

# ASQ Statistics Division Newsletter

Volume 6, Number 4, November 1985

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# Chairman's Message

## "How To" Booklets Series

As I am sure you are aware, the Statistics Division is responsible for the development of the ASQC Basic References in Quality Control; Statistical Techniques booklet series (often referred to as the "How To" Booklet Series). I am delighted to report that we recently reached agreement with the Publication Services Department of ASQC to make available to each Statistics Division member a complimentary copy of one of the booklets from this popular series. Each of you may select one of the ten titles currently in print to receive as a free copy. In addition, all of the booklets will be available for sale to Statistics Division members at specially reduced prices. These booklets are excellent references and I strongly encourage you to avail yourselves of this opportunity. Information on the booklets and details on how to obtain them are described in this newsletter.



## Fall Technical Conference

Congratulations are in order to the entire program committee of the 29th Annual Fall Technical Conference which was recently held in Corning, NY. The strong technical program was a major contributing factor to the success of the conference. Steve Bailey represented the Statistics Division and coordinated our activities. This is the first year in which the Statistics Division co-sponsored the Fall Technical Conference. We look forward to continued active participation in this very successful and worthwhile event.

## National Quality Month

As many of you know, October is National Quality Month. In support of Quality Month activities, the division contributed \$250 to the ASQC national Quality Month Fund which provides financial support for the national "Quality First" promotion program. We also worked with the American Statistical Association Committee on Quality and Productivity to encourage joint programs between ASA Chapters and ASQC Sections during October.

## Expanded Role

In my remarks in the July issue of the Statistics Division Newsletter, I proposed that we increase the number of collaborative activities with the divisions and local sections of ASQC as well as with other professional organizations. I am very happy that we have initiated several joint programs with ASA. In addition to our National Quality Month activities with the ASA Committee on Quality and Productivity, Lynne Hare is forming another joint effort with this committee to examine the feasibility of writing a brochure on the role of statistics in quality and productivity improvement. This will certainly help promote the use of statistics as an important tool to improve quality and hence productivity. The Statistics Division also co-sponsored a session on "Standards for Statistical Method and Sampling" with the ASA Committee on National and International Standards at the ASA Annual Meeting in August.

Mike Mazu, our Education committee Chairman, is updating the Statistics Division Speakers List and will be working with our regional councilors to establish collaborative projects with ASQC local sections. I am still hoping to enlist the active involvement of individuals who hold dual memberships in the Statistics Division and one or more other divisions of the society. These individuals are in an excellent position to explore ways in which we may work more closely with other ASQC divisions. Please contact me if you have any ideas on this subject or are in a position to act as liaison between the Statistics Division and another ASQC division.

The success of our efforts this year depends upon your active participation. I welcome your comments and suggestions and encourage you to write or phone me. The contact I have had with a number of you since taking office has been most enjoyable and informative.

*"While we consider when to begin, it becomes too late." —Latin Proverb.*

# Annual Conference on Applied Statistics

The 41<sup>st</sup> Annual Conference on Applied Statistics will be held at the Claridge Hotel in Atlantic City, NJ on December 2-4, 1985. There are two parallel sessions with six three-hour tutorials in each. One session is oriented toward the pharmaceutical industry, while the other covers general statistical topics and quality control.

Preceding this Conference are two two-day short courses on November 30 and December 1 on Data Analysis and Interpretation of Chemotherapy Trials by Professor Walter H. Carter, Jr. and Statistical Inference Based on Ranks by Professor Thomas Hettmansperger. Information may be obtained from Walter R. Young, Medical Research Division, American Cyanamid Company, Building 60. Room 203, Pearl River, NY, 10965.

# Conference on Advances in Statistical Quality Control

The "Conference on Advances in Statistical Quality Control" was held at the University of Manitoba on June 4-6, 1985. The conference included papers by Dr. Roger W Berger (Iowa State University), Mr. M. James K. Booth (Statistics Canada), Dr. George E. P Box (University of Wisconsin), Dr. Herbert T. David (Iowa State University), Dr. H. James Harrington (IBM), Dr. Thomas Hsiang (Bell Communications Research), Dr. J. Edward Jackson (Eastman Kodak Company), Dr. James M. Lucas (E. I. DuPont de Nemours & Co., Inc.), Dr. Lars Lyberg (Statistics Sweden), Ms. Mary Natrella (U. S. National Bureau of Standards), Dr. John Neter (University of Georgia), Dr. Robert N. Rodriguez (SAS Institute, Inc.), Dr. Edward G. Schilling and Paul A. Miller (Rochester Institute of Technology), Dr. Genichi Taguchi (Japanese Standards Association), and Mr. Brian G. Young (Electronics Products Testing Center Alberta Research Council). The proceedings of the conference will appear in a special issue of the journal *Communications in Statistics* soon with Dr. Lai K. Chan, University of Manitoba, as the guest editor.

# Region Councilor Revisions

New Region 13 Councilor: Stephen B. Vardeman  
Department of Statistics  
Iowa State University  
Ames, Iowa 50011

The Region 9 Councilor: Carlos Morena can be reached at  
Ultramex Corporation 1313 E. Kemper Rd.  
Suite 300  
Cincinnati, OH 45246  
(513) 671-5142

# 1986 Fall Technical Conference

The 30<sup>th</sup> Annual Fall Technical Conference will be held October 23 and 24, 1986, at the Adam's Mark Hotel, Charlotte, North Carolina. The Conference is co-sponsored by the American Society for Quality Control (Chemical & Process Industries Division, Statistics Division) and the American Statistical Association (Section on Physical & Engineering Sciences). The theme is **Statistics and Teamwork; Keys to Quality Improvement**.

Persons interested in presenting a paper for any of the three parallel sessions (Statistics, Quality Control, and Tutorial) should send the title of the paper and an abstract (100 words) to any of the program chairmen of the sponsoring organizations. The session on statistics should be kept at or below the level of *Technometrics*, quality control and tutorial at or below the level of the *Journal of Quality Technology*. The sponsoring organizations are ASQC-CPID: David C. Stump, Tennessee Eastman Company, P. O. Box 1973, Bldg. 284, Kingsport, Tennessee 37662; ASQC-SD: William H. Woodall, Department of Statistics, University of Southwestern Louisiana, P.O. Box 41010, Lafayette, Louisiana 70504. ASA-SPES: David L. Sylwester, Department of Statistics, 332 Stokely Management Center, University of Tennessee, Knoxville, Tennessee 37996-0532.

# Speakers List

Persons who would like their names to appear on a Statistics Division Speakers List are invited to contact the Division through their Regional Councilor or

Michael J. Mazu  
B.F. Goodrich Tire Group  
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# Minipaper: Choosing Subgroup Size on the Basis of Control Chart Sensitivity for X-Bar Charts

Gerald B. Heyes

Many factors affect the choice of rational subgroup size for x-bar charts, including ease of calculation, the nature of the data (e.g. destructive or non-destructive tests), availability, tradition, and economics. In this paper we consider the relationship of subgroup size and the sensitivity of the chart.

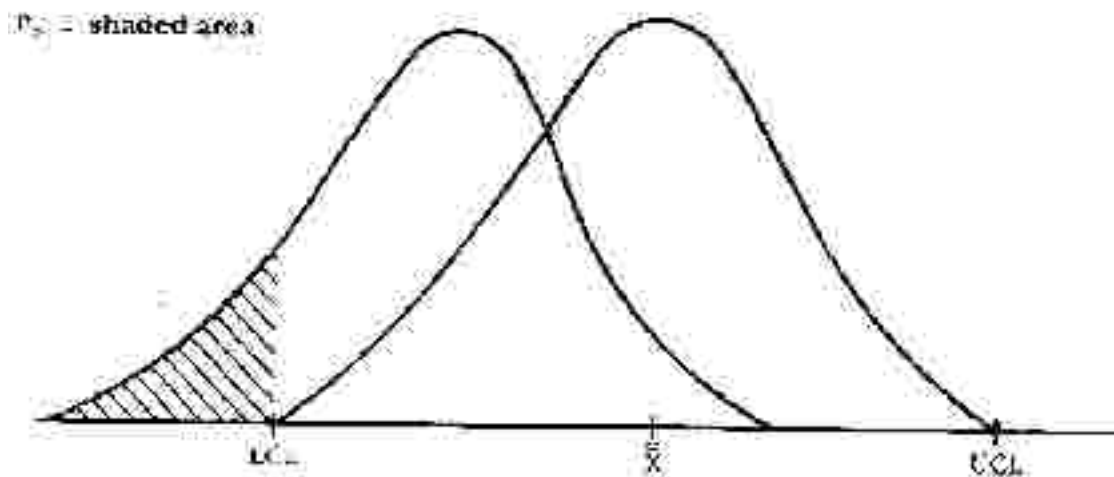
In [Figure I](#) a distribution of averages from a stable process is shown, as is a shift in the distribution. The quantity of interest is  $P_d$ , the probability of detecting a shift of given size. From [Figure I](#) we see that  $P_d$  is the area beyond LCL.

Since the control limits are determined by subgroup size (wider limits for smaller  $n$ ) this area will be, for a given shift size, smaller for smaller  $n$  and, of course, larger for larger  $n$ . In the early history of a process, larger subgroups with higher sensitivities may be desired, but normally smaller subgroups may be chosen to avoid needless adjustments or investigations when shifts of relatively small magnitude occur.

[Table I](#) gives  $P_d$ , in percent for shifts with  $Z = 0.5$  (0.5) 3.0 and subsizes  $n = 3(1) 10, 16, 20, 25, 30$ .

Calculation assumes that the only of lack of control is a point out of range LCL to UCL, so that the table entries are lower bounds for the actual  $P$  when other signals are also used, e.g. long runs above or below the center line. Note that large changes are usually detected for  $n$  in the range 4 to 6,  $n = 5$  is traditionally a popular choice, but  $n = 4$  is not much worse. For example, sampling  $n = 4$  pieces every 90 minutes or  $n = 5$  pieces every two hours both give 20 measurements in an eight-hour shift, and the choice between them may be based on convenience.

Figure I



## Table I Sample Size

Shift	3	4	5	6	7	8	9	10	16	20	25	30
.5	1.7	2.3	3.0	3.8	1.7	6.0	6.7	7.8	16	22	31	40
1.0	10	16	22	29	36	43	50	56	84	93	95	99
1.5	35	50	64	75	84	89	93	96	-	+	+	+
2.0	68	84	93	97	99	+	-	+	-	+	+	+
2.5	91	98	+	+	+	+	-	+	-	+	+	+
3.0	99	+	+	+	+	+	+	+	+	-	+	+

## References

Ott, Ellis R. 1975 *Process Quality Control* pp. 53-56

## About The Author

*Gerald B. Heyes is Quality Assurance Manager with MDA Scientific, Inc. in Lincolnshire, Illinois, and a Senior member of ASQC. With nine years quality experience in the electronics and chemical industries, he is a CQE and holds a bachelor's degree from Blackburn College in Carlinville, Illinois. He has taught statistical quality control for three years and has served on both education and seminar committees for the St. Charles section of ASQC.*

# News from ASA Committee on Quality and Productivity

**By Gerry Hahn**  
**General Electric Company**

The American Statistical Association's Committee on Quality and Productivity has been involved in many exciting undertakings since my report in the January 1985 Newsletter. The committee was organized in 1984 to foster:

- Greater awareness of the role of statistics in quality and productivity improvement.
- Improved training programs for those within and outside the statistical community.
- Better communication among statisticians, and closer co-operation with other groups, such as ASQC and the American Quality and Productivity Institute (AQPI).

We are especially pleased to announce the formation of a joint task force with the Statistics Division of ASQC, to develop a brochure on the role of statistics in quality and productivity improvement. The task force is under the leadership of Lynne Hare (Thomas J. Lipton, Inc., 800 Sylvan Ave., Englewood Cliffs, NJ 07632). Anybody interested in participating in this effort is urged to contact Lynne. Some other recent happenings are:

- Joint meetings were held throughout North America, in honor of National Quality Month, between local sections of ASQC and ASA chapters. This effort was organized by Dick Gunst (SMU) and Bob Mason (Southwest Research Institute, San Antonio, TX). They would welcome feedback on the results.
- The committee has formally established a yearly Research Conference on Quality and Productivity as a continuation of the on-going Mohonk conference organized and sponsored during the past two years by AT&T Bell Labs. The conference will be a self-standing organization, under its own Board of Directors (currently chaired by Tom Boardman, Colorado State University). Next year's conference will be at Oakland University, MI, on June 3 to 5 and is being organized by a committee under the leadership of Stu Hunter (Princeton, NJ).
- A directory of the existing statistical literature in quality and productivity has been developed by Steve Vardeman (Iowa State University) and John Cornell (Florida State University), through the auspices of the Publications Subcommittee.
- The Subcommittee on Measures of Productivity, under the leadership of Jerome Mark (Bureau of Labor Statistics), has developed a draft of a report on "Productivity Measures Developed by the Federal Government" to provide a foundation for subsequent evaluations.
- A new subcommittee, concerned with Services and Support Groups, has been formed under the leadership of Bill Latzko (North Bergen, NJ). This group has drafted a bibliography as its first project. Another new activity is the Subcommittee on Long Range Planning, under the leadership of Steve Vardeman. Its role is to develop long-term goals and plans for statisticians engaged in quality and productivity improvement in general and for our committee in particular.

- The Research Subcommittee, now under the leadership of Larry Crow (AT&T), has established task forces dealing with proposals, programs and dissemination.
- Over 50 members and friends of the committee provided inputs to two articles, authored by Gerry Hahn and Tom Boardman, on the role of statistics in the new quality era. The first article appeared in Amstat News in March 1985; the second is about to be published in Quality Progress. The committee, under the leadership of Tom Hsiang (Bell Communications Research), sponsored a one-day Continuing Education seminar by Dr. Genichi Taguchi and his associates prior to this year's national ASA meetings. The committee also sponsored various sessions at the meeting.
- The committee joined ASQC in accepting an invitation from the American Quality and Productivity Institute, to be designated a "cooperating organization." We are also actively participating in the work of the ASQC/AQPI Educational Forum.
- A team has been established under the leadership of Fred Faltin (General Electric) to coordinate various efforts within the committee to promote and document case studies. A conference devoted to teaching statistics for management is being planned in 1986 by Harry Roberts and George Tiao (University of Chicago).

We continue to welcome willing workers. Those interested are urged to contact any of the activity leaders identified above and in the January 1985 Newsletter or to let me know (3A27, K1, P.O. Box 8, GE CRD, Schenectady, NY 12301). We would also welcome any comments or suggestions.

# Minipapers

Division members are encouraged to submit minipapers on topics of interest. Minipapers are not formally refereed, but they are edited for length and clarity. The queue of papers is currently quite small; send yours in now for prompt attention.



# Volume 1: How To Analyze Data With Simple Plots

**Wayne Nelson**

Data analysis with plots is simple and informative. This booklet explains how to make various plots and interpret them. The plots include: histograms and probability plots for information on a distribution; crossplots for relationships between variables and for variables as a function of time, and hazard plots for product life data. These simple methods are carefully, explained with business and engineering data. Basic knowledge of the normal and Weibull distributions is needed for some parts of this booklet.

**T3501 Price \$4.25**

# **Volume 2: How To Perform Continuous Sampling (CSPO)**

**Kenneth S. Stephens**

Continuous sampling plans were devised for processes involving a continuous or nearly continuous flow of products or other entities. This booklet explains (how to perform) continuous sampling plans. Included are selections of various types of plans, determining parameters, operating the plans and evaluating the performance of the plans. A brief background introduction to acceptance sampling is included. The booklet traces the development of various types of continuous sampling plans. Schematics, nomographs, and tables are included to assist the user. A comprehensive set of references is given to allow for further study of the techniques and principles.

**T3502 Price \$5.50**

# **Volume 3: How To Test Normality And Other Distributional Assumptions**

**Samuel S. Shapiro**

A distributional model underlies most statistical procedures. Decisions based on use of these procedures can be erroneous if the underlying distributional model is incorrect. This booklet describes several procedures for testing distributional assumptions. It includes probability plotting (a graphical technique) and a number of the most powerful analytical procedures for testing normality and exponentiality. The booklet assumes that the concepts underlying tests of hypotheses are understood; however enough details are given so that the reader can carry out each of the tests. Tables required for most of the procedures are included (although only references to other sources are given for a few of the procedures). Sample sheets of probability paper have been included,

**T3503 \$5.50**

# **Volume 3: How To Perform Skip-Lot and Chain Sampling**

**Kenneth S. Stephens**

This booklet in the basic reference series describes the principles, procedures, techniques, and applications of skip-lot and chain sampling. While both of these sampling procedures have been around for some time, their potential for widespread application has not begun to be realized. It is the author's hope that recent work on further developments of these procedures along with this booklet will assist the understanding and application of these techniques-in addition to further practical developments.

**T3504 \$4.50**

# **Volume 9: How To Use Regression Analysis In Quality Control**

**Douglas C. Crocker**

This booklet introduces the reader to the general principles involved in regression analysis (RA) and its use in quality control. The simple (one-predictor) model is examined in detail using a worksheet presuming that "hand (pocket calculator) calculations" will often be appropriate. Example applications are presented. Basic understanding of significance testing and the construction of confidence intervals is assumed.

**T3509 \$9.95**

# Statistical Techniques Booklet Series An Idea That Has Become A Reality

**By John A. Cornell and Samuel S. Shapiro**

At the 1974 Annual Technical Conference (ATC), the Statistics Technical Committee (STC), chaired by Dr. Harrison M. Wadsworth, Jr., discussed plans for providing additional publications in the area of statistical quality control. Under Harry's leadership, it was proposed that "A list should be drawn up of the basic areas to be covered. Then for each area, expository articles which cover these areas should be enumerated."

At the May 1975 meeting in San Diego, California of the STC, attended by H. M. Wadsworth, Edward J. Dudewicz, Robert A. Abbott (ASQC Hdqs. Technical Director), Joseph W Foster, C. Anthony Miller, Harry G. Romig, John S. Ramberg, Dwane L. Dietrich, Wendell F. Paulson, T. Calvin, and R. Freund, Mr. Abbott expressed his hopes and desires for the STC to develop and expand its activities over the next couple of years in such a way that it would become a Division of ASQC. One of his suggestions was for the committee to provide a series of statistical publications (something like 20 pamphlets for the statistical layman). Dr. Ed Dudewicz proposed a bibliography on statistical topics and suggested separate chapters (each a pamphlet) be written which later would be collected into a book. The pamphlet plans were approved at the 1975 ATC and Ed was appointed as Editor for the series, to be called *The ASQC Basic References on Statistical Quality Control*.

In July 1975, Chairman Wadsworth sent out an announcement of the booklet series to all members of the STC stating, "The aim of this series of booklets is to survey areas of statistical quality control, to show what sorts of problems they can solve, and to tell where to go for more details. Thus it would be strongly differentiated from QC handbooks and encyclopedias, which could become references as to where to go for details. For example, an individual requesting information on QC for a specific need could find the power and use of the statistical techniques in this series (so that he might assess better what it could do for his company), and he would be told where he (or a qualified QC person) could find technical details on the area." He went on to say, "In order to meet the above needs, each booklet will approximate 60 printed pages, including a ten-page listing of extensively annotated references. In order to meet the need for editing, selection, and uniformity the Editor will seek an individual of high ability (perhaps even of eminence) in each area to prepare a 100 page (typewritten double-spaced) manuscript surveying the area of his booklet. The usual format will be: a 20-page survey of the area (perhaps told in the form of a case study, preferably drawn from a real-world situation) and its use in a basic situation; followed by details of perhaps 10 or 15 applications in the QC literature (a page or two on each of these) to provide a vital tie with real applications; followed by a 50-page discussion of the area in more detail (something like sketching its skeleton, with references given for the details of the flesh); followed by 20 pages of annotated references." Also, in order to keep notation standardized, "Each author will be asked to follow the Glossary and Tables for Statistical Quality Control."

In December, 1975, the Publications Management Board approved the booklet series and in January, 1976, Editor Dudewicz, assisted now by Paul Feder, changed the title to its present title, *The ASQC Basic References in Quality Control: Statistical Techniques*. (In a handwritten letter from Harry to Ed, Harry

alludes to Lloyd Nelson as being primarily responsible for the suggested change in title.) The initially proposed size of 60 pages per booklet was reduced to approximately 20 pages per by limiting the scope of each topic presented as well as the number of references selected.

In March of 1976, the original Review Board was formed. The members were Norman L. Johnson, H. Alan Lasater, Joseph W. Foster, and Glenn Eversen. Shortly later Edward A. Sylvestre and Harry Wadsworth were appointed to the board. Professor Paul I. Feder was contacted to author the first booklet "How to do QC calculations on a pocket calculator."

Shortly after the ASQC 1979 Annual Technical Conference, Volume 1: "How To Analyze Data with Simple Plots" by Wayne Nelson, appeared in print. At the ATC, Dr. Nelson conducted a 1.5 hour tutorial on his booklet for over 200 people while Dr. Kenneth S. Stephens also presented a tutorial on his booklet, Volume 2: "How to Perform Continuous Sampling (CSP)," The newly formed Statistics Division, under the leadership of founding chairman, William G. Hunter, assumed the responsibility of sponsoring the booklet series.

Seeking partial relief of the editorial duties that he had meritoriously performed for nearly 3 ½ years, Ed Dudewicz invited Professor Sam Shapiro to serve as Assistant Editor of the booklet series in January 1980. At that time Sam was completing the authorship of Volume 3: "How to Test Normality and Other Distributional Assumptions," and accepted.

At the 1980 ATC in Atlanta, a changing of the editorial guard was completed when Professor John A. Cornell agreed to serve as Co-Editor of the booklet series with Sam. Since that summer of 1980, the two have worked together in expanding the booklet series to the current status of ten volumes. The Editorial Review Board has also expanded by the inclusion of such names as Saul Blumenthal, Gerald Hahn, and Alan Gross. Additional reviewers worthy of our thanks and recognition are Cuthbert Daniel (Vol. 1), Peter R.B. Whittingham (Vols. 2 and 4), Bill Bolstad and K.O. Bowman (Vol. 3), Hubert M. Hill and Douglas C. Montgomery (Vol. 5), Nancy R. Mann (Vol. 6), Shaul Ladany (Vol. 7) and J. Stuart Hunter (Vol. 8).

From the days of its inception, the aims of The *ASQC Basic References in Quality Control: Statistical Techniques* booklet series have remained fixed: To survey topics in statistical quality control, show what sort of problems they can solve, and tell where further techniques of the types discussed can be located in practical (usable) form. It is also the aim of the booklets to provide the quality practitioner on the everyday firing line of a manufacturing plant with specific ready-to-use tools for conducting statistical analysis in the quality investigative process.

In keeping with these aims, the booklet series has received continued support over the years. In Volume 1, Number 1 (February 21, 1980) of the Statistics Division Newsletter, Philip B. Crosby (President, ASQC) called the comprehension and handling of statistics "...the most basic of needs for all of us..." He went on to state that "Without numerical information in its most precise form, we cannot complete our responsibility, to management and other fellow employees. And without the tools to first comprehend and then explain the analysis, we are equally impotent." At the 39th Annual Quality Congress, in his Shewhart Medal Address, Professor Norman L. Johnson singled out the booklet series in more specific terms by stating, "Each of these little booklets explains the nature and purpose of a specific set of statistical techniques, and explains how to use them in solution of QC problems. ...I recommend you keep a set handy on your desks."

While the current status of the booklet series is one of good health, it has nonetheless experienced its growing pains. As Editor, Ed Dudewicz recognized the need to reward the authors of booklets for their time and energy spent writing. He proposed to offer each author some type of remuneration either in the form of royalties from booklet sales or by offering the author the opportunity to present a tutorial session on the booklet topic at the ATC or Annual Quality Conference. ASQC denied the first suggestion but supported the second idea. At the 1984 Annual Quality Conference, a popular decision was made by ASQC. As of July 1, 1984, royalties in the amount of approximately three percent (3%) will be paid to authors of new booklets, a plaque or similar memento will be presented to each author in recognition of his/her contribution to the Statistics Division, ASQC, and the field of quality, and an invitation will be extended to each author to present a tutorial on the booklet material at one of the national conferences. We applaud ASQC for their decision.

Looking to the future, we see many opportunities for the booklet series to make an impact on our profession. In his incoming Chairman's message, Pete Jacobs stated, "The 'How To' booklet series has been one of the most valuable contributions made by the Division to ASQC and the field of quality." Pete, like those chairmen before him, has promised to work with the booklet series by promoting its role in the effective use of statistical methods in the field of quality wherever they may be most appropriately used. Now it is up to us as Division members to see that the booklet series does fulfill its role. As Editors we invite prospective authors and reviewers to get in touch with us and give us your suggestions of topics that you would like to see in print as well as your willingness to become involved in this very worthwhile project of the Statistics Division. We welcome, no more importantly, *we need your support*. In fact, a partial listing of topics that have been suggested is:

1. How to Control Two or More Related Variables
2. How to Use Prediction/Tolerance/Confidence Intervals
3. How to Design and Analyze Repeated Measurement Experiments
4. How to Use Control Charts for Variables
5. How to Use Evolutionary Operation (EVOP) Procedures
6. How to Use Sequential QC Methods

# 1985-86 Statistics Division Officers

## **Chairman:**

Peter J. Jacobs  
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## **Chairman-elect:**

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# Editor's Corner

## Tony Salvia

I am happy to be able to serve the Division as the new editor of this newsletter. Ed Mykytka has done such an outstanding job in this position that he'll be a tough act to follow.

The newsletter exists to serve your needs. We welcome any suggestions you have for things you'd like to see, any Queries and Questions, and any contributed minipapers.

Of special note in this issue: the information about the "How To" booklet series. These booklets are extremely informative and helpful, and the price structure is so attractive that we're confident that many Statistics Division members will want the full set.

Once again, I'm happy to be serving as editor, and I'd like to hear from you with your ideas for this newsletter.