RECORD OF SOCIETY OF ACTUARIES
1979 VOL. 5 NO. 1

COMPUTER SYSTEMS

*Moderator: HENRY K. KNOWLTON. Panelists: PAUL F. KINSEY, GODFREY J. PERROTT, HANAN RUBIN**

New Computer applications in :

1. Insurance administration - personal and group
2. Sales illustrations and information to field offices
3. Corporate modeling
4. Use of time-sharing and mini-computers by actuaries

MR. HENRY K. KNOWLTON: In the past 20 years the actuarial profession has regressed in the use of computers, relative to the state of the art of computers. We continue creating expected value models rather than stochastic ones. We do not use econometric models to drive our actuarial models. We are in the business of financial projections yet often we make these projections in an economic vacuum! In our defense, however, have you tried to obtain a quantitative answer from a economist lately. It is very, very difficult, if not impossible.

Within the next 20 years we must interface economic models with actuarial models so that we can explain to our several publics the economic environment supporting our assumptions. The people to whom we present our actuarial conclusions will then have a much better understanding of these conclusions.

DR. HANAN RUBIN: Over the years, computer users have wanted many things that they were not able to receive. We are moving into an era in which computer users will be able to have those things that they always wanted but could not receive. This presentation is primarily in the context of the administration of personal and group insurance, but also reflects actuarial and accounting needs.

To set the perspective, I obviously think from the viewpoint of a very large computer user. I shall not dwell on what our present system environment is in my company or what current projects are now being developed. Projects vary from company to company but there is a thread of commonality among us all. I shall talk of the future systems towards which we are all moving at our differing paces.

Historically, to gain the economies and other significant advantages made possible by computers, accountants and businessmen reluctantly gave up their

* Dr. Rubin, not a member of the Society, is a Vice President of Metropolitan Life Insurance Company.

ledger cards, loan officers gave up their loan cards, and all kinds of manually maintained card files and other records were replaced by computer files. In many cases, it then took hundreds of times as long to obtain information from the files in order to respond to a simple inquiry - often a day or more for a computer interrogation (including supplementary interrogations) compared to the few minutes needed for a manual card look-up. Moreover, administrative and financial work was processed by computers in batches, thereby introducing other timing problems.

With the advent of on-line systems, it is possible to view and update information (and to perform other processes) at a computer terminal, either located with the computer or at a remote site, in a matter of seconds. In effect, the capabilities of the card files were given back to the users - but in a more efficient technology.

Nowadays, the stored data in a computer processing application can be managed by a powerful body of general-purpose computer software known as a data base management system. This is likely to have considerable impact on the future processing environment.

When a data base management system is combined with an on-line system, users can not only have immediate access to information, but each user can have their own unique "logical view" of the data base (in effect, acting as if each user possessed differently arranged card files) - even though only a single copy of the data is maintained in the computer! To better explain this, figure 1 shows how three different types of user request would appear.

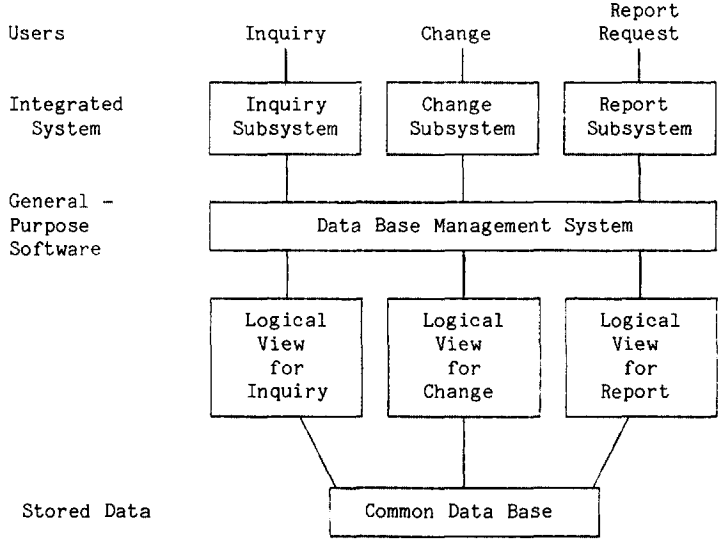

Figure 1.

The three boxes at the top represent three different programs accessing the data base. These programs do not actually read the data from the data base.

They simply request from another program (the data base manager) that certain data be retrieved or changed. The data base manager program does the actual reading and writing of the records containing the data. In this way there need be only one copy of a given item of information yet all users appear to have it as their own.

In a data base system there are no separate files that might become out of step with one another. Business transactions are applied once to the data base (without generating "feedbacks" to update other files). There are various economies to users who thus share a "common" data base and have their interrelated needs satisfied by an "integrated" system. As business needs evolve the lead time required for incorporating changes in a computer system is expected to be sharply reduced as a result of this improved management of data and integrated architecture of systems.

Recent developments in computer storage and processor speeds will enable vast quantities of detailed activity history to be accessible on-line. With this capability in future system environments (and in some cases at present), a person will be able to process a business transaction from start to finish in a single session at a computer terminal. There will be no need for data assembly away from the terminal, no movement of work from station to station, and no holding of partially processed transactions in suspense while further data is being retrieved. Such a system - an on-line, data base managed, integrated system - should be called an information driven system because, instead of having the traditional processing procedure and work flow, the full processing derives from information presented by a person in a single sitting at a computer terminal.

An information driven system for personal life insurance will permit, among other improvements in policyholder services, the quoting and granting of a policy loan on the spot. Immediately the new loan information will be accessible to all company functions that are integrated into the system. Response to the policyholder's telephone inquiry is accurate and up-to-date. Defalcation by promptly cashing out the policy in a different company office will not be possible. In addition, the data base will have the potential to provide increased marketing support to local offices.

An information driven system for group health insurance with a premium-claims-expense-interest-dividend data base will facilitate dividend calculations, renewal underwriting, and improved financial control. The common data base will provide rapid claim status information, financial experience reports, or retention exhibits for a corporate executive of a group customer. This level of service should help acquire new business and conserve existing business. The immediate availability of fund information to group pension customers and efficient employee record keeping services will provide additional marketing incentives for new and existing business.

For the various lines of business, error processing (and associated clerical effort) will be sharply reduced by the immediate validation of input transactions against the up-to-date information in the data base. The clerical cost savings can be appreciable in high volume processing areas such as personal life (and casualty) policyholder services and group health claims. The common data base with detailed activity history is well suited for a "query language" to rapidly produce impromptu reports for company management for a variety of key business purposes.

The classifying and summarizing of accounting information by an information driven administrative system for input to the general ledger, with detail stored in the data base of the line of business, may be an advantageous arrangement (especially when administrative and accounting information originate from the same source). Actuarial calculations will have access to the same data base, thereby eliminating the inherent inefficiencies and inaccuracies of using supplementary files. Access to the common data base will facilitate the calculation of individual policy reserves and their summarization for seriatim valuation of personal insurance reserves on any desired date. For adjustable and/or variable products (as well as others yet to be formulated) both the face amount and policy values may not be determined by facts as of the issue date (essentially, year-plan-age). New product portfolios and pricing decisions (for example, dividend scales and formulas) will be accommodated in a shorter time because of the suitability of the new type of system architecture for incorporating changes. The benefits to the insurance industry derived from the emerging computer era may be at least as significant as those that have come before.

One final remark pertains to an area that we are beginning to hear much about. Distributed data processing is a subject that is receiving wide spread attention. With appropriate controls there may be cost and service advantages from an information driven system running on geographically dispersed computers with geographically distributed data bases linked together by a communications network. This is a rather new field and despite much promotion and attention, it will be some time yet before we really appreciate both the benefits and hazards.

MR. PAUL F. KINSEY: Today I will show you some of the newest field office applications that we have at Northwestern Mutual. I will give examples of terminal screens and the printed output in our general agency offices. This includes inquiry into our data bases, processing of some transactions, and some sales illustrations.

Almost all of these new applications presuppose having visual and printer terminals in the general agencies that are attached by leased telephone lines to the required data bases in our home office computers. Each general agency has a mini-computer with terminals attached. We do some distributed processing by off loading some of the processing to those mini-computers, thereby saving time and capacity on our home office computers.

On-line computer terminal systems are bringing about a dramatic change in the way line organizations accomplish their work in an insurance company. People are more in command, they understand their jobs, and they see attainment of their goals. People who serve the policyowner, the agent and H.O. management are well equipped to do their jobs. The front line people doing daily activities now seem to have a complete set of tools at their work bench. All the data (policy records, agent records, etc.) have been returned to their work areas via the terminal. Calculations using basic data are immediately available. Checking and editing following detailed rules are accomplished by the terminal program based on the terminal operators' input.

The most basic requirement of an on-line terminal system is immediate (direct) access to the data involved. This is also a very expensive part of the system in terms of computer hardware (disk drives, etc.) and in terms of program development of data base systems.

Most on-line terminal systems are developed for functions which are already served by a batch oriented processing system that operates off of a magnetic tape master file. In this case there are two preparatory jobs to be done. The organization of data in the data base must be planned. The data must be transferred to that format on disk drives. The data base design must be such that the data base manager (software program) will efficiently access the required data. The magnetic tape processing system must be modified to access and update the data base rather than the magnetic tape master file.

The purpose of organizing and placing data in a data base is to gain immediate access to the information one wants rather than to wait for access via a batch run. This means access in seconds rather than hours. This is the essence of on-line processing -- having 5-10 second response time on a computer terminal rather than preparing input to a scheduled batch run which is anywhere from hours to overnight away.

Prior to our first computer systems, the user had functional data files in his own work area. For instance, the premium billing and collection division had tickler card files to show premium status. The policy loan division had card files showing the status of loans. Batch processing computer systems took these functional files out of the user areas and put the data on magnetic tape files which were generally accessible only in an overnight run. The on-line terminal system, which is dependent upon immediate access to the data base, has returned the data to the user work area. In fact, the user now can have access to the whole policy record, not just the data relating to their function.

The people on the production line in the user area are working in a very different environment -- the production line has had a major re-tooling. The person with an on-line terminal at his work bench has the tools to take a request from start to finish. Let's examine this new environment.

1. All company data is available through the on-line terminal screens. The change here is that the data is available immediately and this is without the help of messengers, file clerks and keypunchers. People were requesting, finding and assembling data, then collating it with the other requests and delivering it to the decision/action person. Often this was a three day process involving several people, each with some need to analyze the initial request and reacquaint themselves the following day. The terminal operator can process the request in one operation at the terminal.

2. The rules and work procedures for requests are easier to follow and understand. Most of the work procedures are programmed into the terminal system. The balance should be in a job description manual. The terminal screens for the request will lead and prompt the terminal operator through the entire process. The necessary decisions and input will be requested by the terminal screen and the irrelevant will be omitted.

3. Any calculations which are needed for decision making or for the request itself can be done and displayed at the terminal.

4. The terminal screen will edit with known rules. Validity checks of the input data and consistency checks between input and master record status. Results of these checks can be displayed immediately on the

screen. The operator can correct the input before proceeding further. This is a substantial and powerful feature of the on-line processing environment. Work is not only done in one sitting but is also thoroughly checked. Rejects, commonplace in our batch system, have been reduced drastically. Savings are great because very capable and experienced people were required to understand and reprocess the rejects.

5. Putting work procedures into the terminal program with interaction through menus and prompting, make training for a new request or function much simpler. Learning a new job has been shortened dramatically. The users of one terminal system suggested that it formerly took a person a full year to learn one job and now they can learn it in two days on the terminal. Although that example is extreme, all terminal users report a substantial reduction in training time. The improvement starts with the fact that all job procedures are documented. Secondly, most of these procedures are built into the terminal system. The interactive terminal system provides a continuous environment of self-teaching. Each variety of input and policy status provides specific screen prompting relevant to the transaction and hence reinforcement of the training.

6. Our interactive terminal systems have reversed the trend to more and more high level people and specialists. Defining the work procedures for the new systems has forced standards in rules and procedures. Decisions have been forced where rules were never determined or written down before. With rules and procedures defined and available, the number of high level experienced specialists, which were needed for special situations, is decreasing.

7. Since a person can learn a terminal job more readily, it follows that they can learn more terminal jobs. This provides more flexibility in staffing for vacations and for peaks in the various transaction activity. Fractional jobs can be combined; jobs can be saved. Terminal operators enjoy their work more and are more productive. They handle a whole task, from start to finish. Some handle several different functions. Generally we see improved morale, too.

8. Terminal down time is a part of the new terminal environment. The terminal goes dead for one of many reasons and the operator has lost his tool kit. The operator has an overwhelming dependence on the computer/terminal hardware and software. Despite that dependence, the terminal system provides a surprising recuperative ability. We have been surprised in several applications by the ability to catch up following a period of down-time. Similiarly, peaks in work are more easily handled.

Another important gain from the on-line terminal/data base systems is the availability of data to analyze and understand both the activity and the status of work (transactions) in an on-line system.

Data can be drawn from the system to evaluate the work of each terminal operator. Production statistics and error rates can be recorded. The number of on-line edits can be counted and evaluted. The on-line edits requiring operator decisions can be counted. These things do vary with the application and management style. Some non-routine and unstructured

(unplanned) management reports are possible, because of the data base. A sample of activities processed can be selected to audit accuracy, understanding or need for further training.

In underwriting or claims, many helpful reports can be derived to analyze and monitor pending activity. A list can be prepared showing pending cases which have been awaiting further information for XX days or more, or a list of pending cases where no further information is needed but a decision has not been made. This type of list allows activity control or completion control at a low cost. Actual service can be measured against service goals. Trends in the effectiveness of the organization can be monitored.

MR. JOHN M. BURLIEGH: To receive all of the information on a particular policyowner with several different policies, do you have an automatic way to retrieve information from all of the policies ?

MR. KINSEY: Our system provides a "look-up" capability using the policyowner's name. The terminal screen shows a list of all the policy numbers. The operator may then examine any or all of the policies.

MR. BILL JOHNSTON: Since you have mini-computers in your agencies, do the agents program their own sales proposals using information from the company data base ?

MR. KINSEY: They have expressed a desire to do that. We are currently exploring alternatives to provide them such services.

MR. KNOWLTON: With so many people connected to your computer, do you lose sleep at nights worrying about security?

MR. KINSEY: No. We have provided quite a bit of security. For instance, each general agency can examine only the data for their own policies.

MR. JOHN MURTA: When you begin implementation of a system of this magnitude (a large number of screens, a large number of programs, etc), just how smoothly does the process go ? Are there significant problems to be resolved ?

MR. KINSEY: We decided to put our policy data into a data base about 10 years ago. It was operational after about three years. It took us two more years to implement another significant system. The new business system currently in final development is our largest yet. We have probably had a dozen people working on it for three to four years.

MR. GODFREY J. PERROTT: I plan to describe what my company is doing in the corporate modeling area, then to discuss various applications of computers, mini-computers, and timesharing.

Our approach to modeling the individual life and health lines of an insurance company is to create insurance projections based on unit profit studies. These profit studies are based on J. C. H. Anderson's classic paper. Some differences are the use of calendar year studies instead of policy year studies, extension to cover health insurance and accounting for all of the transactions of an insurance policy as they affect the annual statement (including premiums received and commissions paid in the correct calender year, setting up deferred premiums, and providing for modal

lapses).

After we have developed these unit profit studies for each cell in a representative model office, we multiply the unit profit study by the insurance in force (or issued) in each cell of the model to develop projections of the individual insurance operation. Such a projection approach is fairly common in the industry with:

- interest on reserves is used for investment income,

- interest on capital and surplus is projected separately,

- all policies voluntarily leaving premium-paying status are treated as surrendering for the cash value, and

- the whole projection is presented on a before-tax basis.

Lately we have been developing total company projections on an after-tax basis with the following problems :

1. Providing for all of the significant transactions within the individual insurance line, in particular dividend additions, dividend accumulations, transfers to reduced paid-up, and transfers to extended term made during the projection.

2. Correctly including results from other lines of business of the company - including accidental death and waiver of premium benefits.

3. Calculating the company's investment income based on the total assets as of the projection date and the cash flow for each year during the projection. This automatically develops the interest on capital and surplus but raises its own problems in terms of allocation of investment income. At the present time, we have not really addressed the allocation problem but have concentrated on projecting total company operations.

   One of the items in the cash flow is Federal income tax. We have taken an iterative approach (year by year). From the insurance cash flow we develop estimated Federal income tax. Based on that we develop total investment income and actual Federal income tax. Finally based on the surplus position at the end of the year, we modify dividends to policyholders and/or stockholders to attain the desired surplus objectives.

4. Calculating the Federal income tax for each year (particularly if it involves loss carryforwards or carrybacks).

Some of the areas that have given us problems are not the insurance areas. We have relatively little problem with the insurance ramifications of the 1959 Income Tax Act. Calculating the 818(c) increments, reserve strengthening and even loss carryforward and loss carryback are all items with which we are familiar. On the other hand, some of the non-insurance operations of an insurance company have caused unforeseen problems. A simple example is handling liabilities that are not actuarial reserves (for example, premiums paid in advance). In a classic profit study we do not

concern ourselves with them. A second example that has interesting accounting implications is commitment fees. We normally do not think of these as very important, but a recent client for whom we did a projection had income from commitment fees of a million dollars a year. What is the correct way to show them? Should they be treated as income when received (which this client did), or should a liability equal to the commitment fee be set up until the option date and the profit or loss based on the difference in interest rates be shown when it is taken down? The latter approach seems more appropriate but I do not want to develop a model to reflect it.

There are several things we have learned from this process. Accounting for all of the significant transactions of a company has been difficult. Transactions that offset for profit purposes may be significant for tax purposes. All items in the statutory statement and tax return must be reviewed. In the typical profit study, the actual cash incidence of a particular income or expense item is not important as long as the accrual is allocated in the correct year with the appropriate discount.

Many assumptions are not independent of each other. The new money rate and expense inflation rates are often thought related. A common assumption is that inflation is 3% less than the new money rate. It seems most likely that when inflation reaches 10% the new money rate has no margin over the inflation rate and may even be lagging. It may be most appropriate to assume that if there is no inflation, the new money rate should be 3% but the margin over inflation grades to zero as inflation reaches 9% or 10%. Two assumptions whose interaction is sometimes overlooked are the level of production of future business and agency expenses. Frequently a company will run several projections based on different production levels. While this is an excellent way to answer some of the "what if" questions, it does not make sense to use the same level of agency expenses for each projection. If a level of production higher than that expected from the current agency plan is to be achieved, then the expenses of recruiting and subsidizing the additional agency force, possibly additional new product work, and advertising should be included in the projection.

Before I leave corporate modeling, I would like to touch on GAAP deferred Federal income tax. Most of the actuarial community feels that the accountants approach to deferred Federal income tax is incorrect and that, at the least, it charges deferred taxes against income incorrectly by not recognizing the investment income that will be received on the deferred taxes. I agree with this and would like to see better models of deferred Federal income tax. Top management of an insurance company is not concerned about the subtle differences between accountants and actuaries as to what is right. They want the best estimate of what they will be able to report as after-tax earnings in each year (with a clean opinion) . Since corporate modeling is normally addressed to this audience, it is important that we separate our professional concern over the reporting of deferred income tax from top management's need to see what we think the future will hold based on the present accounting environment.

When modeling the entire insurance company, it is imperative that :

- all transactions are shown (even those that are usually considered to offset) correctly, cash as well as accrual,

- the possible interactions of assumptions is considered and all assumptions are consistent, and

- the real accounting and political environment governs, not the ideal one we may desire.

I conducted a limited telephone survey to find how actuaries are using computers, mini-computers and time-sharing that were different from the obvious ones - profit studies, GAAP reserves, valuation and gross premium development. I am sure there are many other interesting applications that members of the audience have been involved in. I would like to encourage anyone during the discussion period to share their particular applications with us. Most of these mini-computer applications are on IBM 5100 or 5110's.

Milliman & Robertson's Chicago office has developed a time-sharing model to study agency staffing. Given a distribution of existing agents and three of

- future agents to be recruited,

- productivity of agent by year of service,

- agents retention rate, and

- total sales for each future year

it will solve for the fourth. It has been used to predict the number of agents needed to be recruited to achieve a particular sales goal and to study the financial implications of spending more on new agent training in order to improve retention.

Milliman & Robertson's Gainesville office has developed a physician staffing model on their mini-computer for use by Health Maintenance Organizations (HMO). Based on the projected number of patient visits and hours that each physician wishes to work, the model will develop the staffing required as the operation of the HMO is projected.

Penn Mutual has developed a model (called Agency Income Model) which will develop a five year projection of each individual agency. Input to the model includes

- premium inforce by agency,

- insurance persistency,

- agent persistency,

- average agent production, and

- recruiting.

This model has been received enthusiastically by the general agents who have been exposed to it. I believe this model is run on their main computer.

Family Life is using a mini-computer to compare reinsurance quotations from different reinsurers. They store a distribution of their business by issue

age and by standard and substandard ratings in the mini-computer. This makes it simple for them to compare different reinsurance premium quotations based on their business inforce. They use a lapse and interest assumption to develop the reinsurance premiums over time and finally the discounted value for that block of business.

Guardian Life uses a mini-computer to develop the IBNR reserve for major medical insurance using a claims runoff approach. Part of their approach is to use a multinomial distribution to fit the claim runoff.

Cologne Re is using a mini-computer to handle their investment analysis. As a by-product the mini-computer generates the entire schedule D for the annual statement.

Occidental Life of North Carolina is using a mini-computer to generate advanced underwriting proposals. They also maintain a file of competitive rates on their mini-computer. They have given up trying to maintain term rates because they changed too often - their file was never current. They also maintain a filing index to every document in the actuarial department on the mini-computer. The index includes

- the title,
- the author, and,
- where the document is filed

These few examples show that actuaries do not lack for inventiveness in finding different ways to use computers.

MR. STEVEN R.GRAINGER: In addition to the usual profit studies, we do general sales illustrations. They are not on a personalized basis. When each policy is issued we show compliance with the NAIC model disclosure laws on an individual basis. There are an increasing number of states that require this. One thing we have experienced is that there seems no direct link between the general EDP computers and the actuarial mini-computers. Quite often we have large computer reports produced by the large computer that we must manually transfer to our mini-computer. This seems a waste of resources. Has anyone else encountered this problem ?

MR. KNOWLTON: We have done some "typing in again". Some users of mini-computers use a 9-track tape to send data back and forth between the big computer and the mini-computer.

MR. PERROTT: Some users have main computers that will read floppy disks and they communicate from their mini to the main computer by writing onto floppy disks.

MR. J. RAE JAMIESON: We send our data from our mini-computer to a time sharing service for one day and have them dump it to a 9-track tape to send data into our main computer.

MR. TIM HARRIS: There are several brands of mini-computer that will communicate directly with the main computers, the Hewlett-Packard (HP) and the WANG WCS2 are two. I have used a HP to transfer data from our main computer to our WANG.

MR. JAMES L. BERGIN: We use a 4 Phase system to input data to our main computer. The 4 Phase system and our WANG mini-computer are linked together. They pass information back and forth between themselves. The 4 Phase system communicates with the main computer.