TITLE: PROJECTING CALENDAR PERIOD IBNR AND KNOWN LOSS USING RESERVE STUDY RESULTS

AUTHORS: Edward W. Weissner
Arthur J. Beaudoin

Edward W. Weissner is currently an Actuarial Director with Prudential Reinsurance Company. His current interests include Reinsurance reserving, reinsurance database design, applications of mathematics and statistics to actuarial problems and presentation of results in a format that clearly defines any problems and suggests solutions. He holds a Ph.D (1970) in mathematical statistics from the University of North Carolina and is a Fellow of the Casualty Actuarial Society (1980).

Arthur J. Beaudoin is currently an Actuarial Assistant with Prudential Reinsurance Company. He has tackled assignments in reinsurance reserving, reinsurance pricing and actuarial systems. He earned a Ph.D (1982) in philosophy from Northwestern University and is striving to become an FCAS.

ABSTRACT:

Periodically, our reinsurance company does a time consuming, indepth reserves study of each of its underwriting areas. These studies generate detailed information on exposure, market factors, report delay patterns, ultimate expected loss ratios, et cetera, for each homogeneous group of contracts in the underwriting area. While these studies enable the company to periodically check the adequacy of its reserve levels in each underwriting area, they, by themselves, do not yield

1) interim IBNR for each future calendar month until the next study,
2) projected future calendar period IBNR and known loss for company planning based on our current book of business and future writings,
3) a comparison of actual "future" calendar period known loss experience with projected "future" calendar period known loss experience,
4) the comparison in (3) by homogeneous group of contracts and by accident period.

The purpose of this paper is to show how the detailed group information from our reinsurance study is used by our company to address (1) - (4) above. It is hoped that in presenting our methodology the reader will be able to abstract general principles that will allow him to develop a similar system based on his reserve study and its output. The methodology to be discussed here is currently in use and programmed on an IBM-PC. A small teaching example is included.

INTRODUCTION

The purpose of this paper is to show how the detailed information from our reinsurance reserve studies can be used to determine the monthly change to IBNR for the interim months until the next reserve study and determine the change to IBNR and the known loss for future calendar periods of interest. It is hoped that in presenting our methodology that the reader will be able to "see how" to develop his own system based on his company's reserving formulae and on the information contained in his company's reserve studies.

Our reinsurance company does an indepth reserve study of each of its underwriting areas as often as possible. Given our management's committment to the production of quality reserve analyses and our difficulties in obtaining useful data from our system along with the usual problems in grouping and analyzing reinsurance contracts, an individual study can take three to four months. While the size of a reserve study prevents us from doing more than one study a year for each underwriting area, it follows, given the enormous effort put into these studies, that they do generate valuable detailed information on exposure, market factors, report delay patterns, ultimate expected loss ratios, et cetera, for each homogeneous group of contracts in the underwriting area. However, while these studies enable the company to periodically check the adequacy of its reserve levels in each underwriting area, they, by themselves, do not yield

1) interim IBNR for each future calendar month until the next study,

2) projected future calendar period IBNR and known loss for company planning based on our current book of business and future writings,

3) a comparison of actual "future" calendar period known loss experience with projected "future" calendar period known loss experience,

4) the comparison in (3) by homogeneous group of contracts and by accident period.

For some time we have been looking for a way to use much of the key information in our latest reserve study to address the concerns in (1) to (4) above. In addition, management wanted us to be able to generate results overnight and to be able to run varying senarios for (2) to (4) above. Of course the obvious solution in light of today's information is to load all the information from your latest reserve study into an IBM-PC with a hard disk and to program it to generate for each group the IBNR and known loss figures you need to answer (1) to (4) above and then to add up the results over all the groups. This is precisely what we did. The inherant speed and storage capacity of the IBM-PC makes it feasible to literally do all kinds of calculations for several hundred groups in a very short time.

We now present our methodology for extending a reserve study into the future. Again, our purpose here is to show our system in the hope that it will help the reader to see more clearly how he could design a similar system for his company based on their

reserve techniques and the information in their latest reserve study.

While we focus on reinsurance for our examples we believe the concepts are applicable to primary companies also.

PLAN OF THE PAPER

In presenting our methodology, we shall follow the following format. First, we shall give a brief overview of our reserves methodology and of the information found in our reserve studies. Then, so we can illustrate our concepts later, we present the "information" from a reserve study at Example Reinsurance Company. This is followed by a discussion of how we extend the results of a reserve study to obtain calendar period IBNR. Next, we address the determination of IBNR for future calendar periods. We will then be ready to discuss the calculation of expected known losses for current and future calendar periods. From there we move on to a brief discussion of the comparison of actual and expected known loss by calendar period. This is followed by a section on general issues which is followed by a final section on implementation of this methodology on an IBM-PC. We conclude with a list of references.

OVERVIEW OF A RESERVE STUDY

Before we can discuss how we would use the results of our reserve study to project IBNR and known loss for future calendar periods, we need to briefly review the essence of our reserve

methodology and procedures. These have been discussed extensively in John (1982), Patrik (1978), and Weissner (1981).

We begin each reserve study by sorting our contracts into homogeneous groups. These groups can be based on coverage (casualty, marine, property, ...), category type (working, catastrophe, retro rated, ...), pro rata or excess, line (automobile, general liability, workers' compensation, fire, SMP, ...), retention, size of contract, ... (see John (1982 p.129-130)). For facultative business some of the typical groups could be casualty certificates with low retentions, property certificate with high retentions, et cetera. For treaty business some of the typical groups could be property pro rata contracts, casualty working contracts, crop hail contracts, funded covers, the large ABC contract, the large DEF contract, et cetera. One of our underwriting areas has over 70 distinctive and credible reserve groups. More typically, an underwriting area has approximately 10 to 30 reserve groups.

Next, we develop the case reserve supplements (they can be positive or negative) which will bring the known reserves associated with each group to a level adequate to pay the ultimate liability. The analysis to do this is based on a review of the pertinent report period loss development triangles. Through an allocation rule based on the known outstanding reserves by accident year, the case reserve supplements for each group are assigned to individual accident years.

Simultaneously, we evaluate the "earned but unreported" premium associated with each group. This is a very important

figure since it can be quite large for a reinsurer and since we use full earned premium as a measure of exposure. Our evaluation is based on the premium reporting practices of each contract. It could also be developed by studying the premium development triangles associated with collections of similarly sized contracts.

We also estimate the underlying distribution of the report lags associated with the claims of each group. This is discussed in detail in John (1982, p.130-154), Weissner (1978), and Weissner (1981, p.287-292). Generally, we have found that the underlying distributions of report lags can be adequately described by an exponential model, a Weibull model or a log normal model. For our purposes here we need only know that a report lag distribution has been selected for each reserve group and that given the distribution and its parameters, we can, for any "accident month", say m, determine the proportion of claims yet to be reported relative to the ultimate number. Since this proportion is the area under the report lag density and to the right of the largest "observable" (not observed) report lag relative to the evaluation date of the study, we will refer to it as a "tail probability" and label it TP_m

We are now almost ready to determine the IBNR for each group. First, let us review our inputs. We have earned premiums by calendar/accident year (these can be allocated to calendar/accident month) along with a good estimate of earned premium which is "unreported". Since a reinsurer has no good measure of exposure like car - years, most tend to use earned premium or written premium as a general measure of exposure.

Since we use earned premium for exposure, it is important to us to have a good estimate of our ultimate earned premium.

Of course, with shifts in rate adequacy even earned premium can prove to be a poor exposure base. To overcome this, our underwriters, based on reviews of prices, retentions, limits, shares, and coverage, provde us with "market adjustment factors", labelled MAF's. These factors record the shifts in rate adequacy from year to year. More specifically, you select any year as a base year and set the MAF for that year as 1. Also, you select a "typical risk" and its price for that year. The MAF for any other year is the price you got or would get for that "typical risk" divided by the base year price. This definition implies that the factors can be above and below one. (If you selected 1980 as your base year, most reinsurers would be exhibiting MAF factors below 1 that decrease by year through 1983 due to the so called "soft market".)

Dividing the calendar/accident year earned premiums by the respective MAF's we have a "better" exposure base. An example may help. Assume you have $200 of earned premium in 1980 and $100 of earned premium in 1981. If a typical $1 risk in 1980 generated only 50 cents of premium in 1981, then the MAF for 1981 is .5 if 1980 is the base year with MAF of 1. It follows that the exposure premium (earned premiums divided by MAF) for 1980 is 200 (200 divided by 1) and for 1981 is 200 (100 divided by .5). Given the underlying pricing assumptions it appears that our exposure premiums are a reasonable exposure base.

In addition to exposure premium by calendar/accident year, we

also have loss experience by accident year. If we combine the known losses with our case reserve supplements, then we can be confident that our reserves for known losses are adequate to pay ultimate losses.

We are now ready to evaluate the IBNR for each group. The formula is discussed in detail in Weissner (1981). Basically underlying our formula are two relationships. They are:

$$IBNR_m = (EP_m \ \% \ MAF_m) \times XLR_p \times TP_m$$

$$XLR_p = \left(\sum_{m \in p} IBNR_m + L_p\right) \% \left(\sum_{m \in p} (EP_m \ \% \ MAF_m)\right)$$

where $IBNR_m$ = the IBNR for accident month m

EP_m = earned premium for calendar/accident month m

MAF_m = the market adjustment factor for month m

XLR_p = the ultimate exposure loss ratio for an accident period p of many months m (note that this ratio refers to "exposure premium" and not premium. Hence the XLR is not the same as the ultimate loss ratio)

L_p = the known losses set to ultimate pay out for the accident period p

TP_m = the proportion of claims yet to be reported for accident month m

m = a specific accident month

p = a specific accident period, usually 2 to 5 years in length, for which the XLR_p is assumed to be constant. (see Weissner

(1981, p.278))

In reviewing the above formulas, it should become clear that all of variables are known for a period p except the XLR and the IBNR. Since there are two relationships and two unknowns, simple algebra yields solutions for the IBNR and XLR (see Weissner (1981, p.293-294)).

It follows from all of the above that as a result of a reserve study we have for each reserve group, either from inputs or outputs, for each month

EP	earned premiums
MAF	market adjustment factors
XLR	ultimate exposure loss ratios

along with a distribution of report lags that can be used to generate TP. Also, though it was not mentioned above we usually have a claim severity, labelled SEV, which is by accident month and which can be used to obtain IBNR counts by the obvious division, that is

$$\text{IBNR Counts}_m = \text{IBNR}_m \ \% \ \text{SEV}_m$$

AN EXAMPLE

Since the purpose of this paper is to show how we use the results of a reserve study to project calendar period IBNR and known loss, we thought it would be best to illustrate the concepts with an example. Since a realistic example would prove to be unwieldly, we include a very simplified example that is completely artificial. None of the numbers are real; in fact they

were selected more for illustration than reality.

Let us suppose that "Example Reinsurance Company" which writes only domestic facultative business did a reserve study as of 6/30/84. Suppose that study followed the methods of the prior section. Further, suppose the homogeneous reserve groups were Property, Casualty and Marine (remember we want to keep this simple).

Exhibit 1 shows for each group the results (inputs and outputs by month) of that 6/30/84 study. For each variable the values are given in vector notation with the 6/84 value as the first component and the 1/80 value as the last component. The symbol ρ, an APL character, is the reshape character. When you see something like 12 ρ .50, you can replace it with 12 .5's. The only exception to the vector notation is the LAG variable. Here we store the general shape of report lag distribution (1 = exponential, 2 = log normal, 3 = Weibull, ...) and its two parameters.

According to exhibit 1 the Property group parameters for October, 1983 are:

EP = 46000

MAF = .73

XLR = .60

SEV = 50

Also the underlying report lag distribution is log normal (2) with parameters 2.24 and .86.

Finally, for groups like Marine where there is zero earned

premium in some months, we will put "filler" numbers in the other variables just to keep the vectors consistent. This will be useful later.

Exhibit 2 shows the IBNR and IBNR counts associated with each group as of 6/30/84. These figures come directly from the reserve study. They can also be regenerated by using the first basic relationship.

$$IBNR_m = (EP_m \times MAF_m) \times XLR_p \times TP_m$$

$$IBNR\ Count_m = IBNR_m \times SEV_m$$

and then summing over the months in each year. If you wish to verify these figures, let

$$TP_m = Pr[Lag \geq \text{"6/84 - m"} + .5]$$

and the distribution functions be:

1) exponental: $F(x) = 1 - \exp(-t(x-s))$

2) log normal: $F(x) = \Phi((\log x - m) \times v)$

where the respective parameters are t,s and m, v.[2]

EXTENDING THE RESULTS OF A RESERVE STUDY

Once a reserve study is completed we would like to use the results of that study to keep the IBNR current until the next reserve study and to project IBNR and known losses for future calendar periods. According to our IBNR formula, if we can get earned premium by calendar/accident month and by group, then we

only need to develop a rule for projecting market adjustment factors, MAF's, ultimate exposure loss ratios, XLR's, and severities, SEV's, into the months after a study. This assumes, of course, that our report lag distribution remains stable.

Let's assume that we can get earned premiums by month and group, that the report lag distribution is stable and that for a "few months" after a study the "most recent" values of MAF, XLR, and SEV should be continued. This seems very plausible.

Exhibit 3 shows the values of our variables by group through 9/30/84. Again, the values are in vector format except here the lead values are for 9/84. Note that the first four values of MAF, XLR, and SEV are the same; that is the latest three months carry the 6/84 value. All prior (for EP, too) values are as they were in Exhibit 1. Also note that Example Re continues to have zero earned premium for Marine.

Using our basic formula, we can now easily calculate the IBNR as of 9/30/84 for Example Re. Exhibit 4 shows the IBNR as of 9/30/84; Exhibits 5-7 show the IBNR calculation in detail for each group. Note that all the variable values below the dotted line came directly from the reserve study. Only the latest 3 months of MAF, XLR and SEV come from our projection rule of "no change". (We are still assuming the earned premiums are real, actual values.)

Unfortunately, while we have the cumulative IBNR as of 9/30/84, we need the September calendar month change in IBNR. To obtain it, we must subtract the August, 1984 cumulative IBNR from the September cumulative IBNR. While this creates no problem

mathemetically, it does confuse some non-actuarial people who are very comfortable with calendar month changes and very uncomfortable with changes to cumulatives.

While it is indeed informative to see the cumulative IBNR associated with a group of contracts as of a certain date split by accident year or even by accident month as in Exhibits 5-7, underwriters and management tend to be more interested with calendar period results. They tend to focus on how much are we writing this year and how much IBNR will be added?

We have found it to be much more productive to discuss the change in IBNR for a calendar month and to show how it can be divided into various pieces due to current and past accident months or years. We now introduce the formula for the calendar month increase to IBNR. The presentation underscores some basic concepts that underwriters and management feel comfortable with; the formula is, of course, equivalent to taking the difference of the cumulative IBNR as of the end of this month and that as of the end of the prior month.

Before we develop the formula for the monthly increase to IBNR, let us comment on notation. Further, let us restrict our interest to a specific group. Clearly, the results for the month are just the sum of the various group results.

For a specific accident month, m, let $F_{\cdot}$ be the proportion of accident month, m, claims that will be reported, according to the underlying report lag distribution, in the calendar month of interest.

That is,

$$P_m = \Pr[\text{Lag} = \text{"calendar month of interest} - m\text{"}]$$
$$= \Pr[\text{"cal. mon.} - m\text{"} - .5 < \text{Lag} < \text{"cal. mon.} - m\text{"} + .5]$$

where all report lags are measured in months. It should be noted that

$$P_m = TP_{m-1} - TP_m$$

since the probability that a claim from accident month m will be reported in this calendar month is the same as the probability that a claim from this accident month m will be reported this month or in the future less the probability that a claim from this accident month m will be reported in the future. The second probability in the difference is exactly TP_m ; the first probability is equivalent to the probability that a claim from the accident month just after accident month m will be reported in the future, i.e., TP_{m-1} where "m-1" means just after m. This formula for P_m gives us an easy way to calculate it.

In discussing the formula we will also be interested in the ultimate expected loss associated with an accident month m. In general this ultimate loss would be the earned premium for the period times the ultimate loss ratio for the period. Recall however that in our reserve study earned premiums have been converted to exposure earned premiums (EP % MAF) and the loss ratio is an ultimate exposure loss ratio. Hence,

$$\text{Ultimate Expected Loss}_m = (EP_m \% MAF_m) \times XLR_p$$

We now discuss the formula for a group. Let us separate the discussion between prior accident months and the current accident month. For the current month, the change (increase) to calendar month IBNR due to it is the ultimate expected loss associated with the exposure for the accident month less the expected losses associated with the exposure for the accident month that should have been reported. Since the expected reported losses equal the ultimate expected loss times the expected proportion of losses to be reported, P_m , we have using the prior notation,

$$\begin{aligned}
\text{Change to IBNR}_m &= \text{Ultimate Expected Loss}_m \\
&\quad \text{less Expected Losses}_m \text{ Reported} \\
&\quad \text{this Month} \\
&= \text{Ultimate Expected Loss}_m - \\
&\quad \text{Ultimate Expected Loss}_m \times \text{Percent Reported}_m \\
&= [(EP_m \ \% \ MAF_m) \times XLR_p] - \\
&\quad [(EP_m \ \% \ MAF_m) \times XLR_p] \times P_m
\end{aligned}$$

For a prior accident month, the change to calendar month IBNR due to it is simply a take down for the expected losses associated with the specific prior accident month that should have been reported. Observe that IBNR for the ultimate expected losses due to this prior accident month would have been included in the prior accident month's calendar month. Hence, as time moves on, we need only reduce the IBNR associated with each prior accident month based on expected reported losses. Following the above, for a prior accident month m, we have:

$$\text{Change to IBNR}_{m} = -[(EP_{m} \times MAF_{m}) \times XLR_{p}] \times P_{m}$$

To clarify this formula let us return to our example. Exhibits 8, 9, and 10 provide the details of the group calculations for the September, 1984 Monthly Increase to IBNR. Note that the first four columns of Exhibit 8-10 are identical to the first four columns of Exhibits 5-7 respectively. Also, in Exhibits 8-10 the fifth column contains the P values whereas in Exhibit 5-7 the fifth column contains the TP values. Note that successive differences of the TP values yield the P values. Columns 6 and 7 show the current month expected increase to IBNR (the ultimate loss due to the current month's exposure) and the current month expected decrease to IBNR (the expected reported losses due to each accident month). Finally, column (8) contains each accident month's contribution to the monthly increase to IBNR. Column (9) shows each accident year's contribution. Again, observe also that all the parameters from the reserve study are enclosed by the dotted lines.

We have found exhibits like this to be very useful in discussing monthly IBNR. It is easy to see the increase in the monthly IBNR due to the current month's new exposure and the decreases in the monthly IBNR due to the prior month's exposures. It is easy to see the "length of the tail" or the number of prior months that still effect the IBNR. Further, for groups like Marine, see Exhibit 10, the scheduled reduction of IBNR due to expected loss patterns is clear to see.

Exhibit 11 summarizes the results of Exhibits 8-10. These

summaries of the monthly change to IBNR by group and by contributing accident year seem to be more than adequate for monthly reports.

Of course, some people will want to see both IBNR's - the cumulative IBNR as of month end and the change in IBNR for the month. Exhibits 12A and 12B do just that. In addition, they show the year to date change to IBNR which is simply the sum of the monthly changes to IBNR for each of this year's months to date. A formula much like the monthly change to IBNR formula can be developed to generate this figure directly.

Exhibit 13 contains a summary of the month's IBNR for August and September, 1984. From these you can verify that the monthly formula is equivalent to taking the difference of the cumulative IBNR figures.

The above methodology and computer sheets describe how we can move the results of a reserve study forward in time to set monthly changes to IBNR. Of course, we have assumed that we would receive earned premium each month by group and that for a "few months" anyway we could extend our factors by using the latest study factors. We'll discuss these assumptions in more detail later.

PROJECTED IBNR FOR FUTURE CALENDAR PERIODS

As soon as the September, 1984 IBNR, both cumulative as of 9/30/84 and monthly change for September, has been reported to the Comptroller, Management wants to know (1), how much more IBNR

will we have to book by year end and (2) how much IBNR will we book next year. The first question is usually motivated by the need to evaluate the year-end results early and often so strategic planning can take place. The second question is usually related to next year's budget and planning process.

Since our best information is contained in the most recent reserve study parameters, it seems only natural to use these parameters with a rule for recent month's parameters along with some good estimates of earned premium for each group.

Let's tackle question one first. Here we must extend our parameters another three months, i.e., to October, November and December 1984. We have already moved the MAF, XLR, and SEV forward in time by assuming that July through September, 1984 have the same values as June, 1984. Let's continue this rule and assign the June, 1984 value for MAF, XLR, and SEV to the values for October through December 1984. (Of course, if there is good reason to increase or decrease values one should do it - more later.) Further, lets assume the earned premium projections for October through December, 1984 are 55,750 and 27,583 per month for the Property and Casualty groups respectively.

Exhibit 14 shows the reserving parameters we shall use to make our year-end projection. They are based on our rule for moving parameters forward in time and on the study earned premiums prior to 6/84, the actual earned premiums for 7/84 to 9/84 and the projected earned premiums for 10/84 to 12/84. Again, the first component of each vector is 12/84.

Using our IBNR formulas, we obtain the projected December,

1984 IBNR results. Exhibit 15 shows the results by group and by accident year. Clearly the expected increase to IBNR over the next three months (10/84 to 12/84) is 120,960, that is 1,538,836 (the all groups cumulative IBNR as of 12/84 - see Exhibit 15) less 1,417,876 (the all groups cumulative IBNR as of 9/84 - see Exhibit 12). One could also take the difference of the respective year-to-date changes to IBNR, that is 491,986 less 371,026.

To determine the change in IBNR for 1985 we need to again move our parameters forward in time. Let's assume that the earned premiums for the next year are projected to be 50,175 and 24,825 per month respectively for the Casualty and Property groups. Marine continues to get zero earned premium. (If you know your earned premium varies by season, you could enter the seasonally adjusted projected earned premium.) Lets also assume that the XLR and SEV can remain at the 6/84 value. However, let's assume that due to increases in prices, the MAF values in 1985 will be 20% higher than at the end of 1984. This means that 7/84 - 12/84 have the 6/84 MAF value but 1/85 - 12/85 have the 6/84 MAF value times 1.2 (a more realistic approach, given that prices have suddenly jumped 20% in a month, would be to let the MAF value in each successive month be approximately 1.02 times the prior month MAF beginning with the 1/85 MAF.)

Exhibit 16 shows the reserving parameters through year-end 1985. They are based on the above rules for setting parameter values. The vector begins, of course, with the 12/85 value.

Again, using our formulas, we obtain the projected December, 1985 IBNR results. Exhibit 17 shows the results by group and

accident year. Clearly, the expected increase to IBNR for 1985 is 145,745, the all groups year to date IBNR increase less the IBNR decrease, i.e., 894,225 - 748,480. You could also subtract the all groups cumulative IBNR figures as of 12/85 and 12/84 (see Exhibit 15) i.e., 1,684,581 - 1,538,836.

Clearly different rules to move the parameters forward in time could have been used. Moreover, in doing projections, you may want to run various senarios. Hopefully, the above illustrates how projections can be developed.

EXPECTED KNOWN LOSSES

In addition to current and future IBNR questions, management also has current and future known loss questions. More specifically, what does the latest reserve study imply about the expected known losses for the latest calendar months? Can we use the expected known loss figures to monitor our actual experience? What does the reserve study imply about the expected calendar period known losses for next year or for the rest of the current year?

Under certain regularity assumptions, the answers to these questions are already contained in our exhibits. In fact, if your losses are reserved to ultimate on the day they are first received and you therefore have no case development to consider, the expected known loss for a calendar period is exactly equal to the "decrease" part of the IBNR for the calendar period. That is, the expected known loss is precisely the expected reported

losses for the calendar period. It follows then that the expected known loss for the September, 1984 calendar month is 56,214 (see Exhibit 11, all groups, the total in column 3) and that the expected number of claims is 781.2. The expected known loss for the remaining three months of 1984 evaluated at 9/30/84 is 177,113 which is the 12/31/84 year to date expected known loss of 627,266 (see Exhibit 15, all groups, the total in column 8) less the 9/30/84 year to date expected known loss of 450,153 (see Exhibit 11, all groups, the total in column 8). The expected number of claims is 1450 which is 8,710.7 less 6,260.7. Finally, the expected known loss for the 1985 calendar year is 748,480 which is the 12/31/85 year to date expected loss figure on exhibit 17 (see all groups, the total in column 8).

Of course, the no case development assumption is definitely an unrealistic assumption. However, if one can assume that case development patterns are stable and that new claims are entering the loss process as fast as old claims are being closed so that the mix of losses in various stages of development is stationary, then the expected known losses for a calendar period still equals the expected reported losses for the calendar period.

To see this we need to discuss a number of concepts. First, the known loss for a calendar period equals the development on claims known at the beginning of the period (i.e., the change in incurred over the period) plus the value as observed at the end of the period of all the newly reported claims in the period. Since claims develop in this senario, the value of a newly reported claim at the end of the period is usually not its

ultimate value or value after development. If we restate the known loss for a calendar period using ultimate values for new claims, we have

Known Loss = Case development on old claims
+ Current value on new claims

= Case development, for the period, on old claims
+ Ultimate value on new claims
- Case development, all time, on new claims

Recall that the IBNR take down (decrease) for expected reported losses in a calendar period is precisely the ultimate value of the expected new claims in the period. If we can now show that the case development on the old claims for the period is equal to the full case development over all time for the new claims, then the calendar period Known Loss is exactly the "take down piece of the monthly IBNR".

Let us now show that the case development for the calendar period on the old claims is precisely the all time case development on the newly reported claims. We are assuming, of course, that the mix of claims is stationary. The following illustration will be helpful in visualizing the concepts.

Assume that each calendar year we get $100 of new claims and that the incurred pattern of development for every calendar year as of each year-end is $100, $130, $110, $100, $95, $95,... Then as of the end of 1983 the report period incurred development

pattern is:

Calendar Year	12	24	36	48	60	72
1978	100	130	110	100	95	95
1979	100	130	110	100	95	
1980	100	130	110	100		
1981	100	130	110			
1982	100	130				
1983	100					

Now, given stable development and constant dollars of new claims the incurred development triangle at the end of 1984 looks like the prior triangle with one older row, i.e.,

Calendar Year	12	24	36	48	60	72	84
1978	100	130	110	100	95	95	95
1979	100	130	110	100	95	95	
1980	100	130	110	100	95		
1981	100	130	110	100			
1982	100	130	110				
1983	100	130					
1984	100						

It follows that the 1983 and 1984 legs of the report period incurred development triangle are:

Calendar Year	12	24	36	48	60	72	84	Calendar Losses (1984)
1978						95	95	0
1979					95	95		0
1980				100	95			-5
1981			110	100				-10
1982		130	110					-20
1983	100	130						+30
1984	100							100
								95

The calendar 1984 known losses are $95. Note however that the $95 is precisely the ultimate payout on the $100 of new claims and that the year by year one year development losses correspond precisely to the all time development pattern for the $100. That is, the development pattern for our $100 of losses is $100, $30,

$-20, $-10, $-5, $0 on a change basis. Thus the 30, -20, -10, -5, 0 is the development pattern for the individual year's case development of old losses or for the all time case development of the new claims.

Thus, if you are willing to assume a level book of claims with an homogeneous mix of development stages, we can use our IBNR exhibits to estimate the known loss for a calendar period. Of course, if you have an expanding book of claims, the suggested procedure would probably misstate the known losses. But even in that case, the expected known losses for our exhibits might serve as a useful guide until you can do something better.

MONITORING ACTUAL KNOWN LOSSES

Since all of our IBNR and known loss figures have been calculated at the group level (recall the groups are those of the latest reserve study) and are available by accident year within group, we have everything we need to monitor actual known loss experience by calendar period. To compare actual versus expected known loss experience for a calendar period, we could first make a comparison at the total level. If a large difference existed, we could do comparisons by group. When the group or groups that generated the difference were found, we could do the comparisons by accident year.

In making these comparisons where the expected known loss was based on projected earned premiums, one should also compare the actual earned permium to the projected earned premium. Since our

formulas use earned premiums as an exposure base, any big deviation from the projected earned premiums can itself be the cause of differences between actual and expected known loss.

SOME GENERAL ISSUES

Before concluding this paper, we would like to briefly discuss some of the underlying, unstated assumptions that may cause problems. The issues to be discussed include the allocation of earned premium to group, earned but unrecorded premium, accident month versus calendar month earned premiums, extension rules for the parameters, asbestos, and contract exclusions.

In this presentation we assumed that the monthly earned premiums received from the Comptroller could be split by group. In our company the earned premiums are not split by group. The comptroller delivers to us each month the calendar month earned premium for each underwriting area. We then allocate this premium to group based on the prior year's distribution of earned premium to group. To the extent that our mix of business is constant this should be reasonable; if the underwriters decide to change the mix of business by group, the allocation will be incorrect. To monitor changes in the mix, we continually ask the underwriters about their plans, about new big treaties, about major cancellations, et cetera. Note that in our example the Marine group had no earned premium since early 1983. Thus an allocation for 1984 would assign zero to Marine. If the underwriters were about to start writing Marine business again, we

would have to adjust our allocation ratios.

We also assumed here that the monthly earned premiums were accident month earned premiums. Clearly the comptroller only has calendar month earned premiums to give us. These can be quite different concepts for a reinsurer since many premiums are sent to us after they are earned. This happens for instance on working treaties which report activity after the quarter, on retro-rated covers which could be sending us premium "on schedule" ten years after the exposure, and on certificates with audits. If we can assume that we "knew" that these earned but unrecorded premiums were coming, then our past accident months have an estimate of earned but unrecorded premiums. If we replace the past accident months estimated earned but unrecorded premiums dollar for dollar with this calendar month's contributions to the past accident months and then set up an earned but unrecorded premium for this accident month to reflect the delays in premium reporting, it seems to us that the increases and decreases to this month's calendar earned premium for earned but unrecorded premiums offset each other, if you are writing a constant premium volume. Hence, the comptroller's calendar month earned premium is for all practical purposes equivalent to the "full" accident month's earned premium.

Let us now discuss our extension rules for moving parameters forward in time. In most of our presentation we either continued the most recent value (i.e., the 6/84 value) or made an across the groups change (i.e., the MAF in 1985 jumped by 20%). It seems to us that within six months of a study the continuation

rule is best. If you want another rule you're free to use it. However in dealing with hundreds of groups we found that the rules for extension should be kept simple, should be applied uniformly to all groups and should apply for several months. While the updating of the parameters is difficult if it is complex, the task is miniscule in comparison to the task of getting underwriters to help you update the parameters group by group.

Finally, we have found it necessary to treat some contracts and issues outside the formula. We do not allow the earned premium for large reserve transfers, funded covers, or certain financial guarantee covers to enter the formula. The IBNR and known loss for these are handled outside the formula. Further, because of the issues surrounding asbestos, and other mass action claims, we handle the IBNR and known losses for them outside the formula.

SYSTEMS IMPLEMENTATION OF THIS METHODOLOGY

In this section we include some comments that might help the reader if he desires to develop a system like ours on a personal computer. We will comment on our hardware, creation of the database, changing the database, monthly runs for financial results, output options, and documentation.

Currently our system is programmed in APL and run on an enhanced IBM PC with 512K internal memory, a hard disk and two disk drives. Our system covers eight underwriting areas. The

largest has two cost centers with approximately seventy groups per cost center. The smallest has one cost center with five groups.

In creating the database of reserving parameters we decided to set up one file for each group's parameters. In fact, the group parameters in exhibit 1 are copies of the group files. If you can download these parameters from another system you can save a lot of time. We load the parameters, including earned premium, from a reserve study by hand. The parameters from the reserve study of the largest underwriting area can be set up in three days. Since we intend to update or extend these parameters forward in time you must leave space in the files for growth. At times, our need to hold up to 20 years of earned premiums has caused storage space problems. We store the data on diskettes and keep the programs on the hard disk.

To update or extend the parameters each month we found that we needed many options. We developed various extension rules, i.e., repeat the prior factor, multiply the prior factor by a selected input, use a new factor that is being input, truncate the prior three factors and update the file using one of the above options for the next four factors, et cetera. Further, we found that we needed to be able to change selected parameters in selected groups. Sometimes a special review of certain large contracts caused us to change the associated group parameters. Also we found that we needed to store the reserving parameters associated with future projections on separate disks from the so called official parameters used for the monthly IBNR.

To obtain the monthly change to IBNR we must obtain from the comptroller the calendar month earned premium for each underwriting area, then allocate it to group and then calculate. We can do all the updating for a month for all the areas and run the results in a day. Usually we set the programs to run over night. We like to do that because then we can print the results by group, by cost center, by treaty or facultative, et cetera. We have various levels of print options depending on how much detail we need. We also have a snapshot option that allows you to look at the output of a group anytime.

In addition to the various print options mentioned above, we have developed several parameter summaries for quick review of the group inputs, and created several summary output reports that help us internally to quickly review the results. Also we have begun to store for historical reference the group results and the above summaries even though they can be recalculated. Management likes quick responses to questions.

Finally a comment or two on documentation. Of course you need to have documentation that explains how to run the system. But you also need a way to keep track of all the extension rules and changes that have been applied to the database. You need to keep track of all the various copies of the database and their reason for being. And you need a production record of all the runs and their use. Finally, make two backup copies of your data disks. If you only have one back up and two disk drives, a new person can erase your database and cause you to have to reload the data.

CONCLUSION

In this paper we tried to show how we use detailed group information from our reinsurance reserve study to determine monthly IBNR changes for interim months until the next reserve study and determine the expected change to IBNR and the expected known loss for future calendar periods of interest. Hopefully you gained some insight into how you could do something similar based on your reserve studies and reserves methodology. If so, our goal has been achieved.

REFERENCES

John, Russell T. (1982), "Report Lag Distributions and IBNR," 1982 Casualty Loss Reserve Seminar Transcript, p.124-165.

Patrik, Gary S. (1978), "An Actuarial Procedure for Estimating a Reinsurance Company's IBNR," Proceedings of the Insurance Accounting and Statistical Association, vol.1978, p.531-534.

Weissner, Edward W. (1978), "Estimation of the Distribution of Report Lags By The Method of Maximum Likelihood," Proceeding of the CAS, vol.65, p.1-9.

Weissner, Edward W. (1981), "Evaluation of IBNR on a Low Frequency Book Where The Report Development Pattern is Still Incomplete," 1981 Casualty Loss Reserve Seminar Transcripts, p.273-294.

EXAMPLE REINSURANCE COMPANY
Reserve Study as of June 30, 1984
Group Parameters

GROUP: PROPERTY

```
EP  = 54000,53000,52000,51000,50000,49000,48000,47000,46000,45000,44000,43000,42000,41
      000,40000,39000,38000,37000,36000,35000,34000,33000,32000,31000,30000,29000,2800
      0,27000,26000,25000,24000,23000,22000,21000,20000,19000,18000,17000,16000,15000,
      14000,13000,12000,11000,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000
MAF = (6ρ0.66),(12ρ0.73),(12ρ0.81),(12ρ0.9),(12ρ1)
XLR = (18ρ0.6),(24ρ0.55),(12ρ0.5)
SEV = (54ρ50)
LAG = 2 2.24 0.86
```

GROUP: CASUALTY

```
EP  = (19ρ24000),23000,22000,21000,20000,19000,18000,17000,16000,15000,14000,13000,120
      00,11000,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000,(12ρ0)
MAF = (6ρ0.51),(12ρ0.64),(12ρ0.8),(24ρ1)
XLR = (42ρ0.9),(12ρ0)
SEV = (42ρ1000),(12ρ1)
LAG = 1 0.02 0
```

GROUP: MARINE

```
EP  = (18ρ0),1000,2000,3000,4000,5000,6000,7000,8000,9000,10000,11000,(14ρ12000),11000
      ,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000
MAF = (54ρ1)
XLR = (54ρ1.2)
SEV = (18ρ1),(36ρ100)
LAG = 1 0.05 0
```

1) 'ρ' can be defined as follows: '5ρb' means b,b,b,b,b.
2) In each vector of monthly parameters, the first component is 6/84 and the final component is 1/80.

EXHIBIT 1

EXHIBIT 2

EXAMPLE REINSURANCE COMPANY
Cumulative IBNR as of June 30, 1984
by Group, by Accident Year

GROUP: PROPERTY

CUMULATIVE IBNR

AS OF:6/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	247,162	4,943.2
83	179,535	3,590.7
82	41,236	824.7
81	10,617	212.3
80	1,698	34.0
TOTAL	480,249	9,605.0

GROUP: CASUALTY

CUMULATIVE IBNR

AS OF:6/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	239,459	239.5
83	319,344	319.3
82	156,903	156.9
81	35,506	35.5
80	0	0.0
TOTAL	751,212	751.2

GROUP: MARINE

CUMULATIVE IBNR

AS OF:6/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	0	0.0
83	0	0.0
82	26,006	260.1
81	28,991	289.9
80	9,404	94.0
TOTAL	64,401	644.0

GROUP: ALL

CUMULATIVE IBNR

AS OF:6/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	486,621	5,182.7
83	498,879	3,910.0
82	224,146	1,241.7
81	75,114	537.8
80	11,102	128.0
TOTAL	1,295,862	11,000.2

EXAMPLE REINSURANCE COMPANY
Reserving Parameters as of Sept 30, 1984 *
Based on Reserve Study as of June 30, 1984
by Group

GROUP: PROPERTY

EP = 54858,52182,53520,54000,53000,52000,51000,50000,49000,48000,47000,46000,45000,44000,43000,42000,41000,40000,39000,38000,37000,36000,35000,34000,33000,32000,31000,30000,29000,28000,27000,26000,25000,24000,23000,22000,21000,20000,19000,18000,17000,16000,15000,14000,13000,12000,11000,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000

MAF = (9ρ0.66),(12ρ0.73),(12ρ0.81),(12ρ0.9),(12ρ1)

XLR = (21ρ0.6),(24ρ0.55),(12ρ0.5)

SEV = (57ρ50)

LAG = 2 2.24 0.86

GROUP: CASUALTY

EP = 27142,25818,26480,(19ρ24000),23000,22000,21000,20000,19000,18000,17000,16000,15000,14000,13000,12000,11000,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000,(12ρ0)

MAF = (9ρ0.51),(12ρ0.64),(12ρ0.8),(24ρ1)

XLR = (45ρ0.9),(12ρ0)

SEV = (45ρ1000),(12ρ1)

LAG = 1 0.02 0

GROUP: MARINE

EP = (21ρ0),1000,2000,3000,4000,5000,6000,7000,8000,9000,10000,11000,(14ρ12000),11000,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000

MAF = (57ρ1)

XLR = (57ρ1.2)

SEV = (21ρ1),(36ρ100)

LAG = 1 0.05 0

1) 'ρ' can be defined as follows: '5ρb' means b,b,b,b,b.
2) In each vector of monthly parameters, the first component is 9/84 and the final component is 1/80.

* Extension rule: Parameters for months after 6/84 are set at the 6/84 value (i.e. MAF, XLR, SEV).
Earned premiums after 6/84 are from the Comptroller.

EXHIBIT 3

EXAMPLE REINSURANCE COMPANY
Cumulative IBNR as of Sept 30, 1984
Based on Reserving Parameters as of Sept 30, 1984 (see Exhibit 3)
by Group, by Accident Year

GROUP: PROPERTY

CUMULATIVE IBNR
AS OF:9/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	336,537	6,730.7
83	138,390	2,767.8
82	33,546	670.9
81	8,956	179.1
80	1,466	29.3
TOTAL	518,894	10,377.9

GROUP: CASUALTY

CUMULATIVE IBNR
AS OF:9/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	361,600	361.6
83	300,747	300.7
82	147,766	147.8
81	33,438	33.4
80	0	0.0
TOTAL	843,551	843.6

GROUP: MARINE

CUMULATIVE IBNR
AS OF:9/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	0	0.0
83	0	0.0
82	22,384	223.8
81	24,953	249.5
80	8,094	80.9
TOTAL	55,430	554.3

GROUP: ALL

CUMULATIVE IBNR
AS OF:9/84

ACC YR	CUM $ IBNR	CUM # IBNR
84	698,137	7,092.3
83	439,137	3,068.5
82	203,696	1,042.5
81	67,347	462.1
80	9,559	110.2
TOTAL	1,417,876	11,775.7

EXAMPLE REINSURANCE COMPANY
Cumulative IBNR Calculation
Domestic Facultative - PROPERTY
As of Sept 30,1984

ACC MON	EP	MAF	XLR	TP	CUMULATIVE IBNR ACCIDENT MONTH	CUMULATIVE IBNR ACCIDENT YEAR (see Exhibit 4)
SEPT 84	54858	.66	.600	.9992	49832	336537
AUG 84	52182	.66	.600	.9760	46302	
JULY 84	53520	.66	.600	.9233	44921	
JUNE 84	54000	.66	.600	.8565	42045	
MAY 84	53000	.66	.600	.7863	37884	
APR 84	52000	.66	.600	.7181	33946	
MAR 84	51000	.66	.600	.6543	30337	
FEB 84	50000	.66	.600	.5959	27086	
JAN 84	49000	.66	.600	.5429	24184	
DEC 83	48000	.73	.600	.4951	19534	138390
NOV 83	47000	.73	.600	.4522	17469	
OCT 83	46000	.73	.600	.4136	15639	
SEPT 83	45000	.73	.600	.3790	14018	
AUG 83	44000	.73	.600	.3479	12580	
JULY 83	43000	.73	.600	.3198	11304	
JUNE 83	42000	.73	.600	.2946	10169	
MAY 83	41000	.73	.600	.2718	9158	
APR 83	40000	.73	.600	.2511	8256	
MAR 83	39000	.73	.600	.2324	7451	
FEB 83	38000	.73	.600	.2155	6729	
JAN 83	37000	.73	.600	.2000	6083	
DEC 82	36000	.81	.550	.1860	4545	33546
NOV 82	35000	.81	.550	.1731	4114	
OCT 82	34000	.81	.550	.1614	3726	
SEPT 82	33000	.81	.550	.1506	3375	
AUG 82	32000	.81	.550	.1408	3059	
JULY 82	31000	.81	.550	.1317	2772	
JUNE 82	30000	.81	.550	.1234	2513	
MAY 82	29000	.81	.550	.1157	2278	
APR 82	28000	.81	.550	.1086	2065	
MAR 82	27000	.81	.550	.1020	1871	
FEB 82	26000	.81	.550	.0960	1695	
JAN 82	25000	.81	.550	.0904	1534	
DEC 81	24000	.90	.550	.0852	1249	8956
NOV 81	23000	.90	.550	.0803	1129	
OCT 81	22000	.90	.550	.0758	1020	
SEPT 81	21000	.90	.550	.0716	919	
AUG 81	20000	.90	.550	.0677	828	
JULY 81	19000	.90	.550	.0641	744	
JUNE 81	18000	.90	.550	.0607	668	
MAY 81	17000	.90	.550	.0575	598	
APR 81	16000	.90	.550	.0546	534	
MAR 81	15000	.90	.550	.0518	475	
FEB 81	14000	.90	.550	.0492	421	
JAN 81	13000	.90	.550	.0467	371	
DEC 80	12000	1.00	.500	.0444	267	1466
NOV 80	11000	1.00	.500	.0423	233	
OCT 80	10000	1.00	.500	.0403	201	
SEPT 80	9000	1.00	.500	.0384	173	
AUG 80	8000	1.00	.500	.0366	146	
JULY 80	7000	1.00	.500	.0349	122	
JUNE 80	6000	1.00	.500	.0333	100	
MAY 80	5000	1.00	.500	.0318	79	
APR 80	4000	1.00	.500	.0303	61	
MAR 80	3000	1.00	.500	.0290	43	
FEB 80	2000	1.00	.500	.0277	28	
JAN 80	1000	1.00	.500	.0265	13	

RESERVE STUDY PARAMETERS

Note: 1) Col(6) = (Col(2) ÷ Col(3)) × Col(4) × Col(5).
2) TP is based on a log normal distribution with parameters 2.24,0.86. It is defined as specified in the section 'An Example .

EXAMPLE REINSURANCE COMPANY
Cumulative IBNR Calculation
Domestic Facultative - CASUALTY
As of Sept 30,1984

ACC MON	EP	MAF	XLR	TP	CUMULATIVE IBNR ACCIDENT MONTH	ACCIDENT YEAR (see Exhibit 4)
SEPT 84	27142	.51	.900	.9900	47421	361600
AUG 84	25818	.51	.900	.9704	44215	
JULY 84	26480	.51	.900	.9512	44450	
JUNE 84	24000	.51	.900	.9324	39490	
MAY 84	24000	.51	.900	.9139	38708	
APR 84	24000	.51	.900	.8958	37941	
MAR 84	24000	.51	.900	.8781	37190	
FEB 84	24000	.51	.900	.8607	36454	
JAN 84	24000	.51	.900	.8437	35732	
DEC 83	24000	.64	.900	.8270	27910	300747
NOV 83	24000	.64	.900	.8106	27357	
OCT 83	24000	.64	.900	.7945	26816	
SEPT 83	24000	.64	.900	.7788	26285	
AUG 83	24000	.64	.900	.7634	25764	
JULY 83	24000	.64	.900	.7483	25254	
JUNE 83	24000	.64	.900	.7334	24754	
MAY 83	24000	.64	.900	.7189	24264	
APR 83	24000	.64	.900	.7047	23783	
MAR 83	24000	.64	.900	.6907	23312	
FEB 83	24000	.64	.900	.6771	22851	
JAN 83	24000	.64	.900	.6637	22398	
DEC 82	24000	.80	.900	.6505	17564	147766
NOV 82	23000	.80	.900	.6376	16499	
OCT 82	22000	.80	.900	.6250	15469	
SEPT 82	21000	.80	.900	.6126	14473	
AUG 82	20000	.80	.900	.6005	13511	
JULY 82	19000	.80	.900	.5886	12581	
JUNE 82	18000	.80	.900	.5769	11683	
MAY 82	17000	.80	.900	.5655	10816	
APR 82	16000	.80	.900	.5543	9978	
MAR 82	15000	.80	.900	.5434	9169	
FEB 82	14000	.80	.900	.5326	8388	
JAN 82	13000	.80	.900	.5220	7635	
DEC 81	12000	1.00	.900	.5117	5526	33438
NOV 81	11000	1.00	.900	.5016	4966	
OCT 81	10000	1.00	.900	.4916	4425	
SEPT 81	9000	1.00	.900	.4819	3903	
AUG 81	8000	1.00	.900	.4724	3401	
JULY 81	7000	1.00	.900	.4630	2917	
JUNE 81	6000	1.00	.900	.4538	2451	
MAY 81	5000	1.00	.900	.4449	2002	
APR 81	4000	1.00	.900	.4360	1570	
MAR 81	3000	1.00	.900	.4274	1154	
FEB 81	2000	1.00	.900	.4190	754	
JAN 81	1000	1.00	.900	.4107	370	
DEC 80	0	1.00	.000	.4025	0	0
NOV 80	0	1.00	.000	.3946	0	
OCT 80	0	1.00	.000	.3867	0	
SEPT 80	0	1.00	.000	.3791	0	
AUG 80	0	1.00	.000	.3716	0	
JULY 80	0	1.00	.000	.3642	0	
JUNE 80	0	1.00	.000	.3570	0	
MAY 80	0	1.00	.000	.3499	0	
APR 80	0	1.00	.000	.3430	0	
MAR 80	0	1.00	.000	.3362	0	
FEB 80	0	1.00	.000	.3296	0	
JAN 80	0	1.00	.000	.3230	0	

RESERVE STUDY PARAMETERS

Note: 1) Col(6) = (Col(2) ÷ Col(3)) × Col(4) × Col(5).
2) TP is based on an exponential distribution with parameters 0.02,0. It is defined as specified in the section 'An Example .

EXAMPLE REINSURANCE COMPANY
Cumulative IBNR Calculation
Domestic Facultative - MARINE
As of Sept 30,1984

ACC MON	EP	MAF	XLR	TP	CUMULATIVE IBNR ACCIDENT MONTH	CUMULATIVE IBNR ACCIDENT YEAR (see Exhibit 4)
SEPT 84	0	1.00	1.200	.9753	0	0
AUG 84	0	1.00	1.200	.9277	0	
JULY 84	0	1.00	1.200	.8825	0	
JUNE 84	0	1.00	1.200	.8395	0	
MAY 84	0	1.00	1.200	.7985	0	
APR 84	0	1.00	1.200	.7596	0	
MAR 84	0	1.00	1.200	.7225	0	
FEB 84	0	1.00	1.200	.6873	0	
JAN 84	0	1.00	1.200	.6538	0	
DEC 83	0	1.00	1.200	.6219	0	0
NOV 83	0	1.00	1.200	.5916	0	
OCT 83	0	1.00	1.200	.5627	0	
SEPT 83	0	1.00	1.200	.5353	0	
AUG 83	0	1.00	1.200	.5092	0	
JULY 83	0	1.00	1.200	.4843	0	
JUNE 83	0	1.00	1.200	.4607	0	
MAY 83	0	1.00	1.200	.4382	0	
APR 83	0	1.00	1.200	.4169	0	
MAR 83	0	1.00	1.200	.3965	0	
FEB 83	0	1.00	1.200	.3772	0	
JAN 83	0	1.00	1.200	.3588	0	
DEC 82	1000	1.00	1.200	.3413	410	22384
NOV 82	2000	1.00	1.200	.3247	779	
OCT 82	3000	1.00	1.200	.3088	1112	
SEPT 82	4000	1.00	1.200	.2938	1410	
AUG 82	5000	1.00	1.200	.2794	1677	
JULY 82	6000	1.00	1.200	.2658	1914	
JUNE 82	7000	1.00	1.200	.2528	2124	
MAY 82	8000	1.00	1.200	.2405	2309	
APR 82	9000	1.00	1.200	.2288	2471	
MAR 82	10000	1.00	1.200	.2176	2611	
FEB 82	11000	1.00	1.200	.2070	2732	
JAN 82	12000	1.00	1.200	.1969	2836	
DEC 81	12000	1.00	1.200	.1873	2697	24953
NOV 81	12000	1.00	1.200	.1782	2566	
OCT 81	12000	1.00	1.200	.1695	2441	
SEPT 81	12000	1.00	1.200	.1612	2322	
AUG 81	12000	1.00	1.200	.1534	2208	
JULY 81	12000	1.00	1.200	.1459	2101	
JUNE 81	12000	1.00	1.200	.1388	1998	
MAY 81	12000	1.00	1.200	.1320	1901	
APR 81	12000	1.00	1.200	.1256	1808	
MAR 81	12000	1.00	1.200	.1194	1720	
FEB 81	12000	1.00	1.200	.1136	1636	
JAN 81	12000	1.00	1.200	.1081	1556	
DEC 80	12000	1.00	1.200	.1028	1480	8094
NOV 80	11000	1.00	1.200	.0978	1291	
OCT 80	10000	1.00	1.200	.0930	1116	
SEPT 80	9000	1.00	1.200	.0885	956	
AUG 80	8000	1.00	1.200	.0842	808	
JULY 80	7000	1.00	1.200	.0801	672	
JUNE 80	6000	1.00	1.200	.0762	548	
MAY 80	5000	1.00	1.200	.0724	435	
APR 80	4000	1.00	1.200	.0689	331	
MAR 80	3000	1.00	1.200	.0655	236	
FEB 80	2000	1.00	1.200	.0623	150	
JAN 80	1000	1.00	1.200	.0593	71	

RESERVE STUDY PARAMETERS

Note: 1) Col(6) = (Col(2) ÷ Col(3)) × Col(4) × Col(5).
2) TP is based on an exponential distribution with parameters 0.05,0. It is defined as specified in the section 'An Example'.

EXAMPLE REINSURANCE COMPANY
Monthly Increase to IBNR Calculation
Domestic Facultative - PROPERTY
For Sept , 1984

ACC MON	EP	MAF	XLR	P	CURRENT CALENDAR MONTH EXPECTED ULTIMATE LOSS	CURRENT CALENDAR MONTH EXPECTED REPORTED LOSSES	MONTHLY IBNR INCREASE DUE TO ACC MON	MONTHLY IBNR INCREASE DUE TO ACC YR
SEPT 84	54858	.66	.600	.0008	49871	39	49832	28308
AUG 84	52182	.66	.600	.0232	0	1099	-1099	
JULY 84	53520	.66	.600	.0528	0	2568	-2568	
JUNE 84	54000	.66	.600	.0668	0	3279	-3279	
MAY 84	53000	.66	.600	.0702	0	3382	-3382	
APR 84	52000	.66	.600	.0682	0	3223	-3223	
MAR 84	51000	.66	.600	.0638	0	2956	-2956	
FEB 84	50000	.66	.600	.0584	0	2656	-2656	
JAN 84	49000	.66	.600	.0530	0	2360	-2360	
DEC 83	48000	.73	.600	.0478	0	1884	-1884	-12317
NOV 83	47000	.73	.600	.0429	0	1659	-1659	
OCT 83	46000	.73	.600	.0386	0	1458	-1458	
SEPT 83	45000	.73	.600	.0346	0	1281	-1281	
AUG 83	44000	.73	.600	.0311	0	1126	-1126	
JULY 83	43000	.73	.600	.0280	0	990	-990	
JUNE 83	42000	.73	.600	.0253	0	872	-872	
MAY 83	41000	.73	.600	.0228	0	769	-769	
APR 83	40000	.73	.600	.0206	0	678	-678	
MAR 83	39000	.73	.600	.0187	0	599	-599	
FEB 83	38000	.73	.600	.0170	0	530	-530	
JAN 83	37000	.73	.600	.0154	0	470	-470	
DEC 82	36000	.81	.550	.0141	0	344	-344	-2344
NOV 82	35000	.81	.550	.0128	0	305	-305	
OCT 82	34000	.81	.550	.0117	0	271	-271	
SEPT 82	33000	.81	.550	.0108	0	241	-241	
AUG 82	32000	.81	.550	.0099	0	214	-214	
JULY 82	31000	.81	.550	.0091	0	191	-191	
JUNE 82	30000	.81	.550	.0083	0	170	-170	
MAY 82	29000	.81	.550	.0077	0	151	-151	
APR 82	28000	.81	.550	.0071	0	135	-135	
MAR 82	27000	.81	.550	.0065	0	120	-120	
FEB 82	26000	.81	.550	.0061	0	107	-107	
JAN 82	25000	.81	.550	.0056	0	95	-95	
DEC 81	24000	.90	.550	.0052	0	76	-76	-515
NOV 81	23000	.90	.550	.0048	0	68	-68	
OCT 81	22000	.90	.550	.0045	0	60	-60	
SEPT 81	21000	.90	.550	.0042	0	54	-54	
AUG 81	20000	.90	.550	.0039	0	48	-48	
JULY 81	19000	.90	.550	.0036	0	42	-42	
JUNE 81	18000	.90	.550	.0034	0	37	-37	
MAY 81	17000	.90	.550	.0032	0	33	-33	
APR 81	16000	.90	.550	.0030	0	29	-29	
MAR 81	15000	.90	.550	.0028	0	25	-25	
FEB 81	14000	.90	.550	.0026	0	22	-22	
JAN 81	13000	.90	.550	.0024	0	19	-19	
DEC 80	12000	1.00	.500	.0023	0	14	-14	-73
NOV 80	11000	1.00	.500	.0022	0	12	-12	
OCT 80	10000	1.00	.500	.0020	0	10	-10	
SEPT 80	9000	1.00	.500	.0019	0	9	-9	
AUG 80	8000	1.00	.500	.0018	0	7	-7	
JULY 80	7000	1.00	.500	.0017	0	6	-6	
JUNE 80	6000	1.00	.500	.0016	0	5	-5	
MAY 80	5000	1.00	.500	.0015	0	4	-4	
APR 80	4000	1.00	.500	.0014	0	3	-3	
MAR 80	3000	1.00	.500	.0013	0	2	-2	
FEB 80	2000	1.00	.500	.0013	0	1	-1	
JAN 80	1000	1.00	.500	.0012	0	1	-1	

RESERVE STUDY PARAMETERS

Note: 1) Col(6) = (Col(2) ÷ Col(3)) × Col(4) (for current month only).
2) Col(7) = Col(6) × Col(5).

EXAMPLE REINSURANCE COMPANY
Monthly Increase to IBNR Calculation
Domestic Facultative - CASUALTY
For Sept , 1984

ACC MON	EP	MAF	XLR	P	CURRENT CALENDAR MONTH EXPECTED ULTIMATE LOSS	CURRENT CALENDAR MONTH EXPECTED REPORTED LOSSES	MONTHLY IBNR INCREASE DUE TO ACC MON	MONTHLY IBNR INCREASE DUE TO ACC YR
SEPT 84	27142	.51	.900	.0100	47898	477	47421	41074
AUG 84	25818	.51	.900	.0196	0	893	-893	
JULY 84	26480	.51	.900	.0192	0	898	-898	
JUNE 84	24000	.51	.900	.0188	0	798	-798	
MAY 84	24000	.51	.900	.0185	0	782	-782	
APR 84	24000	.51	.900	.0181	0	766	-766	
MAR 84	24000	.51	.900	.0177	0	751	-751	
FEB 84	24000	.51	.900	.0174	0	736	-736	
JAN 84	24000	.51	.900	.0170	0	722	-722	
DEC 83	24000	.64	.900	.0167	0	564	-564	-6075
NOV 83	24000	.64	.900	.0164	0	553	-553	
OCT 83	24000	.64	.900	.0161	0	542	-542	
SEPT 83	24000	.64	.900	.0157	0	531	-531	
AUG 83	24000	.64	.900	.0154	0	520	-520	
JULY 83	24000	.64	.900	.0151	0	510	-510	
JUNE 83	24000	.64	.900	.0148	0	500	-500	
MAY 83	24000	.64	.900	.0145	0	490	-490	
APR 83	24000	.64	.900	.0142	0	480	-480	
MAR 83	24000	.64	.900	.0140	0	471	-471	
FEB 83	24000	.64	.900	.0137	0	462	-462	
JAN 83	24000	.64	.900	.0134	0	452	-452	
DEC 82	24000	.80	.900	.0131	0	355	-355	-2985
NOV 82	23000	.80	.900	.0129	0	333	-333	
OCT 82	22000	.80	.900	.0126	0	312	-312	
SEPT 82	21000	.80	.900	.0124	0	292	-292	
AUG 82	20000	.80	.900	.0121	0	273	-273	
JULY 82	19000	.80	.900	.0119	0	254	-254	
JUNE 82	18000	.80	.900	.0117	0	236	-236	
MAY 82	17000	.80	.900	.0114	0	218	-218	
APR 82	16000	.80	.900	.0112	0	202	-202	
MAR 82	15000	.80	.900	.0110	0	185	-185	
FEB 82	14000	.80	.900	.0108	0	169	-169	
JAN 82	13000	.80	.900	.0105	0	154	-154	
DEC 81	12000	1.00	.900	.0103	0	112	-112	-676
NOV 81	11000	1.00	.900	.0101	0	100	-100	
OCT 81	10000	1.00	.900	.0099	0	89	-89	
SEPT 81	9000	1.00	.900	.0097	0	79	-79	
AUG 81	8000	1.00	.900	.0095	0	69	-69	
JULY 81	7000	1.00	.900	.0094	0	59	-59	
JUNE 81	6000	1.00	.900	.0092	0	50	-50	
MAY 81	5000	1.00	.900	.0090	0	40	-40	
APR 81	4000	1.00	.900	.0088	0	32	-32	
MAR 81	3000	1.00	.900	.0086	0	23	-23	
FEB 81	2000	1.00	.900	.0085	0	15	-15	
JAN 81	1000	1.00	.900	.0083	0	7	-7	
DEC 80	0	1.00	.000	.0081	0	0	0	0
NOV 80	0	1.00	.000	.0080	0	0	0	
OCT 80	0	1.00	.000	.0078	0	0	0	
SEPT 80	0	1.00	.000	.0077	0	0	0	
AUG 80	0	1.00	.000	.0075	0	0	0	
JULY 80	0	1.00	.000	.0074	0	0	0	
JUNE 80	0	1.00	.000	.0072	0	0	0	
MAY 80	0	1.00	.000	.0071	0	0	0	
APR 80	0	1.00	.000	.0069	0	0	0	
MAR 80	0	1.00	.000	.0068	0	0	0	
FEB 80	0	1.00	.000	.0067	0	0	0	
JAN 80	0	1.00	.000	.0065	0	0	0	

RESERVE STUDY PARAMETERS

Note: 1) Col(6) = (Col(2) ÷ Col(3)) × Col(4) (for current month only).
2) Col(7) = Col(6) × Col(5).

EXAMPLE REINSURANCE COMPANY
Monthly Increase to IBNR Calculation
Domestic Facultative - MARINE
For Sept , 1984

ACC MON	EP	MAF	XLR	P	CURRENT CALENDAR MONTH EXPECTED ULTIMATE LOSS	CURRENT CALENDAR MONTH EXPECTED REPORTED LOSSES	MONTHLY IBNR INCREASE DUE TO ACC MON	MONTHLY IBNR INCREASE DUE TO ACC YR
SEPT 84	0	1.00	1.200	.0247	0	0	0	0
AUG 84	0	1.00	1.200	.0476	0	0	0	
JULY 84	0	1.00	1.200	.0452	0	0	0	
JUNE 84	0	1.00	1.200	.0430	0	0	0	
MAY 84	0	1.00	1.200	.0409	0	0	0	
APR 84	0	1.00	1.200	.0389	0	0	0	
MAR 84	0	1.00	1.200	.0370	0	0	0	
FEB 84	0	1.00	1.200	.0352	0	0	0	
JAN 84	0	1.00	1.200	.0335	0	0	0	
DEC 83	0	1.00	1.200	.0319	0	0	0	0
NOV 83	0	1.00	1.200	.0303	0	0	0	
OCT 83	0	1.00	1.200	.0289	0	0	0	
SEPT 83	0	1.00	1.200	.0274	0	0	0	
AUG 83	0	1.00	1.200	.0261	0	0	0	
JULY 83	0	1.00	1.200	.0248	0	0	0	
JUNE 83	0	1.00	1.200	.0236	0	0	0	
MAY 83	0	1.00	1.200	.0225	0	0	0	
APR 83	0	1.00	1.200	.0214	0	0	0	
MAR 83	0	1.00	1.200	.0203	0	0	0	
FEB 83	0	1.00	1.200	.0193	0	0	0	
JAN 83	0	1.00	1.200	.0184	0	0	0	
DEC 82	1000	1.00	1.200	.0175	0	21	-21	-1148
NOV 82	2000	1.00	1.200	.0166	0	40	-40	
OCT 82	3000	1.00	1.200	.0158	0	57	-57	
SEPT 82	4000	1.00	1.200	.0151	0	72	-72	
AUG 82	5000	1.00	1.200	.0143	0	86	-86	
JULY 82	6000	1.00	1.200	.0136	0	98	-98	
JUNE 82	7000	1.00	1.200	.0130	0	109	-109	
MAY 82	8000	1.00	1.200	.0123	0	118	-118	
APR 82	9000	1.00	1.200	.0117	0	127	-127	
MAR 82	10000	1.00	1.200	.0112	0	134	-134	
FEB 82	11000	1.00	1.200	.0106	0	140	-140	
JAN 82	12000	1.00	1.200	.0101	0	145	-145	
DEC 81	12000	1.00	1.200	.0096	0	138	-138	-1279
NOV 81	12000	1.00	1.200	.0091	0	132	-132	
OCT 81	12000	1.00	1.200	.0087	0	125	-125	
SEPT 81	12000	1.00	1.200	.0083	0	119	-119	
AUG 81	12000	1.00	1.200	.0079	0	113	-113	
JULY 81	12000	1.00	1.200	.0075	0	108	-108	
JUNE 81	12000	1.00	1.200	.0071	0	102	-102	
MAY 81	12000	1.00	1.200	.0068	0	97	-97	
APR 81	12000	1.00	1.200	.0064	0	93	-93	
MAR 81	12000	1.00	1.200	.0061	0	88	-88	
FEB 81	12000	1.00	1.200	.0058	0	84	-84	
JAN 81	12000	1.00	1.200	.0055	0	80	-80	
DEC 80	12000	1.00	1.200	.0053	0	76	-76	-415
NOV 80	11000	1.00	1.200	.0050	0	66	-66	
OCT 80	10000	1.00	1.200	.0048	0	57	-57	
SEPT 80	9000	1.00	1.200	.0045	0	49	-49	
AUG 80	8000	1.00	1.200	.0043	0	41	-41	
JULY 80	7000	1.00	1.200	.0041	0	34	-34	
JUNE 80	6000	1.00	1.200	.0039	0	28	-28	
MAY 80	5000	1.00	1.200	.0037	0	22	-22	
APR 80	4000	1.00	1.200	.0035	0	17	-17	
MAR 80	3000	1.00	1.200	.0034	0	12	-12	
FEB 80	2000	1.00	1.200	.0032	0	8	-8	
JAN 80	1000	1.00	1.200	.0030	0	4	-4	

RESERVE STUDY PARAMETERS

Note: 1) Col(6) = (Col(2) ÷ Col(3)) × Col(4) (for current month only).
2) Col(7) = Col(6) × Col(5).

EXAMPLE REINSURANCE COMPANY
Monthly Increase to IBNR for September 1984
Based on Reserving Parameters as of Sept 30, 1984 (see Exhibit 3)
by Group, by Accident Year

GROUP: PROPERTY

ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.
84	49,871	21,563	997.4	431.3
83	0	12,317	0.0	246.3
82	0	2,344	0.0	46.9
81	0	515	0.0	10.3
80	0	73	0.0	1.5
TOTAL	49,871	36,812	997.4	736.2

EXPECTED NET $ & # IBNR INCREASE
CAL MONTH = 13,059 261

GROUP: CASUALTY

ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.
84	47,898	6,823	47.9	6.8
83	0	6,075	0.0	6.1
82	0	2,985	0.0	3.0
81	0	676	0.0	0.7
80	0	0	0.0	0.0
TOTAL	47,898	16,559	47.9	16.6

EXPECTED NET $ & # IBNR INCREASE
CAL MONTH = 31,338 31

GROUP: MARINE

ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.
84	0	0	0.0	0.0
83	0	0	0.0	0.0
82	0	1,148	0.0	11.5
81	0	1,279	0.0	12.8
80	0	415	0.0	4.1
TOTAL	0	2,842	0.0	28.4

EXPECTED NET $ & # IBNR INCREASE
CAL MONTH = -2,842 -28

GROUP: ALL

ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.
84	97,769	28,387	1,045.3	438.1
83	0	18,393	0.0	252.4
82	0	6,477	0.0	61.3
81	0	2,470	0.0	23.8
80	0	488	0.0	5.6
TOTAL	97,769	56,214	1,045.3	781.2

EXPECTED NET $ & # IBNR INCREASE
CAL MONTH = 41,555 264

EXHIBIT 11

EXAMPLE REINSURANCE COMPANY
IBNR Review as of Sept 30, 1984
Based on Reserving Parameters as of Sept 30, 1984 (see Exhibit 3)
by Group, by Accident Year

GROUP: PROPERTY

EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 9/84					EXPECTED IBNR INCREMENT YEAR TO DATE: 1/84 TO 9/84					CUMULATIVE IBNR AS OF:9/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	49,871	21,563	997.4	431.3	84	426,873	90,336	8,537.5	1,806.7	84	336,537	6,730.7
83	0	12,317	0.0	246.3	83	0	162,227	0.0	3,244.5	83	138,390	2,767.8
82	0	2,344	0.0	46.9	82	0	31,146	0.0	622.9	82	33,546	670.9
81	0	515	0.0	10.3	81	0	6,334	0.0	126.7	81	8,956	179.1
80	0	73	0.0	1.5	80	0	853	0.0	17.1	80	1,466	29.3
TOTAL	49,871	36,812	997.4	736.2	TOTAL	426,873	290,896	8,537.5	5,817.9	TOTAL	518,894	10,377.9

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 13,059 261 YEAR TO DATE = 135,977 2,720

GROUP: CASUALTY

EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 9/84					EXPECTED IBNR INCREMENT YEAR TO DATE: 1/84 TO 9/84					CUMULATIVE IBNR AS OF:9/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	47,898	6,823	47.9	6.8	84	394,306	32,706	394.3	32.7	84	361,600	361.6
83	0	6,075	0.0	6.1	83	0	59,313	0.0	59.3	83	300,747	300.7
82	0	2,985	0.0	3.0	82	0	29,142	0.0	29.1	82	147,766	147.8
81	0	676	0.0	0.7	81	0	6,595	0.0	6.6	81	33,438	33.4
80	0	0	0.0	0.0	80	0	0	0.0	0.0	80	0	0.0
TOTAL	47,898	16,559	47.9	16.6	TOTAL	394,306	127,755	394.3	127.8	TOTAL	843,551	843.6

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 31,338 31 YEAR TO DATE = 266,551 267

EXHIBIT 12A

EXAMPLE REINSURANCE COMPANY
IBNR Review as of Sept 30, 1984
Based on Reserving Parameters as of Sept 30, 1984 (see Exhibit 3)
by Group, by Accident Year

GROUP: MARINE

	EXPECTED IBNR INCREMENT									CUMULATIVE IBNR		
	FOR CALENDAR MONTH: 9/84					YEAR TO DATE: 1/84 TO 9/84				AS OF:9/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	0	0	0.0	0.0	84	0	0	0.0	0.0	84	0	0.0
83	0	0	0.0	0.0	83	0	0	0.0	0.0	83	0	0.0
82	0	1,148	0.0	11.5	82	0	12,721	0.0	127.2	82	22,384	223.8
81	0	1,279	0.0	12.8	81	0	14,181	0.0	141.8	81	24,953	249.5
80	0	415	0.0	4.1	80	0	4,600	0.0	46.0	80	8,094	80.9
TOTAL	0	2,842	0.0	28.4	TOTAL	0	31,502	0.0	315.0	TOTAL	55,430	554.3

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = -2,842 -28 YEAR TO DATE = -31,502 -315

GROUP: ALL

	EXPECTED IBNR INCREMENT									CUMULATIVE IBNR		
	FOR CALENDAR MONTH: 9/84					YEAR TO DATE: 1/84 TO 9/84				AS OF:9/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	97,769	28,387	1,045.3	438.1	84	821,179	123,042	8,931.8	1,839.4	84	698,137	7,092.3
83	0	18,393	0.0	252.4	83	0	221,540	0.0	3,303.9	83	439,137	3,068.5
82	0	6,477	0.0	61.3	82	0	73,009	0.0	779.3	82	203,696	1,042.5
81	0	2,470	0.0	23.8	81	0	27,110	0.0	275.1	81	67,347	462.1
80	0	488	0.0	5.6	80	0	5,452	0.0	63.1	80	9,559	110.2
TOTAL	97,769	56,214	1,045.3	781.2	TOTAL	821,179	450,153	8,931.8	6,260.7	TOTAL	1,417,876	11,775.7

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 41,555 264 YEAR TO DATE = 371,026 2,671

EXHIBIT 12B

EXAMPLE REINSURANCE COMPANY
Calendar Month IBNR Summary
for August and September, 1984
Based on Reserving Parameters as of Sept 30, 1984

UNDERWRITING AREA	COST CENTER	@MONTHLY NET EP	@MONTHLY INCREASE TO IBNR	>@YEAR-TO-DATE INCREASE TO IBNR	*CUMULATIVE IBNR	CURR
FOR: August 1984						
FACULTATIVE	ALL	78,000	38,253	329,471	1,376,321	US$
FOR: September 1984						
FACULTATIVE	ALL	82,000	41,555	371,026	1,417,876	US$

* EXACT, OFFICIAL FIGURE @ NOT EXACT DUE TO ROUNDING
> NOTE: DOES NOT EQUAL ACTUAL YTD TOTAL, UNLESS THE PARAMETERS CURRENTLY IN USE WERE EMPLOYED THROUGHOUT THIS YEAR
THIS FORMULA EXCLUDES IBNR FOR: CASE RESERVE DEVELOPMENT

EXHIBIT 13

EXAMPLE REINSURANCE COMPANY
Reserving Parameters as of Dec 31, 1984 *
Based on Reserve Study as of June 30, 1984
by Group

GROUP: PROPERTY

EP = (3ρ55750),54858,52182,53520,54000,53000,52000,51000,50000,49000,48000,47000,4600
0,45000,44000,43000,42000,41000,40000,39000,38000,37000,36000,35000,34000,33000,
32000,31000,30000,29000,28000,27000,26000,25000,24000,23000,22000,21000,20000,19
000,18000,17000,16000,15000,14000,13000,12000,11000,10000,9000,8000,7000,6000,50
00,4000,3000,2000,1000
MAF = (12ρ0.66),(12ρ0.73),(12ρ0.81),(12ρ0.9),(12ρ1)
XLR = (24ρ0.6),(24ρ0.55),(12ρ0.5)
SEV = (60ρ50)
LAG = 2 2.24 0.86

GROUP: CASUALTY

EP = (3ρ27583),27142,25818,26480,(19ρ24000),23000,22000,21000,20000,19000,18000,17000
,16000,15000,14000,13000,12000,11000,10000,9000,8000,7000,6000,5000,4000,3000,20
00,1000,(12ρ0)
MAF = (12ρ0.51),(12ρ0.64),(12ρ0.8),(24ρ1)
XLR = (48ρ0.9),(12ρ0)
SEV = (48ρ1000),(12ρ1)
LAG = 1 0.02 0

GROUP: MARINE

EP = (24ρ0),1000,2000,3000,4000,5000,6000,7000,8000,9000,10000,11000,(14ρ12000),11000
,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000
MAF = (60ρ1)
XLR = (60ρ1.2)
SEV = (24ρ1),(36ρ100)
LAG = 1 0.05 0

1) 'ρ' can be defined as follows: '5ρb' means b,b,b,b,b.
2) In each vector of monthly parameters, the first component is 12/84 and the final component is 1/80.

*Extension rule: Parameters for months after 6/84 are set at the 6/84 value (i.e. MAF, XLR, SEV).
Earned premiums for July, Aug, Sept, 1984 are actual figures from the Comptroller, and for Oct 1984 through Dec 1984 are based on Underwriter projections.

EXHIBIT 14

EXAMPLE REINSURANCE COMPANY
Projected IBNR Review as of Dec 30, 1984
Run at Sept 30, 1984
Based on Reserving Parameters as of Dec 30, 1984 (see Exhibit 14)
by Group, by Accident Year

GROUP: PROPERTY

EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 12/84					YEAR TO DATE: 1/84 TO 12/84					CUMULATIVE IBNR AS OF: 12/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	50,682	28,202	1,013.6	564.0	84	578,918	168,630	11,578.4	3,372.6	84	410,288	8,205.8
83	0	9,051	0.0	181.0	83	0	192,400	0.0	3,848.0	83	108,217	2,164.3
82	0	1,826	0.0	36.5	82	0	37,107	0.0	742.1	82	27,585	551.7
81	0	419	0.0	8.4	81	0	7,682	0.0	153.6	81	7,608	152.2
80	0	61	0.0	1.2	80	0	1,047	0.0	20.9	80	1,272	25.4
TOTAL	50,682	39,560	1,013.6	791.2	TOTAL	578,918	406,866	11,578.4	8,137.3	TOTAL	554,970	11,099.4

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 11,122 222 YEAR TO DATE = 172,052 3,441

GROUP: CASUALTY

EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 12/84					YEAR TO DATE: 1/84 TO 12/84					CUMULATIVE IBNR AS OF: 12/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	48,676	9,253	48.7	9.3	84	540,334	58,061	540.3	58.1	84	482,273	482.3
83	0	5,722	0.0	5.7	83	0	76,827	0.0	76.8	83	283,233	283.2
82	0	2,811	0.0	2.8	82	0	37,747	0.0	37.7	82	139,161	139.2
81	0	636	0.0	0.6	81	0	8,542	0.0	8.5	81	31,491	31.5
80	0	0	0.0	0.0	80	0	0	0.0	0.0	80	0	0.0
TOTAL	48,676	18,422	48.7	18.4	TOTAL	540,334	181,177	540.3	181.2	TOTAL	936,157	936.2

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 30,253 30 YEAR TO DATE = 359,157 359

EXHIBIT 15A

EXAMPLE REINSURANCE COMPANY
Projected IBNR Review as of Dec 30, 1984
Run at Sept 30, 1984
Based on Reserving Parameters as of Dec 30, 1984 (see Exhibit 14)
by Group, by Accident Year

GROUP: MARINE

	EXPECTED IBNR INCREMENT									CUMULATIVE IBNR		
	FOR CALENDAR MONTH: 12/84					YEAR TO DATE: 1/84 TO 12/84				AS OF:12/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	0	0	0.0	0.0	84	0	0	0.0	0.0	84	0	0.0
83	0	0	0.0	0.0	83	0	0	0.0	0.0	83	0	0.0
82	0	988	0.0	9.9	82	0	15,839	0.0	158.4	82	19,266	192.7
81	0	1,101	0.0	11.0	81	0	17,657	0.0	176.6	81	21,477	214.8
80	0	357	0.0	3.6	80	0	5,727	0.0	57.3	80	6,966	69.7
TOTAL	0	2,446	0.0	24.5	TOTAL	0	39,223	0.0	392.2	TOTAL	47,709	477.1

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = -2,446 -24 YEAR TO DATE = -39,223 -392

GROUP: ALL

	EXPECTED IBNR INCREMENT									CUMULATIVE IBNR		
	FOR CALENDAR MONTH: 9/84					YEAR TO DATE: 1/84 TO 9/84				AS OF:9/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.	ACC YR	CUM $ IBNR	CUM # IBNR
84	99,358	37,456	1,062.3	573.3	84	1,119,252	226,691	12,118.7	3,430.7	84	892,561	8,688.0
83	0	14,773	0.0	186.8	83	0	269,227	0.0	3,924.8	83	391,450	2,447.6
82	0	5,625	0.0	49.2	82	0	90,693	0.0	938.3	82	186,012	883.5
81	0	2,156	0.0	20.0	81	0	33,881	0.0	338.8	81	60,576	398.4
80	0	418	0.0	4.8	80	0	6,774	0.0	78.2	80	8,238	95.1
TOTAL	99,358	60,428	1,062.3	834.1	TOTAL	1,119,252	627,266	12,118.7	8,710.7	TOTAL	1,538,836	12,512.6

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 38,929 228 YEAR TO DATE = 491,986 3,408

EXHIBIT 15B

EXAMPLE REINSURANCE COMPANY
Projected IBNR Review as of Dec 31, 1984
Run at Sept 30, 1984
Based on Reserving Parameters as of Dec 31, 1984 (see Exhibit 14)
by Group, by Accident Year

CALENDAR MONTH IBNR SUMMARY FOR 12/84

UNDERWRITING AREA	COST CENTER	@MONTHLY NET EP	@MONTHLY INCREASE TO IBNR	>@YEAR-TO-DATE INCREASE TO IBNR	*CUMULATIVE IBNR	CURR
FACULTATIVE	ALL	83,333	38,929	491,986	1,538,836	US$

* EXACT, OFFICIAL FIGURE @ NOT EXACT DUE TO ROUNDING
> NOTE: DOES NOT EQUAL ACTUAL YTD TOTAL, UNLESS THE PARAMETERS CURRENTLY IN USE WERE EMPLOYED THROUGHOUT THIS YEAR
THIS FORMULA EXCLUDES IBNR FOR: CASE RESERVE DEVELOPMENT

EXHIBIT 15C

EXAMPLE REINSURANCE COMPANY
Reserving Parameters as of Dec 31, 1985 *
Based on Reserve Study as of June 30, 1984
by Group

GROUP: PROPERTY

```
EP  = (12ρ50175),(3ρ55750),54858,52182,53520,54000,53000,52000,51000,50000,49000,48000
      ,47000,46000,45000,44000,43000,42000,41000,40000,39000,38000,37000,36000,35000,3
      4000,33000,32000,31000,30000,29000,28000,27000,26000,25000,24000,23000,22000,210
      00,20000,19000,18000,17000,16000,15000,14000,13000,12000,11000,10000,9000,8000,7
      000,6000,5000,4000,3000,2000,1000
MAF = (12ρ0.792),(12ρ0.66),(12ρ0.73),(12ρ0.81),(12ρ0.9),(12ρ1)
XLR = (36ρ0.6),(24ρ0.55),(12ρ0.5)
SEV = (72ρ50)
LAG = 2 2.24 0.86
```

GROUP: CASUALTY

```
EP  = (12ρ24825),(3ρ27583),27142,25818,26480,(19ρ24000),23000,22000,21000,20000,19000,
      18000,17000,16000,15000,14000,13000,12000,11000,10000,9000,8000,7000,6000,5000,4
      000,3000,2000,1000,(12ρ0)
MAF = (12ρ0.612),(12ρ0.51),(12ρ0.64),(12ρ0.8),(24ρ1)
XLR = (60ρ0.9),(12ρ0)
SEV = (60ρ1000),(12ρ1)
LAG = 1 0.02 0
```

GROUP: MARINE

```
EP  = (36ρ0),1000,2000,3000,4000,5000,6000,7000,8000,9000,10000,11000,(14ρ12000),11000
      ,10000,9000,8000,7000,6000,5000,4000,3000,2000,1000
MAF = (12ρ1.2),(60ρ1)
XLR = (72ρ1.2)
SEV = (3  ),(36ρ100)
LAG = 1 0  5 0
```

1) 'ρ' can be defined as follows: '5ρb' means b,b,b,b,b.
2) In each vector of monthly parameters, the first component is 12/85 and the final component is 1/80.

* Extension rule: Parameters for months after 6/84 are set at the 6/84 value (i.e. MAF, XLR, SEV). To reflect market rate increases, the MAF is multiplied by 1.20 beginning with 1/85.
Earned premiums for July, Aug, Sept, 1984 are actual figures from the Comptroller, and for Oct 1984 through Dec 1985 are based on Underwriter projections.

EXHIBIT 16

EXHIBIT 17A

EXAMPLE REINSURANCE COMPANY
Projected IBNR Review as of Dec 31, 1985
Run at Sept 30, 1984
Based on Reserving Parameters as of Dec 31, 1985 (see Exhibit 16)
by Group, by Accident Year

GROUP: PROPERTY

	EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 12/85					EXPECTED IBNR INCREMENT YEAR TO DATE: 1/85 TO 12/85					CUMULATIVE IBNR AS OF:12/85		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	CUM $ IBNR	CUM # IBNR
85	38,011	22,288	760.2	445.8		85	456,136	136,329	9,122.7	2,726.6		85	319,808	6,396.2
84	0	12,324	0.0	246.5		84	0	262,512	0.0	5,250.2		84	147,775	2,955.5
83	0	3,054	0.0	61.1		83	0	61,999	0.0	1,240.0		83	46,218	924.4
82	0	756	0.0	15.1		82	0	13,828	0.0	276.6		82	13,758	275.2
81	0	199	0.0	4.0		81	0	3,405	0.0	68.1		81	4,203	84.1
80	0	32	0.0	0.6		80	0	519	0.0	10.4		80	753	15.1
TOTAL	38,011	38,653	760.2	773.1		TOTAL	456,136	478,592	9,122.7	9,571.8		TOTAL	532,514	10,650.3

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = -641 -13 YEAR TO DATE = -22,455 -449

GROUP: CASUALTY

	EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 12/85					EXPECTED IBNR INCREMENT YEAR TO DATE: 1/85 TO 12/85					CUMULATIVE IBNR AS OF:12/85		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	CUM $ IBNR	CUM # IBNR
85	36,507	7,501	36.5	7.5		85	438,088	48,612	438.1	48.6		85	389,476	389.5
84	0	7,664	0.0	7.7		84	0	102,904	0.0	102.9		84	379,369	379.4
83	0	4,501	0.0	4.5		83	0	60,434	0.0	60.4		83	222,799	222.8
82	0	2,211	0.0	2.2		82	0	29,693	0.0	29.7		82	109,468	109.5
81	0	500	0.0	0.5		81	0	6,719	0.0	6.7		81	24,772	24.8
80	0	0	0.0	0.0		80	0	0	0.0	0.0		80	0	0.0
TOTAL	36,507	22,377	36.5	22.4		TOTAL	438,088	248,362	438.1	248.4		TOTAL	1,125,884	1,125.9

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 14,130 14 YEAR TO DATE = 189,726 190

EXHIBIT 17A

EXAMPLE REINSURANCE COMPANY
Projected IBNR Review as of Dec 31, 1985
Run at Sept 30, 1984
Based on Reserving Parameters as of Dec 31, 1985 (see Exhibit 16)
by Group, by Accident Year

GROUP: MARINE

	EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 12/85					EXPECTED IBNR INCREMENT YEAR TO DATE: 1/85 TO 12/85					CUMULATIVE IBNR AS OF:12/85		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	CUM $ IBNR	CUM # IBNR
85	0	0	0.0	0.0		85	0	0	0.0	0.0		85	0	0.0
84	0	0	0.0	0.0		84	0	0	0.0	0.0		84	0	0.0
83	0	0	0.0	0.0		83	0	0	0.0	0.0		83	0	0.0
82	0	542	0.0	5.4		82	0	8,693	0.0	86.9		82	10,573	105.7
81	0	604	0.0	6.0		81	0	9,690	0.0	96.9		81	11,787	117.9
80	0	196	0.0	2.0		80	0	3,143	0.0	31.4		80	3,823	38.2
TOTAL	0	1,342	0.0	13.4		TOTAL	0	21,526	0.0	215.3		TOTAL	26,183	261.8

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = -1,342 -13 YEAR TO DATE = -21,526 -215

GROUP: ALL

	EXPECTED IBNR INCREMENT FOR CALENDAR MONTH: 9/84					EXPECTED IBNR INCREMENT YEAR TO DATE: 1/84 TO 9/84					CUMULATIVE IBNR AS OF:9/84		
ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	$ IBNR INCREASE	$ IBNR DECREASE	# IBNR INCR.	# IBNR DECR.		ACC YR	CUM $ IBNR	CUM # IBNR
84	99,358	37,456	1,062.3	573.3		84	1,119,252	226,691	12,118.7	3,430.7		84	892,561	8,688.0
83	0	14,773	0.0	186.8		83	0	269,227	0.0	3,924.8		83	391,450	2,447.6
82	0	5,625	0.0	49.2		82	0	90,693	0.0	938.3		82	186,012	883.5
81	0	2,156	0.0	20.0		81	0	33,881	0.0	338.8		81	60,576	398.4
80	0	418	0.0	4.8		80	0	6,774	0.0	78.2		80	8,238	95.1
TOTAL	99,358	60,428	1,062.3	834.1		TOTAL	1,119,252	627,266	12,118.7	8,710.7		TOTAL	1,538,836	12,512.6

EXPECTED NET $ & # IBNR INCREASE (i.e. increase - decrease)
CAL MONTH = 38,929 228 YEAR TO DATE = 491,986 3,408

EXHIBIT 17B

EXAMPLE REINSURANCE COMPANY
Projected IBNR Review as of Dec 31, 1985
Run at Sept 30, 1984
Based on Reserving Parameters as of Dec 31, 1985 (see Exhibit 16)
by Group, by Accident Year

CALENDAR MONTH IBNR SUMMARY FOR 12/85

UNDERWRITING AREA	COST CENTER	@MONTHLY NET EP	@MONTHLY INCREASE TO IBNR	>@YEAR-TO-DATE INCREASE TO IBNR	*CUMULATIVE IBNR	CURR
FACULTATIVE	ALL	75,000	12,146	145,745	1,684,582	US$

* EXACT, OFFICIAL FIGURE @ NOT EXACT DUE TO ROUNDING
> NOTE: DOES NOT EQUAL ACTUAL YTD TOTAL, UNLESS THE PARAMETERS CURRENTLY IN USE WERE EMPLOYED THROUGHOUT THIS YEAR
THIS FORMULA EXCLUDES IBNR FOR: CASE RESERVE DEVELOPMENT

EXHIBIT 17C