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More Effective and Efficient Audits Through Use of Analytical Reviews

By Philip M. J. Reckers and A. J. Stagliano

A major function performed by the independent auditor is discovery and investigation of unusual changes in the financial accounts under examination. Aberrations in account balances are often generated by, and indicative of, substantial changes in business operations. This discovery objective is required of the auditor by the third standard of fieldwork. The auditor's guide in this area, *Statement on Auditing Standards No. 1,* specifically describes two classes of useful procedures. In addition to tests of details for transactions and balances, the SAS notes the importance of *analytical reviews* for investigations of unusual fluctuations in accounts.

While various statistical methodologies have been developed that can be applied as analytical review techniques, it is questionable whether the current level of their implementation is high enough to permit significant economic benefits to accrue. Initial review, of an analytical nature, can make audit engagements both more efficient and effective. Failure to use the analytical review technique is disadvantageous to auditors, their clients, and financial statement users. The discussion below focuses on the usefulness of this audit method, while describing several common and easy to apply review procedures.

The Purpose of Analytical Reviews

Tests of "reasonableness" are appropriate both with respect to limited statement reviews and full-scale financial and operational audits. The auditor should, of course, address the question: What review method will help minimize cost while providing a high level of confidence that an effective audit has been conducted? The answer to this question may vary with, and depend on, such case-specific factors as engagement objectives, client size and industry, and available auditor resources (including both time and expertise).

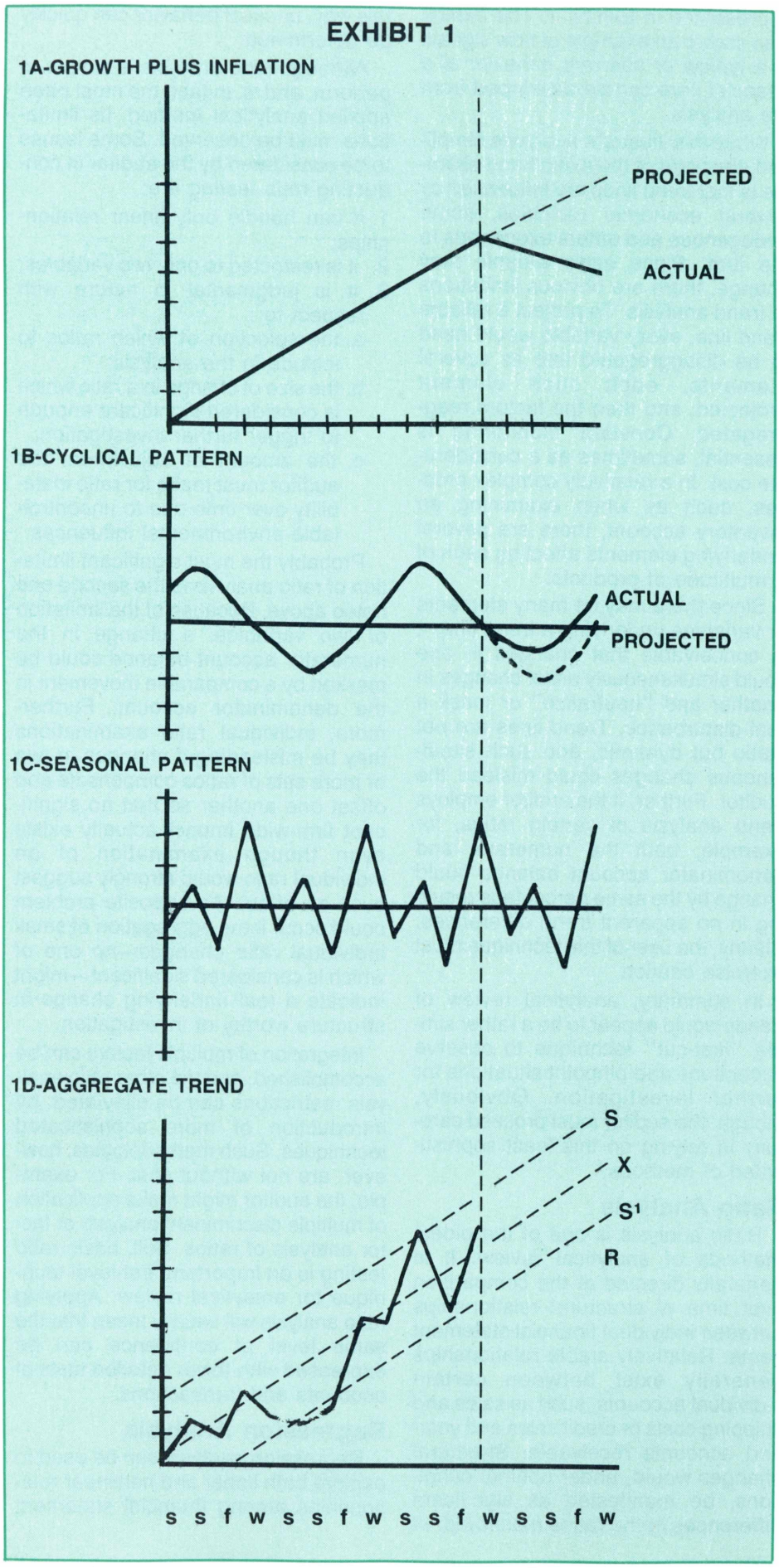
Prudent application of analytical reviews in the earliest phases of an audit can provide for less expensive, yet high quality, audits. Preliminary examination using analytical review techniques would allow minimal testing to be conducted with regard to non-problem areas, and, simultaneously, focus attention on norm-divergent items. When "significant" account changes are detected early in the audit process, investigation might be as simple as a discussion with the client to determine any known source for the apparent aberration. If extraordinary changes are not fully recognized, though, appropriate inquiries might not take place. Or, inquiries might be initiated late in the process, thereby rendering time-consuming and expensive prior auditing efforts unproductive. Proper application of projective-analytical methods could also serve as a cost-effective means for conducting interim statement reviews.

As suggested earlier, the use by auditors of analytical reviews is not always as extensive or sophisticated as might be desired. This may be due to limitations of costs and/or the complexities of certain techniques. Attention will be directed here to the various tools at the disposal of the auditor. Specifically, the discussion will focus on the relative costs and benefits of the available methods. In addition, this paper introduces a new integrative measure—decomposition analysis—which may be used to complement other analytical tests. The techniques to be discussed are: trend analysis, ratio analysis, multiple regression, and the new simple decomposition measure.

Trend Analysis

Trend analysis makes projections of account changes and balances for the current year based on knowledge of prior years' facts. Essentially, this analytic technique uses information about the past to develop projective estimations of the current period. Since a certain regularity or pattern of change is expected, major differences are readily discerned. At its simplest, a freehand charting of past account balances (or, possibly, ratios of balances) might be used to determine the trend. The purpose is a highlighting of those deviant items which might need closer investigation. More precise mappings can be achieved with an application of the least squares method.

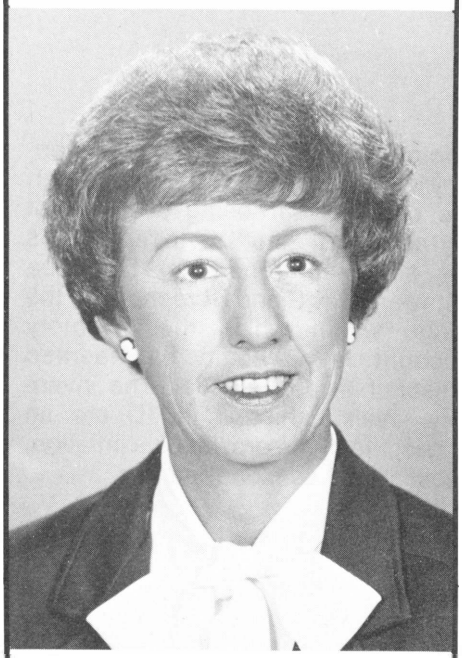
To use this type of analysis as an auditing tool, however, it is necessary to understand the expected behavior of those variables that underlie and produce the "trend." Accordingly, a trend can be divided into at least three basic components: a seasonal pattern, a cyclical factor, and a growth-plus-inflation element. An illustration of how these parts aggregate to form a trend



The exhibit presents quarterly inventory levels over a four year period with the current year being the year of extrapolation. Line "X" (Graph 1D) is the projected trend line. The area between lines S and S^1 represents the range within which the inventory account level would be deemed reasonable, not unusual. The inventory levels exhibited in 1D are an aggregate of the growth plus inflation, cyclical and seasonal factors.

Hypothetical change #1. Assume that due to the introduction of a substitute product by a competitor, growth of the firm slows. The solid line in graph 1A depicts this event. If the cyclical and seasonal patterns move as expected, then the inventory level for the current winter quarter year end would rest at point "R" in graph 1D. As point "R" lies outside the range of acceptance, trend analysis has served the function of drawing attention to a case of potential inventory obsolescence.

Hypothetical change #2. Alternatively, as we find growth slowing, one or more of the other trend elements might simultaneously change. If economic cyclical conditions reverse prematurely, for example, as depicted by the solid line in graph 1B, an appreciable confusing of the auditor's perception for the need for further investigation of the account might ensue. With the various elements now summing to point "R," a point within the acceptance zone, no investigation will be initiated although it should be.



Savill Elected Vice President and Treasurer

The Indianapolis Power & Light Company (IPL) Board of Directors has announced the election of Mrs. Annette L. Savill to Vice President and Treasurer. Mrs. Savill has been Treasurer of IPL since 1981.

A native of Kapuskasing, Ontario, Canada, Mrs. Savill received her bachelor of science degree in business administration and master of business administration at Indiana Central University. She is a Licensed Certified Public Accountant.

Mrs. Savill began her IPL career in 1973 as internal auditor. She later was named: director, general accounting in 1976; assistant controller and assistant treasurer in 1977; assistant controller in 1980; and treasurer in 1981.

She is a member of American Society of Women Accountants, American Institute of Certified Public Accountants and the Indiana CPA Society.

is presented in Exhibit 1. The exhibit also shows an example of how signals of a typical or aberrant behavior of a financial item can be developed from the analysis.

While this illustration is quite simplified, the point of the exhibit and example is that trend lines are influenced by several economic variables, some endogenous and others exogenous to the firm. Since each variable may change, there are obvious limitations to trend analysis. To project a reliable trend line, every variable would need to be disaggregated into its several elements, each such element projected, and then the factors reaggregated. Constant monitoring is essential, sometimes as a considerable cost. In a relatively complex process, such as when examining an inventory account, there are several underlying elements affecting each of a multitude of products.

Since there may be many elements or variables underlying a trend line, it is conceivable that changes in one could simultaneously offset changes in another and "neutralize" or mask a real disturbance. Trend lines are not static but dynamic, and such simultaneous changes could mislead the auditor. Further, if the auditor employs trend analysis of certain ratios, for example, both the numerator and denominator account balance could change by the same percentage resulting in no apparent trend differences. Clearly, the user of this technique must exercise caution.

In summary, analytical review of trends would appear to be a rather simple "first-cut" technique to observe exceptions and pinpoint situations for further investigation. Obviously, though, the auditor must proceed carefully in relying on this least sophisticated of methods.

Ratio Analysis

Ratio analysis is one of the oldest methods of analytical review. It is generally directed at the comparison over time of structural relationships between individual financial statement items. Relatively stable relationships generally exist between certain individual accounts, such as sales and shipping costs or credit sales and year-end accounts receivable. Structural changes would, under optimal conditions, be manifested as significant differences in the ratios monitored. In this way, unusual behavior can quickly be determined.

Although ratio analysis is simple to perform, and is, in fact, the most often applied analytical method, its limitations must be observed. Some issues to be considered by the auditor in conducting ratio testing are:

1. it can handle only linear relationships;
2. it is restricted to only two variables;
3. it is judgmental in nature with respect to:
   a. the selection of which ratios to include in the analysis;
   b. the size of change in a ratio which is considered significant enough to trigger further investigation;
   c. the amount of adjustment the auditor must make for ratio instability over time due to uncontrollable environmental influences.

Probably the most significant limitation of ratio analysis is the second one noted above. Because of the limitation of two variables, a change in the numerator account balance could be masked by a comparable movement in the denominator account. Furthermore, individual ratio examinations may be misleading if changes in two or more sets of ratios compensate and offset one another so that no significant firm-wide impact actually exists even though examination of an individual ratio would strongly suggest such an effect. An opposite problem could occur if the aggregation of small individual ratio changes—no one of which is considered significant—might indicate a real underlying change in structure worthy of investigation.

Integration of multiple factors can be accomplished, and the other ratio analysis restrictions can be alleviated, by introduction of more sophisticated techniques. Such methodologies, however, are not without cost. For example, the auditor might make application of multiple discriminant analysis or factor analysis of ratios. Still, basic ratio testing is an important first-level technique for analytical review. Applying ratio analysis will usually mean that the same level of confidence can be expressed with fewer detailed tests of accounts and transactions.

Regression Analysis

Regression analysis can be used to explore both linear and nonlinear relationships among financial statement

variables. This statistical technique also allows the use of several independent variables in an estimating equation, and is flexible enough to permit inclusion of time-oriented parameters (e.g., seasonality, trend, and cyclical factors) and other categorical qualitative factors. Regression can be used in both a descriptive and predictive mode. As an auditor's analytical review tool, it might be applied in either fashion. To simply gain an understanding of processes and interrelationships among financial factors, a descriptive orientation is appropriate. In a projective mode, the dependent variable of interest might be estimated from the regression parameters and compared with actual results. Aberrations ought to be apparent.

A first order regression function, with two independent variables may be expresed as:

$$E(Y) = B_0 + B_1X_1 + B_2X_2 + E$$

where:

$E(Y)$ is the expected value of the dependent term Y, i.e., the item we wish to predict.

B_0 is a fixed element of the dependent variable Y. (It may have no obvious particular meaning.)

B_1 is the rate of change in Y for each unit of change in X_1, predictor variable one.

B_2 is the rate of change in Y for each unit of change in X_2, predictor variable two.

The number of independent variable included in the equation may exceed two. Frequently the optimal number of independent predictor variables will be four or five.

The major question concerning multiple regression analysis is its cost effectiveness. This is especially relevant to medium size and small audit firms. Furthermore, regression analysis exhibits at least three distinct limitations or disadvantages. These are:

1. The validity of the method is contingent upon the independence of adjacent observations. This condition is often not satisfied with financial data. Adjustments that compensate for failure to satisfy the requirement are quite complex.
2. Precise modeling becomes more difficult, even tedious, when multiple variables are involved that require consideration of various possible lead and lag time periods.
3. When used in a forecasting capacity, the estimated regression parameters will often need to be updated at the end of a period due to the dynamics of changing conditions.

Of likely interest to the reader is a recent note by Frank Koster of Arthur Andersen in the *Auditors Report.* In this paper, Mr. Koster discusses the success he experienced in constructing a regression model for "testing" inventory figures of some stores in a chain that had not taken year-end recent physical counts. The regression model developed sought to predict each store's gross profit percentage. The percentage could then be multiplied by sales to predict inventory. Koster's objectives were noted to:

- Quantify the potential misstatement of inventory for the tested stores.
- Identify—and investigate—"problem" stores (i.e., those whose predicted and recorded results were significantly different).
- Reduce the extent of detailed testing of physical inventories.
- Concentrate more on reviewing the related internal control procedures.

Five variables were selected for inclusion in the regression model. They were:

1) historical gross profit
2) change in "book" inventory
3) inventory shrinkage
4) volume of direct store purchases (store purchases made directly from vendors and which typically allowed lower margins)
5) inventory turnover.

"Overall," Koster concluded, "We considered the regression application successful and were able to change our audit approach as planned," although some miscues developed.

WANTED

Good management articles — accounting related; 10-12 pages typed, double-spaced.

Send to Carole Cheatham, Associate Editor of Special Features, Drawer KY, Mississippi State, MS 39762.

Business Tax Incentive for Removing Barriers to the Disabled

When President Reagan signed "The Deficit Reduction Act" into law during 1984, an obscure tax incentive geared to help businesses and the disabled was reinstated into the IRS Code. Known as Section 190 of the IRS Code, this provision allows businesses to deduct up to $35,000 in taxable years 1984 and 1985 if architectural barriers to disabled persons are removed at the place of business.

Section 190 covers a gamut of items which can make a place of business more usable by the disabled, including replacement of steps with ramps, widening of doorways, and space improvements in public restrooms. Section 190 was part of the IRS Code between 1977 and 1982, but unfortunately it was taken little advantage of because business persons did not know of its existence.

A general brochure about accessible buildings and facilities for the disabled, a booklet of architectural drawings showing the proper design of access elements covered under the IRS provisions, and a copy of the IRS regulations implementing this tax deduction are provided by the Eastern Paralyzed Veterans Association at 432 Park Avenue South, New York, NY 10016.

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EXHIBIT 2

An Application of Decomposition Analysis

Decomposition Formula

$$\frac{CA_c}{2(TA_c)} \times \text{Log}_e \frac{\frac{CA_c}{2(TA_c)}}{\frac{CA_p}{2(TA_p)}} + \frac{LA_c}{2(TA_c)} \times \text{Log}_e \frac{\frac{LA_c}{2(TA_c)}}{\frac{LA_p}{2(TA_p)}} + \frac{CL_c}{2(TLE_c)} \times \text{Log}_e \frac{\frac{CL_c}{2(TLE_c)}}{\frac{CL_p}{2(TLE_p)}} + \frac{LL_c}{2(TLE_c)} \times \text{Log}_e \frac{\frac{LL_c}{2(TLE_c)}}{\frac{LL_p}{2(TLE_p)}} = DM$$

A Numerical Balance Sheet Example

BALANCE SHEET

Assets	Current Year	Prior Year	Liabilities and Equity	Current Year	Prior Year
Current	$100	$140		$ 50	$ 70
(Percent)	(.167)	(.200)		(.083)	(.100)
Long Term	200	210		250	280
(Percent)	(.333)	(.300)		(.417)	(.400)
Totals	$300	$350		$300	$350

Decomposition Measure

$$.167 \times \text{Log}_e \frac{.167}{.200} + .333 \times \text{Log}_e \frac{.333}{.300} + .083 \times \text{Log}_e \frac{.083}{.100} + .417 \times \text{Log}_e \frac{.417}{.400} = DM$$

By and large, regression (and other similar correlational techniques) is a useful analytical review procedure when historical data are available to estimate the relationships of interest.

Decomposition Analysis

Empirical studies have suggested that the decomposition measure has great potential for application by auditors in performing analytical reviews. Specific research analyses have found that:

1) failing firms had, for at least five years before bankruptcy, substantially larger balance sheet decomposition measures than those of comparable firms that remained solvent;
2) the balance sheet decomposition measure outperforms a large set of basic financial ratios in predicting bankruptcy;
3) decomposition measures applied to the distribution of a firm's sales are associated with the riskiness of those sales;
4) decomposition measures are strongly associated with unexpected income changes (supporting the contention that decomposition measures reflect the occurrence of unforeseen events).

The potential applicability of decomposition analysis as a simple supplementary procedure in the audit function is certain. What may not be clear to most auditors is what costs are involved, how easily decomposition analysis can be applied, and the flexibility which this method of analysis brings to the audit engagement.

Interdependencies among various account trends and/or among various ratios (or ratios trends) are often either ignored or subjectively evaluated. In addition, as noted above, ambiguous inferences resulting from conflicting signals may result. Decomposition analysis offers a technique which should be of assistance to auditors in this area. Though statistical decomposition analysis has an imposing title, it is generally quite simple to learn and apply. Until recently, the primary nonauditing use of decomposition analysis has been in the study of allocation problems. Yet, this technique has great potential beyond these types of situations.

Financial analysis is usually concerned primarily with the changes in corporate inputs and outputs—classified as assets, liabilities, expenses, and revenues. Decomposition analysis appears to be a natural method for examining these summarized financial statement items. The essential difference between the information type analysis suggested here and conventional ratio analysis is that the former focuses on decomposition of a financial statement (i.e., on the relationships *within* a set of items), whereas the latter is rarely applied other than to the aggregate individual items.

Decomposition analysis acts mainly as a screening device to scan data

quickly and detect unusual phenomena worthy of more detailed investigation. It is as a filtering device that decomposition analysis may be of greatest service to auditors. While ratio analysis is relatively inefficient in examining all financial statement items and somewhat ineffective in making integrative judgments, decomposition analysis assists such data interpretations. It identifies whether a significant change in financial statement constructs has occurred, and isolates the point at which most of the change is located. Specific investigation can then be applied to the specific area of unusual activity.

Example of Decomposition Analysis. In the following simplified and highly aggregated example, the balance sheet is broken down into only current assets, current liabilities, long-term assets, and long-term liabilities and equity classifications. As noted in the diagram below, these are designated by the symbols CA (current assets), CL (current liabilities), LA (long-term assets) and LL (long-term liabilities and equity). Total assets (TA) and total liabilities and equity (TLE) are also shown.

Balance Sheet

Current Assets (CA)	Current Liabilities (CL)
Long-term Assets (LA)	Long-term Liabilities and Equity (LL)
Total Assets (TA)	Total Liabilities and Equity (TLE)

The computation of the decomposition measure (DM) usually begins with a determination of the proportion that each element is of the whole. For example, the amount of current assets might be measured against total assets. For exposition purposes here, each of the four sections of this simplified balance sheet is divided by the sum of the elements (i.e., twice the asset total). This is done to obtain a fractional measure to be used in the decomposition of each section or account. The use of logarithms ensures that a small positive integer results (while this step is not essential to the analytical technique, it facilitates interperiod comparisons). The measurement focuses on the relative proportion that one part is of the whole.

A short example of the computation is shown in Exhibit 2. Using the terms described in the simplified balance sheet, and differentiating the prior year (p) and current one (c) with subscripts, the complete computation of the decomposition score is shown.

Of course, this example is aggregative. However, an overall first step, as shown in the Exhibit 2 example, might be the most cost efficient as it would obviate more detailed calculations if no significant change occurred. If changes of significance were uncovered, a second level of inquiry might be applied in which each *section* were treated as the allocated whole in independent calculations. In these second level calculations, the intent would be to isolate the area of change in one of the four sections and then focus on specific accounts. This is, then, an iterative process in which coarse tests are completed to determine whether more detailed (and costly) work is required. As such, decomposition analysis is an analytical review tool ideally suited to the audit environment.

Summary

The confidence that an auditor has in the fairness of financial statement presentation can be developed from two major sources: tests of transactions and analytical reviews. The latter tool unfortunately is often entirely overlooked, applied piecemeal to various accounts, or approached from a purely subjective stance. Various techniques are available to assist the auditor in conducting analytical reviews. Since discovery and analysis of unusual financial activity are important to the quality of the independent audit, methods of analysis, like those described here, should find wide acceptance by accountants. Analytical reviews are easily applied tools that could well make the conduct of most audit engagements both more efficient and effective. Ω

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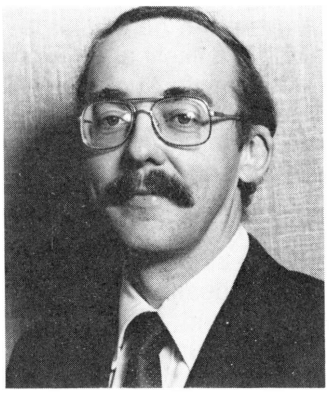

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