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Roger was so special. If you thought you had a good idea, it was smart to first pass it by Roger. He would think about your idea for a while, and then in his ever nice way tell you if he thought it was indeed a good idea. Then he would think about it some more, and come up with an even better idea.

This symposium is dedicated to Roger Herriot, a unique and wonderful person. We will all miss him.

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Executive Director
COPAFS

Part 1

KEYNOTE ADDRESS

IMPROVING THE QUALITY OF FEDERAL STATISTICS

IMPROVING THE QUALITY OF FEDERAL STATISTICS

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1. Introduction

This is the second seminar hosted by the Council of Professional Associations on Federal Statistics (COPAFS) related to the Statistical Policy Working Paper Series of the Federal Committee on Statistical Methodology (FCSM). In deciding on a theme for this talk, I reviewed the working paper for the previous seminar, entitled *Seminar on Quality of Federal Data* (U.S. Office of Management and Budget, 1991). As my title indicates, I have chosen a similar theme. Within the broad subject of "Improving the Quality of Federal Statistics", my main focus is on approaches to improving quality across the federal statistical system as a whole rather than in specific programs. I shall also pay particular attention to the role that the FCSM can best play in achieving the objective of quality improvement.

At the outset I should make it clear that my choice of topic is not to be taken to imply any criticism of the current quality of federal statistics. Indeed, I have a high regard for the federal statistical programs and the professionalism of the federal statistical workforce. Rather, my comments are made from the perspective that, however good the current situation, improvements are always possible.

Equally, my discussion of the role of the FCSM should be interpreted in the same light. Like Bob Groves, who gave the keynote address at the previous seminar, I believe that the FCSM and its working paper series perform a valuable service towards the goal of improving the quality of federal statistics. The working papers also make an important contribution to the general survey and statistical literature. For example, like Bob, I have employed the working papers for teaching purposes. Last fall, I used the excellent recent working paper on indirect estimators (U.S. Office of Management and Budget, 1993a) in my sampling course in the Joint Program in Survey Methodology. The suggestions made below for the Statistical Working Paper Series are offered in the spirit of seeking improvements in a series that has established itself as an extremely useful product.

2. Factors Involved in Quality Improvement

In discussing improvements in the quality of federal statistics, I am interpreting the term "quality" to include not only the production of accurate estimates, but also the production of relevant and timely statistics in a cost-efficient manner, and

the ready accessibility of statistics and data to users. The components of quality thus include:

- *Accuracy.* The estimates produced should have low bias and variance for the parameters being estimated.
- *Relevance.* The parameters being estimated should be the ones that are relevant for users. To ensure relevance, statisticians need to maintain regular and close contacts with users.
- *Timeliness.* The estimates should be up-to-date. The more out-of-date the estimates, the less relevant they are. Equally, other statistical products, such as public use tapes, need to be made available to users in a timely manner.
- *Accessibility.* Statistical products need to be accessible to users through such mechanisms as publications, public use tapes, CD-ROMs, and diskettes. Although restrictions on access may be needed to protect the confidentiality of survey respondents (using such techniques as cell suppression in tables and top-coding and suppression of variables in public use tapes), these restrictions need to be implemented in ways that minimize their consequences for the utility of the data. Good documentation of statistical products is needed to make them readily accessible.
- *Cost-efficiency.* The procedures used to collect and analyze statistical data should be ones that are most cost efficient, taking into account the need to satisfy the other components of quality.

Improving quality thus encompasses: using improved methods of data collection and processing to produce more accurate data; refining definitions of statistical concepts to better meet policy needs; instituting procedures to enable statistics to be produced more rapidly; developing ways to improve access to statistical data; and introducing more cost-efficient methods of data collection, processing and analysis. The broad definition of quality that I am using seems the appropriate one, and one that is consistent with the breadth of the Statistical Policy Working Paper Series. For instance Working Paper 11 deals with industry coding schemes, Working Paper 17 deals with survey coverage, Working Paper 19 deals with computer assisted survey information collection, Working Paper 21 deals with indirect estimates, and Working Paper 22 - an update of Working Paper 2 - deals with statistical disclosure limitation methodology (U.S. Office of Management and Budget, 1984, 1990a, 1990b, 1993a, 1994, and U.S. Department of Commerce, 1978, respectively). Gonzalez's (1994) description of the activities of the FCSM contains a useful review of the broad scope of the Statistical Policy Working Paper Series.

Improvements in the quality of federal statistics can come about in several ways. One is by improving the flow of communication between the user and producer of statistics. As noted above, relevance is a key component of quality and relevance requires the producer to fully understand user needs. Equally, users need to appreciate the inherent limitations in the capabilities of the statistical system that produces the statistics they employ. Regular contacts between users and producers are essential to keep producers aware of changing user priorities and of changes in the structure of society that need to be taken into account in producing relevant statistics in a changing world. The importance of user/producer communication is mainly one that needs to be addressed at the individual statistical program level. Since I am focussing on improving quality in the statistical system at large, I will not expand on this important issue here.

A second means for improving the quality of federal statistics is by increasing the use of what my colleague David Morganstein terms Current Best Methods (CBMs). He prefers this terminology to the more usual Standard Operating Procedures (SOPs) because it conveys the principle that the best methods are evolving over time. In this respect, improvements are produced by increasing the awareness of CBMs among those involved in producing federal statistics and by facilitating their use.

A third means of quality improvement is through research on statistical methodology. Such research can serve both to identify problems with existing methods and to suggest improved methods. The results of this research then feed into the evolving CBMs.

In the last issue of the *Survey Statistician*, Morganstein (1993) describes the application of the process of continuous quality improvement in the survey statistics group at Westat. He identifies three primary elements of the program: employee development; documentation and the use of CBMs; and improved technology. These same elements seem equally applicable for improvements in federal statistics.

The challenges of achieving quality improvement across the federal statistics system are, of course, far greater than they are within a single survey statistics department. Indeed, the challenges are much greater in the decentralized U.S. statistical system than they are in centralized systems such as those at Statistics Canada, and the Australian and Netherlands Bureaus of Statistics. This is not the place to discuss the relative merits of centralized and decentralized statistical systems. All that needs to be noted here is that the problems of communication of current best methods in a decentralized system are severe. The large number of U.S. government agencies that are conducting statistical work provides an indicator of the communication challenge. According to OMB's Annual Report to Congress, in 1994 there are around 80 different agencies that receive direct funding

for major statistical programs. The eleven principal federal statistical agencies receive less than two-fifths of the total major statistical program funding.

As discussed later, I see a prime function of the FCSM as being one of encouraging the use of CBMs. The committee can serve this function by developing working papers detailing CBMs and disseminating them to those engaged in federal statistical activities. In the decentralized environment of the U.S. statistical system, dissemination is a major challenge, a point to which I shall return.

3. Contributors to Quality Improvement

In considering the range of contributors to quality improvement in federal statistics, it is useful to distinguish between employee development on the one hand and the development of CBMs and methodological research on the other. A highly-skilled work force is critical for the production of high quality statistics. The essential components of a highly-skilled statistical workforce are, first, the recruitment of well-trained statisticians, with training appropriate to their job requirements and, second, continuing education over the course of their careers to keep them up-to-date with the many advances that are being made.

In response to a shortage in the numbers of trained survey statisticians, at the end of the 1980's members of the federal statistical system pressed for the establishment of a "Center for Survey Methods" to provide instruction and research training at a Washington-based university. I should like to note here the important contributions of Hermann Habermann and the agency heads of the Bureau of Economic Analysis, the Bureau of the Census, the Economic Research Service of USDA, and the Bureau of Labor Statistics, who worked on the proposal for the Center as part of a 1990 legislative initiative under the leadership of Michael Boskin, then chair of the President's Council of Economic Advisers. These efforts were successful, leading to the establishment of the Joint Program in Survey Methodology (JPSM) at the University of Maryland, a joint program of the University of Maryland at College Park, the University of Michigan and Westat, Inc. The program is now underway, with the first year of the MS program in Survey Methodology completed, and with a proposal for a Ph.D. program in progress. I am pleased to be a faculty member of the Joint Program, a program which I believe holds great promise for improving the quality of federal statistics through training. I should like to recognize the strong support given to the program by Kathy Wallman and all in the OMB Statistical Policy Branch.

In addition to the JPSM at the University of Maryland, there have also been expansions to the programs of other universities in the Washington area that are of direct interest to those working

with federal statistics, such as the recently introduced Federal Statistics Certificate and Masters Degree programs at George Mason University and Masters Degree in Statistics for Policy Analysis at The American University. The numerous courses offered by the universities in the Washington area are generally made available to both degree seeking and non-degree seeking students, and they are often given at times chosen to fit in with full-time work schedules. They provide excellent opportunities for federal statisticians to obtain graduate training in a wide range of subjects. Many federal statisticians have, for instance, learned about such topics as variance estimation with complex samples and recent developments in survey methodology at evening courses at George Washington University and the USDA Graduate School. Through such offerings the universities in the Washington area make important contributions to the training of federal statisticians.

With the major advances taking place in all aspects of federal statistics, there is the need for continual updating and upgrading of the skills of the statistical workforce. One has only to reflect briefly on the advances in methods for questionnaire design, computerized data collection, variance estimation, handling nonresponse, small area estimation, and data disclosure limitation that have occurred within the past ten to fifteen years to realize that a substantial investment in continuing education is essential for keeping federal statisticians up-to-date on best current methods.

As well as through university courses taken on an ad-hoc basis, continuing education can be achieved through short courses, seminars and conferences. Perhaps in response to the recent methodological developments, there has been an impressive expansion of such offerings in recent years. An extensive array of continuing education opportunities is now available for federal statisticians. Moreover, many federal statisticians avail themselves of these opportunities, which I take to be a positive indication both of the desire of federal survey statisticians to upgrade and update their skills and of the strong support of the leadership of the statistical programs for continuing education.

For those in the Washington area, the Washington Statistical Society (WSS) has for many years been making major contributions to continuing education through its short courses and its extensive seminar series. The JPSM also now offers regular short courses at both introductory and advanced levels. In addition, continuing education short courses are regularly offered at the annual meetings of the American Statistical Association (ASA), the American Association for Public Opinion Research (AAPOR) and at the biennial sessions of the International Statistical Institute (ISI).

Conferences serve both as a form of continuing education and as a way to stimulate research work. The scientific programs of the ASA and AAPOR annual meetings and the ISI biennial sessions are

rich in contributions relevant to improving federal statistics. In addition, several series of more specialist conferences have been established in recent years, including the Bureau of the Census's Annual Research Conference, the Conferences on Health Survey Research Methods, the international conferences on survey methods, the Statistics Canada symposia, and now the COPAFS seminars.

Federal statistical programs have much to gain from the attendance and active participation of their staffs in such conferences. I would particularly single out the value of international conferences. We need to keep in touch with the statistical developments that are occurring throughout the world. Sometimes statisticians in other countries can benefit from research conducted in the U.S. and sometimes U.S. statisticians can benefit from research conducted elsewhere. In addition, the increasing interest in the production of comparable economic, social, and environmental statistics across countries points to the need for greater contact between, and collaboration of, government statisticians in different countries.

In the area of employee development, I should finally like to note the significant contribution made by the impressive program of research meetings run throughout the year by the Washington Statistical Society. In addition to three short courses, the WSS held as many as 57 meetings during the 1993-94 year, covering a wide range of topics of interest to federal statisticians. Many of the WSS presentations are made by federal statisticians, and the meetings are generally well attended.

Turning to quality improvement through promoting current best methods, there are again many contributors. Much of the work in this area is initiated and conducted by individual statistical programs, but there are important inputs from other bodies. For instance, many programs have advisory committees that provide expert advice on both substance and methods. In addition COPAFS provides advice, as does the Committee on National Statistics (CNSTAT) of the National Academy of Sciences. Panels of CNSTAT have conducted in-depth studies of specific programs and also of many aspects of federal statistical methodology. The latter include studies of missing data (Madow, Nisselson and Olkin, 1983; Madow, Olkin and Rubin, 1983; Madow and Olkin, 1983), surveying subjective phenomena (Turner and Martin, 1984), microsimulation modeling (Citro and Hanushek, 1991), and confidentiality and accessibility of government data (Duncan, Jabine and de Wolf, 1993).

Quality improvements also come about by improving current best methods. Improvements in CBMs arise out of methodological research, and once again there are many contributors. Much important methodological research is conducted by the federal statistical agencies. Much is also conducted in universities, in survey organizations and in other settings, in the U.S. and

elsewhere, and in the government statistical agencies in other countries. The challenge to maintaining CBMs as "current" and "best" is that of keeping abreast of the large volume of methodological research, and applying its results effectively in current practice. Networks of contacts are needed within the federal statistical system and between federal statisticians and those conducting methodological research elsewhere to keep CBMs up-to-date.

Given the many contributors to quality, what should be the role of the FCSM? Clearly, the FCSM is not well-positioned to contribute directly to quality improvements in programs on an individual basis. Rather, its prime role should be to provide a means for transfer of innovations across programs and for coordination of methodologies where called for.

In her contribution at the closing session of the 1991 symposium, Margaret Martin (1990, p.462) succinctly summarized four functions that the FCSM might perform:

- "(1) exchange knowledge, techniques or experience among committee members to enhance the quality of the member agencies' own operations;
- (2) provide "state of the art" reports to encourage best practice among a broader group;
- (3) recommend areas for improvement and needed directions for research; and
- (4) obtain consensus on such issues as - defining problems and the priorities among them, developing or changing classifications or other concepts, and setting statistical standards."

I think that these four functions provide a good agenda for the Committee.

4. Activities of the FCSM

This section considers each of the functions Margaret Martin lists for the FCSM in turn.

4.1 Exchange of Knowledge, Techniques and Experience Among Subcommittee Members.

In forming a subcommittee to produce a working paper on a particular subject, the FCSM draws upon the expertise on that subject that is available throughout the federal statistical workforce. Membership of a subcommittee then potentially provides the opportunity for an individual to engage in discussions with

others working in the subject, often with different perspectives and experiences. Such a dialogue has the important benefit that the exchange of knowledge, techniques and experience can lead to improvements in the methods applied in the statistical programs from which the subcommittee draws its members. This benefit is particularly important when the subject is one that involves only one or two persons in any one program, so that there is little opportunity for within-program dialogue on it.

In practice, Margaret Martin's comments suggest that subcommittees often have little time for such productive dialogue. Rather, much subcommittee work is report drafting and reviewing, activities that are performed in evenings and at weekends. If this is the case, it is unfortunate: a valuable function of the subcommittee is being lost.

I appreciate that this may not be a good time to ask for additional resources. Nevertheless, the leadership of the statistical programs should recognize the significant rewards that can accrue to their programs and to the federal statistical system more generally from subcommittee activities, and they should seek to ensure that adequate resources are provided to enable the subcommittees to carry out their work as effectively as possible. In part, this means allowing subcommittee members sufficient time to fully perform their roles and in part it means providing each subcommittee with appropriate support staff to work efficiently. The latter could include administrative staff to organize meetings and maintain schedules; editorial staff to help with the production of the working paper; and junior statisticians to serve as research assistants to help with literature reviews and bibliographies if needed (an activity that can provide a valuable learning experience for the junior statisticians).

4.2 Production of Working Papers.

The FCSM has stimulated the production of 22 papers in the Statistical Policy Working Paper Series to date. As I have already remarked, these papers make an important contribution to improving the quality of federal statistics, and to the survey statistics literature more generally. I am therefore somewhat concerned that there appear to be possible signs of some slackening in the pace of working paper production in the last few years. I hope that this is not a true loss of momentum, because I believe there is much more that could usefully be done.

Most of the working papers that I have seen contain valuable descriptions of the applications of the methodology under study across a range of statistical programs. They thus provide a useful review of the state of current practice and help to foster cross-fertilization among programs. To the extent that the programs reviewed are employing current best methods, they document what those methods are. My concern is that the focus may be too narrow.

I think that the working papers would sometimes be improved by a broader perspective on current best methods, examining both the methods used in the government statistical programs of other countries and those used outside government. I acknowledge that some subcommittees attempt to go in this direction, but I think that a more systematic approach along these lines would enhance the value of the working paper series.

In his address, Bob Groves suggested the possibility of including members from outside the federal statistical system in the subcommittees. I note that this suggestion was adopted for the disclosure limitation working paper, with Tom Jabine serving as a member of the subcommittee. I think that this suggestion merits more widespread application. Other possibilities include inviting outside experts to make presentations at subcommittee meetings, arranging small workshops for subcommittee members and outside experts to discuss the issues, and inviting outside experts to review draft working papers. Individuals from outside the federal statistical system may even be asked to draft one or more chapters for a working paper.

If a working paper is to be viewed as a document of best current methods, then it should do more than simply review current practices. It should include recommendations for what are the best current methods, recognizing the variety of different circumstances in which the methods may be applied. To reach agreement on such recommendations may often be difficult, and clearly requires much discussion among the subcommittee members. Lack of sufficient discussion time may well be the reason that the recommendations in the working papers are often not as developed as would be desirable.

Another consequence of viewing the working papers as a means of promoting current best methods is that they should be seen as evolving documents that need to be updated as improved methods are developed. An example here is the latest working paper on statistical disclosure that updates a 1978 working paper to take account of the major advances that have occurred in the intervening period. Progress in recent years in other areas suggests the need to update other working papers, for instance those on developing questionnaires, telephone data collection, the use of microcomputers, and even the fairly recent working paper on computer assisted survey information collection.

The working papers should be prepared to meet the needs of their primary readership, which I take to be those working on federal statistical programs. They should aim to address the questions to which these readers would like answers. In this regard, I should like to recall the wide range of statistical programs that I have outlined earlier, many of which are relatively small. It is in fact the smaller programs that are likely to benefit most from the working papers, since they necessarily lack

the range of expertise that is often internally available in the large statistical agencies. The needs of the smaller programs should be borne in mind in preparing a working paper. To ensure their needs are met, it would be advisable to secure adequate representation of the smaller programs on each subcommittee.

The working papers are valuable only to the extent that they are read. Many able statisticians devote a great deal of effort to the production of each working paper. However, it is my impression that less effort goes into the distribution of the product. The working papers need to reach the desks of those for whom they were written, and mechanisms are needed to ensure that this is achieved. It is also valuable to have a widespread distribution outside the federal statistical system both in the U.S. and abroad. The papers have a great deal to offer to those involved in statistical work in many organizations and countries, and their exposure to a wide spectrum of readers opens up greater likelihood of future improvements. To achieve greater circulation of the working papers it may be useful to publicize them more extensively in appropriate newsletters and journals in the U.S. and abroad and to build up an international network of contacts to aid in the distribution. The recent article describing the working paper series by Gonzalez (1994) is helpful in this regard.

I am not in a position to suggest the best distribution system for the working papers in the federal statistical programs. One possibility might be to identify an individual in each program to serve as a liaison to the FCSM, and send copies of the working papers to that individual. The individual might also be asked to provide suggestions of topics for the FCSM to study. Another possibility is to organize a well-publicized workshop on the topic of a working paper as it is released. Since the working papers have become substantial documents, the workshop could provide a useful primer for those interested in its contents. To some extent, this COPAFS seminar serves such a role, but it is more general in nature spanning the contents of many working papers. The WSS may be able to play an important role in helping to achieve a wide dissemination of the working papers to statisticians in the Washington area.

4.3 Areas for Improvement and Directions for Research.

A number of the working papers indicate areas for improvement and for research, but these issues are not as fully developed as might be desirable. I attribute this situation to the limited discussion time available to the subcommittees. To identify needed improvements goes beyond describing current methods to pinpointing their weaknesses and coming up with ways by which the weaknesses may be addressed. Developing an effective research agenda requires a great deal of deliberation by the subcommittee.

Subcommittees of the FCSM are appointed on the basis of their technical expertise in the given subject area. As such, they are well-positioned to determine incremental research agendas for the given subject. They are, however, less suited to making proposals for major restructuring. In the last seminar, Fritz Scheuren (1993) and Steve Fienberg (1993) talked about the possibility of paradigm shifts in federal statistics. It would be useful to consider setting up federal committees of a different type, composed of individuals with wide experience and broad vision, to examine the possibilities of major changes in the ways federal statistics are produced. Users of statistical data have an important role to play in such committees. As an example, the possibility of continuous measurement in place of the Census long form, which is currently under discussion at the Bureau of the Census, raises a number of possibilities for substantial changes in other data collection efforts. Such committees may be separate from the FCSM, but they should maintain close contacts with it.

4.4 Developing Consensus Across Statistical Programs.

Margaret Martin notes that the objective of obtaining consensus on definitional, conceptual and classification issues has not been well met by the activities of the FCSM. Such consensus building requires lengthy discussions, and shortage of discussion time may again be the root of the problem. Also, different programs will have vested interests in preserving their own definitions, and that will make the attainment of consensus difficult. With a decentralized statistical system, the risk of definitional differences occurring when several programs overlap in their subject matters is high. Consensus building on definitions and methods across programs holds promise of significant advances in fields that cut across different agencies (e.g., aging, children, disability).

5. Topics for Future Working Papers

In concluding, I shall take the opportunity to put forward some specific suggestions for future working papers. Before giving them, I should however like to make two general points. First, I think that the FCSM should have a mechanism for generating suggestions from the federal statistical community at large. At an earlier point, I suggested that liaison persons be appointed in each program. If that suggestion were adopted, one role of those appointed could be to seek suggestions from their colleagues and to forward them to the FCSM. Another possibility is for the FCSM to convene meetings from time to time, perhaps in conjunction with the WSS, to discuss possible subjects for working papers.

My second point concerns the form of the working papers. With the needs of the statisticians working in the smaller statistical programs in mind, I suggest that the FCSM could usefully commission

some of the working papers to be prepared in a manual-style format, reviewing the given methodology in a relatively nontechnical and applied way, and giving practical advice on the implementation of the methodology (e.g., the availability of software). Manuals of this type could be extremely helpful to those inexperienced in the use of the methodology. They need not be lengthy documents; indeed the shorter the document, the more useful it might be. Working Paper 9 on *Contracting for Surveys* (U.S. Office of Management and Budget, 1983) is along these lines. Other illustrations are provided by the manuals on sampling errors (Butcher and Elliot, 1986) and on weighting for nonresponse (Elliot, 1991) produced at the U.K. Office of Population Censuses and Surveys.

In addition to updating some of the existing working papers as discussed above, my specific suggestions for new working papers, undoubtedly blinkered by my own interests, are:

- *Quality profiles.* The error profile for the CPS (Brooks and Bailar, 1978), which was the third report in the working paper series, was an important advance in treating total survey error. Since then the SIPP Quality Profile (Jabine, King and Petroni, 1990) and the Schools and Staffing Survey Quality Profile (Jabine, 1994) have appeared, and other quality profiles are being developed. A subcommittee might usefully develop a blueprint of what such quality profiles should contain, and the methods that may be employed to produce the requisite data, based on the experience that has been gained to date.
- *Economic statistics.* At the previous seminar, Bob Groves commented that there is a distinct bias in the working paper series towards household surveys at the expense of economic statistics. I observe no change in that situation, and think that this should be remedied.
- *Customer surveys.* The requirement that government agencies conduct customer satisfaction surveys has brought many agencies with no prior experience of surveys in direct contact with survey research. In response to this situation, the U.S. Office of Management and Budget (1993b) has produced a resource manual on customer surveys and the JPSM has run a series of short courses to provide training in the conduct of such surveys. A detailed working paper on the subject would be extremely useful.
- *Evaluation research.* Large sums of money are spent by many agencies conducting experimental and quasi-experimental studies to evaluate and compare the effectiveness of various programs. A working paper on this subject could make a valuable contribution to this work.

- *Nonresponse adjustment methods.* Considerable advances have been made in methods of weighting adjustment for total nonresponse and imputation methods for item nonresponse since the late 1970s when the CNSTAT Panel on Incomplete Data studied the subject. Imputation methods are also being used more widely. A working paper on weighting and imputation could be particularly useful for those programs that have little prior experience in this area.
- *Variance estimation.* A working paper that examines the current methods and software for variance estimation, that considers the presentation of sampling errors in survey reports, and that deals with the use of generalized variance functions could be extremely useful, especially for those working in the smaller statistical programs.

6. Concluding Remarks

In concluding, let me restate that my suggestions for the Statistical Policy Working Paper Series are made in the spirit of continual quality improvements in what is a very successful activity. My particular plea is to the leadership of the statistical programs to make sure that this work is supported in the way it deserves. The quality of federal statistics derives considerable benefit from the Working Paper Series. The success of an endeavor such as this depends on the tireless support of those behind it. In this case, the FCSM is exceedingly fortunate to have Maria Gonzalez at the helm. Without her unstinting efforts over many years, it could not have succeeded as it has.

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