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Session 19PD
General Modeling Techniques

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Panelists: Kevin R. Brimmer
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Summary: Timely and accurate modeling is becoming a critical skill in an actuary's repertoire. In today's environment, actuaries use models in many activities. The panel discusses important considerations involved in the following variety of projection purposes (such as pricing, financial planning, and so on):

- *Model platforms*
- *Model structure*
- *Static and dynamic model validation techniques*
- *Data integrity*

MR. KEITH E. FLOMAN: We're going to be talking about general modeling considerations. Our panel is very distinguished. We have Brian Reid from Milliman & Robertson (M&R), Steeve Jean from Ernst & Young, and Kevin Brimmer from Aid Association for Lutherans. I'll be moderating the session. I'm a consulting actuary from Ernst & Young.

All the work I do centers around modeling in one way or another, whether it be financial reporting, actuarial appraisals, annuity reinsurance or management reporting. If you look at the list of sessions at the symposium in 2000, you'd see that models are essential to most of the

discussions. There was a discussion at another session that dealt with discussions on the regulatory environment and how focus is shifting towards actuarial judgment. As things shift towards actuarial judgment, the actuaries are going to be relying more and more on models, which basically provide the foundation for most of the work that we do.

As a matter of fact, a few clicks on the Internet at the SOA Website will get you to the definition of an actuary. It says actuaries improve financial decision-making by developing models to evaluate the current financial implications of uncertain future events. I don't think I need to further explain that our reliance upon models is pretty large. The type and complexity of the model is going to depend on a lot of factors, and improvements in technology are kind of breaking down the walls as far as where we can go with models. Ideas can become reality. The time constraints are coming down in the building of a model.

Brian Reid's going to start our discussion. He's going to discuss the issues involved in the selection of a model and the selection of the modeling platform. Steeve's going to follow Brian, and he's going to take us from the selection of the modeling platform and go into the building of the model. Kevin will close with the analysis and results in consolidation. I think in model development, we probably spend too much time on the first two and not as much time on the analysis or results; so the analysis and consolidation of results is an important aspect of model building. With that, Brian Reid is going to start us off. Brian is the Alpha Sales Director with Milliman & Robertson's Seattle office. Alpha is M&R's proprietary actuarial modeling software. He has been involved in actuarial software since 1995. His areas of expertise include product development, cash-flow testing, asset/liability modeling (ALM), and corporate planning. He has reinsurance experience.

MR. BRIAN S. REID: My presentation is broken into two pieces. First is a general discussion on typical model uses and some of the challenges and trends that I see in my role as somebody who goes out and talks to people about modeling all the time. The second piece is ideas and a discussion on the selection of software, some of the criteria you might want to consider, and how you get through the process. I understand that because I sell software for a living, everyone is

going to attach a credibility factor to everything that I say. I don't want to venture a guess as to where that falls between zero and 100, but I worked hard to try and put together a very objective presentation. For most actuaries, selecting software is something you're only unfortunate enough to have to do once or a few times in your career. What I want to do is share what I've learned in about five years of helping companies go through this. If you do find yourself in a situation where you have to choose a system, you can get through it with as little pain as possible.

Let's start with just very high-level, typical model uses, like product development, profitability analysis, and sensitivity testing. We certainly see more people using complex models for business planning today as there's more and more focus on how results vary from plan. People are putting more effort into making their plan more precise, and that requires more complex models. As for financial analysis, many companies are doing GAAP and they are very interested in cash-flow testing, asset/liability management (ALM), and stochastic analysis. I'm referring to modeling things other than interest rates on a stochastic basis. That's a real hot item, and I'm going to talk about that more in just a second.

Let's discuss a few of these in a bit more detail. As for product development, we look at models that are going to give us cellular results so we know where our profitability lies by model cell. We want to look at composites so we understand how our profitability is distributed by things like age and sex and underwriting class. More and more, I see companies not only having an interest in the internal rate of return (IRR) or the ROE, but also wanting to know specifically what this new product is going to do to the income statement and the balance sheet. You must come up with sales estimates by working with your marketing people, and put together a new business projection. Hopefully, you can use the same model to do that. Finally, with sensitivity tests, use the model to do a lot of what-if analysis so you understand clearly where you're exposed to any risk if your experience doesn't work out as assumed.

Like I said, for business planning more and more people are using complex models for existing business. Many companies will start with their cash-flow testing model or some hybrid of that and go into a little bit more detail for more recently sold products. You're going to layer on new

business, and then you have to come up with sales volume estimates for all of the products that you're currently marketing.

ALM is certainly a very active area these days. I break it into two things: evaluating risk and evaluating solutions or alternatives to manage the risk. On the evaluation of risks, one of the first tools we would use would be stochastic scenarios. In the past, stochastic scenarios really just meant interest rate scenarios. Today we see, with the growth in separate account products, a scenario typically would have to have equity returns included in it. Many companies want to see inflation in there on some correlated basis as well. If you have multicurrency exposure, perhaps you have exchange rates in your scenarios also.

The next thing you really have to pay attention to across these scenarios is policyholder and agent behavior. I'm referring to policyholder behavior for lapses, premiums, loans, withdrawals, and that sort of thing. On the agent side, what kind of persistency are you going to have? Under certain scenarios, would you see some sort of shift in production from one product form to another? What kind of risk does that entail? Finally, a lot of companies go the next step and apply option pricing techniques to get option-adjusted analysis so that you're really looking at more precise market values of your assets and your liabilities as you go forward in your projection.

Once you think you have a handle on the risks, the more important job is trying to figure out how you're going to manage those risks. On a prospective basis, you can look at your investment strategies and your crediting strategies. If that's not adequate, in other words, if you can't sort of trade your way out of any risky scenarios that you identify in the evaluation phase, perhaps you need to do something at time zero like restructure your asset or your liability portfolio. You might sell some of the assets that are problematic or sell a block of business that gives you more risks than you want. You may even buy a block. Maybe that will immunize you, by buying something that offsets the risk on the block you are concerned about. Finally, in portfolio hedging, up and down interest rates might be your problem. You could go out and buy caps or floors or other derivative instruments to eliminate that risk.

This list of challenges just comes as part of what people ask me about when I'm out there talking about software and talking about the things that they struggle with. People often ask about guaranteed minimum benefits on the separate account products, how to price them, how to reserve for them, and how to model them. Equity-indexed products are both complex, and there are so many different forms. Many people are looking for solutions to be able to model those well. Combination products, like accelerated benefit riders, look like tacking on a long-term-care policy to the end of a life or an annuity product. You have disability income (DI) policies that turn into long-term care now. This really presents a major modeling challenge because the change forms halfway through. How are you going to figure that all out? Finally, there are multicurrency portfolios for international companies that have their liabilities in a domestic currency backed with foreign-denominated assets. How do you deal with capturing the exchange-risk there?

I've talked a little bit about scenarios already. Certainly, as people work on their modeling, they're using more robust economic scenarios rather than just interest rates. The other thing I see is people are putting more time and effort into the science of generating those scenarios. There are sessions about the current state of economic scenario generators. We're also seeing more people use more and more scenarios. A number of years ago, everybody was running level interest rate scenarios with some sensitivity testing. Then we came to the New York 7. We now have the C-3 Committee with its 12 and 50 scenarios. I regularly talk to companies who feel that they have to be running at least 1,000 scenarios for certain types of analysis. Again, as Keith mentioned, as hardware continues to improve, these are possibilities. The bar just keeps being raised.

As for stochastic analysis, one of the more interesting things that I think is going on these days is looking at things other than interest rates on a stochastic basis. The last three or four SOA meetings I've been to have had sessions on this subject. We've done some work in our product to do this. I was kind of a nay sayer in the beginning, thinking you just do it deterministically and sensitivity test it. Now, though, I've seen what it can do. I think the most important thing that it allows you to do is be able to help management understand what kind of earnings variance they might expect due to random fluctuation. You can go to your management and say, "You've

got about a 90% probability in any given planning period of having a plus or minus 5% variance in earnings, just based on random fluctuation in mortality.” That’s something that they really need to know. They want to know how much volatility they should expect. When they see the results come out, they can identify what is just noise and what is actually a problem that they might need to address with management.

The other thing I think you can do is price reinsurance. By that I’m actually specifically talking about stop-loss. It is very difficult to price stop-loss arrangements on a deterministic basis. Some of the new product features I just mentioned, like the guaranteed minimum benefits, should also be priced using a stochastic approach rather than a deterministic approach.

Enhanced asset modeling. Rather than modeling your asset defaults as a haircut to yield on all of your assets, you can model them stochastically and explicitly, even getting down to salvage value for any of the assets that would default.

I really think that this is, again, a real hot item. Everybody’s talking about it. People get very interested when I talk about it. It’s usually a session at every SOA meeting. I think we’re going to see more and more of it. The property & casualty (P&C) side has been doing it for a long time, and we’re finding new ways to apply it to our industry.

How would you go about selecting a modeling platform? Let’s start with some of the considerations. I’ll list them in the order that they usually come up as I’m talking to people. It’s just a loose rule of thumb. Price usually comes up early on. Actuarial capabilities is another consideration; in other words, which products do you support? Platform design is usually around the middle. Support is usually around the end. The vendor relationship sometimes comes up and sometimes it doesn’t.

Let me hit these in a little bit more detail, so that, if you go through this process, you can get as much information as possible. Then, when you do need to make your decision, you’ll feel well armed. Price is easy. It’s all about numbers, so it’s easy to do a comparison. I can’t state this for sure, but I believe that all of the products being sold today are sold with a heaped upfront fee and

then a more levelized, lower, ongoing fee. You can put them on a piece of paper and compare. You certainly want to ask enough questions, though, to understand whether there are any possible additional costs. For example, consider upgrades. Would there be any charges for upgrades, and, if so, what would they be? Is there any additional software that you would need to run a system; if so, how much would that cost? Usage expansion. In other words, you're going to license the system for a certain use. If you expand your use to more users or more sites, or if your company grows, will there be charges? How would those be laid out? Oftentimes, people want to see that in a contract, so they have a locked-in price schedule going forward.

Support. You really want to understand what is defined in the basic package for standard support that would be "free." If you need additional support, like customizing your system, how would you pay for that? What might that cost? Finally, the same thing applies to training. What's in the basic package? If you want additional training, what would the fee structure for that be?

You spend a lot of time on actuarial capabilities. Any system you get to do your modeling needs to be able to model all the assets and the liabilities that you have in your business. You just sort of pick through the list and make sure that the system can do what you need. Regulatory compliance is pretty standard. Does it deal with all the regulations? Regulation XXX and some of the new guidelines would be good examples today. If it's important to you, does it deal with reinsurance? If it's important to you, does it allow you to do GAAP analysis? If you need it to compress your in-force extracts down to a model, does it have a model generator? If so, how does that work? Does it have a stochastic scenario generator? If so, what's the science behind it? Is that adequate for what you want to do? If you have your own, and many companies do, is it an easy process to get your scenarios into the system that you want to run them through?

Platform design is usually the main part of the demo. You look at a system and figure out what it is and what kind of technology is used to put it together. What's the file structure? In other words, how is the thing built? You also look at processing speed. What sort of run times are you looking at? As for flexibility, there are two things there. First, what can you change? In other words, how open is the system? How flexible is it? Second, how do you go about making those changes? How easy or difficult is it to make modifications? Once you do modify the system,

what kind of audits do you have in there to make sure that it's doing what you want it to do? If you have lots of people changing the system, what kind of controls do you have to make sure that you stay on top of that so it doesn't get out of control?

Next, consider upgrades. How often would you need to upgrade the system? What's the process? How easy or difficult is that? Then, consider reporting options. What are the standard reports that come out of a projection system? Do they meet your needs? How easy is it to modify those reports? A question I always get is, can you get the data out and into a spreadsheet? As actuaries, we often just want to get the stuff there and do what we want to do after the fact. The final consideration is ergonomics. *Ergonomics* is just a big word for ease of use. What is the look and feel of the system.

Support often comes up later in the discussion. I think the first line of support is documentation. We all want to be able to answer our own questions if we can. You want to understand how a system is documented. What's the form? How current is it? Is it useful? If you do need to go to the vendor for support, the first question is how will it be provided? Is that by phone? By e-mail? By Website? What is more important than process is expertise. Will you be able to get answers to your questions quickly and accurately?

Oftentimes I think of enhancements as coming under support. How often is the company enhancing the software? What kind of enhancements are coming out? What is very important is how do they decide what is going to be enhanced. What sort of say would you have in that process? Finally, there is assistance that would go beyond normal support. If you actually needed help with something, and you were willing to pay for it, how would that work? Who's available to help you? What kind of resources are around?

One more consideration in the vendor relationship. If you already have a relationship with a vendor, this is a lay-up. You already know whether you do or don't want to work with them and expand your relationship further. Oftentimes, you're looking at lots of vendors, and you're trying to narrow the field down. You might not have existing relationships with all of them. You might want to spend a little time doing some due diligence to try to understand what their

business model is? In other words, how can they succeed so that they'll be able to continue to support the product? What are their long-term goals and the commitment to achieve them?

You're going to get answers to that to the extent that it's possible. You probably want to look at some sort of historical performance to validate that it matches up with what they've been doing. A great deal of judgment is needed, but hopefully this will be a long-term relationship that you enter into, so you probably do want to spend a little time thinking this part through.

I cannot prioritize those things for you. I would not try. That really depends on what you need and what you want. I think the thing I could most help with is the process because I've seen so many companies go through it from start to finish. How do you get from not even knowing what's out there to being ready to make a decision? First you're going to identify your alternatives. Maybe you look at publications and Websites or talk to people. Get the universe defined. Next, you'll probably request some marketing material or maybe spend some time talking to a salesperson, hopefully narrowing the field a bit. Then, bring the rest of the field in for demonstrations. Get a first-hand look at the software. Hopefully that narrows it down a little bit further. Then consider asking for references. Some people skip this, and some people use it. I think it's a very effective way to get a large amount of objective information very quickly. I think that there are actually three types of references, and if you can get them, it makes a lot of sense to spend time talking to people.

The first would be try to talk to a company that is similarly situated to you. If you're a medium-sized mutual, talk to a medium-sized mutual. If you're a reinsurer, talk to a reinsurer, and so on.

Another good reference would be a company that might be using or has used more than one of the systems that you have narrowed it down to. Hopefully they will share with you some objective comparisons on what they liked about one versus what they liked about another. You can never get that from sales or marketing material. This is live stuff, and people are usually willing to share. The third reference might be to talk to somebody who has recently gone through the decision process. You might be in the middle of the process. If they've recently done it, they might have put months and months into looking at things, and they can share

everything they have found in ten minutes. It might not be enough to make your decision, but it could provide you with a lot of useful information.

Hopefully, that narrows it down even further, and you either get to just one or more than one alternative. Maybe you go through an evaluation phase. If you do, hopefully you'll be ready to make a decision at the end of the evaluation.

My last topic is evaluations. That is the area I see the most, and I have seen so many people do it so differently. I've seen evaluations done very well, and I've seen them done not so well. If you are going to evaluate software, you have to have the following three requirements in place or you're very likely not going to get what you need out of the evaluation to make a better decision.

First, you need to have a set of reasonable goals. What are you going to try to do? You've got a period of time to evaluate the software. Do not go into an evaluation saying we're going to play with it. I have never seen that work well. You need to have something that you're going to try to accomplish. Price a product. Build a line-of-business model. Do some ALM. Hopefully do something similar to what you're going to use the product for. Make sure that it is a reasonable goal and you can actually accomplish it with the resources you have in the time that you have. Once you've set up the goal, come up with a plan. Who's going to do it? How much time can they devote to the project? Try to set some milestones so that you stay on target and make sure you do achieve your goals at the end.

Finally, try and come up with some objective criteria. The worst thing that can happen is you might evaluate two systems. You have four people working on them, and when you get to the end, you find out that two liked one and two liked the other. You're no better off than when you started. It's difficult to come up with objective criteria for software, but it can be done. I recommend you spend some time up front trying to measure things as you go through the process. It's hard on the back-end to go back and try to get those things figured out.

If you have those three things in place, chances are your evaluation will succeed, and you will feel comfortable with your decision at the end. Next, there are different ways to get the

evaluation done. The first and the most common is what we call a trial period. Give us the software for a month, two months, three months, or whatever it is. Do some training up front, provide support during the period, and hopefully, if you have those three things in place, you will have done something, and you will know whether the software does what you need it to do.

The common failure in that approach is that it's an evaluation. It always takes a second seat to doing real work. You often see the time period come and go, and nobody does anything. It stayed in the box. That's one of the reasons I actually like the second approach, if it can be pulled off. I call it a focused project with assistance. Let's use pricing a product as an example. Rather than trying to do it on site in your spare time over three months, maybe you can take a few key people, and get them off site, if that's possible. That's definitely the best way to go—have somebody from the vendor come in and help you get something done. Let's say in a week you want to price a product. Maybe it's not all the way done, but at least you go through the process. The reason I think that's a better approach is first, you get it done in a much shorter period. Second, you get some real work done. Third, and most importantly, you see the product or the system that you're looking at function at its best. In other words, if you just had some basic training, and you fiddle around with it for three months or so, you still will not be an expert at the end. If you have some expert guidance as you go through, any systems that you're evaluating will be seen in its best light. I think that's the way that they all should be compared.

The last one only applies if, through all those other phases, you get to a point where you say I think I know which one I want to buy. Out of all the options, I narrowed it down to one, but I didn't do an evaluation, so I'm not really sure. I don't know if I want to commit. Maybe I'm going to do an evaluation of just this single system.

Another way to approach that might be to talk to your vendor and find out if they'd be willing to forget the evaluation, in lieu of a money-back guarantee. You would do the contracts and the training, and pay the money, but have a period of time during which, if the software doesn't do what the vendor claimed it did, you can give it back. Maybe there would be some nominal fee for the support or the training or whatever. I think this is a very good approach because it goes back to the evaluation attitude. Whenever you're doing an evaluation, it takes a second seat. If

you buy the system, but you have protection on the back-end, people go into it thinking, this is real work. You're converting your models, you're pricing your products, or whatever it is, and you're going to see the system in its true light. You'll be ready to make a decision at the end of the period and to determine whether you want to keep it.

I can't stress enough that if you're going to do an evaluation, you must make sure you have those three things in place. I see so many companies spend a lot of time and effort, but they are not ready to make their choice when the time is up.

MR. FLOMAN: Next up is going to be Steeve Jean. Steeve is a senior manager at Ernst & Young in Philadelphia. He has extensive experience modeling in both the United States and Canada. He's currently a member of the Society's Committee on Life Insurance Research, and Steeve's going to be discussing this from the perspective of now that you've selected your platform, it's time to build your model.

MR. STEEVE JEAN: When you've selected a modeling platform, there are four steps that you're going to go through, and the first one will be getting all your in-force data. That applies both to assets and liabilities. The second step will be building your model, which means gathering all the product information or the asset information. The third one I'm going to talk about is setting up assumptions. The final step consists of validating the results.

There are usually two main sources for your in-force data. You can get your in-force data from an administration system or a valuation extract. They will usually have different information, and the advantage of the valuation extract, or extract from a valuation system is usually that you have reserve balances that you can use in your model or to validate your model. What I mean is that some systems will allow you to bring in a file and use the actual reserve in the file as your starting point for your projection. That eliminates the step of validating your initial reserve. As such, that can be a plus. On the other end of the administration system, you have a lot more information on historical premiums, cumulative premiums, and distribution channels. You have to compare both and see what's best for your model.

The source of the data can also be third party administrators (TPAs). I've seen cases where some products are administered by third parties, and the third party provides an extract to the carrier. That extract was not designed to be used to build a model. It has very limited information, and we've had roadblocks for which we had to go back and try to get a different extract. You have to be careful with that, especially if you have multiple TPAs handling different and various products.

Obviously, you have to look at your data to make sure they are good quality and complete. You also need to look at the timeliness of transaction-based data. For example, the account value is on a variable. The processing is done on a monthly basis. The account value on the extract or in the system is as of the last transaction date, and when you get to the end of the period, like the end of the year, you're off by half a month on average between the account value that's on the system and the actual asset value, especially when you talk about variable annuities or variable life. You have to be aware of that. You might have to true up your account values, and with the current volatile market, it can be significant.

The granularity of models is basically the number of cells you're going to have. The first step will be to slice and dice your in-force data. You can generate tons of statistics on age, channels, premium payment mode, dividend options, and so on. You're going to have a big stack of statistics on the in-force data, and then you're going to try to narrow it down to determine which cells you will put in your model.

There are going to be different factors as far as setting up the number of cells in your model. For example, if you use your model for a business plan, and you need to project quarterly earnings, it's going to be set up differently than if you do cash-flow testing. The reason is you need to project quarterly earnings in the business plan. You might have to have quarterly cells. You cannot assume everybody is issued mid-year because the results won't make sense. That's going to quadruple the size of your model compared to cash-flow testing or an asset/liability management (ALM) projection. You have to be aware of that.

There's also the sensitivity of the results. If you think you have too many cells, you might try different scenarios, and if you combine some cells or eliminate some levels of detail in your model, it might affect results significantly. Another driver of granularity is availability of assumptions. If you don't have an assumption at that level of detail in the first place, you might not even want to model it. Another driver is your financial reporting analysis requirements. If you're required to provide results by distribution channel, or if you need to look at different subsidiaries within a company (it could be the same product, but it's issued through multiple companies), you have to provide results or projections for each subsidiary. That's also going to influence your model structure. There's definitely a big trade-off between precision and run time; again, you might have to try different approaches to see what's best for your needs.

One comment on the in-force data. The joint life products usually require a little more work than just generating statistics because you need to define model cells that have two lives. When you create your statistics on joint life products, you want to be aware of that and make sure that you set up your cells according to your statistics.

Now we have an in-force extract. We've defined the cells we're going to model, and we have to build all the products and set them up in your software. First, you're going to gather all the product information and rates. That means pricing memos, prospectuses, sample contracts, and all the rates you can think of, like premium rates, dividend rates, cash values, and paid-up addition purchase rates. The amount of data you're going to need is endless. Do not underestimate how much work populating your cells represents.

If you can coordinate with product development, that's going to make your life a lot easier, especially when they have a new product coming out. They usually have a model. It could be on a different platform, but if you can piggyback on what they've done, you can make that process a lot easier. That also applies to a new dividend scale or new pricing, new costs of insurance (COIs), and new premiums. If you coordinate with those folks, usually you're going to save a lot of time.

Assumptions. Again, as for the rates, you're going to need tons of assumptions for your model, decrements, mortality, or lapses, and so on. On the investment side, you're going to need yields, investment and disinvestment strategies, spreads, default rates. You'll also need them on the liability side to get your credited rates, policy loans, interest credited to dividends left on deposit. There are many assumptions that you'll have to set, and those have to be updated periodically. When you set up your process, you want to make it as automated or as simple as possible, so when you need on a periodic basis to refresh those assumptions, it won't take you a month to do that.

For cash-flow testing and ALM or stochastic scenarios, as Brian said, some of the assumptions have to be dynamic (e.g., lapse rate, premium). For example, market performance, could affect your premiums or your surrender rates or loan rates, your dividend options, and so on.

There are potential problems with setting assumptions. If you have outdated experience studies when you validate your results, there's going to be a big disconnect, and you might have to go back and redo some of your experience studies. Some of the assumptions might not be available, and the reason I refer to this one is because, on flexible premium products, one of the assumptions you're going to need to set are premium tracks and premium persistency. If you don't have such a study available, you're going to have to do one, and that requires a lot of data. The approach you're going to take will depend on the data that are available. In some cases, you might have all the historical premiums and derive a pattern. In other cases, all you have is cumulative premium paid to date, and it's more difficult to derive a pattern. It's going to be a different approach to set up your premium assumption, but this usually requires a lot of historical data and a lot of work.

Static validation is usually the easy one. You just want to make sure you match your policy counts and face amount. That's how we picked up static. As I mentioned previously, our account values were not up to date. We were validating what we had in the model to actual asset shares, and it didn't reconcile. That's how we picked it up. The potential problems come in if you need to validate initial reserves. If you're calculating reserves or using reserve factors in your model, when you try to validate the initial reserve, it's a little more complicated because you

might need to drill down and try to identify which cells are off. Or, there's a disconnect between the actuals and calculated reserves. If you use premium in-force as a measure for static validation, yearly renewable term (YRT) might cause you a little problem, too.

Static validation. The tool that I've used is a database. We get the in-force extract, and then we bring that into a database. We try to dump our model results in the database, and then do roll-ups to basically do a cell-to-cell comparison.. Your extract is on a seriatim basis. Your projection is on a cell basis. You try to roll up your extract to make it comparable, and that is very helpful in identifying or resolving those reserve validation problems.

Dynamic validation. There are different levels of validation. You will want to validate some of the model calculations. You're going to take one policy, do the calculation in a spreadsheet, compare that with what the model's doing, and make sure it ties in well. If you customized the model calculations for specific needs, then you want to make sure that those customized codes work.

When you validate "expected" to "actuals," the actuals are available at different levels of detail. Some actuals are available at the product level. You will be able to validate a product, like premiums, dividends, or costs of insurance (COIs). You might be able to do that at a product level. If you take investment and expenses, those are usually allocated at a segment or product group level. You are going to do your dynamic validation at that same level that the actuals are determined or allocated. You're going to start to use a really bottom-up approach to do your dynamic validation.

You want to validate all your cash flows and your increase in reserves. When we talked about static validation we were validating the initial reserve, but on a dynamic validation you want to validate the increase in reserve. You might also want to validate gross profits if they are used to calculate DAC. If there's significant reinsurance, you want to be able to validate the reinsurance projections separately. You want to do it on a gross and a net basis.

There are potential problems with your model. As we said, if you have outdated assumptions or experience studies, obviously it won't validate. There is model noise. You might just need more cells. If you rolled up too many, or if you don't have enough cells in your model, it might not validate, and you might have to go back and increase the number of cells. One problem on the flexible premium side is if you don't do premium tracks, which is basically high-fund and low-fund policies, you're going to overestimate the surrender charges. What happens is you have policies with high funds and policies with low funds. If you keep them together, you're going to have an averaging effect. Then you're going to project more surrender charges than you're actually going to collect. If you split your in-force into two groups, that usually corrects the problem.

If you have vanishing premium products, you will have to be careful about validating premiums and surrenders. Any type of economic feature that has to be validated could be a source of problems or disconnects. There are significant surrenders of paid-up additions also. Statutory reserves on universal life products are usually a little harder to validate. Brian was referring to long-term care riders being added to annuities or those combination products. That increases the complexity of your model. There's an additional level of validation that you're going to have to do.

Guaranteed Minimum Death Benefits (GMDBs) or no-lapse guarantees are usually a source of problems. The reason for that is guarantees on products are usually based on historical performance or premium. The model doesn't have that information. When it projects a block of business, it cannot appropriately determine if the guarantee is going to kick in or not. You have to be careful that those guarantees don't screw up your projections. Any type of accruals, manual entries, adjustments for prior years, and so on have to be stripped out to be able to do your dynamic valuations.

Policy backdating is another problem. You create in-force populations as of a specific point in time, and when you move onto the next quarter, you've not only added those issues for that period, but you've also added issues to the prior year because of backdating. That causes an allocation problem between what you book as first-year premium and what the model will

probably project as renewal premium. The same thing happens with commissions. You have to be aware of that problem when you do your dynamic validation, especially on premiums and commissions. In some cases, you don't know that you're not comparing apples with apples, and by the time you figure it out, you spin your wheels quite a bit.

There are three other issues. The first is new business. You're going to need a new business projection, and you will usually have multiple new business scenarios. You're going to have to set up your model to be able to accommodate that. The second one is maintenance. You have the regular maintenance, you update your in-force populations, and you also update your assumptions. In another piece of maintenance, you build your model and you validate the results. You're going to do your static and dynamic validation, but over time, we tend to do less and less validation. The model has been up and running for three or four years. Everything has gone well in the past. You start doing less and less validation. At one point, the model starts to break down. The maintenance is not just a regular update. You have to keep an eye on what the model's doing and make sure you do a thorough validation of the results. You can do checks in a cycle. Periodically, spend a little more time on different parts of the model to keep it in good shape.

The last piece of maintenance is the upgrade. That can be quite painful, especially if you have a lot of customization and custom code in your model. You have to bring that over to a new version, validate all your modifications, and then validate just the version upgrade itself. Understand what changed between the old version and the new version. Usually there's a validation process when you upgrade as well, and this could be time consuming.

The final issue is documentation. There's a regular documentation. You want to document your process and your assumptions, but you also need to be able to replicate or reproduce prior results. Clients often have a hard time doing that. It is difficult to go back a quarter or a year and reproduce what you did last year. It's complicated because there isn't enough documentation. Clients don't have all the files. They update the model, but they don't keep the old models. You have to be aware of that as well and make sure you keep very good documentation.

MR. FLOMAN: Last up is Kevin Brimmer. Kevin has worked for Aid Association for Lutherans for 15 years. For the past five years, he has been doing asset/liability management, and for ten years prior to that he was working on fixed and variable annuity pricing. Kevin is going to talk about analyzing results, and he's going to bring some of the experiences that he has had to the table.

MR. KEVIN R. BRIMMER: Brian spoke of general model uses and how to select the software, and Steeve spoke of how to build a model. The very important topic of validation gets short-shifted. Again, I'll be discussing, analyzing and consolidating results with an emphasis on looking at results from an enterprise point of view.

A question that I like to ask is, why do we build models? What is the problem that we're trying to solve? I think the obvious answer is that we want to be able to make some sort of a decision and do what we need to do to analyze results. We want to be able to look at the big picture, and, of course, we want to quickly answer management's questions.

You can select the best model and the best software. Develop the best assumptions and have them validated perfectly, but if you can't analyze results and do it in a timely manner, you might not be adding a lot of value. We currently spend 80% of our time building models and gathering data and only 20% analyzing the data. I have no science to back that up. I just pulled that out of the air. However, that's just the kind of feel that I get. I've talked to other actuaries at other companies, and we agree that we spend way too much time on the building aspect but not enough time on the analyzing aspect. As a goal, we want to reverse that. We want to spend more of our time analyzing data and doing what-ifs, because that's where FSAs can add value. You can have any pre-ASA do all the experience studies you want, but FSAs need to do more analysis as opposed to just model building.

To be able to achieve this goal, we must be able to efficiently integrate and summarize the results of our numerous underlying models. Again, I'm taking a big picture point of view here. I think we need to use the appropriate modeling tools that are available for each business rather than be

constrained to just one. In the future, I think you're going to see more companies use software from more than one vendor.

I think we need to capture relatively large amounts of data so that the decision model that we're using can be used to address a wide array of questions. We need to slice and dice the results in virtually any fashion, but they must be supported by the underlying model data. We used the term granularity. That's one of my favorite terms.

To help us do this, I think any robust enterprise-type wide model should support the following standardized reports. I do think they should be standardized so that you're not reinventing the wheel all the time. Your audience must be comfortable with what they're seeing. They're not getting a new piece of paper that says they spend all their time analyzing the form of the report as opposed to looking at what the report says. I've seen that time and time again, at least at our company. Of course, the goal of analyzing is being able to explain what changed and why. In any financial projection that we're going to make, you're going to have to have some sort of an executive summary. You need some pro forma income statements and balance sheets. You'll need some supplemental data. We use present value, but many companies use value-added information. The key is, use whatever financial information you need to make the decision at hand.

My experience has shown me that there are a critical few assumptions that can change and have the impacts of those changes on an enterprise-wide basis. For the most part, you're going to have changes in sales, in expenses, and in your underlying economic scenario. You need the flexibility to make macro adjustments, or some sort of a scaler adjustment, to any of the other underlying assumptions in there. In the big picture, you have sales, expenses, and the scenario. Of course, to be able to analyze, we need to compare and contrast previous scenarios to help us figure out what changed and why.

I'll talk a little bit from my own experience about consolidation. I tried to build a consolidation system in some unnamed professional actuarial software, and I was woefully unsuccessful. I flamed out. I couldn't model mutual funds or credit unions very well, and I had a poor health

model. AAL is a fraternal benefit society, and we have universal life, variable universal life (VUL), deferred annuities, variable annuities, immediate annuities, disability income (DI), and long-term care.

We're trying to model mutual funds and a credit union. It is a fairly complete laundry list. I'm sure many of you deal with the same things I do. I tried to pull this all together but it didn't work. Then I thought, let's try something else. Let's try to do it on a spreadsheet. I spent close to two months trying to do this in a spreadsheet. Once again, I was unsuccessful. The main reason is that I had too much data I was trying to track for the spreadsheet. I was up to 60 megahertz, and I only had three product lines; my spreadsheet was starting to choke and puke. I wasn't able to compare and contrast. I wasn't able to do the analysis of what changed and why because the machine just simply couldn't handle that much data. I also had a bunch of errors in the links in the versions I had. It was very time consuming to drill down.

I have a very understanding boss. He didn't fire me, and he even gave me one more chance at it. I tried to do this in a PC-based access database system with a lot of visual basic for applications. I'm happy to say that I'm still an actuary, and I was successful. I believe I was successful because the database can handle tremendously large amounts of information. It's much less error prone. There's much less manual intervention. It's very easy to combine results in a database. It's very easy to manage multiple versions. Adding new products or years or whatever features is very straightforward. It takes just a couple of clicks of the mouse. It's very easy to filter, sort, and find specific data in this sort of a consolidation system.

Let's talk about how this particular consolidation system works. Using the visual basic for applications, we built in some screens and menus. The underlying model data are just brought into the system with a click of the mouse. Whatever the underlying model system is, we just send it out to a database format. You just go out and click on it, and it brings it right in. I'm certainly not a systems guru, so I wouldn't know how to do it otherwise. We can make changes on the fly. The lowest level of granularity is by product, but in our consolidation system, we can put in whatever we want. If we were really particular about it, we could put it in on a seriatim basis. The system could handle it, as long as we put in more memory. The underlying data

comes from our professional actuarial models and from our spreadsheets. We have a credit union vendor model, and we have some mutual fund models, and we just pull it all together.

What are the advantages of this approach? I believe it significantly streamlines our consolidation, our reporting, and our ability to change model assumptions which, of course, frees up more time for us to be able to do analysis. We have more time for analysis, but when you have the capability to do more, rest assured, you'll be asked to do more. I believe we were committing fewer errors and putting out higher quality reports. There's just better controls in this database system. What's more important is we can quickly and accurately answer our management's questions.

What are the disadvantages of this approach? It took us a good six months to build it, and we spent enough consulting dollars. I believe we received good value for the money that we spent. We didn't have the expertise in-house to do this entirely on our own, so we had to go outside. We got a lot of value, but it's a consideration. We did need to learn the database software, and database software isn't as intuitive as a spreadsheet in my opinion. Some would argue with me. I'm very comfortable in Excel, but I'm not as comfortable in a database yet.

The users must have a very deep, strong understanding of what's going on to be able to use this sort of a system. That's probably true of any sort of a modeling system. Many ASAs and pre-ASAs are let loose and can run that professional actuarial software and have some success with it. However, I wouldn't trust a pre-ASA with this sort of a system, and I wouldn't trust my own boss with this system either. You need a certain level of understanding to be able to use it and stay out of trouble.

MR. ROBERT G. MEILANDER: My question is directed at Brian. I'd be interested in any comments you might have. You talked specifically about economic assumptions and varying interest rates on equity returns and inflation. I'm just wondering how you do that and make sure that they're consistent with one another.

MR. REID: I could not give you a scientific answer that would make you think I understand the science of stochastic generation of scenarios. I would say that I've seen lots of different stochastic generators where some assume correlation between interest rates and equity returns. Others do not. Depending on the purpose of the model, sometimes the correlation is appropriate, and sometimes you actually don't want any correlation. You really want true random scenarios, if you will, in multiple dimensions. Keeping it all straight and making it all work properly goes back to the people who understand the science of how it's built and how it produces the scenarios that you're going to run through the system. Then I think it's actually the system itself using the scenarios. I mean that just goes to the integrity of whatever the modeling platform is that you're using. Can it deal with that information appropriately?

MS. KITTY HSIAO-YUAN CHING: I'm working for Aegon Institutional Market. I have one question regarding modeling techniques. My company has a big volume of mainly institutional business. We are thinking of modeling our business on a seriatim basis, but we haven't ever done that. It seems that most of you are very experienced. I would like to hear any suggestions you have or about things I need to pay attention to when I model on a seriatim basis.

MR. JEAN: Seriatim is probably the most accurate modeling you can think of. When you say institutional, what kind of business do you mean?

MS. CHING: GIC.

MR. JEAN: For example, if you take corporate-owned life insurance (COLI) or bank-owned life insurance (BOLI) business, the only concern you might have is when you put lapses in. It's all or nothing. So, there are some assumptions. You have to be careful when you work with COLI or BOLI business, but other than that, I don't see any issues.

MR. FLOMAN: I would say modeling on a seriatim basis does take away some of the uncertainty involved in your model. If your model has the capability to handle seriatim modeling, then it's a benefit.

MR. JEAN: That is what you're often going to do on the asset side. The assets are going to be modeled on a seriatim basis because there are less cells or items than on the liability side. It would be appropriate.

MR. FLOMAN: If you're modeling on a seriatim basis, you will have very large cells, so you want to test the variability of your results and probably run a lot of scenarios to see where your results fall.