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PENSION PLANS FUNDING AND COST

Moderator: DANIEL F. McGINN. Panelists: NEWTON L. BOWERS, JR., LAURENCE E. COWARD, THOMAS M. MALLOY, CECIL J. NESBITT.

1. What is the impact of ERISA on corporate pension plan funding strategies? What cost methods and assumption variations are employed in evaluating the pros and cons of varying strategies? What risks exist for the corporation, the employees, and the stockholders when alternate funding strategies are adopted? How are such risks measured?

2. What are the ethical considerations involved in deciding how to make provision for inflation in pension plan costing? Are considerations substantially different for corporations and governmental entities because of the differences between stockholders and the taxpaying publics? How and why should the actuary's assumptions differ?

3. How much use do actuaries make of "cash-flow" projections? Will actuaries change their methods and approaches because of ERISA?

4. To what extent are actuaries using new approaches in pension plan funding to assist corporations in evaluating alternative investment strategies?

5. Will the use of Accrued Benefit Cost Method be curtailed because of ERISA's imposed Funding Standard Account? If so, why and how will use of this cost method be affected?

6. Discussion of paper by Cecil J. Nesbitt, Newton L. Bowers, Jr. and James C. Hickman, "Introduction to Dynamics of Pension Funding."

MR. DANIEL F. McGINN: Ever since ERISA arrived on the scene, there has been considerable confusion between funding strategies, funding policies, and investment strategies for pension plans. Under ERISA, a corporation is supposed to adopt a funding policy for the plan which takes into account the cash flow requirements of the plan and forms a basis for the corporation's decisions as to the types of investments to be made and the conditions for managing those investments. Funding strategy relates to the choice of the level of funding between the new minimum legal contribution and more conservative levels of contribution and it also relates to the allocation of the cost between present and future generations of stockholders. From my view, the investment strategy relates to long-term expectations of a corporation and long-term planning of a corporation to implement a funding policy. Today, we are discussing pension plan funding and cost which relates to the actuarial determinations as to <u>incidence</u> of employer contributions. These determinations

must be made with a reasonable understanding of the funding policy and the investment strategies of the corporation.

ERISA also has significantly altered the flexibility that corporations have in funding the unfunded actuarial liability under a pension plan. ERISA has placed on the actuary a responsibility to participants since the actuary is legally retained by the corporation, or the plan administrator, on behalf of participants. This seems to alter the actuary's ability to assist the corporation in making purely business decisions since he must make a reasonable compromise between business considerations and the well-being of the plan participants.

Today we will explore some of the general concepts imposed by ERISA and Tom Malloy, Associate Actuary with Connecticut General, will present his views with regard to each of the first 5 questions which are on the agenda. Laurence Coward, Executive Vice President, William M. Mercer, Ltd. will, on the other hand, talk on these subjects from a Canadian viewpoint. ERISA doesn't apply in Canada, of course, but it is difficult for anything to happen in this country which doesn't ultimately affect Canada. Also, whatever is legislated in Canada will probably be reflected in U.S. legislation.

In order to assist you in focusing on the differences between the funding and cost problems in the U.S. and in Canada, Mr. Malloy and Mr. Coward will discuss each question separately. Professor Nesbitt will also comment on some of these questions. Finally, I may interject some comments and questions on the subject. Hopefully, our discussion will demonstrate that in this "ERISA environment" there is plenty of room for actuaries to explore new concepts in pension plan funding. When we are through with our discussion, Professors Bowers and Nesbitt will present in outline form an explanation of their paper, an "Introduction to the Dynamics of Pension Funding", which they have written with Professor James Hickman. After that, we will open this session to general discussions and questions from the floor. With this framework of our presentation in mind, I am asking Mr. Malloy to open this discussion with his comments on Item Number 1.

MR. THOMAS M. MALLOY: ERISA, with its use of "reasonable" and "best estimate", has certainly focused everyone's attention on the quality or integrity of the assumptions used in the valuation of a pension plan. It will, I believe, force the actuary to deal more directly with the two rather separate elements of valuation work, elements that have not been viewed as totally separate in the past.

Given an employee census, a specific benefit plan and a set of actuarial assumptions, the actuary can produce the present value of future benefits to be paid under the plan, and this prospective liability should exist independent of the cost method employed. It can be produced (and probably should be produced) for all plans, regardless of the cost method.

The actuarial cost method merely allocates this value over time. It deals with the incidence of plan cost over time and should not affect the basic estimate of the present value of ultimate plan costs.

The cost method considers the degree of current funding (assets) and determines a current deposit such that the entire future obligation is addressed in some systematic, orderly fashion.

A funding strategy should be concerned with identifying that series of systematic payments whose incidence fits the requirements and capacity of the plan sponsor. The actuary should be capable of outlining the consequences of alternate funding strategies, but the plan sponsor should participate in the process, just as he participates in the choice of a minimum or maximum incidence in the funding of his prior service cost.

The basic risk involved in selecting a funding strategy is the transference of cost from one period to another and the consequent maldistribution of cost among generations of stockholders, taxpayers, or whatever other group bears the ultimate cost of the venture. (This presumes we don't get involved in a strategy that could generate negative funds at some time).

A particularly obvious example of this is the frequent practice of amortizing prior service cost as a level dollar amount over a fixed number of years. The apparent trend to earlier retirements, stimulated, in part, by subsidization of the event, has many plans amortizing prior service accruals well beyond the time when a significant portion of the related work force is retired. This may not be wrong, but it certainly would be in conflict with a funding strategy that is based on the premise that pension cost is a labor cost, and that it should be funded over the period in which the labor was expended.

MR. LAURENCE E. COWARD: We do not have ERISA in Canada, but instead have CAPSA and Pension Benefit Acts. I will discuss pension plan funding against this background, since legislation and practices in one of our countries so often flows over to the other.

For constitutional reasons, the Canadian legislation regulating pension plans is provincial. Pension Benefits Acts are in force in Ontario, Quebec, Alberta and Saskatchewan. A similar federal Act covers the Yukon and North West Territories and employment under federal jurisdiction. Two more provinces, Manitoba and Nova Scotia, have joined the club and their Acts will soon be in force. The seven Acts are basically similar, although small differences do occur.

The solvency standards required in Canada are stronger than those in the United States, but we do not have a Pension Benefit Guaranty Corporation. Instead, current service costs must be paid currently, past service costs over 15 years or less, and experience deficiencies over 5 years or less. The main issues in pension funding are the choice of actuarial bases for both assets and liabilities and what constitutes an experience deficiency.

We do not have a minimum Funding Standard Account. Instead, the authorities place much dependence on the Guides to Professional Conduct of the Canadian Institute of Actuaries. By a fortunate coincidence, these guides are identical with those of the Society of Actuaries.

In Ontario the regulation requires that the valuation be prepared "using assumptions which are adequate and appropriate and methods consistent with sound principles established by precedence or common usage within the actuarial profession."

The practical effect on funding is that long amortization periods are not allowed. Funding is usually conservative because of pressure from the provincial authorities. However, the accrued benefit principle is often favored over projected valuation methods, largely because it minimizes the possibility of experience deficiencies.

The authorities interpret the regulations as requiring actuarial valuations (which govern the funding) to be on a "going concern" basis. In other words, the actuary must assume that the pension plan will continue in force indefinitely. Not all actuaries agree with the authorities and it has been argued that a "winding up" valuation should satisfy the regulations. I suspect that the regulation will be altered, if necessary, to confirm the "going concern" principle.

Following last June's meeting of the Canadian Association of Pension Supervisory Authorities (CAPSA), work has been done to revise the funding rules. The idea is that deficiencies in final pay plans due to excess salary increases and deficiencies due to change in actuarial basis should be fundable over 15 rather than five years. One suggestion is that experience deficiencies would be determined from the funded ratio, that is, the ratio of assets to liabilities for accrued benefits.

MR. DANIEL F. McGINN: I have a few supplemental questions I'd like to ask. Can an actuary properly advise a corporation regarding its pension plan funding without also being fully knowledgeable of the corporation's long-range planning for the expansion of its work force, the opening or closing of plants, the introduction of new products, and the obsolescence of existing products? Can the actuary advise on funding strategy without knowledge of the corporation's expectations for the return on invested capital? In other words, can an actuary ever really give completely effective advice without becoming part of corporate planning of a corporation? And if the answer happens to be affirmative, then I'd ask how the actuary, privy to corporate secrets, can handle the conflict of confidentiality with the mandate of the best estimate and full disclosure under ERISA? I think those are rather interesting questions, and I'd like to know if anyone on the panel would like to at least comment.

MR. THOMAS M. MALLOY: I'm always willing to give an opinion. I guess the question is whether the actuary can provide totally effective advice without having broad deep penetration of the inner workings and future expectations of the corporation itself. No, we really can't, but we always do. We're basically involved with providing certain material to commercial enterprises and there are certain dates when certain information is needed. At that point you go with the best you have. I think my earlier remarks say, though, that I don't think it's something we should become casual about. On the point of proprietary information that might be obtained in being an advisor or a confidant to the manager of a corporation and which we should disclose in executing our duties with respect to the best interest of the plan participants, that's something each of us has to deal with individually. I can't offer any

guide to it. I think you just speak about it frankly with the corporation. I wouldn't like to see that particular apparent conflict block communication between the employer and his actuary.

MR. LAURENCE E. COWARD: I suggest that ideally the more background information you have, the better valuation you will do. But in the real world, there's a limit as to how far you can carry this, and I think probably some actuaries try to be too clever in taking too much into account. The end result is a huge variation between the valuation results of one actuary and another. It is possible to concentrate so much on the side issues that you don't do a particularly good job on the main valuation. I know in Canada, some years ago, we had one trust company that went around saying that every single pension plan was individually tailored, that they examined the characteristics of each plan and developed an investment policy suited to that particular plan and to no other plan in the world. Well, that was a lot of eyewash, it was a great sales gimmick. When I examined what they were actually doing with the funds they received, I couldn't detect any difference between plans. So I think we should try not to be distracted from the main pertinent points by trying to take into account absolutely everything that's going on in the whole universe.

MR. DANIEL F. McGINN: It seems to me that ERISA almost mandates that an actuary try to dispel the mysticism which surrounds the valuation process and become more involved and more knowledgeable of the corporation and its plan. Since antimysticism is not on the agenda, I guess we'll go on to the second question.

Before we discuss that question, I have some observations of my own. Recently, my firm was retained by an accounting firm to provide actuarial advice in connection with its audit of a major city's retirement system. The city's actuaries had been there for 100 years and everything had been going along very smoothly but, for some reason, we were asked to evaluate all of the actuarial assumptions and methodology. We found that everything the actuary did seemed to be right. He used the right methods and he had the salary scale. The salary scale he used made no provision for an escalation of salaries which would make sense based on recent experience. Nor did the investment earnings factor he used make a provision for inflation. It was almost identical with the actual investment return being earned by that fund at the current time, and wasn't too much different from the expected rates in the foreseeable future. So we found that there was no margin whatsoever for inflationary trends of salaries.

I presume many of you read last Sunday's New York Times, which had an article on public retirement systems. It was rather horrifying and it seems to me that Congress should have enacted PERISA before they enacted ERISA. From what I've read and what I've seen and what I've learned from other actuaries, most public funds are not making any provision at all for the effects of inflation on projected costs. I think that's very clearly one of the reasons why so many of these plans have lush retirement benefits, and have been creating staggering but unrecognized potential burdens on the taxpayers who ultimately will pay the bill. Ultimately, these cities will either have to cut benefits or bury the taxpayers under a mountain of debt. It seems to me that actuaries should speak out about

making some kind of provision for inflation, at least giving the cities an idea as to how their costs might move in the future if certain things happen in the way of inflation or salary changes. For example, under the plan we were looking at, salaries had been increasing for quite some time at about 7% to 8% per year across the board. Everyone here knows that in 20 years, at that rate of interest, a dollar today would just about quadruple in value. And what happens if a man is earning ten thousand dollars of salary, and gets a nice little two hundred dollar annual pension increment under a two percent benefit formula? The plan sponsor funds the two hundred dollar increment, the actuary does everything properly in the way of cost methods and assumptions, but that two hundred dollars becomes eight hundred dollars. These plans are, by and large, final pay plans and that two hundred dollars becomes eight hundred dollars, leaving a six hundred dollar benefit gap that's going to have to be filled somehow. Ultimately, the entire burden will be shifted to the taxpayers, at least by the time the employee retires. New York City requires such enormous sums to fund its pension plan - which is a pretty lush plan, like most city plans that I've seen - that it can't afford to continue in the Social Security system. It seems to me that, under any meaningful code of ethics, actuaries have an obligation to start doing some planning for cities like they do for corporations, trying to give taxpayers insights - make it part of the public record - as to how pension costs might move, if the salary increases of recent past are ever duplicated. So, I think when we discuss these questions, we'll conclude that, just as inflation must be incorporated into pension funding for corporations, the same rule should apply to cities. Now after that little commentary, I'd like to ask Tom to talk about the ethical considerations in considering how to provide for inflation and pension plan costing and then go on to the question of whether or not governmental entities should conform to the same rules as corporations.

MR. THOMAS M. MALLOY: I think the presence of inflation as an element in the ultimate cost of a plan is unarguable. I find it very difficult to produce an estimate of future benefit liability based on an inflationary investment yield that doesn't consider the impact of such inflation on the benefit level itself. I would be the first to admit that the level of inflation to be recognized is subject to great debate. A primary requisite for our work should be a striving for internal consistency of all assumptions affected by future economic activity. If the benefit structure of a particular plan prevents the recognition of probable inflationary impact, the actuary must seriously consider the consequences of recognizing any significant inflation in other aspects of the valuation.

I don't feel there should be of necessity different rules for different classes of plans. Corporate plans probably have more control and disclosure operating on them at present. The lack of such discipline probably places a greater burden on the actuary to see that proper recognition is given to factors which could cause shifts in the incidence of plan costs over time and that these items are disclosed and discussed, when working for the plan of a governmental entity. The plan sponsor may have many considerations which argue for a particular incidence of cost over time. The actuary should be assuring himself that the sponsor's decision is reached in the context of "full awareness" of all the factors involved.

MR. LAURENCE E. COWARD: The actuary should make some allowance for inflation in his valuation basis. Inflation is a fact of life that cannot be ignored. The main question is whether implicit or explicit allowance should be made. I do not think full allowance should be made for the inflation element in the interest rate, even in career average or flat benefit plans where no salary scale is being used. It seems unsound to rely on future inflation to keep a pension plan solvent, since such inflation will most likely require the plan to be liberalized. Actuaries deal in probabilities and perhaps the probability of plan liberalization should be taken into account, at least implicitly. It could be argued that inflation is largely "a product of the times" to be dealt with as it occurs. In career average and flat benefit pension plans, it seems proper, if not necessary, for the actuary to be conservative, bearing in mind the high probability that the benefits will be raised periodically.

A good question is how much of the actuary's conservatism should be disclosed to his clients. It has been suggested that the plan sponsor should have full details of the financial effects of various actuarial assumptions and make final decisions on the assumptions to be used. This may be ideal if the sponsor is enlightened and if the actuary is persuasive. In the real world, the sponsor is tempted to take a short-term view, to choose the lowest cost assumptions, and to undervalue actuarial judgment. I think actuaries should take a strong professional stand as to what is a sound actuarial basis and remember that they have responsibilities to employees as well as to employers.

MR. CECIL J. NESBITT: I had two comments here but the first has already been fully covered by my colleague. The second is that Allison - Winklevoss and Trowbridge - Farr have illustrated the effect of modifying these assumptions. Our paper also will permit the calculation of the differences produced in values for our model plan by differences in the basic rates. However, another paper would be needed to explore the effect of maintaining one level for the assumed rates while another level is actually experienced.

MR. DANIEL F. McGINN: I was with somebody yesterday who told me that one actuary priced out the plan for a fairly large city at 25 or 30% of payroll. Another actuary came in who happened to believe that inflation should be considered; he came up with a cost rate of approximately 150% of payroll. There's an awful gap there and it raises a question as to the credibility of actuaries if they don't do something that at least seems to look like it's based on reality rather than fairy tales. I'd like to move on to Question Number 3: How much use do actuaries make of cash-flow projections and will actuaries change their methods and approaches because of ERISA?

MR. THOMAS M. MALLOY: Cash-flow projections are useful in several instances. They aid in the examination of a fund's future basic liquidity, the relative security of emerging plan liabilities, or other aspects relating to the sound management of the venture. A point to remember, however, is that cash flows are quite sensitive to variations in experience and their utility can deteriorate rapidly as the period over which they are run out expands. I think it will be accepted that one can better identify the present value of retired life liabilities that will emerge under a plan over the next 10 years than one can plot the year-by-

year emergence. Another point to keep in mind is that "cash-flow" projections for any significant period require some rather explicit assumptions relating to the demography of the employee group itself. The greatest single benefit I have derived for my rather limited forays into cash-flow exercises is the learning experience it offers one. Dr. Jay Mendell in his remarks last fall in Bal Harbour alluded to this with his advice: "Throw out the forecast, keep the forecaster".

Cash-flow work can be a rather hazardous exercise in speculation if the plan sponsor's organization is not capable of dealing with its own planning within a comparable time horizon. I honestly hope that actuaries will consider new methods in their work. Not out of any sense of defensiveness or reaction to ERISA, however, but in recognition that there needs to be more choices in the manner in which we spread costs over time. The present family of cost methods describes a few discreet points on a theoretically broad spectrum of cost incidence. I would hope that the federal regulators and the accounting profession will recognize that there are other possible cost patterns. Actuaries should be creative in working with their clients in developing such alternative methods.

MR. LAURENCE E. COWARD: While pay-as-you-go and terminal funding are prohibited over most of Canada, many companies find cash-flow studies to be valuable. The studies do not only show the income and outgo in future years, but also construct valuation balance sheets at three-year intervals in future. Hence, the effect of the government rules on funding liabilities over 15 and 5 years can be exhibited, as well as the effect of various degrees of conservatism in the valuations and funding policies.

MR. CECIL J. NESBITT: A number of plans, particularly in the public sector, provide for separate accounting of the funds required for active employees and for retired employees, and carry out a transfer from the fund for actives to the fund for retireds when retirement occurs. For such plans, it would be useful to prepare what I call a semi-projection, namely, an estimate of the year-by-year transfers required to provide for new retirees. This is offered simply as a suggested means for better understanding of such plans. It is, of course, related to the terminal funding concept, and ERISA requires a stronger funding method for private plans.

In general, I believe that presentations in terms of present values only are inadequate and that actuaries should supplement these increasingly by projections of various types and lengths.

MR. DANIEL F. McGINN: I'd like to comment that, with the introduction of the funding standard account, it would behoove actuaries, before they give too much advice, to test out some of the results on a series of alternative assumptions to find out under what conditions funding deficiencies might arise and perhaps create some serious problems for the corporation's clients: Question Number 4: To what extent are actuaries using new approaches in pension plan funding to assist corporations in evaluating alternative investment strategies?

MR. THOMAS M. MALLOY: I question whether new approaches in pension plan funding are needed for the evaluation of alternative investment strategies. This is said within the limited definition of a funding method which has these features:

a) defining an ultimate funding goal,

b) evaluating the current progress of the adopted funding strategy,

c) defining current contribution needs within the adopted strategy.

Investment strategies open up another area of study. If I have a funding strategy which involves the prefunding of liabilities to the extent that significant assets will be invested over periods of time, then I would expect that further examination of cash flows and liquidity pattern of the asset pool may help me in managing the investment of such assets. I've participated (or observed other actuaries) in several different activities along these lines.

They all end up working with aspects of the problem that might be put in focus if we viewed the pension fund as a separate and distinct financial institution, having its own corpus of funds, future inflow and outflow of cash and certain fiduciary obligations as to the management of such assets so as to optimize yield and minimize risk. Some of the fiduciary constraints will be imposed by regulators, some by the plan sponsor and his own personal tolerance of risk in performing his duties. The pension fund as an investment vehicle has its cash flows imposed on it. Some forecasting of such cash flows is necessary for the orderly structuring of an investment strategy. The nature of underlying liabilities giving rise to the asset may influence investment strategy, i.e., employee money, retired life liability, etc.

The actuary, because he is involved in these same considerations in providing advice as to funding strategy, will be in a position to contribute to the investment strategy discussion. There is much activity today in the area of statistical analysis of economic cycles and the historical yield characteristics of various classes of investments. Actuaries with the time and inclination for this work may become quite sophisticated in providing insights here which contribute to the development of investment strategies. My own view is that this doesn't represent any new approach to the classic goals involved in funding strategy, but rather an extension of the work of the actuary to another area of the total operation of a pension plan that has not, in the past, had all the attention it deserves.

I would point out that this can lead to areas in which actuaries may feel they are conversant, i.e., economic and investment theory, but it is an area that can demand some rather strong cooperation between three distinct professionals - actuary, economist, and investor. As a profession we should not overlook the need to have all the requisite talent bearing on a problem, and as individuals we should avoid assuming roles which require expertise in areas where we are not personally comfortable.

MR. LAURENCE E. COWARD: I'm not sure that I understood the question. I couldn't quite see why pension funding should help in evaluating the performance of a fund, so I really don't have much of an answer to this. I do very much support the last speaker's remarks. If actuaries are going to get into the investment business, then I think they had better specialize in it. Not every pension actuary is qualified to talk on investment strategy by any means and yet there is no reason why we shouldn't have a group of specialists, as they certainly have in the United Kingdom, who make investments one of their specialties.

MR. DANIEL F. McGINN: And I don't know the answer myself. Let's go on to Number 5: Will the use of the accrued benefit cost method be curtailed because of ERISA's imposed funding standard account? If so, why and how will the use of this cost method be affected?

MR. THOMAS M. MALLOY: The accrued benefit cost method has the capacity to generate some rather heated debates, pro and con, whenever it is discussed. I personally don't feel that its use will be curtailed under ERISA and I would not be surprised if it came into greater use. What will be dismaying is when it is adopted for the wrong reason. As mentioned under Item Number 1, the actuary is involved in two or three basic tasks when he values a pension plan. He should produce a reasonable estimate of the total liability represented by the plan. He then applies a cost method which allocates this total cost over time. My biggest concern with the accrued benefit method is that in its present mode of application, it does not provide any insight into the total liability involved, but goes directly to the current year's cost generated under the method. I would be much more comfortable with its general use if, when considered as an alternative method of funding, it displayed all the pieces.

In any discussion of funding strategy, I would like to see the following items for each cost method under consideration:

the total present value of future benefits,

assets on hand,

amounts yet to be funded (i.e. present value of benefits less assets).

These items should be the same regardless of the cost method involved and it is the allocation over time of the "yet to be funded" liabilities that lead to a funding strategy. It then becomes quite clear that for the specific employee group at hand, a lesser required payment in the early years under one method must lead to higher payments in later years if the same "yet to be funded liability" is to be addressed over comparable periods of time.

The classic division of the "yet to be funded" into present value of future normal costs and unfunded accrued liabilities has to be recognized as an arbitrary convention which for the most part has served its intended purpose quite well.

The key consideration, however, should involve a conscious adoption of a specific incidence of cost over time that fits with both the plan sponsor's

ability to pay and his own level of concern as to the incidence of cost over time as well as the likelihood that such cost incidence may or may not follow some predictable index, e.g., level dollars per year, dollars per life, % of payroll, etc.

The actuary's task is to see that his client is making an informed judgement relative to the incidence of plan cost over time. He should speak up when the circumstances of a plan render one method potentially inappropriate. Beyond that, the actual funding incidence (with its federal strictures) is pretty much an arbitrary business decision.

MR. LAURENCE E. COWARD: As to funding methods, the entry age normal and frozen initial liability methods are more commonly used and accepted in the United States than in Canada. An accrued benefit cost method with salary projection is frequently used in Canada for final average salary plans. A survey of large plans by the Ontario Pension Commission in 1975 showed that, out of 46 final average pension plans, 15 were valued on an accrued benefit method and 31 on a projected method. In the case of 82 career average and flat dollar pension plans, 60 were on an accrued benefit method and 22 on a projected method.

MR. DANIEL F. McGINN: I think we should move on to the Bowers - Hickman - Nesbitt paper.

MR. CECIL J. NESBITT: There are two handouts. One is my introduction to the paper, and the more urgent handout is the one prepared by Newton Bowers which has about 30 formulas that he will run through when he talks about the paper. One or two housekeeping items, Mr. Trowbridge yesterday gave the correct authorship of the paper, namely, Bowers, Hickman and Nesbitt. It happened that the typing of the paper was in my department and somehow or other my name got first. Another item: if and when you actually read the paper, notice that we have a rather subtle convention. When there are plain printed A's and B's and P's, those relate to just a unit of initial pension benefit, but if the A or the B or the P is in bold face - and you have to look at it carefully to see whether it's bold face or plain - then it refers to a value for the plan as a whole, not for an individual unit benefit. Finally, I thought TICA was a well-known abbreviation. It turned out, it isn't. It came out in the paper as Transactions of the Institute of Chartered Accountants, instead of Transactions of the International Congress of Actuaries. We'll correct that.

This paper organizes some pension funding theory out of a variety of ideas to which the authors have been exposed over the past 20 years. A starting point was Trowbridge's familiar paper on 'Fundamentals of Pension Funding' which by means of a simplified model of a pension plan operating in a stationary population greatly clarified the basic principles underlying funding methods. Meanwhile, demographers such as Nathan Keyfitz were exploring the theory of stable populations subject to fixed rates of fertility and mortality. A stable population provides a more general setting in which to study pension funding theory and we make some simple use of the idea. Also, inflation of prices and wages has stimulated actuarial thought regarding the actuarial management of pension and social security systems, and laid the ground for new theory. I will mention briefly some of the papers which have preceded ours:

1959 - Niessen: Cost Calculations for Pension Funds Subject to Adjustment for Inflation.

- Nowlin: Insufficient Premiums.

1960 - Myers: Actuarial Analysis of Pension Plans under Inflationary Conditions.

1967 - Taylor: The Generalized Family of Aggregate Cost Methods for Pension Funding.

1968 - Francis and Scholey: Pension Fund Finance, Equalization of Burdens and Accumulation of Assets.

- Hickman: Funding Theories for Social Insurance.

1970 - Humphrey, Langham, Snelson and Sparks: Pensions and Company Finance (which is a good reference for this panel discussion).

1974 - Trowbridge: Social Security Amendments, 1969-72.

1975 - Allison and Winklevoss: The Interrelationships among Inflation Rates, Salary Rates, Interest Rates, and Pension Costs.

- Trowbridge and Farr: Theory and Practice of Pension Funding.

- Hickman and Montgomery: Pension Funding under Wage and Price Inflation.

1976 - Kischuk: Interest and Inflation in Pension Plan Valuations.

Of the present authors, Hickman was the first to have something put in print (in his 1968 paper) on these matters. In 1973, I picked up the ball at the Harvard Actuarial Conference in a note entitled 'Are There Ideas in Population Mathematics Which are Adaptable to Pension Funding Theory'. The answer was clearly yes and I tossed the ball to Newton Bowers to see what his mathematical mind would make of it. After a decent interval, he came back with a lengthy manuscript which was discussed with Trowbridge and at our actuarial seminar at Michigan. Various suggestions were made such as: cut it in half, add some numerical illustrations, redefine the growth functions, etc. Meanwhile, Hickman and Montgomery at Wisconsin were working on the ideas, stimulated by a reading of the Trowbridge-Farr manuscript. Last summer, Trow stepped in to suggest that the three authors get together on a paper that could be used as a reference for the theory underlying some of his statements about inflationary models. The result is a completely mathematical paper (my fault), with no numerical illustrations, as we knew these would become available in the Trowbridge-Farr text, and were or would be available in a number of other sources.

The mathematics is elementary and we hope it will not deter too many readers. A continuous model is used throughout so that the power and facility of calculus is available. Many of the formulas have readily comprehensible verbal interpretations, and these are given alongside the formulas.

The model plan we discuss is a pure pension plan operating in a population with fixed rates of decrement but with possible generation-wise growth. A salary scale is used and permits year-of-experience modification of salaries under inflation or other cause. Retirement is at a fixed age, and pensions are adjusted by a function which may be related to duration since retirement. There is no vesting of benefits on withdrawal or death, and in that respect, our model plan differs from the Trowbridge-Farr illustrations which take account of vesting of benefits on withdrawal after 10 years of participation. Also, we give no consideration to the expense factor.

Instead of working out the theory separately for each of the main funding methods, we discuss a comprehensive family of funding methods simultaneously by using the cumulative pension purchase concept developed by Cooper and Hickman in their 1967 paper, "A Family of Accrued Benefit Actuarial Cost Methods". This eliminates redundant mathematics and saves on Transactions' printing costs but does entail more than casual effort by the reader or user. To apply the theory to a particular funding method, one has to select an appropriate accrual function and, as our students would say, plug it into the formulas, and grind out the results. This makes reviewing of the Cooper-Hickman paper a prerequisite to the understanding of our paper.

The paper concludes with what we call the exponential case in which the population growth, salary growth and pension adjustment functions are each exponential. The results for this case are in general agreement with statements and numerical illustrations in Trowbridge-Farr and elsewhere. An example is the Liability Growth Equation, discussed by Francis and Scholey, Trowbridge-Farr, among others, and the observation that, if the growth rate equals the interest rate, then normal cost rates (under individual funding methods) all equal the pay-as-you-go rate. Another example is a Trowbridge-Farr statement that a replacement effect (new pensions less pensions terminated) is zero if the salary growth rate and pension adjustment rates are equal. In our case, the growth rate is the composite of population and salary growth rates. The exponential case of our paper could also be used to develop some of the ideas of the recently distributed paper by Kischuk.

The theory could be adapted easily to what I call the precisely vested case wherein on withdrawal or death the participant is credited with the individual reserve on hand for him (individual rather than aggregate funding being assumed). In effect, funding would have gain or loss only from salary and investment experience prior to retirement. This has implications for so-called *targeted plans*.

I have talked in general terms about the setting and the scope of our paper. Professor Bowers will discuss some of the mathematical concepts and the detailed formulas. We would encourage you to read, enlarge and utilize our paper but warn you that it will take a modicum of mathematical effort which we hope will bring its own rewards.

MR. NEWTON L. BOWERS, JR.: This paper discusses a particular model for a pension plan. As in all mathematical models, compromises must be made. The model must attempt to reflect the real life object being modeled, but must also be simple enough to manipulate analytically. Our objective here is to give insight into the operation of a pension funding scheme, not to provide numerical results for accounting or tax purposes. We chose a continuous model for reasons of simplicity. Mathematics of differential

equations are more familiar to most actuarial readers than the corresponding mathematics of difference equations. At various points in the discussion on the assumptions upon which the model was built, choices had to be made balancing realism with practicability. Others with different backgrounds might have made different decisions at different points. I will indicate some of these possibilities as I proceed.

The model we use starts with that of Trowbridge in his classic 1952 paper. Entry is fixed at age a and retirement is fixed at age r. Only retirement benefits are considered - thus no account is taken of death, disability, or withdrawal benefits. Survivorship is independent of time and follows a single decrement survivorship function l_x. The retirement benefit is a continuous annuity. We define the initial rate of pension payment as b times the final salary rate and provide for possible change in the benefit payment rate after retirement.

Let us first describe the pension incurrence function h(t). We separately project the number of employees who will retire at time t and the initial benefit per new retiree at time t.

The model for projecting the number who will retire is the cohort or generation approach. The density of new retirees at time t is defined as $g_1(t)l_x$. Thus the density of employees age x at time t is $g_1(t+r-x)l_x$. The g_1 function is evaluated at time t+r-x since persons age x will retire r-x years later. The proportion of this group which is expected to survive so as to retire at age r is l_r/l_x. This g_1 function will be our device to provide variations in the size of the work force. We define $g_1(0) = 1$ where 0 is a convenient time origin. It should be pointed out that for the density of retirees at age $x(x>r)$ at a particular time t is also expressed by $g_1(t+r-x)l_x$.

The initial benefit per retiree is b times the final salary at the time of retirement. We assume the salary of an employee aged x at time t is $g_2(t)\ s(x)$. The initial benefit level for new retirees at time t is thus $b\ g_2(t)\ s(r)$. The salary function s(x) thus represents the relative salaries by age at all points in time. The $g_2(t)$ function represents the level of salaries at time t; inflationary changes in salaries will thus be modeled by a change in the g_2 function. The above assumption, that salaries at all ages are changed by the same percentage when the general level of salaries changes, seems to be reasonable. Again we define $g_2(0) = 1$ so that s(x) represents the salary levels at the time origin. Combining we obtain formula (8) for h(t), the density of new pensions incurred at time t.

A pension adjustment function was introduced into the model to provide for a change in the benefit payment rate following retirement. We assumed that the pattern was age dependent only. This is convenient and fits well with the special case we investigated in the last section of the paper. Changes in benefit levels would seem to be related to cost-of-living changes. The g_2 function, which reflects wage level changes, includes the workers' shares of productivity increases. In any case, a closer tie-in between the pension adjustment function and the g_2 function might be desirable. We chose the simpler way.

As Cecil noted, we discuss a family of funding methods simultaneously in the paper by use of the accrual (of liability) function M(x). This method was first used in the 1967 paper that Jim Hickman co-authored. The several funding methods discussed in the 1952 Trowbridge paper are represented by different accrual functions. Examples are given in the paper following (13). Different funding patterns from the standard ones can also be considered. One that occurs to me is to define M(x) as the level of age r pension benefits vested by age x per unit of projected initial age r pension benefits. This might be viewed as a lower bound on permitted funding methods. In a real life pension plan, the accrual function would be a function of not only the attained age but also the entry age. The model is simpler but introduces no essential error in the results.

Four functions of age x per unit of projected initial pension were discussed. While we continue to use much of the vocabulary of pensions and pension funds as used in the 1952 Trowbridge paper, we adopted insurance notation since it seems to capture the essential nature of the functions, A for present value of future benefits, V for accrued liability or reserve, and P for normal cost or annual premium rate. A(x) is defined in formulas (14) and (15). $\ddot{a}^{\beta}_{r}$ is the present value of the varying annuity with the rate of payment at age r equal to one per year. For age x greater than r, the annuity value is the present value of the varying annuity with current annual rate of payment equal to $\beta(x)$, so that it still refers to an annuity of one per year back at age r. V(x) is given by M(x)·A(x), formula (16), and P(x) = m(x)A(x) as in formula (17). These are the liabilities and normal costs associated with the particular funding method chosen. It is shown that these definitions are consistent in the sense that the present value of future normal costs, which was the fourth of these individual functions, added to the accrued liability equals the present value of projected pension benefits. The symbol (Pa)(x) was used for the present value of future normal costs.

We next examined five functions which relate to the valuation of the plan. These plan functions are indicated by bold face in the published version of the paper and by cursive letters for the same formulas when they are shown below. Two of these are flow-type functions, $\mathcal{B}(t)$ and $\mathcal{P}(t)$. $\mathcal{B}(t)$ is the annual rate of pension outgo at time t. It is defined in formula (26). The time rate of change of $\mathcal{B}(t)$ is given in equation (27). The first term is the density of new pensions incurred at time t. The second represents pensions terminated by deaths among the retirees, and the third expresses the adjustment of pension payment rate by change in age among those receiving benefits. $\mathcal{P}(t)$, the annual rate of normal cost for the plan at time t is similarly defined (in formula (34)) and the differential equation found (equation (36)). A verbal interpretation of the various terms can be made.

The remaining three functions are more of the balance sheet type. $\mathcal{A}(t)$ is the present value of the future pension payments to participants covered by the plan at the time t. It is most conveniently defined by formula (30). Two different differential equations for $\mathcal{A}(t)$ are developed. The first term in the right member of equation (31) represents the present value of future pensions for new entrants, the second term takes account of assumed interest, and the third term expresses the rate of pension outgo. The other equation given in formula (32) is more reminiscent of that developed for $\mathcal{B}(t)$. The first term is for new entrants, the second represents the change in present value through aging, and the third represents present values released by death.

$V(t)$, the accrued liability of the plan as of time t, is of a similar type. It is most compactly defined in formula (38) and leads to two differential equations, equations (40) and (41). Equation (40), the Liability Growth Equation, is the more important. It is a generalization of the Equation of Maturity stated by Trowbridge in 1952. In the mature, stationary case the Liability Growth Equation reduces to $P + \delta V - B$. Equation (40) leads to several interesting results in the last section of the paper. The other differential equation (41), has two terms, one of which can be recognized as an increase due to aging term and the other as a release through termination term. We similarly define the present value of future normal costs of the plan at time t, $(Pa)(t)$, and develop the differential equation for it.

So far we have talked about how the liabilities and present values of the model plan change with respect to time. Let us now discuss how the fund is built up to meet the pension obligations. We studied the case where the actuarial assumptions are realized. Additional results should be obtainable for cases where there are systematic actuarial gains or losses. In particular, it would seem easy to take into account an investment rate of return different from the rate used to calculate present values.

The application of the theory developed so far to an individual cost method is direct. First, we note that the differential equation for the growth of the fund (52) bears a strong resemblance to the Liability Growth Equation, particularly if the earned interest rate equals the rate used to evaluate present values. If we label the unfunded accrued liability of the plan at time t as $U(t)$, we obtain the differential equation given on the formula sheet.* The equation states that the unfunded liability is the sum of normal costs which should be paid and interest on the unfunded liability. Offsetting these are contributions actually made. If the unfunded accrued liability has been reduced to zero, we need merely to contribute the normal costs to hold it there. If, on the other hand, we contribute an amount equal to normal costs plus interest on the unfunded accrued liability, this liability will remain constant. Again the presence of actuarial gains or losses will change these results. * $\frac{dU(t)}{dt} = P(t) + \delta \cdot U(t) - C(t)$

The situation is more complicated in the case of aggregate cost methods. The aggregate cost method based on a particular accrual function M(x) consists of two steps. First, we find the mean temporary annuity $\tilde{a}(t)$. $\tilde{a}(t)$ is defined in equation (56). Further, $(Pa)(t)$ is the difference $A(t) - V(t)$. This suggests that we might perform an individual valuation to obtain the several required factors, $A(t)$, $V(t)$, and $P(t)$. I understand this is not common practice. The second step is to find an aggregate contribution rate $C(t)$. This is defined so that a mean annuity at the annual rate of $C(t)$ is sufficient to make up the difference between the present value of future pension benefits and the fund in hand. (See formula (59)). From this, we obtain the result given in equation (64). This says that if the funding is rapid enough so that we have a "small" mean temporary annuity, then the fund size will approach the size of the accrued liability for the corresponding individual cost method. Further, the annual contribution rate approaches the annual rate of normal costs.

Some common funding methods involve a modification of the aggregate cost method. At the inception of the plan, for convenience now labeled as time 0, the present value of future pension benefits, $A(0)$, is split into

two pieces. Often the split is on the basis of service prior to the inception of the plan as against that subsequent to inception. This past service portion is kept separate from future normal costs and is amortized over, for example, the first twenty years of the plan. The remaining present value, $\mathcal{A}(t)$ less the "unfunded" past service liability $\mathcal{L}(t)$, is funded by the aggregate cost method. The result is given in equation (70). A comparison with equation (64) shows that the unfunded past service liability $\mathcal{L}(t)$ is mathematically equivalent to an interest-bearing asset of the fund. The total assets $F(t)+\mathcal{L}(t)$ will converge to $\mathcal{V}(t)$, the accrued liability, under the same conditions of sufficiently rapid funding that were needed in the strictly aggregate cost methods.

As an application of the results developed so far, we looked at the exponential growth case. The number of new entrants is assumed to follow an exponential pattern $g_1(t) = e^{\alpha t}$. This leads to a stable pattern by age for the number of employees and retirees with the size of the total population growing in the same exponential pattern. Similarly, the $g_2(t)$ function which represents changes in the level of salaries is assumed also to follow an exponential pattern, $g_2(t) = e^{\gamma t}$. These strong assumptions lead to a number of results. First, the five plan functions $\mathcal{B}(t)$, $\mathcal{P}(t)$, $\mathcal{A}(t)$, $\mathcal{V}(t)$, and $(\mathcal{P}\mathbf{a})(t)$ all grow exponentially as does the total wage cost at time t. A typical differential equation is $\frac{d\mathcal{V}(t)}{dt} = \tau\mathcal{V}(t)$ where $\tau = \alpha+\gamma$. Second, such ratios as normal cost as a percentage of wages and the mean temporary annuity are no longer functions of t but remain constant. Specific formulas for $\ddot{a}(t)$ are given which now depend on δ, τ, and the accrual function $M(x)$. Equation (85) shows that $\ddot{a}(t)$ can be expressed as a temporary annuity at the rate of interest $\delta-\tau$. Finally, the Liability Growth Equation becomes equation (87). This can be interpreted to mean that only $(\delta-\tau)\mathcal{V}(t)$ of the assumed interest is available for pension outgo, the remainder $\tau\mathcal{V}(t)$ being required for growth of the liability. What this means for a long-term situation where $\tau>\delta$ is unclear. It may be economically impossible. Alternatively, it may suggest pay-as-you-go as the only viable funding method in these high-growth, low-return situations.

We also examined the more specialized case where $\delta = \tau$. The most unusual result is that $\mathcal{P}(t) = \mathcal{B}(t)$ for all t and all funding methods. This does not imply that all funding methods are equivalent to pay-as-you-go. Any advance funding method will define an accrued liability $\mathcal{V}(t)$. There remains the problem at the inception of the plan to bring the fund up to the accrued liability. Again it is unclear to me what this implies as to funding methods chosen.

In this paper, a foundation has been laid for the mathematical exploration of pension funding under conditions of growth which may arise from inflation or other sources. The theory has been applied to the relatively simple case of exponential growth. The theory itself can be developed further. Other applications are possible such as covered groups which have not reached maturity, exponential growth with a dampening factor or change in growth rate after a period of years, or situations with actuarial gains or losses. I hope this paper will stimulate such further developments.

(Formula and equation numbers shown on pages 172 to 175 are those used in the paper.)

MR. DANIEL F. McGINN: Thank you Mr. Bowers. That might be a wonderful paper to require in the future for enrolled actuaries. We certainly would have a controlled group then.

I'd like to know if there are any persons in the audience who would like to ask any questions.

MR. HARRY M. SARASON: I found this paper extremely stimulating without fully understanding it. We are talking about a going pension plan. However, the plan may be discontinued, or the corporation may move its activities away from where an employee desires to live, so he is vitally affected by the underlying economic entity. I want, however, to point out something else which has come up several times in connection with projecting the rate of interest. We actuaries are doing something that I was taught as a statistician never to do, and that is project a trend into the future. We should get at underlying causes, of course. There are several things that are pertinent here. One is that since pension funds and related funds now own 50% of the stocks traded on the Big Board, we're coming to a limit. We can't own 101% of those stocks. Next, I want to give you an illustration of my credibility as a projector. My business associates were talking about the stock market constantly, and I didn't pay any attention because I knew for sure I couldn't predict the stock market. To my amazement, however, I suddenly started telling them every week-end what was going to happen in the stock market next week, and 8 times in a row I was absolutely correct. The 9th time the Dow Jones Industrial Average was below 700, and I predicted that on Monday and Tuesday it would get up to 700 and 725, and then drop back below the 700 mark. Well, I was absolutely right about the 700 and the 725, but then the stock market took off to above the 900 level. So I've got a batting average of seven out of eight: seven singles with the score of 13 to nothing in favor of our team and one hitting into a triple play in the last of the ninth, with the bases loaded and our team just one run behind. Now my prediction for the future: the Dow Jones Industrial Average in December of this year will hit somewhere around the 650 mark.

MR. RICHARD S. HESTER: The purpose of this session was to talk about funding policy. Well, without reviewing every single word in ERISA, the only reference I find to funding policy is in Act Section 402 where it says that every plan shall provide a procedure for establishing and carrying out a funding policy and method consistent with the objectives in the plan. There is a discussion of this in the committee report, explaining that this procedure is to enable the plan fiduciaries to determine the plan's short- and long-run liquidity needs and communicate these requirements to the persons who manage plan assets. The committee goes on to say that you have to spell out whether contributions are coming from employees or from the employer.

MS. MARY RIEBOLD: There is no basis whatever to reject the accrued benefit cost method as an appropriate actuarial method under ERISA. That the actuarial profession should even hint at this by the introduction of this topic is quite disconcerting.

First, the method itself is a rational and orderly one. The annual costs for a single employee developed thereby accumulate in an explainable fashion to the reserve required at the normal retirement date. That an increasing pattern of costs occurs when a single employee is considered

can make this method a very useful tool when employed by a thoughtful actuary. There definitely exist situations where the combination of plan benefits, the funding philosophy of the plan sponsor, the type of employee group and actuarial assumptions indicate that the accrued benefit cost method would be clearly preferable to other methods. There seems to be no reason to force the actuary to abandon this theoretically sound approach in such situations. Of course, for many employee groups, the incidence of increasing individual costs is not at all evident in the level total costs which occur.

Secondly, ERISA itself [Act Section 3 (31)] includes it as an acceptable "advance funding actuarial cost method". Act Section 303(b)(1)(A), which describes the calculations of the alternate minimum funding standard, specifies as one of the charges "the lesser of normal cost under the funding method used under the plan or normal cost determined under the unit credit method". This again recognizes the method as an appropriate actuarial tool. Nowhere in the Statements of Managers or elsewhere in the legislative history have I found any reference to an intent to curtail this method.

Finally, there seems to be an actuarial consensus that use of the method will increase because of ERISA. The 1975 survey of "leading consulting actuaries" by the Council on Economic Priorities (undertaken with technical guidance from three fellows of the Society of Actuaries) is an example. A preliminary tabulation of the responses show 11 of 23 actuaries believed there would be an increase in the use of the method. (Correspondingly 11 also expect an increase in use of frozen initial liability method, 7 expect an increase in use of individual entry age method, and only 2 expect an increase in the individual level premium method).

In summary, the difficulties which may occasionally be encountered in the use of the accrued benefit funding method should, by no means, destroy the use of the method. It provides a needed cost flexibility in many situations with no loss in benefit security and it is affirmed by ERISA. Certainly, there may be problems arising from the utilization of this - or any other - method. (Some of these could involve the greater likelihood of overfunded situations, the necessity of careful explanations to clients of the cost progressions, and the duty for general "prudence" in selecting methods and assumptions). But the solution - or avoidance - of these problems are matters for which our actuarial education has prepared us.

MR. DANIEL F. McGINN: I want to thank each speaker for contributing to a most interesting session.

With ERISA's Funding Standard Account and the potential 'experience deficiencies' which it can generate and with the ever-present potential corporate liability if a plan terminates, the challenge to the actuary is whether or not he can adapt himself to being a more dynamic advisor to corporations and their pension planning. As plans grow in size, pension plans have an ever-increasing influence on corporate earnings, and the actuary who won't survive is the one who will not change.

SOLVENCY STANDARDS FOR LIFE COMPANIES IN THE UNITED STATES, CANADA, AND THE UNITED KINGDOM

Topics Discussed:

1. Threats to solvency under changing economic conditions
2. Balance sheet valuation rules and standards
3. Contingency reserves
4. Taking action when events presage possible insolvency