A SUPPLEMENT TO Contingencies

Actuarial Software Now

Winter 2006

Data Quality

Is your data the best it can be? We show you how to clean it up... and keep it that way.

ERM Software

How to use the newest programs to keep your cutting edge.

Health Software

Health care actuaries are facing new challenges every day. Software can help you stay focused.

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Data Quality and How to Achieve It

Garbage in, garbage out—some things never change.

By Thomas N. Herzog, Fritz J. Scheuren, and William E. Winkler

Caring about data quality is key to safeguarding and improving it. Explicit and meticulous attention to data is of growing importance if information is not to become misinformation.

The most commonly cited properties of data quality are relevance, accuracy, timeliness, comparability, and completeness.

Relevance

- Do the data meet the basic needs for which they were collected, placed in a database, and used?
- Is it possible to use a database for several different purposes? (A secondary, or possibly primary, use of a database may be better for determining what subsets of customers are more likely to purchase certain products and what types of advertisements or e-mails may be more successful with different groups of customers.)

Accuracy

We can't afford to protect against all errors in every field of our database. What are likely to be the main variables of interest in our database? How accurate do our data need to be? For example, how accurate do our data need to be to predict:

- Which customers will buy certain products in a grocery store? Which customers bought products this week, 12 months ago, and 24 months ago? Should certain products be eliminated or added based on sales trends? Which products are the most profitable?
- How people will vote in a congressional election? (We might be interested in demographic variables on individual voters, such as age, education level, and income level.) Is it acceptable if the value of the income variable is within 20 percent of its true value? How accurate must the level of education variable be?
- How likely are individuals to die from a certain disease? (Here the context might be a clinical trial in which we're testing the efficacy of a new drug. The data fields of interest might include the dosage level, the patient's age, a measure of the patient's general health, and the location of the patient's residence.) How accurate does the measurement of the dosage level need to be? What other factors need to be measured (such as other drug use or general health level) because they might mitigate the efficacy of the new drug? Are all data fields being measured with sufficient accuracy to build a model to reliably predict the efficacy of various dosage levels of the new drug?

Timeliness

How current does the information need to be to predict which subsets of customers are more likely to purchase certain products? How current do public opinion polls need to be to accurately predict election results? If data editing delays the publication/release of survey results to the public, how do the delays affect the use of the data in general-circulation publications and research studies of the resulting microdata files?

Comparability

Is it appropriate to combine several databases into a data warehouse to facilitate the data's use in exploratory analyses, modeling, or statistical es-

timation? Are there data fields (e.g., Social Security numbers) in these databases that allow us to link individuals across the databases? How accurate are these identifying fields? If each of two distinct linkable databases has an income variable, then which income variable is better to use? Or is there a way to incorporate both into a model?

Completeness

By completeness we mean that no records are missing and that no records have missing data elements. In the survey sampling literature, entire missing records are known as unit non-response and missing items are referred to as item non-response. Both unit non-response and item non-response can indicate lack of quality.

In many databases, such as financial databases, missing entire records can have disastrous consequences. In survey and administrative databases, missing records can cause serious problems if they're associated with large companies or with a large proportion of employees in one subsection of a company.

When such problems arise, the processes that create the database must be examined to determine whether certain individuals need additional training in use of the software, the software isn't sufficiently user-friendly and responsive, or certain procedures for updating the database are insufficient or in error.

How to Get High-Quality Data

There are three ways to obtain high-quality data, in descending order of value.

- **Prevention:** Keep bad data out of the database/list. The first and most preferable way is to ensure that all data entering the database/list are of high quality. One thing that helps in this regard is a system that edits data before they are permitted to enter the database/list.
- **Detection:** The second scheme is for the data analyst to proactively look for data quality problems and then correct the problems. Under this approach, the data analyst needs at least a basic understanding of (1) the subject matter, (2) the structure of the database/list, and (3) methodologies that might be used to analyze the data. Of course, even a proactive approach is tantamount to admitting that we're too busy mopping up the floor to turn off the water.

If we have quantitative or count data, there are a variety of elementary methods, such as univariate frequency counts or two-way tabulations, we can use. More sophisticated methods involve exploratory data analysis techniques. These methods are often useful in examining (1) relationships among two or more variables or (2) aggregates. They sometimes reveal large amounts of anomalous data that may be erroneous.

Record linkage techniques can also be used to identify erroneous data. Record linkage can also be used to improve the quality of a database by linking two or more databases, as illustrated in the following example.

Making the Database Fit for Use

Goal: A department store plans to construct a database with a software interface that allows customer name, address, telephone number, and order information to be collected accurately.

Developing system requirements: All the organizational units within the department store need to be involved in this process so their operational needs can be met. The marketing department, for instance, should inform the database designer that it needs both (1) a field indicating the amount of money each customer spent at the store during the previous 12 months and (2) a field indicating the date of each customer's most recent purchase at the store.

Data handling procedures: Whatever procedures are agreed upon, clear instructions must be communicated to all of the affected parties within the department store. For example, clear instructions need to be provided on how to handle missing data items. Often, this will enable those maintaining the database to use their limited resources most effectively and thereby lead to a higher quality database.

Suppose two databases had information on the employees of a company. One of the databases had highly reliable data on the home addresses of the employees but only sketchy data on the salary history on these employees, while the second database had essentially complete and accurate data on the salary history of the employees. The records in the two databases could be linked and the salary history from the second database could be used to replace the salary history on the first database, thereby improving the data quality of the first database.

- **Repair:** Let the bad data find you and then fix things. By far the worst approach is to wait for data quality problems to surface on their own. Does a chain of grocery stores really want its retail customers doing its data quality work by telling store managers that the scanned price of a can of soup is higher than the price posted on the shelf? Will a potential customer be upset if a price higher than the one advertised appears in the price field during checkout at a website? Will an insured whose chiropractic charges are fully covered be happy if his health insurance company denies a claim because the insurer classified his health provider as a physical therapist instead of a chiropractor?

Practical Tips

The question arises: What's the best way to allocate the limited resources available for a sample survey, an analytical study, or an administrative database/list? The typical mix of resources devoted to these three activities in the United States tends to be on the order of:

- Prevent: 10 percent
- Detect: 30 percent
- Repair: 60 percent

Our experience strongly suggests that a more cost-effective strategy is to devote a larger proportion of the available resources to preventing bad data from getting into the system and less to detecting and repairing (i.e., correcting) erroneous data. In our judgment, a much better mix of resources would be:

- Prevent: 40 percent
- Detect: 30 percent
- Repair: 30 percent

One approach would be for each company to have a few individuals who have learned additional ways of looking at available procedures and data that might be promising in the quest for process improvement. Before being adopted, of course, any such procedures should be at least crudely quantified and evaluated as to their potential effectiveness in reducing costs, improving customer service, and allowing new marketing opportunities.

Many companies and organizations may have created their procedures to meet a few day-to-day processing needs, leaving them unaware of other procedures for improving their data. Sometimes suitable training in software development and basic clerical tasks associated with customer relations may be helpful in this regard. Under other conditions, the staff members creating the databases may need to be taught basic schemes for ensuring minimally acceptable data quality.

In all situations, the company should record the completion of employee training in appropriate databases and, if resources permit, track the effect of the training on job performance. A more drastic approach is to obtain external hires with experience and expertise in (1) designing databases, (2) analyzing the data as they come in, and (3) ensuring that the quality of the data produced in similar types of databases is "fit for use."

A more cost-effective strategy is to devote a larger proportion of the available resources to preventing bad data from getting into the system.

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With the right tools, change is exciting. Without them, it's terrifying.

Regulators and insurers around the world are recognizing that the traditional formulaic approach to determining reserves and capital is no longer adequate, leading to an economic approach to measuring the financial strength of companies. While drafting the changes to the regulations has been a challenge, the broad changes necessary for insurers to comply with the new regulations present a far greater challenge.

At Milliman, we saw this coming and have spent the last several years focusing our development efforts on leveraging MG-ALFA®, MG-Triton™, and our industry expertise to offer you the tools you need to meet these challenges head-on. We offer the flexibility to continue processing in today's environment while you look forward to the future requirements. More importantly, regardless of the timing of the enactment of the new regulations, you will have the opportunity to move seamlessly between formulaic and principles-based as the industry evolves due to our development efforts to integrate our platforms.

A major focus has been to dramatically improve the speed and capacity of MG-ALFA to deliver the horsepower necessary to perform the stochastic and nested stochastic analysis necessary to meet the emerging requirements. Since MG-ALFA was already an integrated ALM system, we do not have to focus our development efforts on workaround solutions or entirely new platforms. We have also invested heavily in our integration with multiple grid computing solutions. Many of our clients are taking advantage of the exponential leap in computing power that can be delivered with grid computing.

The result is that we now enjoy a significant advantage in speed and capacity and have delivered these evolutionary improvements to our clients.

We have also been focused on implementing process controls, and providing the necessary analysis and audit tools for both stochastic valuation and nested stochastic projections.

The bottom line is that Milliman is already capable of performing the nested stochastic calculations that are necessary in order to project PBR and EC values into the future. While other systems talk about new platforms that will one day be able to do it or about future development that will enablehandle such calculations, we have been using these tools for more than a year.

Why take a path with short-cuts or promises for the future when you can move forward with a proven leader that can deliver what you need now?

For more information, please contact: Brian Reid at (860) 535-0573 (brian.reid@milliman.com) or Mark Mahany at (860) 687-0170 (mark.mahany@milliman.com).

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Consider that over the last seven years, MG-ALFA's annual growth rate has averaged 20 percent. A satisfied customer base has earned us a retention rate in excess of 99 percent. Plus, our revenues result as much from the expansion of existing business accounts as they do from new sales. For you, buying into that kind of success translates into the advantages of sharing development costs across our substantial client base. In the end, our longevity indicates how dependable the market finds our products. When you consider all the years we've been providing the preferred strategies, tools, and solutions that actuaries need, you might say our history offers you a bright future.

For more information on the long-term security that Milliman and MG-ALFA offer your business, or for a demonstration, please contact Brian Reid at (860) 535-0573 or at brian.reid@milliman.com.

The Maturing of Enterprise Risk Management Software

ERM enables the measurement, monitoring, and management of risk.

By Tony Dardis

Insurance company risk management began when insurance began. And insurance company risk management software of some shape or form started when insurers first started using computer software. Whether that was the actuary using the mainframe to produce lapse and mortality studies, or the chief financial officer using a BASIC program to prepare the monthly new business summary, this was the seed of today's highly sophisticated generation of risk management software solutions.

Today, the concept of enterprise risk management (ERM) takes risk management from the line-of-business level to being organization-wide. The common theme underlying ERM is that it enables the measurement, monitoring, and management of the enterprise-wide risks to which the organization is exposed, recognizing that risks can be interrelated.

With the emergence of ERM has come the need to make the ERM strategy operational. This has led to the emergence of the ERM software solution.

The solutions seen in the market today recognize that ERM can mean something very different depending on who is looking at it. ERM, in other words, is in the eye of the beholder. For the chief operating officer, ERM may mean being able to monitor operational risks and take remedial action. For an auditor, ERM may mean there is enterprise-wide compliance with Sarbanes-Oxley. For the chief actuary, or chief risk officer, ERM may mean being able to project out the future finances of the operation and assess capital requirements based on these expected incomes and outgoes.

The development of the ERM software market has reflected these different interest groups, and the market today comprises highly specialized software offerings that are tailored to meet users' demands.

There are basically two types of ERM software: financial projections software and risk database software. There are others, such as systems that are focused on corporate governance and compliance, but it's in financial modeling and risk databases that we're seeing the greatest growth in ERM software.

Financial Projections Software

Financial projections systems are right at the cutting edge of academic theory and new technology. These systems give the user the ability to construct a completely integrated model that enables the future finances of the enterprise to be projected. For the model to be genu-

inely enterprise-wide it must recognize the interaction of the various risks to which the enterprise is exposed, and how these risks are correlated.

Financial projections systems are of interest to anyone in senior management who has a responsibility for the financial well-being of the firm: the chief financial officer, the chief actuary, or the chief risk officer.

Financial projections systems have historically been excellent at projecting more tangible risks that can be described by probability distributions, but they're less good at enabling the user to allow for risks that can't be so easily described in probability terms, such as operational risks. Examples of operational risk are the probability of key data loss, employee fraud, or an unexpected class action suit.

Financial projections systems have generally become better at enabling operational risks to be incorporated into the financial projections process. But even more important, they've become better at talking to other systems that can help quantify operational risks, such as risk database software. This gets to one of the key requirements of a good enterprise financial modeling software package: It must have the flexibility to interact with and read data from a variety of other systems.

In addition, users are increasingly looking for the ability to customize so that their enterprise model properly reflects the specifics of their organization's product suite and structure. At the same time, a certain basic functionality is expected from the enterprise system. Hence the need to be able to build on basic core functionality, and all within a framework that enables an audit trail to be maintained.

As enterprise systems strive to build more and more base functionality, or at least give the user the ability to switch on that functionality if needed, many financial modeling systems actually find themselves at the cutting edge of academic theory. In order to be able to give real value added, the software vendor finds itself having to develop new ways of looking at things. The concept of "smart modeling" as a way to reduce how many scenarios you run through a model, for example, is beginning to be provided as an add-on offering to some enterprise modeling systems. As a corollary to this, buyers of enterprise software look closely at the risk position reports produced as part of the out-of-the-box package:

- *Asset reports.* Credit-risk reports are of increasing interest to insurers. Providers of financial projections software are increasingly leveraging off what the banks have been doing in this area for many years.
- *Liability reports.* The traditional actuarial reports, such as experience analyses (mortality, lapse, etc), are being supplemented with reports that present the results of new valuation techniques such as market-consistent embedded value.
- *Asset-liability reports.* The standard techniques of asset-liability management, namely duration and convexity, are being supplemented by more advanced techniques such as the asset-liability efficient frontier.

No article on financial projections systems — even a short one — would be complete without mentioning speed. Users seem to have an insatiable appetite for speed enhancement. With often very large models being used (some large life liability portfolios could have 20,000 or more complex model points) the software provider is in a constant state of trying to address challenges of memory and speed.

Risk Database Software

Risk database software is quite different from financial projections software. Such software packages typically enable key employees to record what they see to be risks, such as claims handling, for the part of the business they're responsible for. Depending on the consensus that emerges for that particular risk area, the exposure will be noted and appropriate risk management strategies will be put in place. The situation is then monitored over time. This is really an extension of what many companies' internal audit divisions have been doing for many years, only bringing the process into a much more

structured and organized environment. These systems generally use a variation on the "green/amber/red" approach to categorizing risks and help as an early warning tool.

Risk database systems are "enterprise systems" in that they're enterprise-wide and need to take into account risks to which the overall organization is exposed. For example, staff may consistently highlight data error as a recurring risk, in which case this would get a high severity rating and management would need to take action to manage this risk across the enterprise.

These systems tend to be used more for audit-type functions, including meeting Sarbanes-Oxley requirements. Many risk database systems are now being described as "operational risks software" but in fact such software in itself doesn't analyze operational risks. The systems can, however, provide good data that can aid in the quantification of operational risks. Things become really interesting when attempts are made to wrap in the operational risk assessment with our financial projections analyses, in which case many more parties start to get very interested in what's coming out of the risk database system.

It's in crossing this divide between financial modeling enterprise software and risk database software where some big challenges are and where some big opportunities lie.

Wider Aspects of ERM Software

This article has focused on what ERM software solutions calculate and what reports they can produce, but there are wider aspects of ERM software that are becoming increasingly important and should be mentioned:

- *Grid computing*. As a potential answer to the issue of speed, more companies are setting up a grid that enables many processors to share the calculation load. There are a number of grid providers and a number of companies that have successfully implemented a grid solution.
- *End-to-end processing*. It's an increasing requirement that the ERM system is brought off the lap-top and into the world of IT, where programs are set up for fully automated runs, with all the controls that need to go around that. In other words, the ERM system is now being brought into the complete IT infrastructure of the organization.

"End-to-end" processing refers to having a completely integrated structure for developing new ideas, writing specifications, building the programs, testing, automating, and introducing the results into a live production environment. If you want to see what the ERM system is going to look like in the year 2010, you really need to start rubbing shoulders with your local IT expert.

As ERM continues to mature as a discipline, the tools to execute the risk management strategy are maturing as well.

In Closing

As ERM continues to mature as a discipline, the tools to execute the risk management strategy are maturing as well. Financial projections and risk database software solutions are emerging as cornerstones of the ERM implementation strategy for financial services companies. Because these systems support (and need the support of) multiple stakeholders, the process of selecting, implementing, and governing ERM software solutions is dynamic, complex, and interrelated — not unlike the risks and enterprises the systems are designed to model.

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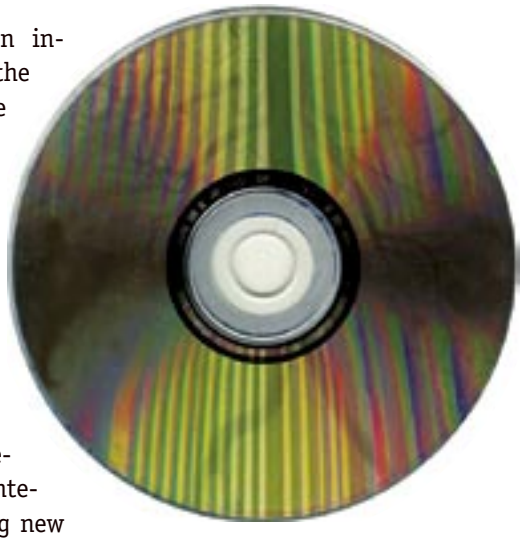

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Practice Leader
Mercer Oliver Wyman Actuarial Consulting, Chicago, Illinois

GGY is in the business of helping our customers increase the productivity of their actuarial resources through a fast, easy to use and controlled enterprise wide actuarial modeling system. We have been providing solutions to our business partners in the US, Canada and other countries since 1989. Providing solutions means that we will commit to actually solving problems and help our business partners realize measurable, positive change.

Our focus is software.

We are in the software business, not the consulting business. You know that our only interest is to provide you with the best system possible and to keep moving it ahead to meet your needs.

AXIS is incredibly fast.

AXIS is optimized for speed so you can get results fast. The system was designed from the ground up to be fast. How does 16.2 million records per hour sound? That is what one of our clients told us they did at 2005 year end for their C3 Phase II work. Speed is more than raw processing power. It also refers to how fast you can get your information into the system and how fast you can get your results out.

AXIS – more speed when you need it.

For many applications if you double the number of processors, you will cut the time in half. Speed is becoming more of an issue as companies want to do more stochastic work. We have designed new ways of using existing models for stochastic analysis so as to make thousands of scenarios a realistic option. With AXIS GridLink you get Grid capability along with the security, performance and reliability that you need.

AXIS is easy to upgrade.

AXIS can be upgraded to a new version in a matter of a few hours, not weeks or months. AXIS automatically converts your data and compares these results with the previous version to ensure they are consistent when you upgrade.

AXIS is designed to meet today's requirements with tomorrow in mind.

AXIS is a powerful cash flow based system. The emerging principles-based approach will put significant demands on you. AXIS has supported principles based reserving for many years and is ideally positioned to meet the developing standards.

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You may need outside help from time to time. If so, you can choose from many consultants to assist with implementation or urgent projects. You are not stuck with one company for your consulting needs.

Every customer is a reference.

Why should this matter to you? We want you to be able to phone any of our customers at anytime and get a good review of AXIS and GGY service. We need to earn that good review every day and that is how we run GGY. Clients tell us we are the exception in the business.

You have integrity and security with AXIS.

With the calculation engine being locked down you do not have to worry about one of your users making changes to the actuarial code that affect results. This is very important from a control and auditing perspective especially for SOX compliance. Over 1300 users - all using the same code - continually review and validate AXIS results, producing unsurpassed systems integrity.

You get to use the same data for everything.

AXIS allows you to choose to do your valuation, cash flow testing and any other corporate work using seriatim data to give you more consistency in your work. You avoid the need to manage and reconcile different models for different applications.

AXIS code is protected and extremely flexible.

AXIS alleviates your need to provide the programming expertise along with the considerable associated cost. Your people can spend their time obtaining and analyzing results rather than worrying about programming and maintaining the system. And you are able to use ideas from other users that we have built into the system.

AXIS – one system for all your needs.

AXIS is a single system that supports all your actuarial applications. Now you can have one system that everyone uses. You get consistent results while greatly increasing the efficiency of communication between departments and the rotation of actuarial staff. And you do not need to spend a lot of effort in reconciling different systems.

Product Applications

- Pricing & Product Development
- Planning / Financial Projections
- Evaluating Blocks of Business
- Surplus Adequacy Testing
- Valuation for Financial Reporting
- Cash Flow Testing
- Asset Liability Management
- Stochastic Risk Analysis
- Earnings and Experience Analysis
- C3 Phase II
- Economic Capital
- Principles-Based Approach

Knowing Your Risks

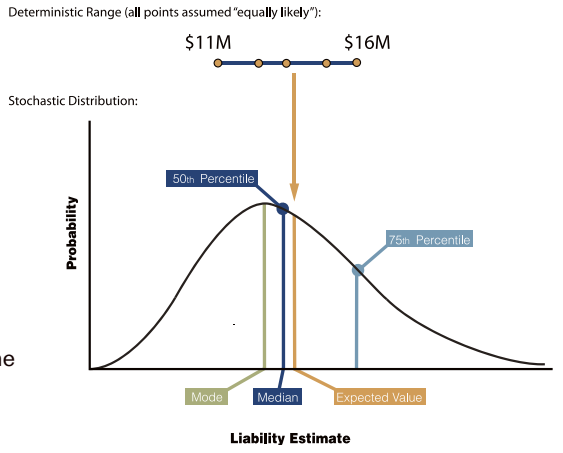
Improvements in software and computing power are opening a new frontier and changing the way actuaries estimate losses. Practical stochastic modeling tools are now within reach. So besides getting a better reserve estimate, analysts can now develop a clearer picture of their risks.

Those who explore these new approaches will find more valuable information in their data, and can better answer a number of formerly vexing questions. *How risky is our current business? How risky is the business we're about to write? How do we set reserves today to make sure we remain solvent tomorrow?*

Under the traditional deterministic approach, future risks are projected based on past data and clearly stated assumptions. For decades, it made perfect sense that deterministic methods were the solutions of choice because they were the best application of the tools at hand.

Now a new frontier is emerging. Increasingly, actuaries can turn to innovative tools to better understand their risks. Stochastic models, such as bootstrap, collective risk, and GLM, recognize the dynamics of an uncertain future and allow companies to extract new and valuable information from their data. In a range of estimates taken from several deterministic methods, it is often assumed, for lack of better information, that all points in the range are equally reasonable. On the other hand, a stochastic estimate provides a wealth of statistical information about the liabilities, such as the likelihood that future payments may exceed a given reserve level.

This is not to say that deterministic methods are dead—on the contrary, analysts still need them every day. But the search for the best estimate of all possible outcomes is likely to find its surest compass in the form of stochastic models. These models are continuing to evolve, which makes finding the right partner for exploring the new frontier all the more vital. At Milliman, we have some of the best minds in the industry guiding companies just like yours, helping them understand and implement these new solutions.



While $16M may appear prudent, a stochastic approach reveals a 25% chance that future payments may exceed that level.

Where will stochastic models take us? In addition to typical reserving work, a view of the true nature of risks allows for better pricing, smarter underwriting, and more judicious use of reinsurance. The application of these models may also unlock the long-sought potential of enterprise risk management, and will bring greater clarity to interactions with regulators, shareholders, and rating agencies.

Science and software have begun to catch up to the true nature of risk. Those who use the new tools to get a clearer statistical picture of their overall risk can reap all the benefits that come with better information—foresight, security, and confidence.

For more information, contact Milliman at 800-404-2276 or www.actuarialsoftware.com.

Sure, rugged individualism is great. Just not for estimating your reserves.

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In business, we admire independence and self-reliance. We value a can-do, go-it-alone attitude. But there are just some things better left to others. Building software to help estimate your casualty reserves, for instance. The fact is, no one knows reserving solutions like Milliman. Over 300 clients use our ReservePro and Affinity systems. Their feedback constantly improves our products, making them industry standards that are less costly to maintain, yet more sophisticated and flexible than internally developed solutions. So your benefit is a more reliable process for consistent reporting, expanded analytical capabilities, and better departmental controls.

Also, in order to cover a wide range of needs, our solutions are scalable – from the supportive framework of ReservePro to the flexibility of Affinity. Choose from a desktop application for a single user, or a complete toolset and database for reengineering your entire reserving process. Either way, the result is a better way to estimate reserves.

For more information on how our tools can help you streamline your work and focus on what's important, visit us at www.actuarialsoftware.com, or call (800) 404-2276.

What's Next in Health Software?

Product innovation is usually the primary cause of changes in software.

By Paul Morrison

Before joining an actuarial software firm, I was responsible for the pricing and valuation of a small block of individual health reinsurance business that was predominantly disability income, specified illness, and long-term care. These responsibilities required my department to build, maintain, and run a number of actuarial models.

My new responsibilities are similar in many ways. I no longer have staff but I do have clients who use software produced by my company to build, maintain, and run actuarial models of their businesses. I'm in contact with these clients on a daily basis and I wanted to share some observations about the likely trends that I see in actuarial software.

These trends will not occur in a vacuum. Generally, there's a cause for the beginning of a new trend or a change in the direction of an old trend. Product innovation is usually the primary cause of changes in software. Every company has built a process around product development and the process bumps along in fits and starts. It progresses quickly when one great forward-thinking idea from one insurer is quickly followed by a number of lesser ideas from all insurers that refine and enhance the original. Call it a kind of collective creativity. Actuaries are often asked to guide this process by glancing over our shoulders for reality checks. This creative process slows and could stop if too much time is spent looking backward rather than forward.

The good thing about this process is that while some actuaries and/or companies may be stopped and looking backward at any point in time, the process itself doesn't stop because not everyone is looking the wrong way.

Whether home-grown, purchased from a vendor, or any combination of the two, modeling software must always be on the leading edge of the newest product changes. There will always be a need continually to add new functionality in order to handle the next great idea in product design.

On the health insurance side, my company's software is used primarily for disability income, long-term care, and specified illness lines of business because of the long-term nature of these risks.

I believe that the disability income line (individual and group) is relatively mature. There is a certain level of product uniformity and actuaries have been able to standardize the definition and structure of statistics gathered for use in models. A decade ago, this line was suffering from poor profitability and the natural response was to return to the basics. I foresee that the pace of change in this market will be fairly slow for at least two more years. This should hold true for disability income software as well.

Long-term care insurance is maturing. There have been a few inter-company experience studies but there are still so many fundamental variations in policy forms and so few policies and claims that the credibility of data in these studies is a real problem. To increase the credibility of the studies, there needs to be an increase in sales. In my opinion, though, the industry is

still looking for the key feature that will appeal to the boomers and unlock the vast market potential.

What will this key innovation be? Tax-qualified plans boosted sales but I think they fell short of everyone's expectations. I don't know what this key will be but I do know that actuarial software will have to keep up with the product development wherever it tends to lead us. I expect to see continued changes to this line for some time until it matures.

Specified illness is still the smallest of the three lines if you consider only the products referred to as critical illness. I use the word "specified" in order to include in the scope the older cancer policies that fell out of favour a few years ago.

As I write this in July, I'm looking at the flyer for the Critical Illness Insurance Conference in September. When you read this in November, you may already know what new trends in critical illness products were discussed in Phoenix.

As I see it, the critical illness market in the United States is nowhere near as developed as it is in many other countries around the world. I believe that over the short term, the U.S. insurers will have to play a game of catch-up if they want to compete in this market.

I believe that some software developers will also have to play catch up because critical illness insurance may be new to them. I expect that other software developers (mainly those who have an international clientele) are already able to supply a usable set of modeling tools for critical illness policies, which could give them a temporary market advantage.

Principles-Based Future

Changes in laws and regulations will also drive some improvements in software. Do you recall the harassment you suffered a year or two ago to fill out those forms that document your process controls? Have you noticed that you're now dealing with more auditors who are trying to determine whether what you described in those forms is actually what you do? If so, you might want to send a quick thank you note to Sen. Sarbanes and Congressman Oxley.

The effect of Sarbanes-Oxley on actuarial software was probably not very great but it has had a tremendous impact on how actuarial software is used and which software will continue to be used. Spreadsheets, for example, have drawn a lot of criticism. In addition to and independent of Sarbanes-Oxley, external auditors are now more interested in testing and proving actuarial models. They've made or are making changes to their practice standards because of the negative view of their past work in regard to some spectacular company insolvencies. On the horizon, you should also see that the principles-based approach to valuation will cause increased scrutiny of actuarial models because they'll be more complex, more dynamic, and require more judgment.

The principles-based approach will definitely focus everyone's attention on assumptions and levels of margins used in those models. The traditional use of claims costs in health insurance won't work because they obscure the impact of four assumptions in one set of numbers. Those assumptions — incidence, severity (i.e. termination, run-off, utilization), interest, and expense — must be separated, documented, and justified under a principles-based approach. Health actuaries have resisted software that forces the use of first-principles approaches with the justification that each separate assumption can't be reliably made due to lack of experience data. That excuse is

Maintaining separate platforms for pricing, valuation, and risk management is an obvious inefficiency and will become a lightning rod for expense reduction initiatives.

simply not acceptable in the principles-based world. Explicit assumptions are required with annual review and justification, and appropriate margins for uncertainty in each assumption. The more that each assumption is a guess, the higher the margin will be initially.

As a direct result of the principles-based approach, health actuaries will be expected to undertake further experience studies at both the company and industry levels. The carrot of reduced margins as experience emerges will also motivate them. Software will also have to be able to use the results of these studies. Software that doesn't will have to be changed dramatically but software that already supports the definition and application of explicit assumptions and separate margins will gain the market advantage.

Furthermore, the software required for principles-based calculations will be more sophisticated. The actuarial models built on this software will be complex. Within this more complicated environment, actuaries must still satisfy their auditors in terms of Sarbanes-Oxley and generally accepted auditing standards. This will drive the need for more report details from the software and will also discourage program-it-yourself solutions, which are very hard to review or audit and are highly prone to errors.

Speed Is of the Essence

The principles-based approach may also require some risks to be modeled stochastically. Complex models using complicated software running many model points or cells over many different scenarios causes another problem — time. It's always of the essence. None of us has enough of it. How quickly can we get the result?

Actuaries must spend time on developing the model as well as running it. What's the slowest part of the process? Is it the run time or is it the time it takes to build a reasonable model? How will the software industry address these issues?

Currently, a lot of effort is going toward applying many processors to a single set of calculations. This is an area of research that's not solely an actuarial issue. It has attracted some of the best and brightest minds from many different disciplines.

Being able to throw more hardware at a model to reduce runtime is a great advantage but it's only one of the considerations. The design of the system affects the speed. The efficiency of the code affects the speed. The number and selection of scenarios run are critical factors. Again, much of the research into improving the efficiency of the models and the mathematical techniques to be used comes from people outside the actuarial profession. I believe that actuarial software developers will continue to explore and exploit new strategies to improve efficiency, while at the same time providing the ability to use more and faster hardware.

Maintaining separate platforms for pricing, valuation, and risk management is an obvious inefficiency and will become a lightning rod for expense reduction initiatives. Even if the platform is the same but it's customized to each specific function, there will be inefficiencies. I believe that a final significant trend will be toward convergent, integrated-purpose applications. These will have to be well-designed, easy-to-use, flexible applications and you may find yourself dealing with a single vendor in the very near future, if you're not already.

This is clearly an exciting time to be working with models and modelling software for health insurance. The pace of change will continue to accelerate, and it will be fascinating to look back in five years time and see what changes were anticipated, what ones came unexpectedly out of the blue, and what new technologies made it all possible.

Paul Morrison is an actuary with GGY Axis in Toronto.

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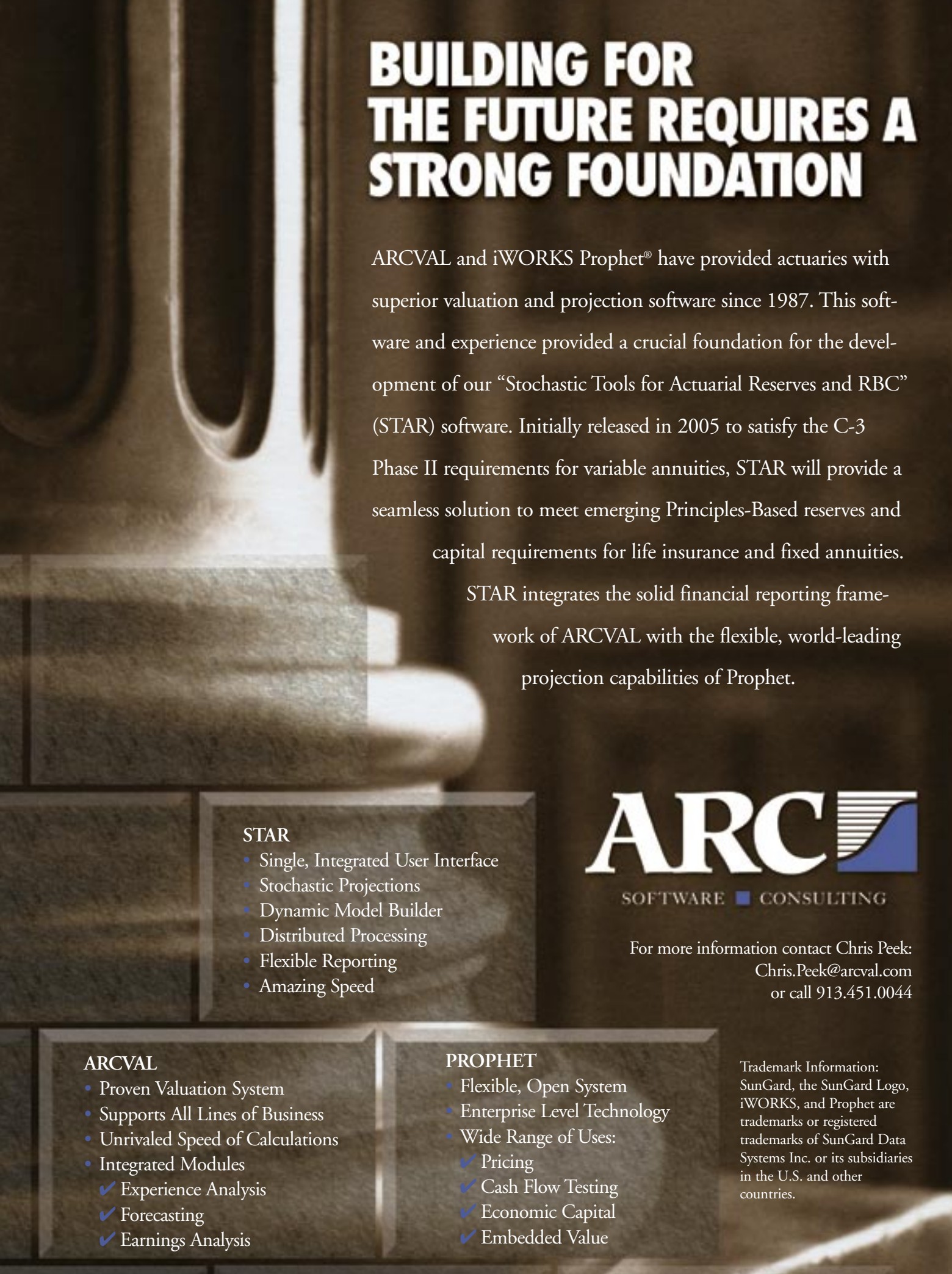
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