HURRICANE SIDNEY

by Colin J W Czapiewski

BIOGRAPHY

Colin Czapiewski is the Actuary of Terra Nova Insurance Company Ltd.
Colin previously worked in the life then the property/casualty side of
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Fellow of the Institute of Actuaries in 1984. He became a Member of
the American Academy of Actuaries in 1990. Colin has chaired several
working parties on property/casualty insurance in the UK on subjects
including Claims Exposure, Marine Insurance and Reinsurance,
Independence of Actuaries at Lloyd's, Coverage Triggers and Latent
Claims. He has written a paper on pricing of risks in the London
insurance and reinsurance market. In addition he has served on
various working parties including ones on US Legislation, the Role of
the Actuary in General Insurance, and the certification of insurance
liabilities.

ABSTRACT

The major claims problems facing London Market companies and Lloyd's
syndicates arise from the deterioration of casualty claims, including
asbestos and pollution, or a large property catastrophe, such as a
hurricane or earthquake. This paper hypothesises a US hurricane
landing in Florida. The company will face losses from a variety of
classes in its business profile. Without knowing the full extent of
its actual losses, it can roughly measure its exposure to such a
catastrophe. It can then trace how the resultant gross losses travel
through its reinsurance programme, and determine the net loss to the
company.

There are many complications and considerations en route. The paper
explains how these are dealt with and uses numerical examples
throughout. Much of the inevitable jargon is translated to enhance
the general understanding.

In the light of various hurricanes over the last few years that have
caused concern or even significant damage, the paper shows how a
London Market insurer views the hurricane from the other side of the
Atlantic.

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1.   Synopsis

This paper demonstrates the gross and net effect to a London
reinsurer of a hypothetical USA hurricane. It covers some
practical means by which the company may estimate its exposure
to such a catastrophe, and the progress of the gross loss
through the reinsurance programme. Points of concern to the
company are not restricted to the net position, but cover other
less obvious areas, such as cash flow, failed reinsurance
security, excess of outwards over inwards reinstatement
premium.

The aim of the paper is not to give too much detail, but rather
to give the reader a flavour of how a London reinsurance
company views such a catastrophe.

2.   Introduction

Two types of claims provide London reinsurance companies with
some of their biggest headaches. One is the problem of latent
casualty claims that emerge from the past to erode any current
surpluses. (These are notably asbestos and environmental
pollution claims.) The other is the short sharp shock of a
major catastrophe. We consider the latter.

It is important that a company hypothesises such a major catastrophe in its structuring of a sound reinsurance programme. Clearly, if losses under such a catastrophe exceed the limits of the programme, then this may indicate that the programme is insufficient and yet higher limits may need to be purchased to prevent a substantial net loss to the company. Conversely, if the losses fall far short of the limit, then perhaps excessive reinsurance has been purchased, exceeding the effect to the company of any possible loss event.

In this paper, hypothetical Hurricane Sidney passes through the North Caribbean Sea and traverses Florida (see Appendix 1). Many of the assumptions have been kept simple and straightforward to avoid introducing unnecessary added complications, whilst retaining the concepts involved of such a catastrophe passing through the reinsurance programme of XYZ. For instance, no damage is assumed to occur outside Florida in the USA, and the nearby islands were unaffected. Marine and Aviation losses are not considered. No Casualty losses are assumed to occur.

3.   The Company

XYZ is an insurance company operating in the London Market. The business written by XYZ (its inwards business) comprises a variety of classes and is introduced and serviced by Lloyd's brokers. A large proportion represents reinsurance of USA companies. The reinsurance programme for XYZ (its outwards business) is mainly placed with other London companies and with Lloyd's syndicates.

XYZ writes "main account" Property and Casualty business, directly insuring and reinsuring other companies, and also writes some "retrocession" business, mostly London Market Excess of Loss (or LMX).

As the company is well run, XYZ employs a qualified actuary, a Fellow of the Institute of Actuaries. He mainly gets involved in the quarterly reserving process and assists the underwriters in pricing some particular risks. However, he is heavily involved in a variety of roles in the underwriting and claims processes, and he controls the Management Information System (MIS).

Overall, XYZ is a sound company, well regarded in London and USA circles. It is well capitalised and owned by a number of large institutions. Its inwards business is, therefore, of good quality and it has a full and well established outwards reinsurance programme.

4.   The Exposure

4.1   Whereas the measurement of premium income and claims is fairly straightforward, it is far more difficult to measure exposure to future claims. For a direct writing personal lines company, the number of cars or houses, perhaps grouped (or banded), eg by engine size or cost of car, forms a comparatively accurate assessment of the claims potential of the company. However, the heterogeneous classes of reinsurance business make the exercise of exposure measurement far more difficult.

At best, any estimate of exposure is certain to be a rough
idea of the potential for claims, but it is essential for
an attempt at such a measurement to be performed.

4.2 Part of the MIS (as run by the actuary) in XYZ involves a
summary of the aggregate exposure. The systems providing
the MIS should be created to form a framework within which
the underwriter may input the data relating to exposure.
It is worth emphasising that the co-operation and
understanding of the underwriter are essential for the
measurement to be realistic and, therefore, useful.

4.3 For all business, there will be a system of coding to
identify the geographical area of exposure. For a
small, one state, company this is straightforward. For
larger companies, this will prove difficult as the
assigned coding may well only be possible as "USA
Nationwide". For LMX and other retrocession business, the
only possible coding might be "Worldwide"!

The resultant exposure by geographical area for a
Florida loss may be $XM for "Florida only" exposure, $YM
for "USA Nationwide" and $ZM for "Worldwide".

4.4 For the <u>main account</u> business from larger companies, the
     USA Nationwide exposure may be narrowed down in several
     ways:-

     a) a further breakdown may be obtained from the ceding
        company, (say exposure by State);

     b) past catastrophe losses may be examined, to help assess
        the market penetration of that company in Florida;

     c) information by line of business and by State may be
        available from a co-ordinated database, such as that
        provided by A M Best.

     Thus an estimate of the exposure contribution from this
     company may be obtained. To re-emphasise, we are not
     talking about an exact science but a best estimate, and so
     some judgement and rough calculations are not out of
     place.

4.5 For <u>retrocession</u> business, such calculations are
     considerably out of place. The traditional market
     practice is for small lines and a balanced book.

     A worthwhile method of exposure measurement is to divide
     the business by bands of rate on line.

(ROL means the premium divided by the layer, and is expressed as a percentage. Hence, for a catastrophe reinsurance layer of $3M excess $3M at a price of $300,000, the ROL is 10%. In the same programme, the layer of $4M excess $6M may cost $200,000, ie. a ROL of 5%. Other things being equal, the higher up the programme, the less the probability of claims, and hence, the lower the ROL (see Appendix 3). The assumption being that market forces create an equitable distribution of ROL's between layers and between companies).

The amount of the book of business exposed to a particular size of catastrophe is based on experience of prior catastrophes, and current conditions, and may be, say, all "first loss" business up to that with a ROL of 2%. By first loss business, we mean to exclude those "back up" risks where one or more losses must be suffered before claims are incurred.

4.6 Some classes of business have easier measurements of exposure than others. For a catastrophe layer of $5M xs $10M, the maximum exposure for one event is the reinsurer's share (or "signed line") of $5M.

However, for a quota share treaty, the measure is less rigid. Fortunately, there is often an "occurrence aggregate" implied in the risk written, which gives a maximum loss per event. In the cases without such a figure, the underwriter must use his judgement or attempt to obtain an estimate from the ceding company.

For risk excess business (ie. risks written to protect individual large properties or insureds), the number of losses per event is normally restricted. Otherwise an assumption of the number of losses likely to be affected by a catastrophe must be made instead.

4.7 In conclusion, it can be seen that this measurement of exposure is more of a guesstimate of the possible loss to be suffered by the catastrophe. More work can be performed by examining the larger risks carefully and by analysing the effect of actual historic catastrophes.

At the end of the exercise it is worth discussing the outcome with underwriters to get a second opinion as to whether the overall exposure measurement looks reasonable. The underwriter will also appreciate the feedback.

4.8 Appendix 2 shows the assumed losses to be experienced under Hurricane Sidney. The inwards classes of business affected are as follows:-

   i)   property catastrophe excess of loss, ie. specific catastrophe exposed business;

   ii) property risk excess of loss, as described in section 4.6;

   iii) property other main account, mostly quota share but some excess and surplus lines exposure written through US insurance agents with binding authority;

iv)   property retrocession, mostly worldwide exposure
      written as LMX, but also some USA retrocession
      business written on a USA Nationwide basis;

v)   property net account, ie. business written inwards
      that is excluded from reinsurance protection. This
      may be associated with the nuclear industry or
      specifically excluded for some other reason;

vi)   casualty. This may be workers compensation or even
      architects professional indemnity insurance for
      buildings collapsing that should in theory
      withstand such a hurricane. However, we assume
      that no exposure is actually affected by Hurricane
      Sidney.

4.9   The proportions of exposures that are assumed to result in
      claims under Hurricane Sidney are also shown in Appendix 2.
      Clearly, the size of the hurricane and the overall cost will
      determine this proportion. Our assumption is one of a severe
      catastrophe. All of the Florida specific, and a good deal of
      more general geographical exposure, is assumed to have resulted
      in losses.

5. The Reinsurance Programme

5.1   The cost of reinsurance is a significant item of expense
      for XYZ, and for many other companies and Lloyd's
      syndicates. To purchase too little may leave the
      solvency of the company at risk. To purchase too much
      is a waste of resource and will affect profitability.

      However, the reinsurance must be purchased before the
      inwards business is written, and so the amount
      purchased, and more specifically, the shape of the
      programme, will involve judgement and something of a
      calculated gamble.

5.2   Facultative reinsurance protection is not so common
      today as it was just a few years ago. The expense and
      time consumed may be deemed to make it inappropriate in
      today's market. There will be exceptions, but for XYZ
      we assume that no facultative reinsurance is purchased.

5.3   XYZ has a property surplus reinsurance treaty and
      another for its casualty business. Within XYZ, there
      are strict guidelines as to the maximum amount of each
      individual risk permitted to be ceded to each treaty,
      and the type of business to be ceded. However, the
      individual underwriter will still have some scope for
      judging the actual amount to be ceded. The benefit of

such reinsurance is to be able to write larger lines on inwards business (and therefore, to be able to see more, and better quality, risks), to enable the underwriter to have more control over the terms under which the risk is written, to give the underwriter some flexibility on what he retains for XYZ and what he passes to the treaty reinsurers, and to make a small overriding profit on business ceded.

The restriction may broadly be that the maximum line per risk is $250,000 of which up to 40% may be ceded. The business must be property business excluding any nuclear or retrocessional risks.

5.4   It has often been advanced that the most cost efficient type of account protection is stop loss insurance rather than excess of loss. Despite this theory, the lack of availability of stop loss insurance means that in practice, excess of loss insurance is the vehicle used to protect the account.

Again for practical reasons, reinsurers are wary of an account that contains some retrocession business. This may lead to a problem in placing the overall reinsurance protections. So in XYZ insurance company, there are two distinct programmes at the lower layers. The "generals" excess of loss programme protects the main account, excluding retrocessional business and various other

classes written on a net basis. The retrocessional
excess of loss programme protects that business
specifically written as inwards retrocession business.
Some of this will be spiral business, ie. excess of
loss, on excess of loss, on excess of loss, etc.....

5.5   Whereas Appendix 3 shows the details of the reinsurance
       programme in the usual way, Appendix 4 shows the excess
       of loss programmes in graphical form. This is an
       excellent method of presenting the shape of the
       reinsurance, ie. the quantity of horizontal and vertical
       coverage. A feel of the whole programme can be gained
       immediately.

       The main difficulty in the graphical presentation is to
       show which layers are shortplaced (ie. the brokers were
       not able to fully place the reinsurance) or have
       co-reinsurance (ie. the ceding company was obliged to
       retain a specific proportion of the reinsurance).

       For XYZ, the reinsurance programme is as follows:-

       a) the generals protect the main account (ie. excluding
          retrocession and net account business) for $2.5M
          excess $0.5M;

       b) the retrocessions protect the inwards retrocessional
          business for $2.25M excess $0.25M;

c) the "blankets" sit on top of (a) and (b). This
   provides a further protection of $3.5M. The effect
   is that the main account overall protection is $6M
   excess $0.5M and the retrocession account protection
   is $5.75M excess $0.25M. Although clearly for one
   event, care must be taken not to double count this
   layer of blanket protection; it gives $3.5M
   protection in total for generals plus retrocession;

d) other reinsurance programmes will be assumed not to
   be relevant to this example.

5.6   The details underlying the format of Appendix 3 are as
      follows:-

a) Column 1 describes the layer of reinsurance. In the
   generals, there are two entries for $0.5M excess
   $0.5M. The second is known as a "backup" layer. If
   the "up front" layer were to be fully utilised then
   this backup layer would be triggered.

b) Column 2 shows the aggregate deductible. This is the
   amount of loss that must be paid within the layer,
   and retained, before the reinsurance is effective.
   For the $0.5M excess $0.5M, two total losses (or the
   equivalent partial losses) must have occurred before
   the reinsurance can commence. For example, say 5
   losses have occurred, viz $750,000, $2M, $1M,
   $250,000, $1M. The effect of these to the layer of
   $0.5M excess $0.5M is as follows:-

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i)   the first loss contributes $250,000

ii) the second loss $500,000 (maximum)

iii) the third loss $500,000

iv) the fourth loss $0 (it did not reach the lower limit of $0.5M)

v)   the fifth loss $500,000.

The first and second losses, and part of the third loss will be consumed within the aggregate deductible. The remainder of the third loss and the fifth loss will be recoverable (although see columns 5 and 6 below). Hence, of the $1.75M of losses to the layer, $1M will comprise the aggregate deductible and $0.75M will be recoverable.

c) Column 3 shows the reinstatement premiums due. It is usual that excess loss cover is not just for a first loss but for 2 or 3 or even more. In the layer $0.5M excess $0.5M, there are 2 reinstatements at 100%. This means that the reinsurance will provide up to 3 losses. After the first loss is payable, the reinsured pays a reinstatement premium (in this case 100% of the original premium). If a second loss occurs, then as before, the reinsured pays his 100% of premium again. However, if a third loss occurs then, as there are no further reinstatements due, no

further premium is paid. (If a partial loss is recovered then a prorata amount of any reinstatement premium due will be paid.)

In this programme, for the backup layer of $0.5M excess $0.5M, the reinstatement premium payable is 50% for the first loss and 75% for the second.

d) Column 4 shows the rate on line. This is simply the premium payable divided by the cover. For the first layer this is $125,000/$500,000, ie. 25%. All things being equal, there should be a functional (although not linear) relationship between the ROL's for different layers.

e) Column 5 shows the co-reinsurance. From the reinsurer's point of view, it is preferable that the reinsured retains part of the layer. It is generally accepted practice for 5% of the layer for main account and 10% for retrocession business (and blankets) to be retained. Although this does not apply to backup layers.

f) Column 6 shows the placement. Ideally the broker
   will be able to place all the order for the layer,
   except of course for the retained co-reinsurance.
   For the programme of XYZ insurance company, this was
   not done. 5% was not placed in addition to the 5%
   co-reinsurance in the generals layer $1.5M excess
   $1.5M. Other gaps in coverage appear in the
   retrocession and blanket programmes.

g) Column 7 shows the 100% premium payable.

5.7   It is useful to look at Appendices 3 and 4 together.
       The graphical presentation shows the horizontal axis as
       number of losses and the vertical axis as amount of
       loss.

       The gaps indicate where no coverage exists. For each
       loss, the first $0.5M of the generals is retained. The
       next layer of $0.5M excess $0.5M has an aggregate
       deductible of 2 losses. The next layer has an
       aggregate deductible of 1 loss. The remaining layers are
       "straight in", with no deductible.

       The shading denotes the proportion of each layer placed.

5.8   In summary, the reinsurance programme protects the
      company in the event of a loss, but the company will be
      left with the following:-

      i)   the amount of the lower limits, ie. $0.5M for the
            main account and $0.25M for the retrocession loss,
            plus,

      ii)   co-reinsurance, plus,

      iii) shortfall in placement, plus

      iv)   any excess of outwards reinstatement premiums over
            inwards reinstatement premiums, plus

      v)   the amount that the loss exceeds the upper limit of
            the programme!

6.   Hurricane Sidney travelling through the reinsurance programme

6.1   Appendix 2 shows the derivation of the assumed gross
      loss to XYZ. It also subdivides by type of inwards
      business. Before the excess of loss programme is
      activated, the facultative and proportional reinsurances
      take effect.

      We assume that no facultative reinsurance will be
      involved in this example. This would be fairly typical
      in today's market. However, XYZ has a property surplus

reinsurance treaty. As a general rule for XYZ,
underwriters cede about a third of their overall inwards
premiums to this treaty. Correspondingly, a third of
the losses would be recoverable.
No retrocessional business is permitted to be ceded to
the treaty and, clearly, the net account business is
fully retained.

As seen in Appendix 5, the overall effect is that, of
the $7.5m gross loss, $1.3m is ceded to the property
surplus reinsurance treaty and $6.2m is the "gross/net"
loss, i.e. gross of the excess loss programme but net of
other reinsurance.

6.2   The losses reaching the "generals" excess loss programme
       are those under the catastrophe X/L, risk X/L and "other
       property" types of inwards business. The total amount
       of loss relating to these types of business is $2.5m.
       As the generals programme is for $2.5m excess of $0.5m
       (i.e. up to losses of $3.0m), the loss is wholly
       contained within the programme as follows (see
       Appendix 6):-
       i)   the first $0.5m is retained by XYZ.
       ii) in the bottom layer of $0.5m excess $0.5m, there
            is an aggregate deductible of $1m (i.e. two total
            losses). In this scenario, we assume that there
            has been an earlier loss of $1.1m to XYZ. Hence,
            Hurricane Sidney contributes the second loss to the
            deductible, and no recovery is made.

iii) the next layer is $0.5m excess $1m with an
aggregate deductible of $0.5m (i.e. one total
loss). Of the deductible, $100,000 has been
contributed by the earlier loss. As $0.5m is
contributed by Hurricane Sidney, the $0.4m
completes the deductible and $100,000 is
recoverable. However, there is 5% coreinsurance,
and so only $95,000 of loss is recoverable. This
recovery activates a reinstatement premium at 100%
of $100,000. This premium is pro rata to the loss,

ie.   amount of actual recovery X 100% of original premium,
              layer

or $95,000 X 100% X $100,000 = $19,000
       $500,000

iv)   the third generals layer is $1.5m excess $1.5m with
      no deductible. There is a potential recovery to
      this layer of $1m (a total main account loss of
      $2.5m less $1.5m), of which coreinsurance is 5% and
      there is an additional 5% placement shortfall.
      Thus the recovery is $900,000, the coreinsurance is
      $50,000 and there is a shortage of $50,000. The
      reinstatement premium charged at 100% of the
      original premium (of $225,000), is $135,000,
      being:-

      $900,000 X 100% X $225,000 = $135,000
      $1,500,000

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6.3   In Appendix 7 the progress of inwards LMX and USA
       retrocession business through the retrocession
       reinsurance programme is followed. The total
       retrocession loss is $3.5m gross. All this business is
       excluded from the property surplus reinsurance treaty,
       and recoveries are only made from the retrocession
       excess loss programme.

       i)   The initial $0.25m of loss is retained.

       ii) The first layer of $0.75m excess $0.25m has an
            aggregate deductible of $750,000, or one loss. As
            Hurricane Sidney is deemed to be the first
            retrocession loss of the year greater than
            $250,000, then all the $750,000 is retained to fill
            this aggregate deductible.

       iii) There is no aggregate deductible for the next layer
            of $1.5m excess $1m, but there is coreinsurance of
            10% and a placement shortfall of 10%, leaving only
            80% placed. Hence $1.2m is recoverable. The
            reinstatement premium is due at 50% of the original
            premium of $750,000,

            ie. $1,200,000 X 50% X $750,000 = $300,000
                $1,500,000

iv) the retrocession loss is $3.5m, but the limit of
the retrocession excess loss reinsurance programme
is $2.5m. Hence $1m goes through to the blanket
excess loss reinsurance programme. This programme
protects both main account and retrocession
business, and sits above the general and
retrocession reinsurance programmes, but for
Hurricane Sidney, all of the main account loss was
contained within the general excess loss programme.
(Note that the excess point for a main account loss
would have been $3m and not $2.5m.)

The first layer of the blanket (for retrocession
business) is $1.5m excess $2.5m. Of this, 10% is
coreinsured and there is a placement shortfall of
18%, hence 72% is placed. The recovery is
$720,000. The reinstatement premium at 100% of the
original premium (of $300,000) is $144,000,
calculated as follows:-

$\frac{\$ \ 720,000}{\$1,500,000}$ X 100% X $300,000 = $144,000

6.4   Appendix 8 summarises the passage of the Hurricane
Sidney hypothetical loss. The $7.5m gross loss becomes
$6.2m after the recovery of proportional reinsurance.
This gross/net loss is further reduced by $2,915,000
from the excess loss programmes. The net loss is
therefore $3,285,000.

However, to reinstate its excess loss reinsurance protections, further premiums are paid out; these total $598,000. Against this amount, but not described to date, would be the further inwards premiums received by XYZ from its ceding companies to reinstate their own reinsurances.

Clearly the aggregate exposures involved a fair amount of judgement, but the whole exercise is certainly worthwhile and should be performed whenever a new reinsurance programme is being considered.

7. The Design of the Reinsurance Programme

7.1 Each year, every London Market company or Lloyd's syndicate must assess its reinsurance programme. There will be an element of continuity with many of the segments of the programme and with a number of the reinsurers. Some new layers may be added, or the programme reshaped, when new markets may need to be found. The company (or syndicate) will consider its expected inwards business profile and may well discuss the market position with several insurance brokers before designing its new reinsurance programme.

The following may also be considered:-

i)   Pricing levels. Are prices different from
        last year?

        If cheaper, should further reinsurance be
        purchased to enable more inwards business to
        be written, and hence more expected profit
        obtained?
        If more expensive, should less reinsurance be
        purchased and more risk retained (or less
        inward business written)?
        Is the change in reinsurance prices evenly
        spread or is it concentrated in particular
        areas, i.e. is the shape different?
        (Because of one particularly large loss,
        prices at the higher layers may have
        increased considerably, but those at the
        lower layers, which are more sensitive to
        frequency losses, may be relatively
        unaffected.)

ii)   Availability of cover. Following a freak
        sequence of catastrophes, it may not be
        possible even to obtain quotations for
        reinsurance protection. The market has been
        known almost to close while the companies and
        syndicates review their position. However,
        in normal circumstances, most reinsurances
        can be placed if the price is right!

iii)   Capital and Solvency. If XYZ is well
capitalised then it may well feel able to
retain a larger net amount of a catastrophic
loss than a company run on more slender
margins. It is vital that the shareholders
are fully aware of this risk strategy and
consequent greater volatility of earnings.
In addition, the solvency of the company
after such a catastrophe must be secure.

7.2   When a company such as XYZ designs its reinsurance
programme, it will start with its forecast of inwards
business. A table will be constructed showing the
expected premium income to be written, by type of
business and by currency.

An attempt to estimate the exposure will also be made,
again split broadly by type of business.

7.3   The first level of reinsurance will be facultative on
individual risks. This was a form of reinsurance used
more extensively until the mid 1980s. It is not so
common in today's market. The advantage is that the
protection may be utilised for a specific inwards risk.
The costs and administrative time consumed lessen the
attraction.

7.4   The second level of reinsurance is the proportional
        treaty. This may be a quota share or surplus treaty,
        but the general overall effect is for a proportion of
        the premium to be paid away in return for a proportion
        of the losses to be paid. This enables the reinsured to
        write larger gross lines, see a wider range of risks and
        have more control over the terms of the risks.

        There may be several proportional treaties covering
        different groupings of risks.

7.5   Losses net of the above two levels of reinsurance are
        protected by the excess of loss programmes: the third
        level of reinsurance. This is the final level of
        reinsurance and therefore the most important. Any
        losses not covered by these excess of loss reinsurances
        are retained by the company.

        The design of an excess loss programme has two
        directions: the horizontal cover reflects the frequency
        of loss whilst the vertical cover reflects the severity
        of loss.

For lower layers, where losses will occur more frequently, more horizontal cover will be required than for higher layers, where losses may be expected to occur once every ten or even one hundred years. Hence the reinsurance programme will develop a rough triangular shape.

It is possible to purchase less reinsurance initially and buy reinstatement policies to provide more cover after a loss event has occurred, but the prohibitive prices at that time usually mean that this is not an efficient option. It is a much less costly strategy to purchase a more comprehensive programme at the outset.

Assessing the results of a series of loss scenarios as described in this paper is the preferable method of gauging the vertical cover required. Such scenarios may include a Californian earthquake, a USA North East Hurricane, a Texas Hurricane, a Tokyo earthquake, and other major catastrophes that could be envisaged to threaten the book of the company. The results of these scenarios will indicate the necessary ultimate level of cost to XYZ and a management decision will dictate whether some of the hypothetical loss should be retained net, given the current circumstances as described in section 7.1.

The overall retention (as mentioned in section 5.6) also
includes the amount of loss retained beneath the
reinsurance programme. It may be decided to retain the
first $250,000, $500,000, $1m, etc... This amount will
be determined not by loss severity but by expected loss
frequency. The actuary may assist by examining losses
in prior years and expressing these at current prices
based on the current book of business (and exposure),
and given current conditions (ie. on an "as if" basis).
The number of losses per annum on an equivalent basis
may then be found, and hence an expected number of
losses per band of severity may be derived.

By such methods the required shape and level of the
programmes as presented in Appendix 4 can be derived.

8.   Other factors to be considered

8.1   The above concentrates on the final net position of the
       loss to XYZ. However, in practice it is likely that XYZ
       will pay reinsureds before recovering from reinsurers.
       There will be a cash flow problem. Facilities must be
       in place to finance the cash flow problems that will
       arise. Clearly, as cash payments may be required at
       short notice, the types of investment held will be of
       importance. Furthermore, a catastrophe may occur at the
       same time as a lack of investment confidence, thus
       emphasizing the consideration that must be given to the
       investments.

Alternatively, some special banking loan arrangements may be purchased to provide credit in such circumstances.

8.2   If a catastrophe crosses an international frontier then several _currencies_ of loss will be involved. The wording of the reinsurance contract may specify a very different rate of exchange than that current in the market. Considerable currency complications in the calculation of the erosion of the aggregate deductible, as well as the "correct" level of the upper and lower limit, may emerge and have to be solved. Again, there may be a problem of realisation of investments to provide the appropriate currency.

To take an example, consider an excess loss reinsurance programme expressed in US$ with a contractual exchange rate of £1 = US$2. The programme may involve, say, the first $15M of loss.

The current exchange rate may be £1 = US$1.5. The loss may be £5M plus $6M. Now in real terms, the loss is $13.5M and well within the reinsurance programme. But at the contractual rate, the loss is $16M and through the top of the reinsurance programme.

Clearly, problems arise in apportioning the £ and $ content of the loss. If we assume that all the $6M comes first, then the loss exceeds the top of the reinsurance programme by £0.5M or $0.75M (i.e. the $15M comprises $6M + £4.5M). However, if we assume that the £5M comes first then the loss exceeds the top of the protections by £0.67M or $1M (i.e. the $15M comprises £5M + $5M).

Currency problems are very real for an international reinsurer and could certainly form the basis for a very full paper in their own right!

8.3   In the event of a major catastrophe, some reinsurers may not be able to meet their obligations and hence the net loss to XYZ will be greater than anticipated. It may be necessary to assume some proportion of <u>uncollectable reinsurance</u>. A full process of reinsurer security evaluation, prior to the placement of reinsurance protection, is thereby shown to be of great benefit.

8.4.   As mentioned earlier, the payment of claims by a reinsurer is normally accompanied by a payment to reinstate the cover. These <u>reinstatement premiums</u> occur on both inwards business and outwards business. Often the assumption is made that these cancel each other out.

However, exercises should be performed to discover whether this assumption is valid, and careful monitoring of reinstatement premiums should take place in the event of actual catastrophes. This is especially important for a highly geared operation, i.e. a company or syndicate with a large proportion of its inwards premiums paid out for reinsurance protection, and hence a corresponding low net retention.

9.   Conclusion

9.1   This paper is primarily a practical exercise in considering the construction, continuance, and refurbishment of a reinsurance programme. No attempt has been made to introduce the theory of the optimum upper and lower limits of a programme, but rather to get a feel of the current more rough and ready methods which are actually used in practice. Inevitably, the theoretically "correct" programme will not result. However, the London insurance market is not just about the theory, but is a complex market with a very high degree of personal relationships. Exercises to show which layers are cheap or dear are normally well received, but there are so many mitigating circumstances why the actual ROL has been selected. Often the reinsurance programme is not just seen as a one year, one off concern, but as a continuing longer term relationship between reinsured and reinsurer which can benefit both.

9.2   It is unlikely that many of the readers of this paper
      will be fully aware of the salient features of the
      London Market. However, the paper gives a feel of the
      atmosphere of the market, explains some of the more
      unusual local features, and shows how the London Company
      views aspects of a large USA Catastrophe.

      A wide selection of papers has been written by London
      Market Actuaries and the interested reader may well wish
      to contact the Institute of Actuaries in London for
      further information.

Sidney.Doc

Path of Hurricane Sidney

FLORIDA EXPOSURES FOR XYZ INS CO

Areas affected by Hurricane Sidney:-

(i)   Florida
(ii)   USA Nationwide
(iii)   Worldwide

Gross Exposures in $m's:-

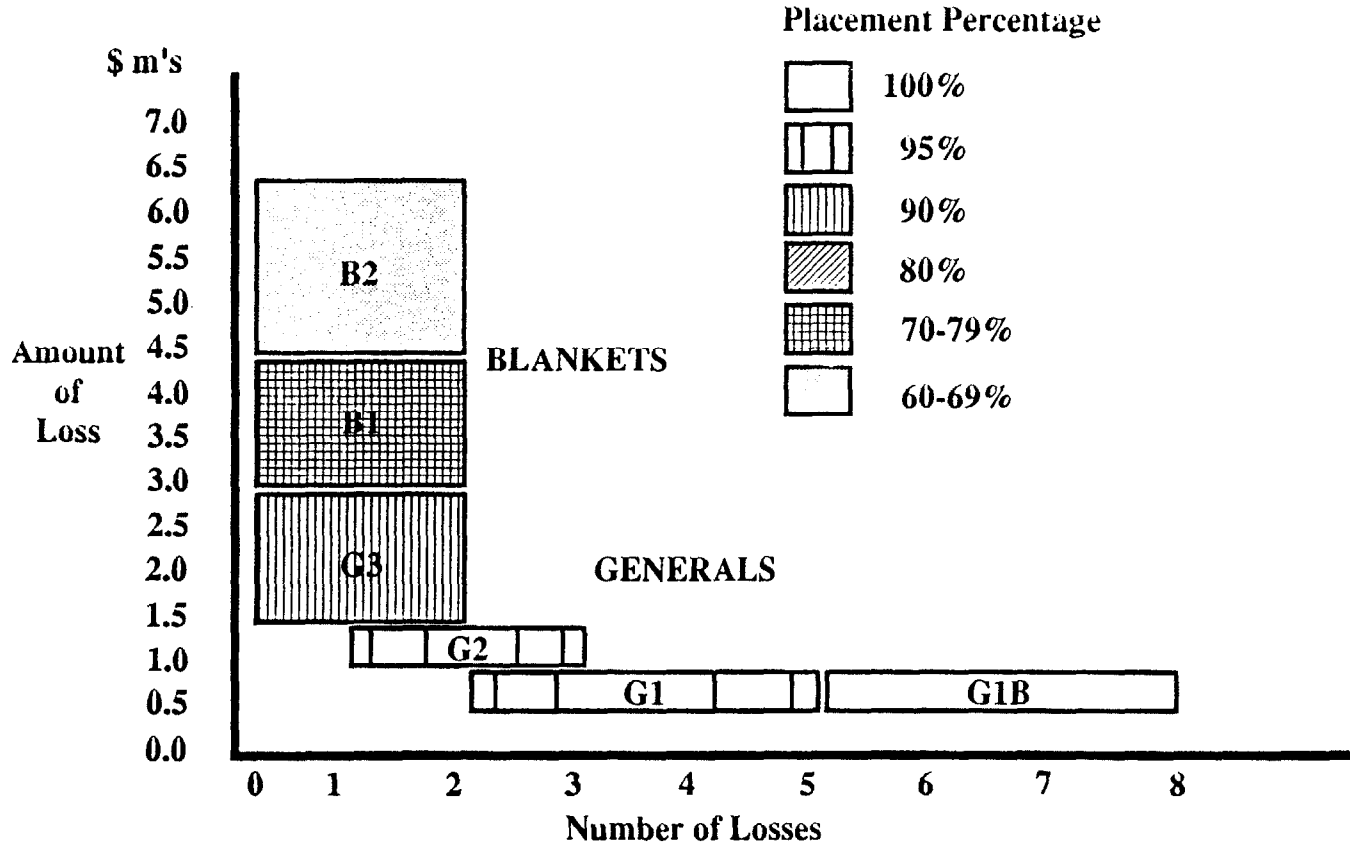| Type of Inwards Business	100% Exposures			Proportion exposed to Hurricane Sidney*			Hurricane Sidney Exposures			
	Florida	USA	Worldwide	Florida	USA	Worldwide	Florida	USA	Worldwide	Gross Exposure
Property Catastrophe X/L	0.8	3.6	1.0	100%	50%	20%	0.8	1.8	0.2	2.8
Property Risk X/L	0.2	1.0	0.0	100%	20%	-	0.2	0.2	0.0	0.4
Property Other Main A/C	0.2	1.0	0.0	100%	40%	-	0.2	0.4	0.0	0.6
Property Retrocession & IMX	0.0	0.5	4.0	-	100%	75%	0.0	0.5	3.0	3.5
Property Net A/C	0.0	0.5	0.0	-	40%	-	0.0	0.2	0.0	0.2
Casualty	0.2	4.0	2.0	0%	0%	0%	0.0	0.0	0.0	0.0
Total	1.4	10.6	7.0				1.2	3.1	3.2	$7.5m

A similar exercise would be performed in respect of facultative and proportional outwards reinsurance protections to derive the exposure net of these levels of reinsurance.

* These proportions are derived judgementally by examination of type of business and exposure expected to Hurricane Sidney.

XYZ Ins Co Reinsurance Programme for 1991

	(1)	(2) Aggregate Deductible	(3) Reinstatements	(4) ROL	(5) Co Reins	(6) % Placed	(7) Premium (100%)
i)	Generals						
G1.	Layer $ 500,000 xs $ 500,000	$1,000,000	2 @ 100%	25%	5%	95%	$125,000
G1B.	$ 500,000 xs $ 500,000	$2,500,000	1 @ 50% 1 @ 75%	12%	0%	100%	$ 60,000
G2.	$ 500,000 xs $1,000,000	$ 500,000	1 @ 100%	20%	5%	95%	$100,000
G3.	$1,500,000 xs $1,500,000	$ 0	1 @ 100%	15%	5%	90%	$225,000
ii)	Retrocession						
R1.	Layer $ 750,000 xs $ 250,000	$ 750,000	1 @ 100%	40%	10%	90%	$300,000
R2.	$1,500,000 xs $1,000,000	$ 0	1 @ 50%	50%	10%	80%	$750,000
iii)	Blanket						
B1.	Layer $1.5m xs $3.0m for Main A/C $1.5m xs $2.5m for Retro A/C	$ 0	1 @ 100%	20%	10%	72%	$300,000
B2.	$2.0m xs Underlying.	$ 0	1 @ 100%	10%	10%	66%	$200,000
iv)	Casualty X/L						
	....						
v)	Risk X/L						
	(Windstorm exclusive)						

XYZ Insurance company - 1991 Generals Reinsurance Programme.

Appendix 4

XYZ Insurance company - 1991 Retrocession Reinsurance Programme.
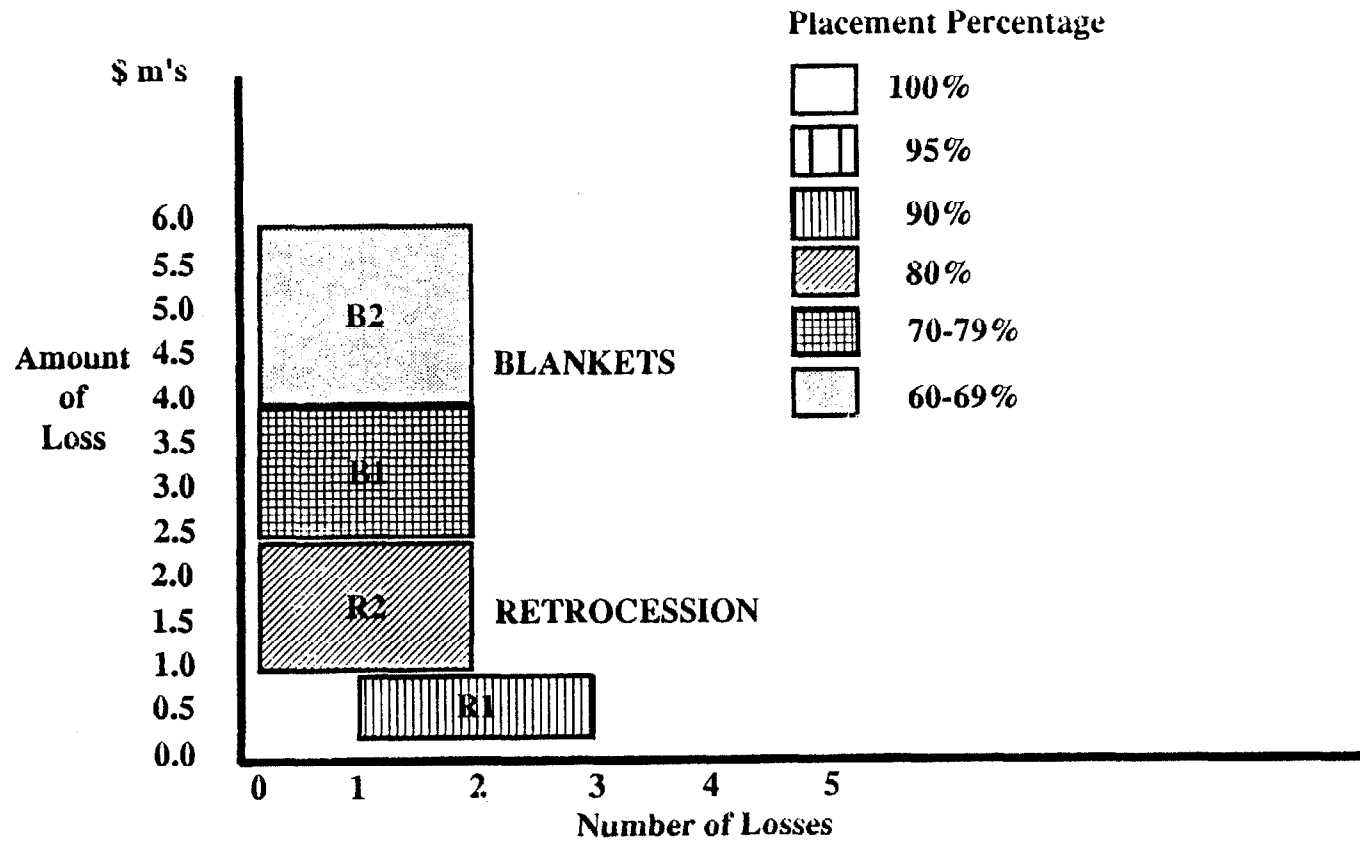
Estimated gross losses to XYZ from Hurricane Sidney

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Type of Inwards Business	Gross Exposure	Property Surplus Reinsurance Tty	Gross/Net Exposure
Property Catastrophe X/L	$2.8M	$1.0M	$1.8M
Property Risk X/L	$0.4M	$0.1M	$0.3M
Property Other Main A/C	$0.6M	$0.2M	$0.4M
Property Retrocession & LMX	$3.5M	$0.0M	$3.5M
Property Net A/C	$0.2M	$0.0M	$0.2M
Casualty	$0.0M	$0.0M	$0.0M
	$7.5M	$1.3M	$6.2M

Ultimate losses prior to X/L reinsurance programme = $6.2M

Calculation of Net Loss (i)

i) <u>Generals</u>

Losses after facultative & proportional reinsurance to generals:-

Property Catastrophe X/L	$1.8m
Property Risk X/L	$0.3m
Other Property	$0.4m
	———
	$2.5m
	———

	Layer	Retention	Co Reins	Shortage	Recoverable	Reinstatement Premium
	1st $500,000	$500,000	0	0	0	0
1.	$ 500,000 xs $ 500,000	$500,000	0	0	0	0
2.	$ 500,000 xs $1,000,000	$400,000 *	$ 5,000	0	$ 95,000	$ 19,000
3.	$1,500,000 xs $1,500,000	0	$50,000	$50,000	$900,000	$135,000
		$1,400,000	$55,000	$50,000	$995,000	$154,000

Hence, of the $2.5m loss to the generals, $995,000 is recoverable and $1,505,000 is retained. $154,000 of reinstatement premium will be paid.

* Assuming an earlier loss occurred in 1989 of $100,000 to this layer and a total loss to the underlying layer, ie. $1.1m in total to XYZ.

Calculation of Net Loss (ii)

(ii) **Retrocession**

Losses before retrocession excess loss protections are $3.5m (no facultative or proportional reinsurance).

	Layer	Retention	Co Reins	Shortage	Recoverable	Reinstatement Premium
	1st $250,000	$250,000	0	0	0	0
1.	$ 750,000 xs $ 250,000	$750,000	0	0	0	0
2.	$1,500,000 xs $1,000,000	0	$150,000	$150,000	$1,200,000	$300,000
		$1,000,000	$150,000	$150,000	$1,200,000	$300,000

Hence $1,200,000 is recoverable, $1,300,000 is retained net, and $300,000 of reinstatement premium will be paid. $1,000,000 goes through to the blanket reinsurance protection.

(iii) **Blanket**

1.	$1,500,000 xs $2,500,000 (IMX)	0	$100,000	$180,000	$ 720,000	$144,000

Hence $720,000 is recoverable and $280,000 is retained net. $144,000 of reinstatement premium will be paid.

Appendix 8

Calculation of Net Loss (Summary)

(iv)   Summary

The gross loss from Hurricane Sidney is: $7.5m

Facultative & Proportional Reinsurance is: $1.3m

Hence the loss net of fac & prop'l reins is:$6.2m

By the general reinsurance
protections with a loss of $2.5m:

$ 995,000 is recoverable
$1,505,000 is retained
and $ 154,000 is paid as
      reinstatement premium

By the retrocession reinsurance
protections with a loss of $3.5m:

$1,200,000 is recoverable
$1,300,000 is retained
$ 300,000 is paid as
      reinstatement premium
and $1,000,000 goes to the blanket
      reinsurance programme

By the blanket reinsurance
protections with a loss of $1m:

$ 720,000 is recoverable
$ 280,000 is retained
and $ 144,000 is paid as
      reinstatement premium

Not forgetting the net account loss of: $ 200,000 which is retained.

Hence the loss position net of all
reinsurance is:

$2,915,000 recoverable
$3,285,000 retained

$6,200,000 (crosscheck)

Plus a reinstatement premium paid of: $ 598,000

ie. net loss is $3.88m