

**1988 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS**

COMMITTEE ON SOLVENCY STANDARDS FOR FINANCIAL INSTITUTIONS

MR. DAVID J. CONGRAM: This topic will be presented in three parts. The presentations by Allan Brender, Robert Howard, Helmut Engel, Philip Pothier and Michel Giguere will involve the work of the Modeling Subcommittee of the Canadian Institute of Actuaries (CIA) Solvency Standards Committee. I would first like to acknowledge the team of members, too numerous to name individually, who have contributed and supported our work. This includes the members of the full Solvency Standards Committee, whose help and advice we have appreciated, as well as those who have directly supported each of us in our modeling work. Frankly, it would have been impossible to assemble the material, which will be presented here, without the commitment and dedication of these people.

We will be referring to two sets of material: (1) the Statement of Direction of the CIA Solvency Standards Committee and two papers outlining the scenarios that are to be tested, and (2) the illustrative report on solvency testing for the Solvent Stock Life Insurance Company.

The November 1985 Canadian Institute of Actuaries report of the Crawford Committee on the broadened Role of the Valuation Actuary in Canada recommended that "the

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valuation actuary's formal opinion should encompass the ability of the company to meet its future obligations with respect to both existing business and anticipated future new business."

In preparation for the valuation actuary taking on this broadened responsibility, the Committee on Solvency Standards has been considering the best approach to addressing this challenge and working to put in place standards, tools and training to allow the valuation actuary to assume this broadened role.

The Statement of Direction states that, in the short term, the CIA Solvency Standards Committee will concentrate on the projection of future capital and surplus needs based on the current and prospective formula surplus requirement as developed by the Canadian Life and Health Insurance Association (CLHIA). In pursuit of the short-term objective, the valuation actuary will be required to calculate various projections for a period of five years based on a company's business plans and to perform and test various scenarios of certain pessimistic but not impossible deviations from his base assumptions. This will be optional for 1988 and 1989 but mandatory in 1990.

The objectives for these sessions are as follows:

- a. To illustrate how the testing of surplus requirements could be performed in various adverse scenarios.

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- b. To demonstrate using a model that the testing can be performed for the total company.
- c. To illustrate most of the features that should be included in the model.

Over 1987-1988, we have modeled a typical but hypothetical federally licensed Canadian life insurance company involved in a wide range of products. In this session we will provide you with an overview of our initial results and review with you how these results have been prepared and how the scenario testing proposed by the Committee has been applied. We will provide a company overview. Then we will review, by each product line, the modeling and provide further details of the results and the issues that have been raised.

Each of our Committee members will present the model that he has been responsible for developing. We will cover one product line in this session.

The scenario testing the Solvency Committee is recommending can best be described as a verification that a life insurance company will be able to meet the new minimum continuing capital and surplus formula requirement for each of the next five years under a variety of possible future experience and strategies. This verification is to be performed by modeling the company's operations.

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The types of tests required are deterministic rather than stochastic (compared to the approach in the U.S. which has concentrated on the interest rate scenarios being tested). Another difference is the concentration on following through any deterioration of experience into the valuation assumptions at the end of the projection period.

Emphasis has been on sensitivity testing of key assumptions.

The choice of scenarios to be tested is important. The base case is a projection for five years based on the company's business plan, including new business and the actuary's best guess concerning such plans and expected future experience. The base case forms a reference point for the sensitivity testing.

The Solvency Committee has specified ten prescribed or required scenarios to be tested. Each of the scenarios to be tested involves the deviation of a single factor from the values assumed in the base case.

Slide 1 lists the ten required scenarios. The first three scenarios deal with the basic experience of mortality, morbidity and lapse rates. Scenarios 4 and 5 deal with movements in the new-money rate, increasing and decreasing, respectively. Scenarios 6 and 7 address new-business assumptions. The former assumes no growth, and the latter assumes twice the rate of growth in the base scenario. Scenario 8 deals with policy

SLIDE 1

REQUIRED SCENARIOS

1. Mortality deteriorates for each of the projection years at 3 percent per annum.
2. Morbidity deteriorates for each of the projection years at 3 percent per annum.
3. Lapse rates become half or double, whichever is more unfavorable, those in the base scenario.
4. The short-term new-money rate increases linearly by 3 percent over the projection period.
5. The short-term new-money rate decreases linearly by 3 percent over the projection period.
6. New-business sales continue with no growth.
7. New-business sales grow at twice the rate in the base scenario.
8. Policy claims in the first projection year are at the level of the ninety-fifth percentile in the distribution of aggregate claims and are at a normal level thereafter.
9. Defaults of assets (debt) occur at twice the level anticipated in the base scenario.
10. Unit expenses increase at 3 percent per annum in excess of assumed inflation.

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claims in the first projection years at the ninety-fifth percentile. Scenario 9 deals with the default of assets at twice the expected level. Finally, scenario 10 deals with the deterioration in unit costs.

Additional scenarios should be chosen by the actuary based on the results of the prescribed sensitivity testing and his knowledge of the circumstances of the company. They would be chosen to encompass items that in his judgment could be a source of difficulty or danger to the company.

We plan to go into some detail of the actual modeling we have performed, outline our interpretation of the various prescribed scenarios, and show the way we chose additional scenarios. On occasion we will be fairly technical in nature, but our concentration has been based on the practical implementation of the scenario testing.

The first part of this session is to provide an introduction to our work by joining the valuation actuary of the Solvent Stock Life Insurance Company in the office of the president. The actuary has just received the initial runs of his model covering the base case and prescribed scenarios. He is concerned about the results and wants to brief the president on what has arisen and his thoughts on where he should go from here. He knows that the board meeting is coming up when the company's plans for the next year

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will have to be discussed, and he is expected to provide some commentary in accordance with the new requirements on the role of the valuation actuary.

Our fictitious company is quoted on the Toronto, Montreal and Vancouver stock exchanges and is a medium-size stock life insurance company with a fairly robust participating fund. The company was formed some time after the Depression in the 1950s and has had some strong growth over the past number of years.

The company is divided into five main divisions: the participating products division; the nonparticipating guaranteed individual products, which include the Term-to-100 division; the nonparticipating nonguaranteed individual products, which are principally the universal life division; the individual and group annuity products division; and the group life and health products division.

The company's premium income in 1988 is expected to be \$342,000,000. Thirty percent of this revenue will be from the annuity business, 40 percent from the group operations and the balance from the individual life insurance business. Twelve percent is in the participating line, and 6 percent is in universal life.

Our assets are just over \$1 billion. Ninety-four percent of these assets are in fixed-income instruments and the balance in stocks and real estate.

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Let us move over to the office of the president. Bob and Helmut are just about to begin their conversation:

FIRST REPORT TO CEO BY THE VALUATION ACTUARY

(Note -- This was a dramatization presented at the 1988 Valuation Actuary Symposium)

Actuary

Hi, Bob, I asked for the meeting with you today to talk about the preliminary results of the solvency testing. This is the first year in which we have to do this work, and I want to show you our preliminary results to keep you up to date on what we are finding.

CEO

Not so fast. I'm not with you yet. Could you go over what this testing is again?

Actuary

The Canadian Institute of Actuaries (CIA) required that I do solvency testing by August of this year. The purpose of this exercise is to give us confidence that the company will remain solvent over the next few years.

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CEO

But we are a very strong company financially. We have lots of surplus, and the rating agencies give us a AAA rating. What more do we need?

Actuary

Well, let me carry on. I think you will see the need.

CEO

OK. Tell me what you have done so far.

Actuary

We divided the company up in the same way that we are organized by division. I'll show you details of that in a minute.

We have been developing and testing our model. We are now fairly confident that it works OK, but I still want some more checking to be done. It is just a model, but it does reasonably replicate our 1987 financial results.

We then projected results for the next five years using our best guess assumptions. This is called the base scenario.

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Next, we also produced results for the prescribed scenarios. These scenarios are prescribed by the CIA and have to be done by all actuaries.

That is the stage where we are at the moment. I thought that we should get together to give you a chance to see these preliminary results. I think you have to get involved in the process since some of the results are rather "interesting."

CEO

"Interesting!" Your tone suggests bad news! What did you learn?

Actuary

Before I show you our preliminary results, let me go through some more details of the models, so you are comfortable with how we got the results.

Exhibit 1 shows the divisions and product lines that were used in the model. These are consistent with the level of detail in which we do our major planning and reporting during the year.

Note that I have shown corporate, or surplus, separately. This includes our shareholder funds and also some excess funds that we have not originally allocated to the product

EXHIBIT 1

DIVISION OF THE COMPANY

- PRODUCT LINES

- GUARANTEED INDIVIDUAL INSURANCE

- WHOLE LIFE NON-PAR

- TERM-TO-100

- UNIVERSAL LIFE

- WHOLE LIFE PAR

- ANNUITIES

- SPDA

- IA

- GA

- GROUP LIFE & HEALTH

- GROUP LIFE

- GROUP HEALTH

- CORPORATE/SURPLUS

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lines. Thus, each product line has some surplus of its own, and there is a remaining amount of surplus in corporate.

CEO

That sounds fine. But exactly what output are you getting from all of this work? Is it of any use to us? Will I be able to understand the results?

Actuary

We do a five-year projection, using 1987 as the base year, and going out to the end of 1992.

We show statutory revenue accounts and balance sheets in the same format as they are presented in our annual report. When you see the numbers, you will be able to recognize them.

We also show a statement of change in financial position for each of the five years. This helps us to ensure that the model is correct, and as a side benefit, it also gives a projection of cash flows. This is something that you were interested in last year, but we couldn't give you.

And finally, we also show the required surplus.

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CEO

Is that the new formula that the Office of the Superintendent of Financial Institutions (OSFI) now wants? Isn't that the same as what the CLHIA wanted?

Actuary

We've used the CLHIA formula. We don't know yet whether OSFI will adopt the formula as is.

CEO

OK, let's see some numbers.

Actuary

If you don't mind, I'd prefer to go over our key assumptions first. The numbers will make more sense afterwards.

CEO

As you wish.

Actuary

We started with summarized models, by division, representing the current in-force business. The data for this came off the various policy administration files. We had to

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do some massaging, but we ended up with an overall set of models by product line, which show how our in-force business will behave.

As I said before, we had to do a base projection using what we call best guess. Now in our case, we used the pricing assumptions. This includes lapses, mortality, and expenses. We then used our latest five-year business plan for the new business sales assumptions.

One key assumption I've made is that our current investment strategy will not change. I've talked to Bill in Investments. Between the two of us, we agree that the assumptions we've built into this model reasonably represent the way he would handle investment policy under the different scenarios.

We've also assumed that there is no change in our current valuation methods or margins. Of course, this could change with the Policy Premium Method (PPM). We've reflected the current philosophy of the company with respect to matching and with respect to the degree of risk that we feel is within each product line.

The trickiest part of the modeling is to have it reflect management's responses to the different scenarios. It's impossible to build in every response to every scenario within a model. What we have assumed isn't necessarily what we think management must do,

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just what you might do. We can model other responses, too. You will have to get involved with us in this.

Now for the numbers.

CEO

Good.

Actuary

The table in Exhibit 2 shows the results of the base projection. Remember, this is based on the way we currently operate, using best-guess assumptions, and is based on our business plan.

The 1987 figures are the ones shown in our annual report last year-end. We had a total surplus of \$110 million. Out of this, \$56.5 million was needed to meet the new CLHIA required minimum capital formula. This gave us a surplus ratio of 183.9 percent, which seems fairly safe.

CEO

Hold it. These numbers are incredible. There has to be something wrong. This shows our ratio falling like a stone. I don't have to be an actuary to see that it will hit 100

EXHIBIT 2
BASE PROJECTION

(millions)

<u>Year</u>	<u>Profit</u>	<u>Total Surplus</u>	<u>Required Surplus</u>	<u>Ratio</u>
1987	\$11.2	\$110.1	\$ 56.5	183.9%
1988	10.5	115.1	64.8	167.5
1989	9.7	119.8	73.7	152.7
1990	10.3	124.5	83.4	140.2
1991	11.2	129.7	94.2	129.0
1992	12.0	134.9	105.6	119.7

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percent right after that. What about our profits? Our business plan showed that the business we are writing is profitable. This can't be right.

Actuary

That was my reaction, too, when I first saw the projection results. We are still working at validating the results, but they appear to be OK. And I can explain the trend.

The principal cause for this decline in the surplus ratio is the high planned rate of growth in the five-year plan, with the resulting statutory strain. The products are priced to give a profit in the assets-share runs, but these figures are statutory results. The differences are (1) the reserve strain that we have always had to initially absorb and (2) the additional effect of the CLHIA formula, which also uses up surplus.

The rate at which our statutory earnings are projected to grow over the five years is lower than the rate in which the total in-force business is growing, and that results in a declining surplus ratio.

You can see why I wanted you to see these figures before we went any further.

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CEO

I can see why you thought they were "interesting." Let me think for a moment. I can't accept this. It flies in the face of everything I have seen before.

Actuary

Let me reassure you that the base projection doesn't show any immediate danger to the company in the next few years. I think that any of the concerns raised by the base projection can be dealt with in the normal planning cycle this year.

CEO

This is still rather disturbing. Do you have any results by division?

Actuary

Yes. Exhibit 3 shows the surplus ratios by the individual divisions. I'm showing the 1987 actual figures and the 1992 projected numbers.

CEO

These results are just incredible! How can our guaranteed individual insurance business go down like this? Look at our Whole Life Par and our annuities! What's going on here? They're all going down the tubes!

EXHIBIT 3

BASE PROJECTION - BY DIVISION

(millions)

REQUIRED SURPLUS RATIO

	<u>1987</u>	<u>1992</u>
GTD INDIVIDUAL INS.	134.7%	52.9%
UL	133.7	85.4
WL PAR	294.3	140.9
ANNUITIES	232.3	94.2
GL&H - LIFE	110.2	111.3
HEALTH	107.1	100.0
TOTAL	183.9	119.7

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Actuary

In each of these cases, there are different underlying dynamics causing this. When you are looking at these figures, you have to remember that corporate surplus is not shown as a line, but it is included in the overall total.

We also have to run a set of prescribed scenarios as well. These scenarios are mandated by the CIA and must be run by every company, every year. This ensures consistency in testing among all companies. These prescribed scenarios also lead into sensitivity testing. Could we take a look at them now?

CEO

I hope they aren't all as bleak as this.

Actuary

Exhibit 4 shows the results of the ten prescribed scenarios. Remember, up to now you have only seen the base projection which is our best guess of future experience. For each of the prescribed scenarios, we vary just one of the assumptions.

EXHIBIT 4

RESULTS OF PRESCRIBED SCENARIOS

<u>SCENARIO</u>	<u>1992 SURPLUS RATIO</u>
1. MORTALITY DETERIORATES BY 3 PERCENT PER YEAR FOR FIVE YEARS	66.0%
2. MORBIDITY DETERIORATES BY 3 PERCENT PER YEAR FOR FIVE YEARS	115.8
3. UNFAVORABLE WITHDRAWALS	35.1
4. NEW MONEY INTEREST RATES INCREASE BY 3 PERCENT OVER FIVE YEARS	135.0
5. NEW MONEY INTEREST RATES FALL BY 3 PERCENT OVER FIVE YEARS	105.7
6. NEW SALES CONTINUE AT 1987 LEVELS	138.1
7. NEW SALES GROW AT TWICE THE BASE PROJECTION RATE	102.2
8. MORTALITY AND MORBIDITY CLAIMS IN 1988 AT 95TH PERCENTILE	117.6
9. DEFAULT RATES DOUBLE EXPECTED	113.4
10. UNIT EXPENSES INCREASE AT 3 PERCENT OVER INFLATION	92.7

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CEO

These results are very disturbing. Do you mean that if our mortality goes up by just 3 percent a year, it has that much affect on our surplus ratio? And look at the withdrawal scenario, it's even worse!

Actuary

One of the main effects in some of these scenarios is that, at the end of the five years, we have to change the valuation assumptions to be consistent with the experience of the particular scenario.

Thus, the total effect is not just the extra mortality, or lapses, experienced over the five years but also the cost of the increase in the reserves to reflect this deteriorated experience.

As you can see, we have some varied results. All of the numbers have to be compared to a base projection of 119.7 percent in 1992. The scenarios, in which we are vulnerable, are mortality, withdrawals, and increases in unit expenses.

The mortality experience and lapse experience are especially important for the Term-to-100 product. Since this is one of our big new sellers, this type of experience would affect the company quite badly.

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The good news is that the interest-rate-change scenarios don't affect the results too drastically. This is because we have an investment policy of maintaining a well-matched asset position relative to our liabilities, especially for the annuity lines.

Scenarios 6 and 7 show the results of changing the levels of new business. Again, not surprisingly, if you have increased rates of growth, the volume of in-force business and strain will go up, and therefore, our surplus ratio will go down.

Scenario 8 is an interesting one. It means that in 1988 we have the worst claims year in twenty for both mortality and morbidity. This doesn't significantly hurt us.

CEO

Again, all of this is really disturbing. When I saw the base scenario, I thought it was bad, and this is even worse. What do you propose to do now?

Actuary

So far, we've done the preliminary work, which we had just presented to you. We have built and tested the model. We've run the base scenarios and the prescribed scenarios. We are now going to have to run some additional scenarios. Some of these prescribed ones showed sensitivities, so I want to do some more testing.

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CEO

You're joking. Isn't all this bad enough?

Actuary

Now remember, in none of these scenarios is the company insolvent. It just means that our surplus ratio could be compromised in a few cases, in which case we would have to modify some of our operations. We have to know where we are vulnerable to changing experience and try to make sure that these scenarios, if they start to evolve, don't hurt the company seriously.

I'm going to have to interpret the results, to make you, management, the board, and ultimately the regulators, feel that our company is still safe. Now, this will include a report to management.

This will give details by division, so that the division managers can buy into the results and understand where their vulnerabilities are, and how they could possibly change their operations if one of the scenarios looks like it's happening.

I am not going to manage their operations for them, but this is a tool that can make them more aware of potential financial impacts. Before I finalize things, I'm going to confirm all of the assumptions used with the division managers.

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Finally, I have to give a formal report to you and the board by the end of August.

CEO

You'll certainly get their attention with these results, and I mean both the division heads and the board. I'm sure they're going to look at the assumptions quite a bit more.

This reminds me, let me go back to something you said earlier. You said that the modeling was done in the divisions rather than in your department?

Actuary

It was a combined effort. We set the specs of what solvency testing involved and the standards the models had to adhere to. The divisions did the modeling for the products and for the assets assigned to them. My department then did the consolidation and handled the shareholder funds.

CEO

How confident are you of the accuracy of everyone's work? Is everyone working on a consistent basis?

Actuary

Let me talk about the issue of consistency first. The approach taken by each of the divisions, and the data processing languages used, are not totally consistent. However, I

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assured myself that this is due to the underlying characteristics of each product line. Each line has some features or risks that it is more sensitive to, and the models were designed with this in mind.

At this point, I haven't done all the checking that I would like to do, but I have looked into it enough to convince myself that it is likely the preliminary numbers are right so that I wanted to present them to you.

CEO

I appreciate your coming to me when you did. With two months to go to the final report, this doesn't leave us much time.

I still find it hard to believe your results. I want you to bring together all of the people who have been involved in the modeling. Have each present to the others, and to their division management, what he has done. I want to know if anything is wrong or has been overlooked. If you find anything material, get back to me immediately.

If the results still hold after this checking, then I want you to present me with the alternatives open to the company that would leave us as strong at the end of five years as we are today.

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I want to see your report well before the deadline. Until I understand all the implications of your report, I don't want anyone who doesn't absolutely have to be working on this project to know anything of its contents. Is there anything else?

Actuary

Yes, I still want to run some additional scenarios to test some more for key sensitivities.

CEO

Oh yes. I had forgotten about that. Are you confident that you can do all this in time? I want an update from you at least every two weeks on the results. I look forward to hearing from you. This has certainly been an "interesting" meeting.

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Corporate Presentation

Our valuation actuary has asked me to provide you with a corporate overview of the modeling work that we have performed. I plan first to review the structure we selected for the model and the implications related thereto. Second, I will review the parameters that we used in performing the various scenario tests. Third, I will comment on a couple of aspects comparing the corporate consolidation and various product lines. Finally to round out my comments I will discuss some issues and problems we stumbled on that we hope you can avoid.

In choosing a structure for scenario testing, the three most logical breakdowns are either by product line, geography or responsibility, or investment strategy. As a stock company with a participating and health fund, we thought it essential to treat these two lines of business separately. Given the range of products that the company was selling, a product subdivision appeared the most appropriate.

We structured the model (slide 2) so that we could view each product line as a stand-alone or could combine the lines to provide an overall corporate structure. This would allow us to not only address the problems of a specific product line but also analyze those problems that arise in a corporate environment.

SLIDE 2

MODEL STRUCTURE

		<u>COMPANY DIVISIONS</u>
		< PARTICIPATING
TOTAL CORPORATE MODEL	< SHAREHOLDER SURPLUS	< NONPARTICIPATING GUARANTEED INDIVIDUAL PRODUCTS
		< NONPARTICIPATING NONGUARANTEED INDIVIDUAL PRODUCTS
		< INDIVIDUAL AND GROUP ANNUITIES
		< GROUP LIFE AND HEALTH

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As expected in a complex corporate structure, each of the models were developed by different people and were designed to accommodate the specific characteristics of the products being modeled. We had the additional challenge of developing the models in geographically different locations, and therefore, a significant coordination problem arose. We basically designed the models along the lines of the company divisions.

To properly reflect the corporate environment, with each product line able to help out the other, we found we needed a separate asset segment to handle cross-application of assets and fund shareholder dividends. The Shareholders Fund was born.

Having designed our structure, we then had to decide on the allocation of responsibilities. We decided the divisions should be held responsible for:

1. Projecting the benefits related to their particular product line.
2. The actual investments supporting their liabilities and the surplus allocated to their product line.
3. Expenses and taxes.
4. Both actual and required surplus by the CLHIA rules.

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By means of a diskette the divisions transferred to corporate:

1. An income statement for the five-year (1988-1992) projection period.
2. A balance sheet opening and closing for each of the five years (Dec. 31, 1987 - Dec. 31, 1992).
3. The CLHIA's surplus.
4. A Statement of Change in the financial position.
5. Miscellaneous items to allow recalculation of taxes and CLHIA surplus at the corporate level.

We made use of the government statement structure as this was already well-defined and known. The decision to include the changes in a financial position was wise. It provided an excellent check on the structure and internal consistency of the models as well as a number of items needed for tax calculations.

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Appendix 2 of the handout for the symposium provides an outline of the input data and Appendix 3 provides an illustration of the base case in the format in which it was consolidated in the corporate segment.

The corporate segment therefore had to take on the responsibility of the maintenance of the parameters to ensure that each model was assuming a consistent environment, consolidating the models, maintaining the shareholders fund and the associated investments, and doing any restatement due to consolidation at the corporate level.

Our choice of structure and the manner in which the lines of business models were developed created specific operating constraints. First, there was a single flow of data for the five years of projection, and therefore, changes related to restatement reflecting the corporate entity could not be picked up the following year in each of the individual line-of-business models. This had to be handled within the corporate entity. The Shareholders Fund was located in corporate to facilitate these flows.

We chose to segment the assets principally because we wanted to be able to look at the models as stand-alone companies as well as part of a corporate entity. In particular, we chose to separate the participating and nonparticipating funds. While this would not be true in real life under current legislation, we felt this was an acceptable approximation. We did not assume any investment trading, although we considered it an important item.

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We thought it could be added as an enhancement. We did not include any reinsurance but did limit face amounts used in the model. Again we felt this may be a necessary enhancement particularly for smaller companies.

Finally, each of the line-of-business models modeled the opening in-force business. We know this is an issue. Given the nature of our model, we did not have many options. There are excellent reasons why modeling the in force is preferable, but I will allow others to address this issue.

We had to make some decisions regarding the operating environment. Given the fact that the new tax law was not final as we were developing our models and final regulations are still not available, we decided to use the pre-1988 tax environment.

The illustrative report of the Solvent Stock Life Insurance Company refers to regulations from the Office of the Financial Institutions. The Office has not yet published regulations under the Act defining the minimum capital and surplus requirements, so we have used, as a proxy throughout our model, the June 1988 CLHIA formula. This formula has been developed in the current valuation environment, therefore we decided we would also continue to use the 1978 Canadian modified method for valuation purposes.

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The parameters used in the scenario testing were subdivided between common parameters and those which were model-specific. I will be outlining the way we approached the common parameters.

The base index was the federal-bond, long-term interest rate. In the way we structured our models, this index was where we could build in changes in the underlying interest environment. We included in the model a yield curve that would allow us to build changing investment environments into the model. To allow for quality, we included both industrial bonds and mortgages.

References to the actual assumptions used can be found in the section on Method and Assumptions in the illustrative report. Wherever possible we have used the CIA Report on Canadian Economic Statistics and made reference to this document.

In the area of stocks we selected the assumptions with regard to appreciation and dividends. For real estate we used an index tied to inflation for rents, expenses and selected the level of appreciation. Finally, we selected a default index for each of the assets. For the base scenario, we maintained the 1987 yield rates during the five-year period.

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The current statutory rules regarding the treatment of realized or unrealized capital gains and losses were followed. A taxes- paid method of accounting was used.

I would now like to take a few moments and provide some insight regarding corporate consolidation.

First a calculation of taxes was done for each model. Then a separate tax calculation was performed at the corporate level. Our model was taxable under most scenarios. We asked ourselves the question why our model was in a taxable situation while a number of companies are not paying tax under the 1987 tax regime.

Clearly as a Canadian company, we cannot obtain any benefit from Branch taxation rules. Slide 3 compares our asset portfolio with the Canadian industry. Our participation in Canadian stocks is quite low. With a small amount of dividend income, our ability to shelter income is restricted. The restriction on trading activity also influences the level of taxable income.

The CLHIA required surplus was recalculated taking into account the corporate consolidation level. When you see values at a line of business or product line level, the required surplus is calculated on a stand alone basis. When you see corporate values

SLIDE 3

DISTRIBUTION OF ASSETS

LIFE FUND

	INDUSTRY	SOLVENT STOCK LIFE INSURANCE CO.
BONDS	42.8%	58.2%
STOCKS	6.7	0.8
MORTGAGES	38.7	25.3
REAL ESTATE	5.2	6.1
POLICY LOANS	5.3	3.0
CASH & MISC.	<u>1.3</u>	<u>6.6</u>
	100.0%	100.0%

COMMITTEE ON SOLVENCY STANDARDS FOR FINANCIAL INSTITUTIONS

they are calculated on a corporate consolidation basis. The effect was to improve the ratio of free surplus to CLHIA required surplus by about 3 to 4 percent.

One can make some interesting comparisons at a corporate level. Slide 4 compares the amount of equity the company must hold by product line (i.e., CLHIA requirement and any nonqualifying surplus like 50 percent of cash surrender values and negative reserves) with the liability being held for the product.

The annuity line at 1.7 percent is the lowest and reflects the fact this line has significant unrealized gains in real estate holdings, which can offset any C-1 component. This ratio rises to about 3 percent by the end of 1992 as new business dominates and unrealized gains do not build as quickly. This might be compared with trust companies, which are required to hold equity in the ratio of 20:1 or at about 5 percent of deposits. I would caution such a comparison as it must be remembered that the mismatch reserve would be held as a liability in the life company while the trust company accounting would treat it as an equity requirement.

The participating line is somewhat below the other insurance lines at 8.2 percent. The universal life product line is inflated because of the short duration of the business. By 1992 the ratio had dropped to 13.6 percent. Nonparticipating life, however, is influenced by heavy deficiency reserves on Term-to-100 in the liabilities lowering this ratio.

SLIDE 4
LEVERAGE

<u>PRODUCT LINE</u>	<u>STATUTORY ACTUARIAL RESERVE</u>	<u>REQUIRED & UNAVAILABLE SURPLUS</u>	<u>RATIO</u>	<u>LEVERAGE</u>
Participating	\$122,677	\$10,112	8.2%	12.1
Universal Life	19,303	5,572	28.9	3.5
Guaranteed Whole Life	113,322	13,580	12.0	8.3
Group Life	76,500	7,778	10.2	9.8
Group Annuity	450,000	7,750	1.7	58.1
Group Health	<u>90,000</u>	<u>20,000</u>	<u>22.2</u>	<u>4.5</u>
TOTAL	\$871,802	\$64,792	7.4%	13.5

COMMITTEE ON SOLVENCY STANDARDS FOR FINANCIAL INSTITUTIONS

The requirement on the group health line is fairly high, reflecting the nature of that business.

Finally I would like to provide some insight into the problems that arose through the modeling process from the corporate perspective. This type of exercise forces you to look at an operation under a set of circumstances that you may not have experienced and certainly challenges your thinking. I am still learning and still questioning the results. When experience turns adverse and strengthening is needed with necessary changes in the valuation basis, items do move in ways you are not expecting.

Challenging and retesting are part of the process, so make sure you leave time for that process. You will need it.

We were forced to organize the structure and approach early due to our geographical separation. It proved to be invaluable. However, for all of our preparation, we have had our share of difficulties:

1. Income statements, balance sheets and changes in financial position didn't reconcile.
2. We needed the correct approach to handle expenses. You cannot handle expenses as a corporate parameter, but you do need to deal consistently with the various levels and types of expense. Corporate overhead, divisional overhead, fixed and

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variable costs need to be thought through especially with discontinuities in production. My own view is you model them and then test the results against the normal budget process. You may wish to build in explicitly large commitments such as rents, etc.

3. We needed to coordinate the handling of accruals and timing of our model transactions. This can affect the CLHIA required surplus and make the balance sheet look strange.
4. A consistent approach and timing to transfer of earnings between division and corporate was needed. This is particularly important when analyzing by product line.
5. We needed to build additional scenarios.
6. How do you handle management corrective action and how fast?
7. We experienced the normal set of programming and data handling challenges, such as hard-disks crashing.
8. We had overlaying of data and circular formulas.

COMMITTEE ON SOLVENCY STANDARDS FOR FINANCIAL INSTITUTIONS

My advice in dealing with modeling problems is try to stand back from the detail. You can easily be buried in paper. Build in those comparison and reasonability checks right from the start. They pay enormous dividends in the process of removing programming problems and ensuring that you understand the underlying process at work.

**1988 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS**

ANNUITY SEGMENT MODEL

MR. J. HELMUT ENGELS: I am here to describe the model used for the annuity segment of the company. Let me quickly describe the types of products included in this segment.

First, there is a single premium deferred annuity (SPDA). The model uses assumptions and a product design for an individual product. The annuity built into the model has a five-year term. The interest rate credited at the point of sale is guaranteed for this five-year period. Then at the time of maturity, the cash value will either be cashed out by the policyholder, be rolled over into a new SPDA at the then current interest rate, or be applied to buy a Single Premium Immediate Annuity, assuming that the person has now reached retirement age. Any early withdrawal will have a market value adjustment applied.

The second type of annuity contract in the model is an immediate annuity. In this case, I used an individual immediate annuity, issued at age 65, with a ten-year certain term. Any of the methodology would be just as applicable to group vesteds or other types of immediate annuities.

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In the model, the premiums for this product come not only from new business from outside the company but also from retirement rollovers from the other two contracts -- the SPDA and the group annuity contract.

The third type of annuity in the model is a group deferred annuity. This is a group product which assumes that the group contract holders will make yearly premium payments, and each of those payments will accumulate at that year's guaranteed interest rate for the three years. This three-year term could be varied quite easily. It assumes that these premiums will accumulate in a fund that will be used to buy retirement annuities when the people in the group reach age 65. Any early withdrawals of cash value will have a market value adjustment applied.

When you are assembling a model such as this, especially for a make-believe company, you are torn between putting in too much detail and keeping it really simple. There is a great variety of annuity products being sold or in force. When I picked these three, I was trying to keep the number of products small but still get a model that had several different types of products.

In the model's structure (using Lotus 123 on a microcomputer), there are separate cells for each issue year for the in-force liabilities of the two deferred annuity products. The cash flows of each of these liabilities are then projected in detail. The SPDA, because

ANNUITY SEGMENT MODEL

it's a five-year product, has five cells. Similarly, the group annuity has three cells since it's a three-year product. This is really just a detailed bookkeeping exercise.

The immediate annuities were summarized into five attained-age blocks. These were for ages 65, 70, 75, 80, and 85. In the extreme, you could model using cells representing each attained age and each issue year. I wanted to keep the number of cells reasonably small since LOTUS isn't unlimited in size. I used just the five cells and assumed that I could weight them to make the model close to reality.

The model has assumptions for new sales between 1988 and 1992. These new sales are projected for each product using separate cells for each year's sales. Again, the cells will roll over and mature at different times. By the end of the five-year projection period, we will still have five cells for the SPDA product and three for the group annuity product, but we now have ten cells for the immediate annuity product.

Slide 1 shows the types of assumptions that are included in the model. Details of the rates used in the model are part of the handout for this session. I'll warn you that the assumptions were chosen for the purpose of this modeling exercise and are not taken from any company's actual assumptions.

SLIDE 1

PRODUCT ASSUMPTIONS

- CREDITED INTEREST RATE
 - = ASSET EARNED RATE
 - Less INTEREST MARGIN FOR EXPENSES
 - Less INTEREST MARGIN FOR PROFIT
 - Less INTEREST MARGIN FOR DEFAULTS

- ROLLOVERS
- EXPENSES, PER POLICY & PERCENTAGE OF PREMIUM
- MORTALITY TABLE
- LAPSES
- RETIREMENTS
- AVERAGE SIZE

ANNUITY SEGMENT MODEL

The interest rate credited to the policyholder is based on the actual asset interest rates earned, less margins for expenses, profit, and defaults. The asset earned rate is different for each of the products because I assumed each is backed by a different combination of asset types. The SPDA product, for instance, is based on a combination of five-year and ten-year corporate bond rates.

Other assumptions in the model include:

- liability rollovers at the maturity dates of the deferred annuities,
- expenses, based on both policy and percentage of premium,
- a mortality table for the immediate annuity product,
- lapses,
- retirement rates, and
- average size, which is needed for the per policy expenses.

All are different for each product and are easily changed within the model. The assumptions are contained in tables which also can be changed easily for each of the scenarios.

For these types of products, how you model the assets is just as important as the liabilities. For assets, the model has many cells of existing assets. These cells represent

the different asset types and issue years. New assets are developed in new cells as the projection evolves.

Slide 2 shows the assets used in the annuity model. There are five- and ten-year corporate bonds, five-year mortgages, some cash, and some real estate.

A key characteristic of this model is that the assets backing the three annuity products, and the assets representing the surplus, which is assigned to the annuity model, are totally comingled. In other words, the assets are not segmented for each of the three products and surplus separately, but they only exist as a single block of assets. How you could design the asset portion of a model would have to depend on how your own company does or doesn't do segmentation of assets.

Real estate is included as an asset in the model, even though you don't normally think of real estate backing annuities. However, companies do have real estate in their portfolio, and real estate can back surplus in any case. It's also interesting that real estate has a very long duration, and thus it could be used to back a portion of the immediate annuity contract, which is fairly long.

When you use real estate, you are subject to the recently revised accounting rules for real estate. This revised accounting is not yet mandatory, but I believe most companies

SLIDE 2

ASSETS

FIVE-YEAR CORPORATE BONDS

TEN-YEAR CORPORATE BONDS

FIVE-YEAR MORTGAGES

CASH

REAL ESTATE

VALUATION ACTUARY SYMPOSIUM, 1988

have switched to it. This allows you every year, to bring into income 10 percent of the difference between 95 percent of the market value and the book value. Similarly, you also amortize any realized gains or losses.

Thus, the model has to keep track of the original cost, the current book value, and the current market value. You also need depreciation assumptions because you still have to do a tax calculation. You need assumptions with respect to net rental income and how much the market value will grow by each year, and how this is interpreted under the prescribed scenarios. For instance, in the scenarios where interest rates change, how are real estate returns affected?

The real estate assumptions used in this model are that the net rental income rate is 8 percent of the book value and that the market value growth is 5 percent a year. Now, this sounds like you are getting 13 percent, a higher rate of return than the other asset types. However, you have to remember that, because of the statutory accounting, you only realize a portion of that unrealized gain every year. In other words, there's a lag in the real estate earnings, so you don't really see 13 percent appearing in your statutory statements. You see a smaller amount, probably under the rates there for corporate bonds.

ANNUITY SEGMENT MODEL

One thing that you need in a model for product lines that are linked strongly to assets is an investment policy. Slide 3 shows the assumptions that I used at the start of the model. This put 15 percent of the assets into five-year corporate bonds, 45 percent into ten-year bonds, 35 percent into mortgages, 5 percent in cash, and a level \$4 million of new investment into real estate every year.

This particular investment policy, combined with the assets that I had at the start of the projection, produced a reasonably immunized position.

If the company's policy is to maintain an immunized position, then as the mix of the liabilities changes (such as is the case in the different scenarios), you have to dynamically change this investment policy, as well, to stay immunized. The complicated logic this requires was not built into this model. The model requires some logical, manual interface to appropriately change the investment policy as the scenarios change. *Appropriately* means what your own management would, or could, do in each case. Thus, for each scenario you have to be prepared to change your investment mix for new investments.

I would like to quickly summarize the results from the annuity model (Slides 4-7).

SLIDE 3

ASSETS

INVESTMENT POLICY

FIVE-YEAR CORPORATE BONDS	15%
TEN-YEAR CORPORATE BONDS	45%
FIVE-YEAR MORTGAGES	35%
CASH	5%
REAL ESTATE	\$4 MILLION

ANNUITY SEGMENT MODEL

Slide 4 shows the starting position to give you an idea about the size of the figures used. It has a total of \$450 million of liabilities. Premium income for 1988 is \$100 million. There are also rollovers of in-force business. At the start of 1988, the annuity segment was assigned \$18 million of surplus. The relative sizes of the segments and their surplus were determined ahead of time.

Slide 5 shows the results of the base projection. The premium growth was assumed to be 10 percent per year. Ten percent doesn't sound that large, but combined with the expected rollovers of existing business, this projection actually results in liabilities having a compound yearly growth rate of 20 percent over the five-year projection. So, even though we're starting with a growth rate in new premium that doesn't seem too high, it does result in a product line that has a high liability growth rate.

You can see that the statutory profit is fairly level. These are products that are priced to be profitable. However, the growth rate is such that the statutory strain keeps the profit fairly low. In other words, there's a lot of strain invested in this product line.

Total surplus grows over the five years. Note that the surplus is not equal to the previous year's surplus plus the profit. The difference is the shareholder dividends that are paid back to the corporate segment.

SLIDE 4

STARTING POSITION

LIABILITIES 31/12/87:	SPDA	\$100,000,000
	GA	100,000,000
	IA	250,000,000
1988 NEW PREMIUMS:	SPDA	50,000,000
	GA	25,000,000
	IA	25,000,000
1988 ROLLOVERS:	SPDA	15,727,000
	GA	33,220,000
	IA	2,970,000
SURPLUS 31/12/88:		18,000,000

SLIDE 5

BASE PROJECTION

(millions)

	<u>Premiums</u>	<u>Liabilities</u>	<u>Profit</u>	<u>Surplus</u>	<u>CLHIA</u>	<u>Ratio</u>
1987		\$450.0		\$18.0	\$7.8	232%
1988	\$100.0	548.3	\$3.1	19.6	11.8	166
1989	110.0	661.8	3.3	21.2	16.1	132
1990	121.0	792.2	3.3	22.9	20.8	110
1991	133.1	941.2	3.5	26.3	26.0	101
1992	146.4	1,105.8	3.5	29.8	31.6	94

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Because of the high growth in the liabilities, the minimum required surplus for the Canadian Life and Health Insurance Association (CLHIA) formula also grows fairly rapidly.

This results in the CLHIA ratio, which starts at 232 percent at the end of 1987, is down to 94 percent by the end of 1992. Again, this is due to the large growth in this line of business, which requires a lot of CLHIA surplus to back it.

Now, the line is certainly not insolvent, but it's relying on the availability of surplus from corporate, or from other lines of business, when the total company results are looked at. —

One thing that we had in our rules for how we run these models was that half of a segment's profit had to go to corporate as shareholder dividends. So, in 1988, while you see a profit of \$3.1 million, it was actually twice that. However, we also had the rule that when a segment's surplus is no longer sufficient to meet the CLHIA ratio, then shareholder dividends are no longer payable. This happened in 1991 and 1992 in this model. That is the reason the surplus for annuities shows larger increases in the last two years.

In summary, we have here a high-growth scenario for this product line. Even though the products in the base scenario are inherently profitable, the statutory results show some

ANNUITY SEGMENT MODEL

problems. The statutory profits from this segment on its own are not sufficient to overcome the statutory strain resulting from the high rate of growth.

Slide 6 shows the results of the prescribed scenarios. The first prescribed scenario is a deterioration of mortality by 3 percent per year. Since the SPDA and the group annuity products don't have mortality, this scenario just affects the immediate annuity product. Now, the word *deterioration* encompasses whatever makes your results worse. Thus, for annuities, the scenario assumes that mortality improves by 3 percent per year. This scenario produces the worst results for the annuity line of business. Profits decrease slightly each year due to paying higher annuity payments. However, the biggest effect occurs at the end of 1992 when the immediate annuity reserves have to be revalued to reflect the improved mortality. This causes reserves to be increased by \$26 million in this model, which is more than the statutory profit that exists at that time.

Scenario 2 deals with morbidity, and it doesn't apply to this model.

The third prescribed scenario involves lapses doubling. In this case, the 1992 ratio decreases slightly to 89 percent. The deferred annuity products need a certain level of rollover in order to amortize their initial sales expenses. When the policies lapse early, you don't get this. On the other hand, with a lower in force, you need less CLHIA

SLIDE 6

BASE SCENARIO:	1987 RATIO	232%
	1992 RATIO	94%

PRESCRIBED SCENARIOS:	<u>1992 RATIO</u>
# 1 - MORTALITY DETERIORATES	-4%
# 2 - MORBIDITY DETERIORATES	N/A
# 3 - DOUBLE LAPSES	89
# 4 - NEW MONEY RATES UP	89
# 5 - NEW MONEY RATES DOWN	100
# 6 - LEVEL NEW SALES	110
# 7 - NEW SALES DOUBLE	66
# 8 - MORTALITY AT 95TH PERCENTILE	94
# 9 - DEFAULT RATES DOUBLE	70
#10- UNIT EXPENSES UP	82

ANNUITY SEGMENT MODEL

required surplus. The net effect is that it makes things a little worse but not dramatically.

Scenario 4 involves new-money rates going up, and scenario 5 is for new-money rates going down. Since the model keeps things reasonably immunized, you don't get much effect from this. The changed new-money rates are automatically passed on to the policyholders when the pricing is done, with the company maintaining level profit and expense charges. The 1992 result for new-money rates going up is decreased because of the slightly higher in force caused by the higher credited interest rates. This is partly offset by higher earnings on the surplus portion.

Scenario 6 involves having level new sales. The required surplus ratio is 110 percent in 1992, an improvement over the base scenario. This is due to the lower statutory strain and lower in force. However, the actual effect on the required surplus ratio is understated. Recall that the base scenario stops paying shareholder dividends in 1991 and 1992. Because of the improved statutory results for this scenario, shareholder dividends are higher in all the years within the base scenario. If the difference in shareholder dividend is taken into account, the ratio is really 132 percent instead of 110 percent.

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Now this illustrates one of the interesting things that can happen when you do this type of testing. When we set the rules for the payment of shareholder dividends, we did not realize the effect those rules would have on the analysis of results of the individual lines. Having a definition that half the year's profits go to shareholder dividends but only if the CLHIA surplus is positive sounds simple enough in the beginning. But when you do the analysis of the projection analysis, you get scenarios where these dividend payments stop or start at different times from those in the base projection. This can partly hide the true effect of those scenarios.

Slide 7 shows that scenario 7 is new sales doubling, and not unexpectedly, with all the strain, this brings our ratio down to 66 percent.

Scenario 8 involves mortality at the 95th percentile. For annuities this has little effect. It means that you have some improved mortality in 1989, which causes annuity payments to be higher both in 1989 and in the future years, but it doesn't require any revaluation.

Scenario 9 involves having default rates double. For a line like annuities, with large assets, this has a major impact. It reduces the surplus ratio down to 70 percent at the end of 1992. Again, the results are helped by having lower shareholder dividends and, of course, lower income taxes, so the reduction to 70 percent understates the true effect. Also, scenario 9 assumes that the defaults are worse for five years but then stop being

SLIDE 7

ANALYSIS OF EARNINGS BY SOURCE

INTEREST ON SURPLUS	\$12.6 M
 <u>SPDA</u>	
NEW BUSINESS:	
RESERVE STRAIN	(5.2) M
EXPENSE STRAIN	(3.2)
 IN-FORCE STRAIN RELEASE	 4.4
PROFIT MARGIN	<u>2.0</u>
	(2.0) M

GA

-
-
-

IA

-
-
-

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worse, so that you don't have to revalue. So again, the 70 percent does not involve any revaluation which would make it far worse.

The final required scenario is to have unit expenses increase by 3 percent over the rate of inflation. Again, this reduces the profits and, therefore, results in a lower ratio, but not significantly.

I'd like to go back briefly to the structure of the model and some of the underlying assumptions we made in how it should work.

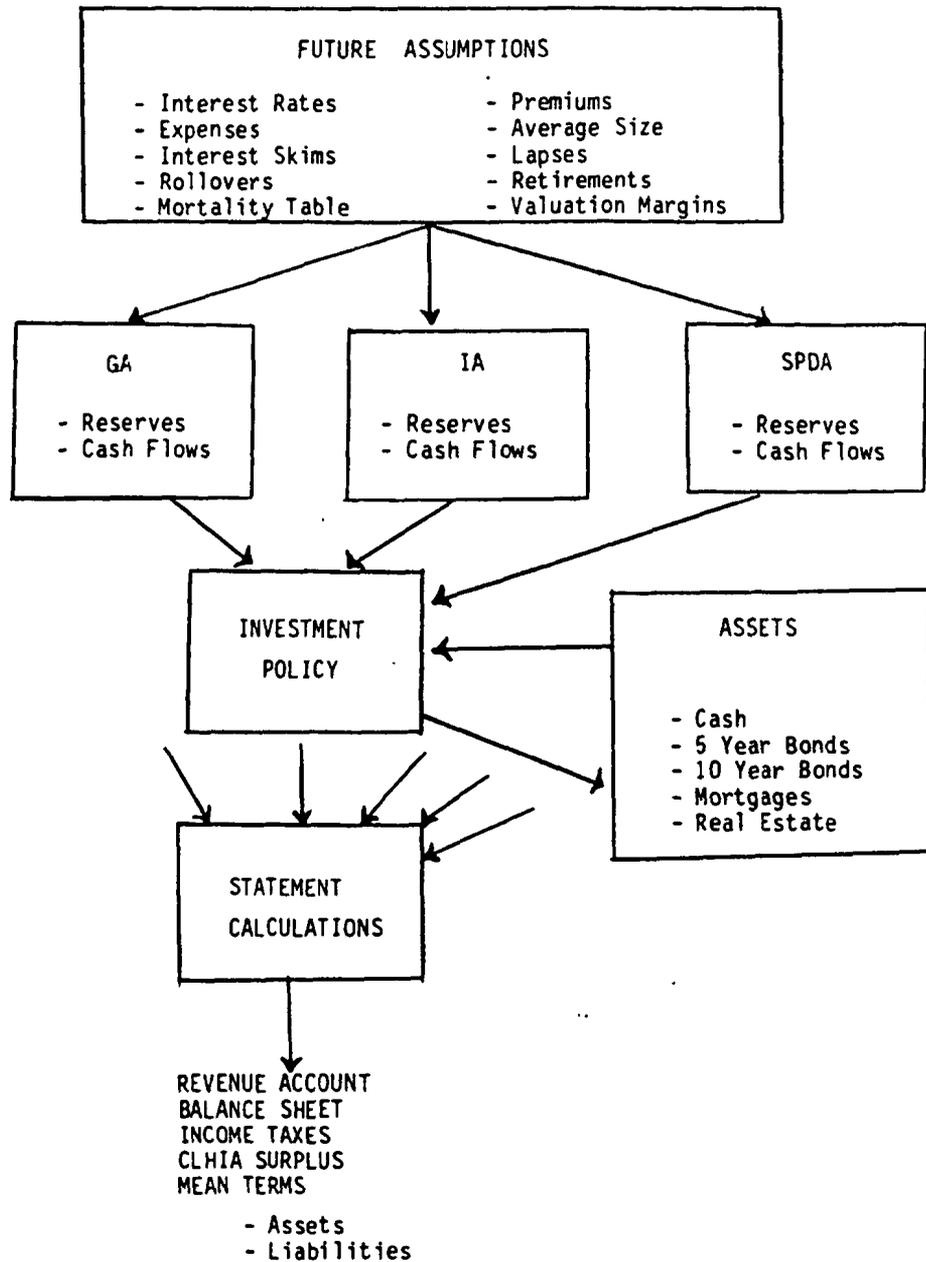
Slide 8 gives a summary of the data flows of the annuity model. At the top there are sections for the input of assumptions. All of these are in tables and are easily varied for each scenario.

The assumptions then feed down into the three independent product sections of the model. Within each of these sections, the model projects all of the cash flows and does reserve calculations.

Those net cash flows then flow together into the investment policy section which moves the net cash flow into the assets. The assets also have maturities that move through the investment policy and back into new assets.

SLIDE 8

SUMMARY OF ANNUITY COMPANY



SLIDE 8 - Continued

TIMING OF CASH FLOWS

CASH FLOWS AT 1/1:

- NEW PREMIUMS
- EXPENSES (EXCL. ROLLOVER EXPENSES)
- INVESTMENT OF NET 1/1 CASH FLOWS

CASH FLOWS AT 31/12:

- ROLLOVERS
- EXPENSES FROM ROLLOVERS
- ASSET MATURITIES
- LAPSES
- ANNUITY PAYMENTS
- INVESTMENT INCOME
- DEFAULTS
- SHAREHOLDERS DIVIDENDS PAID
- TAXES PAID
- INVESTMENT OF NET 31/12 CASH FLOWS

ANNUITY SEGMENT MODEL

The asset section of the model is totally separate from the liability section. So the assets back all of the liabilities and surplus and are not separate for each product.

On a slide it is difficult to show all the movements of data that go into the actual calculations of the statement. All the cash flows, the reserves from each of the liability sections, and data from the assets move down into the statement calculation. What comes out of the calculation are the statements for this segment and the information that feeds over to the corporate model. This information includes revenue accounts, balance sheets, data for the calculation of income taxes, and data for the CLHIA surplus formula.

The model also calculates mean terms for both the assets and the liabilities in order to allow one to change the investment policy as needed and thus maintain an immunized position.

An issue that occurs when you try to keep a model fairly simple is the timing of your cash flows. I made several assumptions in this model.

On January 1, the cash flows include (1) new premiums coming in from outside the company, (2) expenses that are associated with these premiums except for rollover expenses, and (3) the investment of the resulting net cash flow.

VALUATION ACTUARY SYMPOSIUM, 1988

Everything else happens on December 31. This includes rollovers, expenses associated with rollovers, all asset maturities, lapses, and annuity payments. All investment income is received on December 31, defaults happen; shareholder dividends are paid; and finally, there is investment of the resulting net cash flows.

This investment of cash flows is done both on January 1 and December 31. Note that you can't keep the net December 31 cash flows just in cash and then invest on January 1 of the next year, even though this appears even simpler. If you keep it in cash over the year-end, you would be inflating the company's cash position on the balance sheet. The company shouldn't have a large amount of cash since it already will have invested that cash in bonds and mortgages. Keeping the net December 31 cash flows as cash also means that you have errors in calculating the CLHIA ratio.

This investment that takes place on December 31 will have to use the interest rates on January 1 of the next year when setting up the cells of assets and liabilities. In other words, the interest rates for the investment on December 31, 1988, will use the 1989 interest rates.

In summary, we have a company that does all of its business on the first and the last days of the year.

ANNUITY SEGMENT MODEL

I made some other simplifying assumptions in this model.

The model assumes that the company has an immunized investment position. This requires active management of the mix of the assets, especially as the mix of the liabilities changes in any of the scenarios. This is not a function programmed into the model but has to be manually managed for each scenario.

The model also assumes no trading of assets. Again, it keeps things simple. This didn't turn out to be a major defect for this model since I never needed to disinvest in any year.

No early lapses are allowed in the model because the products assume a full market value adjustment for early lapses.

The bonds in the model are not callable.

The scenario testing requires reserves to be revalued as the experience changes in several of the scenarios. You could have the model revalue either every year or just at the end of the five years. This model just does one revaluation at the end of the five years.

VALUATION ACTUARY SYMPOSIUM, 1988

I'd like to give you a bit of advice for when you develop your own models. When we started the model, I asked the student doing the programs to put in a lot of intermediate tables of data, so we could see how the model works. I didn't want just a black box. This was great for debugging the program.

But when we started analyzing the results, we had a lot of trouble understanding what was happening. For instance, in various scenarios you have new business changing, and this changes new strain. You have in-force business running off, and strain being released. You have shareholder dividend changes, taxes changing, higher interest earnings on surplus, etc.

They all happen together, and a simple revenue account is not enough to do the explaining. Going back to the detailed worksheets to figure this out was very time-consuming. We found we needed a chart showing earnings by source if we wanted to simplify the analysis of the results of the scenarios.

Slide 7 shows an example. First you have your earnings on surplus in the segment. Then for each product line you have sources of earnings. I've just shown the SPDA here. But there is something similar for the other lines as well. Slide 8 shows the amount of new business strain, the in-force release of strain, profit margins, etc.

ANNUITY SEGMENT MODEL

I strongly advise you to put this type of analysis in your models as part of the output for each scenario. It helps to analyze results faster, and with the number of scenarios that you will be looking at, you need all the help you can get.

