarterly magazine for upper management (see *On Q*, May 1986).

The premier issue, sponsored by AT&T, will feature the NIPPONNEUROSIIS cover story by A.V. Feigenbaum; an analysis story on "Reliability in a Throwaway Society" by Thomas Hine, author of the new best seller, *Populuxe*; a profile on First Chicago; and an interview with Father Theodore Hesburgh, president of Notre Dame. In addition, this issue will begin a four-part series on the 1986 ASQC/Gallup survey with distinguished executives commenting on selected questions. An ASQC commentary written by President Dana Cound (GenCorp) completes the editorial content of the first issue.

According to Josh Hammond, publisher, "Everything is going smoothly. Only the anticipation is getting out of control." Editing and production have been facilitated by Brenda Niemand, who will be working for us on a contract basis as needed in the role of assistant editor. Brenda is the former managing editor of the book division of the American Heritage Publishing Co. She has publishing experience with *House & Garden*, *McCall's*, and the Metropolitan Museum of Art. She is a Phi Beta Kappa from Duke University with a major in English Literature.

Josh and Brenda can be reached in New York City at the following address: 253 West 73rd Street, Suite 2C, New York, NY 10023. Telephone: (212) 724-3170; telefax: (212) 362-0128.

Scientists Try Using AI to Make Money

Scientists at the Oak Ridge National Laboratory in Tennessee are exploring the use of artificial intelligence techniques to help in the production of U.S. currency. One application is in the formulation of inks, where an expert system has been used in a somewhat limited sense to help in the mixing of ink components.

A more important goal is to develop a machine-vision system for inspecting printed notes. The current process is very labor-intensive, with each note requiring about 2 seconds to be examined by a trained worker.

Developing a system to detect flaws in printed matter as complex as a currency note is a formidable task. According to Carroll Johnson, a research scientist at Oak Ridge, the problem is

compounded by the fact that machines might recognize flaws differently than humans do. For example, a human might immediately spot a flaw in George Washington's nose but miss a flaw in one of the many scrolls on a one-dollar note. A computer, however, might do the opposite.

The Oak Ridge group is surveying human inspectors to determine what mistakes they would most likely catch, the goal being to develop a model of human perception. Later, a machine-vision system will be tailored to emulate that model. The Oak Ridge group hopes to have a working currency-inspection system ready for the Bureau of Engraving by 1990. A similar system might also be used in the production of postage stamps.

NUTS TO YOU

The US Department of Agriculture (USDA) has moved to implement a smart card-based peanut marketing system. The program, designed to automate the peanut buying and selling process, began with a pilot test last year at five buying points in the state of Georgia. Although the test involved only 150 peanut farmers in three counties, the first phase of the implementation involves 46 buying points and 3,000 farmers in 19 counties.

Smart cards, which are the same size and thickness as conventional plastic cards, contain a built-in microprocessor with about 8K of user memory, plus processing power and security protection. The cards store data such as a farmer's name and address, farm quota pounds, crop loan eligibility and farm number. When a farmer brings his crops to a buying point, the card is inserted into a terminal. The card is read and a full history of transactions in the peanut marketing program is displayed. Based upon that information, a buyer can decide whether to buy the crop under the quota or non-quota program and the new sale is recorded on the card.

Sales transaction data is transmitted to a central state office and is used to formulate peanut program policies.

How to Analyze Reliability Data

This one-day course covers the basics of collecting and analyzing reliability data to make informed decisions on warranty costs, preventive replacement, design changes and comparisons of vendors, materials, operating environments, etc. This course is aimed at engineers and others involved in reliability testing, design, product service, maintenance of production and plant equipment, and field data collection and analysis. Submit the \$225.00 fee (\$195.00 if paid by April 20) to Registrar Wayne Nelson at 739 Huntington Drive, Schenectady, NY 12309 or call (518) 346-5138. The fee includes coffee breaks and the ASQC booklet *How To Analyze Reliability Data*, authored by the instructor, Wayne Nelson.

Researchers Claim Working Part-Time at a VDT Poses No Threat to Pregnancy

Two researchers have concluded that pregnant women who work at VDTs less than 20 hours a week don't appear to be at higher-than-normal risk of having a miscarriage. However, they cautioned that more study is needed to determine if women who work at VDTs more than 20 hours a week run a higher risk.

According to William Butler at the University of Michigan, who teamed with colleague Kelley Ann Brix to study the 817 pregnancies of 728 women. "Pregnant women who worked 1 to 20 hours a week at VDTs had the same miscarriage rates as women who did not work at the machines." Of 697 pregnancies among women working 1 to 20 hours a week at a VDT, there were 145 miscarriages, which Butler and Brix said were about as many as expected. But of the 120 pregnancies reported by a group working more than 20 hours a week, 26 ended in miscarriage, "about four more" than expected.

The study was funded by the March of Dimes, which is still examining possible effects of VDTs on birth defects. Brix said more work is needed to find out if using a VDT full-time is hazardous to pregnant women. The National Institute for Occupational Safety and Health is conducting a study that will focus only on full-time VDT workers.

Automation and Quality Control — A Sharper Focus

There is no shortage of statistics dealing with the semiconductor industry, although there is considerable disagreement concerning the interpretation of the facts. Quality, or lack thereof, is still perceived as the major cause of the Western nations' loss of market share to Japan and other competitors. Also, lower costs of the Japanese product have become a serious problem for memory devices, in particular.

Concerning the quality issue, the Western nations were far ahead of Japan in terms of product quality until about the mid 1970s. At that point Japan, which had been improving quality of product at a steady, rapid pace for many years, first equalled and then surpassed the Western nations, whose rate of quality improvement, although steady, has been much slower than that of Japan. Since the early 1980s, although the rate of product quality improvement of the Western nations has increased to substantially the same as that of Japan, the gap between actual product quality levels is not closing. The Japanese currently enjoy

clear superiority.

The Japanese are not magicians; rather, they are very persistent in their analysis of each and every device or process failure mechanism. Such analysis is not exciting or dramatic; it is simply hard work that ultimately pays off. These scientific and engineering analyses must support day-to-day activities in real time. The Japanese realize that this ongoing diligence is essential for success in negotiating the learning curves of both device design and fabrication technology to improve quality and yields.

Automation continues to be one key to both improved quality and higher yields. If each item of existing state-of-the-art fab equipment were 99 percent efficient, the overall yield after just 10 process steps would be about 90 percent. After 50 steps it would be only 60 percent, and this would drop to 37 percent after 100 steps.

Successful automation in any field requires highly consistent equipment and materials. For the fabrica-

tion of semiconductors, material purity is essential, but uniformity in this respect is difficult to achieve from batch to batch. The fabrication equipment must also be fully characterized and the data must be used to specify and maintain real-time processing parameters for each step.

Much of today's equipment is less than 99 percent efficient. Moreover, for practical reasons it should not be expected to perform flawlessly at its performance limits. A conservative approach backs off a bit at each step, demanding something less than ultimate performance. With this approach, consistency will improve, making possible improved product quality at an acceptable yield. If it enters the market early enough, by taking such a conservative approach, with diligent attention to detail, virtually any nation can be competitive in a worldwide market, keeping in mind constantly that the customer expects, and can always get, high quality at a reasonable price — somewhere. — TT ■

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