# Market Bulletin



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FROM:	Head of Risk Management	
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SUBJECT:	APRIL 2004 REALISTIC DISASTER SCENARIOS	
ATTACHMENTS:	Yes	
ACTION POINTS:	Managing Agents to complete RDS process set out in the attached Guidance and Instructions	
<b>DEADLINE:</b>	Noon on Friday 4 <sup>th</sup> June 2004	

Attached to this bulletin is the 'Guidance and Instruction' pack for the April 2004 Realistic Disaster Scenario (RDS) exercise. This pack has been produced as a result of the first year's work on the overhaul of Lloyd's RDSs.

The principal aim of the overhaul process has been to improve the consistency of syndicate's submissions, to aid the comparison of syndicates' risk profiles and to enhance the modelling of Lloyd's overall exposure to major catastrophes.

Lloyd's has worked closely with representatives from the market, including a 'Market Experts Group', that has met fortnightly over the last year to work with Lloyd's in the development of an improved approach to the assessment of aggregate exposures.

A number of key decisions have been taken by Lloyd's during the overhaul process that affect the reporting requirements placed on syndicates. In making these decisions, Lloyd's has sought to arrive at the appropriate balance between costs and benefits, and has consulted with representatives from the market at each stage. Lloyd's will complete the overhaul of its RDSs by 1<sup>st</sup> April 2005 and will take account of feedback received on this year's exercise.

The revised RDS Reporting Software will be issued on 16<sup>th</sup> April 2004 and a series of RDS workshops has been organised for the week beginning 19<sup>th</sup> April 2004. The aim of these workshops is to provide guidance to syndicates on the revised RDS software and process, to present worked examples on different loss calculations and to provide a forum for the

discussion of the many issues pertaining to modelling potential losses. Those wishing to attend these workshops should contact Brenda Wostear (020 7327 5819 or brenda.m.wostear@lloyds.com).

Managing agents should complete the RDS returns by noon on Friday, 4<sup>th</sup> June 2004.

This bulletin is being sent to all active underwriters and managing agents. A copy of this bulletin has also been sent to members' agents, Lloyd's advisors, corporate members, recognised accountants and market associations, for information.

Stephen Manning Head of Risk Management

# **REALISTIC DISASTER SCENARIOS** APRIL 2004



# **Guidance and Instructions**

LLOYD'S

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# INTRODUCTION

Objective	The objective of Lloyd's Realistic Disaster Scenario ('RDS') exercise is for syndicates to estimate the losses they would incur from a variety of hypothetical disaster scenarios, using consistent and appropriate methods and assumptions.
	The RDS exercise should be viewed in the context of Lloyd's key Franchise objective 'to create and maintain a commercial environment at Lloyd's in which the long term return to all capital providers is maximised'. The principal aim of the exercise is to manage the security of Lloyd's for aggregating catastrophes and other large losses.
RDS Overhaul	This 'Guidance and Instructions' pack for the April 2004 RDS exercise has been produced as a result of the first year's work on the overhaul of Lloyd's RDSs.
	The principal aim of the overhaul process has been to improve the consistency of syndicates' submissions, to aid the comparison of syndicates' risk profiles and to enhance the modelling of Lloyd's overall exposure to major catastrophes.
	Lloyd's has worked closely with representatives from the market, including a 'Market Experts Group', that has met fortnightly over the last year to work with Lloyd's in the development of an improved approach to the assessment of aggregate exposures. The assistance of the individuals involved and the support of their respective organisations has been invaluable and their contribution is greatly appreciated.
	A number of key decisions have been taken by Lloyd's during the overhaul process that will affect the reporting requirements placed on syndicates. In making these decisions, Lloyd's has sought to arrive at the appropriate balance between costs and benefits, and has consulted with representatives from the market at each stage. Lloyd's will complete the overhaul of its RDSs by 1 April 2005 and will take account of feedback received on this year's exercise.
	A number of Lloyd's syndicates are already at the cutting edge of loss modelling within the insurance industry. The overhaul process has sought to capture the 'best practice' principles and methodologies used by these syndicates, and to raise loss modelling standards within the market as a whole, through the new RDS recommendations and reporting requirements.
	The overhaul process has also highlighted the importance of working with consistent terminology. A set of definitions has therefore been developed and is included in section A of this document. The new guidance also highlights the need for syndicates to obtain high quality data and to pay particular regard to sources of uncertainty when modelling their exposures.

# Use of the Results

The loss estimates resulting from the RDS exercise provide a stress test of syndicates' exposures to aggregating catastrophes and large individual loss events, as well as information on the sources of anticipated reinsurance recoveries. These measurements are used as an input to Lloyd's Risk Based Capital system, in assessing compliance with the Franchise Guidelines and in identifying potential reliance on individual reinsurers. Through aggregating losses from particular events, the overall risk exposure of the market can be assessed, which links into the capitalisation of Lloyd's.

The analysis also extends to the consideration of cash flow and liquidity modelling, which are critical in the understanding of a syndicate's resilience to a major loss event.

# **RDS Workshops**

A series of RDS workshops has been organised for the week beginning 19 April 2004. The aim of these workshops is to provide guidance to syndicates on the revised RDS process, to present worked examples on different loss calculations and to provide a forum for the discussion of the many issues pertaining to modelling potential losses.

Details of these workshops have been publicised via the LMA and those wishing to attend should contact Brenda Wostear (020 7327 5819 or brenda.m.wostear@lloyds.com) to book a place.

# **A DEFINITIONS**

Insured Value	The <b>Insured Value</b> is the total value of the underlying asset (or activity, for example, in the case of Business Interruption insurance) that is covered by the syndicate by way of insurance and/or reinsurance. This figure is determined before the application of policy or treaty limitations on cover, such as coinsurance, deductibles or limits. The Insured Value is also referred to as the Total Insured Value or 'TIV'.
Footprint	The <b>Footprint</b> refers to the geographical or physical extent of a RDS event. Only Insured Values inside the Footprint will be assumed to be affected for the purpose of the RDS calculations.
Aggregate (reported item)	The <b>Aggregate</b> is the sum of exposed Insured Values inside the Footprint, having taken the syndicate's participations and contract terms into consideration. This figure should correspond to the maximum Gross Loss that could be incurred, in the situation where 100% of the Insured Values within the Footprint were destroyed.
	It should be noted that the Aggregate will vary according to the zones that are used to define the Footprint (i.e. a Footprint defined using zip-codes may give a different answer to one defined at County Level).
Ground-up Loss	In the context of physical property insurance, the <b>Ground-up Loss</b> is the expected value of the damage from the RDS event expressed in terms of Insured Value, before the application of any policy or treaty limitations on cover, such as coinsurance, deductibles and limits.
Gross Loss (reported item)	The <b>Gross Loss</b> is the expected value of the loss arising from the damage to the Insured Value from the RDS event, after the application of syndicate participations and policy or treaty limitations on cover, such as coinsurance, deductibles and limits.
Net Loss	The <b>Net Loss</b> is the expected value of the loss from the RDS event after reinsurance recoveries, but before Reinstatement Premiums have been paid and received.
Inwards Reinstatement Premiums (reported item)	The <b>Inwards Reinstatement Premiums</b> are the premiums that would be expected to be received following the loss from the RDS event, in order to reinstate the cedant's reinsurance protections affected by the loss.
Outwards Reinstatement Premiums (reported item)	The <b>Outwards Reinstatement Premiums</b> are the premiums that would be expected to be paid following the loss from the RDS event, in order to reinstate the syndicate's reinsurance protections affected by the loss.

Final Net Loss	The <b>Final Net Loss</b> is the expected value of the loss from the RDS event after reinsurance recoveries have been received and Reinstatement Premiums have been paid and received.
Damage Ratio	The <b>Damage Ratio</b> is the average proportion of the Insured Value that is damaged in the RDS event. This might be determined as the ratio of the Ground-up Loss to the Insured Value.
Probable Maximum Loss ('PML')	The term <b>'PML'</b> has a number of possible meanings and its application can be the source of confusion.
	In the assessment of losses from a possible property fire, reasonable judgements can be made as to the proportion of the total value that will be destroyed, with reference to fire protection and compartmentalisation provisions such as fire breaks and fire doors. In these circumstances, a 'PML' can be determined with reference to the number of compartments within a property that might be affected by a fire.
	However, for most scenarios, the assumption that there are physical limitations on the extent of damage is questionable. It is therefore recommended that the term 'PML' should only be used in limited circumstances, where there are physical constraints on the level of damage that may be incurred.
Industry Loss	The assumptions for some of the RDSs include the level of Insurance Industry Loss that relates to an event. These figures provide guidance on the scale of event that should be considered and can be used in 'Market Share' loss estimation methodologies.
	Insurable Industry Loss
	The <b>Insurable Industry Loss</b> figure is defined as the total loss that would have been borne by the insurance industry if there had been a 100% take-up of insurance.
	Insured Industry Loss
	The <b>Insured Industry Loss</b> figure is defined as the total loss borne by the insurance industry having taken account of the actual Take-up Rate for insurance.
Take-up Rate	In assessing the total losses that will be borne by the insurance industry, for a particular event, it is necessary to estimate the proportion of potential losses that are actually insured, and the <b>Take-up Rate</b> describes this relationship. For instance, residential insurance Take-up Rates for earthquake cover in California are known to be low, but are high for windstorm protection in Florida.

# **B** REPORTING REQUIREMENTS

Date of Exercise	Loss calculations so reinsurance protection any relevant reinsurar taken into account in the	hould be based on exposures and unutilised is in place at <b>1 April 2004</b> . Any live exposures and nee remaining from prior years of account should be he loss calculations.
Date of Board Approval	For each syndicate, m <b>Board Approval</b> field (see page 14). This s the managing agent approves the RDS sub	anaging agents are required to complete the <b>Date of</b> on the Main Screen in the RDS Reporting Software should be the date on which the board of directors of t, or a sub-committee with delegated authority, omission on behalf of the managed syndicate.
Reporting Deadline	All RDS returns must t	be submitted by noon on <b>Friday, 4 June 2004</b> .
Mandatory RDSs	Seven of the sevent These are:	een RDSs must be completed by <b>all</b> syndicates.
	Number	RDS
	11	Second Event (i.e. an 'Andrew' hurricane in the immediate aftermath of a 'Northridge' earthquake)
	12	Florida Windstorm (comprising two separate events)
	13	California Earthquake (comprising two separate events)
	14	New Madrid Earthquake
	15	European Windstorm
	16	Japanese Earthquake
	17	Terrorism
	There is no 'de-minimi syndicate has no ex should submit a 'nil' re	s' reporting level for the seven mandatory RDSs. If a posure to a mandatory event its managing agent turn.
Minimum Number of RDSs	All syndicates must co seven mandatory RDS scenarios do not gen syndicates are recomp page 47)	omplete a <b>minimum of nine scenarios</b> (including the Ss described above). Where the suggested optional erate a loss above the 'de-minimis' reporting level, mended to use the Alternative A & B scenarios (see
'De-minimis' Reporting Level	Syndicates need not Gross Loss of less that capacity.	include an optional scenario that results in both a an 10% and a Net Loss of less than 3% of their 2004

Syndicates in 'Run-off'	Syndicates that are no longer active, but still have live exposures, are subject to the same reporting requirements as active Syndicates.
Capacity Quoted Net of Qualifying Quota Shares	Capacity should be stated net of any Qualifying Quota Share ('QQS') facility.
Aggregate to include QQS	Aggregate exposure data should include exposures written under an insured QQS agreement.
Reporting QQS Recoveries	Recoveries relating to a QQS agreement should be shown on the 'Exposures' screen under a separate recovery class – 'Outwards R/I – Qualifying Quota Share'.
Breakdown of Reinsurance Recoveries	Syndicates are required to provide a breakdown, by reinsurer, of their anticipated reinsurance recoveries for each event. The figures should reconcile to at least 90% of the anticipated recoveries for both facultative and treaty (including stop loss) protections.
	The latest set of Lloyd's Outwards Reinsurance System (LORS) codes will be incorporated within the RDS Reporting Software prior to distribution. Should any security not appear on the listing, syndicates should first check the validity of the code with the LORS team or their broker, and then contact the Loss Modelling department (details at the front of this document).
Reporting Stop Loss Protections	Syndicates should record their stop loss recoveries on the 'Exposures' screen, using the 'Stop Loss' option within the 'Placement Type' categories. The commentary facility should be used to explain the extent of any stop loss cover relied upon in the scenarios, including details such as limits and excess points.
	The 'Reinsurance' screen includes a separate 'Stop Loss' column, in addition to the 'Facultative' and 'Treaty' recoveries fields. The figures entered in the 'Treaty' field should exclude any 'Stop Loss' recoveries that are reported separately.
Related Parties	In order to facilitate monitoring of arrangements that fall within the Related Parties regime set out under Regulatory Bulletin 081/99 dated 20 September 1999, managing agents are required to detail the business assumed from and ceded to related companies (as defined by the Lloyd's Act 1982).
Reporting Cash Flow Profile Estimates	Syndicates should complete the 'Cash Flow' screen for each event. Syndicates should assume that year and quarter dates commence on the date of the loss, <b>1 April 2004</b> . When completing cash flow details, percentages should be based on the largest cash deficit in a particular quarter.
Reporting Anticipated Sources of Funding	Syndicates should complete the 'Funding' screen for the event producing the largest cash deficit
Overview of Returns	The following two diagrams describe the relationship between the different reported items and provide an outline of a syndicate's RDS return.

# **RELATIONSHIP BETWEEN REPORTED ITEMS**



# **OUTLINE OF SYNDICATE RETURN**



FUNDING FOR LARGEST CASH DEFICIT

# C RDS REPORTING SOFTWARE

## **Software Screens**

Syndicates' returns should be submitted using the RDS Reporting Software. There are seven entry screens:

Screen	Description
Main Screen	to enter the syndicate number and confirm the date of Board sign-off
Scenarios / Events	to select scenarios and events that will be reported
Exposures	to enter loss details (specifically Aggregate, Gross Loss, Reinsurance Recoveries and Reinstatement Premiums) at 'Class of Business' and 'Placement Type' level
Reinsurance	to enter the breakdown of reinsurance recoveries by reinsurer
Cash Flow	to enter the expected cash flow profile for each event
Funding	to enter the anticipated sources of funding for the event that produces the largest cash deficit
Capacity + Notes	to enter capacity and comments on the syndicate's return

### **Software Release and Distribution**

The software will be available to download from the Market Reporting website on the **16 April 2004**.

The download will also contain a manual for the software. Additional guidance on the use of the software will be given in the RDS workshops.

# D CALCULATION PRINCIPLES

Reporting the Expected Value of Losses	There is a range of possible outcomes (i.e. loss levels) that might arise on the occurrence of an RDS event. The reported loss figure should correspond to the expected (average) value of this range of possible outcomes.
Following an Auditable Process	In producing loss estimates, syndicates should follow an auditable process that allows the reproduction of the results and that will stand up to review by Lloyd's or other parties.
Identification of Key Assumptions	Syndicates should identify the key assumptions in their calculations, particularly those based on subjective judgements. Where their impact is material, assumptions should be reported using the commentary facility in the RDS Reporting Software.
Considering All Lines of Business	Catastrophes have the potential to impact many different lines of business and this should be recognised in considering the impact of an RDS event.
Use of Loss Modelling Software for RDS Returns	Syndicates may use catastrophe loss modelling software, as produced by AIR, EQECAT or RMS, to model their expected loss exposures. Lloyd's recognises results produced through the appropriate use of these packages for submission under the RDS exercise, provided that the reporting requirements within the RDS Reporting Software are met and that all relevant exposures and lines of business are included in the return.
'Best Estimate' Basis	In estimating the expected value of the range of possible outcomes, syndicates should choose the most reasonable value, which corresponds to neither an optimistic (low loss) nor a pessimistic (high loss) view.

# E RECOMMENDED BEST PRACTICE

Segmenting Data	Where practical, exposure data should be organised into homogeneous groups that can be treated as having common characteristics and to which similar methodologies and assumptions might be applied. The 'Class of Business' and 'Placement Type' categories described in section F (pages 18 and 19) provide a guide to the segmentation that might be applied.
Allocation of Exposures within Footprints	Not all data on Insured Values is sufficient to identify whether exposures lie within the Footprint of an RDS event. However, it is recommended that decisions should be taken as to which exposures lie within a Footprint <b>before</b> calculating the Aggregate for a particular RDS event. This might involve the application of average industry exposure figures (examples of which are included in the assumptions for the California Earthquake and Florida Windstorm scenarios) or judgements about which key exposures lie within the Footprint.
	By following this practice, the Aggregate figures provided by managing agents will be determined on a more consistent basis. Syndicates are asked to pay particular regard to the definition of <b>Aggregate</b> in Section A (Page 8).
Appropriate Use of Conservative Assumptions	Where a component of the loss estimation process is subject to a great deal of uncertainty, say in the absence of any underlying exposure data, syndicates should adopt a conservative (i.e. pessimistic) approach to setting their assumptions and should record this using the commentary facility in the RDS Reporting Software.
Involving Underwriting and Other Experts	The estimation process should include input from underwriting, claims and other personnel. For instance, focused reviews of contract/treaty terms might be carried out on the largest components of the loss estimates. These reviews might identify that event sub-limits or occurrence limits will have a significant impact on the loss payable by the syndicate.
Allocation of Effort	It is recognised that an exhaustive analysis of every element of the RDS process is impossible. Nevertheless, syndicates should identify the most material components of their estimates, allocating effort accordingly and detailing their assumptions using the commentary facility in the RDS Reporting Software.
Consideration of Uncertainties	The loss modelling process will comprise a number of assumptions, choices of methodologies and subjective assessments (e.g. concerning the performance of reinsurance contracts). These decisions are often made in response to incomplete data concerning exposures or the events themselves. Syndicates should consider the potential sources of uncertainty in their calculations and satisfy themselves that the allocation of effort and the control of the calculation process are consistent with regard to these different sources of uncertainty.

Recognising Volatility in Calculating Expected Losses to Layers	Loss estimates will be based on the expected value of a range of possible outcomes for a given RDS event. It should be recognised therefore, that Ground-up Losses can occur that are significantly in excess of their expected value. As a result, a given RDS event can generate losses to insurance and reinsurance layers set above the expected loss level (e.g. a contract with an expected Ground-up Loss of £5m, providing cover of £5m xs £5m, would have a non-zero expected loss).
	Recommended methodologies that can be used to assess the impact of the above volatility are illustrated in section G (pages 20 to 34).
Using Alternative Methodologies	Alternative methodologies should be used to provide a check on loss estimates. These might include 'Market Share' or 'Maximum Line Size' methods, as described below.
'Market Share' Loss Estimation	In the absence of adequate exposure data, it may be necessary to estimate Gross Losses by considering the proportion of the total Industry Loss that will be borne by the syndicate. This proportion might be determined with reference to exposure estimates, historical loss experience or the share of total market premium income received. The usual method, especially for lines like workers compensation, is with reference to premium income.
'Maximum Line Size' Loss Estimation	An alternative approach to estimating losses, in the absence of adequate exposure data, might be to base loss estimates on the specific terms of the contract or treaty. Examples where this might be used include 'Per Risk Excess of Loss' and 'Liability' contracts.
	In using this approach, typical Gross Loss estimates will assume the total exhaustion of the relevant policy or treaty limits. Particular regard should be paid to occurrence and peril sub-limits in this context. Partial exhaustion of limits may be justified with reference to historical losses or market share data. Where material to the final result, the methodology and assumptions used should be described using the commentary facility in the RDS Reporting Software.

# **F SEGMENTATION**

Purpose	The 'Class of Business' and 'Placement Type' segmentation categories provide guidance to syndicates as to the approach that might be taken to identifying the similar (homogeneous) groupings of exposures that should be analysed in estimating losses. The segmentation may also help in structuring the auditable process that syndicates should follow.
Application	In completing the 'Exposure' screen in the RDS Reporting Software, syndicates should select the appropriate 'Class of Business' and 'Placement Type' for each reported segment of the RDS event loss. Where it is unclear which categories should be used, syndicates should select the best available combination and report this using the commentary facility in the RDS Reporting Software.
Level of Reporting	Many of the categories are subgroups of other categories (e.g. Specie/Fine Art is a subgroup of Property). Syndicates are asked to report at the finest, practical level of detail, without recourse to an arbitrary allocation of exposures and losses between lines of business. 'Specie/Fine Art' loss figures, for example, need only be reported separately if the analysis is actually carried out at that level. The highlighted 'Class of Business' categories opposite, represent the minimum level of detail that should be reported.
	It is recognised that some syndicates may only be able to make use of the higher level groupings. As a result, for 2004, Lloyd's will not draw any conclusions about the total exposure in the market for the detailed classes, but would ask syndicates to provide this level of data wherever possible as it indicates where exposures may be concentrated.
	Lloyd's will continue to work with the market to improve the analysis of exposures at subgroup level.

2004 Reporting Categories

**Classes of Business** 

The following reporting categories should be used for the April 2004 RDS exercise.

Aviation Aviation hull Aviation war **Aviation liability** Aviation premises liability Aviation products liability Energy liability, inc. pollution and ROW Energy property damage Energy OEE/COW Energy Offshore Energy Onshore General/Miscellaneous liability Bankers Contingency/Pecuniary loss D&O Extended warranty Financial Guarantee PI/E&O Non-Marine liability Life/Personal Accident/Medical Expenses Medical Malpractice Marine Marine cargo Marine hull Marine war **Marine Liability Property Liability** Motor liability Nuclear liability

Property physical loss or damage Agricultural crop **Business interruption** Commercial Engineering Jewellers block Livestock/Bloodstock Mortgage Impairment Motor FTC Motor physical damage Nuclear property damage Residential Specie/Fine art **RI Outwards** RI Outwards - Qualifying Quota Share **Reinstatement Premium** Protection Third party legal liability **TRIA** recoveries Space Space launch Space operating Terrorism Workers comp/Employers liability Commercial RITC Personal stop loss **Political risks Contract frustration** Retrocession Whole account

#### **Placement Types**

Binder/Line Slip Cat XL Direct & Facultative Proportional Risk XS Stop Loss General/Unspecified

Syndicates will also need to record the approach taken to modelling the loss estimate for each segment, using the following categories.

#### **Modelling Types**

Market Share Maximum Line Premium Derived Modelled (AIR) Modelled (EQECAT) Modelled (RMS) Modelled Internally

# G MODELLING PRINCIPLES AND WORKED EXAMPLES

The calculation principles and recommended best practice set out in sections D and E should be followed in calculating loss estimates for all RDSs.

The following worked examples illustrate the differing approaches that can be taken to estimate the losses from an RDS event. The examples are based on property insurance contracts, with assumptions similar to those prescribed for the Florida Windstorm (landing in Miami-Dade and Pinellas) and California Earthquake (focussed on Los Angeles and San Francisco) events, detailed on pages 50 to 61. The principles and practices described are, however, applicable to a wide range of business classes.

Syndicates that use loss modelling software supplied by AIR, EQECAT or RMS have the option to make use of results for identified events within the event catalogues of those companies. However, in doing this, they must be satisfied that they have captured all of the affected exposures and lines of business in their return.

# WORKED EXAMPLES

#### Purpose

### **Example Insured Properties**

	TYPE			
	COMN	IERCIAL	RESIDENTIA	
COUNTY	ID	TIV	ID	TIV
	C1	100	R1	50
	C2	80	R2	40
v	C3	60	R3	30
^			R4	20
			R5	10
			R6	5
	C4	100	R7	20
	C5	60	R8	10
v	C6	60	R9	10
I.			R10	5
			R11	2
			R12	2
	C7	80	R13	20
	C8	50	R14	20
7	C9	40	R15	10
2			R16	2
			R17	2
			R18	2

Worked examples have been provided to illustrate the approaches that syndicates might adopt in calculating their loss estimates.

The worked examples are based on a simplified event, affecting three counties, X, Y, and Z.

Loss estimates are calculated for several theoretical contracts that cover the insured properties in the table opposite.

The insured properties have been separated by county and occupancy type.

TIVs, or Total Insured Values, in these examples are assumed to comprise of Building Value, Contents Value, and Business Interruption/Additional Living Expenses Values.

In these examples only TIVs will be considered.

An example event has been devised and the event description can be seen in the following table :

## **EVENT DESCRIPTION**

#### **GROUND UP DAMAGE FACTORS**

	COUNTY		
	Х	Y	Z
RESIDENTIAL	20%	10%	2%
COMMERCIAL	10%	5%	1%

INDUSTRY LOSS VALUES

INDUSTRY	INDUSTRY LOSS
RESIDENTIAL	10,000
COMMERCIAL	5,000

The worked examples deal with several methods that can be used in the calculation of loss estimates. Alternative methods to those demonstrated can be used.

The majority of the methods use the expected ground-up loss as the basis for the calculation. This can be calculated as the product of the insured value and a damage factor.

Once the expected ground-up loss has been calculated there are several approaches that can be used to calculate an estimate for the loss to the contract. Essentially, these methods are concerned with assessing the proportion of the expected ground-up loss that will fall within the contract layer. To do this, assumptions are made as to the distribution of values that the actual loss might take. Alternatively a 'first loss' curve can be used to estimate the effect of the Deductible and Limit.

# 'Modelled Internally' Methodologies

## Method 1: Bathwater



outcomes

### **Exposed Values**

When one of the following methodologies is used by syndicates to calculate a Loss Estimate, they should report the result in the RDS Reporting Software using the 'Modelled Internally' modelling type.

The principle behind this method is to assume that all outcomes generate a loss equal to the expected loss (i.e. there is no spread of possible values).

This is the simplest method, where the expected ground-up loss is determined, and then contract limits and deductibles are applied to that value, as illustrated.

The process to calculate the loss estimate is as follows :

Define the expected ground-up loss as EGUL, and then

Calculate

#### EGUL - DEDUCTIBLE

If this is less than zero then, the loss estimate is zero. If not then this needs to be compared with the Limit, and the loss estimate is the lesser of the two values.

By defining the Deductible as D, and the Limit as L, the estimate of loss to a contract is equal to

MIN(MAX(EGUL-D,0),L)

For a typical contract it is important to consider the potential maximum value that a syndicate could be exposed to.

If the TIV is below the Deductible then no loss can arise to the contract. If the TIV is above the Deductible then the potential loss is equal to the difference, subject to the Limit for the contract, as expressed in the following equation :

EXPOSED VALUE = MIN(MAX(TIV-D,0),L)

## Method 2: 'Zero or Total' Loss







cange of possible outcomes

The principle behind this method is to assume that a risk either experiences a total loss or zero loss, therefore the expected ground-up loss EGUL is equal to :

From the equation above the probability of a total loss is equal to :

#### P(Total Loss)=EGUL / TIV

If the expected ground-up loss has been calculated as

<b>T</b> D (	V	DAMAGE		EXPECTED
IIV	Х	FACTOR	=	GROUND UP LOSS

The formula for the probability of total loss can then be determined to be :

P(Total Loss) = DAMAGE FACTOR

If the TIV is less than the Deductible the loss estimate is zero.

The loss estimate is the area of the rectangle defined by the exposed values and the probability of a total loss. This area is equal to :

Substituting this into the equation for the loss estimate, gives the following expression for the loss estimate:

EXPOSED VALUE x DAMAGE FACTOR

In the previous method, loss was distributed between two values (Zero Loss or Total Loss). It is extremely unlikely that these are the only two loss values that could be observed. The 'Spike' method assumes that the value of the loss could be any value between the Total Insured Value and Zero.

Ideally, the distribution of the potential losses would be known, and a loss estimate could be calculated from this distribution. The actual distribution of potential loss values is difficult to ascertain, and is simplified by a decreasing, linear distribution in the Spike method, as illustrated in the diagram opposite.

The loss estimate returned using this methodology is the area indicated in the diagram.

The area shaded in the diagram can be calculated to be the area of the triangle above the Deductible less the area of the triangle above the Deductible and Limit.

Taking into consideration that the insured value may be less than the Deductible and the Limit, this area can be derived as:

- -

$$\mathsf{EGUL} \times \left[ \left( \frac{\mathsf{MAX} (\mathsf{TIV}\text{-}\mathsf{D},0)}{\mathsf{TIV}} \right)^2 \cdot \left( \frac{\mathsf{MAX} (\mathsf{TIV}\text{-}\mathsf{D}\text{-}\mathsf{L},0)}{\mathsf{TIV}} \right)^2 \right]$$

### Variation of Methods

The methods described above are all simple approximations of the actual distribution of loss around the expected ground-up loss.

The methods used can be adapted to use different distributions.

For many risks it is unrealistic for the maximum possible loss to be the Total Insured Value. In circumstances such as these it is possible to replace the TIV in the formula with an estimate of the maximum possible loss.

By adapting the methods in this way it is possible to adjust the calculation to reflect the characteristics of the contract. This can be seen below for the Spike method, where a lower maximum possible loss affects the magnitude of the loss estimate.



The possible reduction in the maximum possible loss has increased the area of the region bounded by the Deductible and Limit.

This reduction in the maximum possible loss would also have an affect on the 'Zero or Total' Loss method.

Further guidance on how to adapt the methods will be given in the RDS workshops.

The principle of this method is to assume a distribution for the range of possible values with a mean equal to the expected ground-up loss. This method samples values from that distribution which commonly has a standard deviation that is based on the mean, e.g. 3 times the mean.

Syndicates should first calculate the expected ground-up loss. An appropriate distribution (producing non-negative values only) should then be selected and parameterised to have a mean equal to the expected ground-up loss and an appropriate standard deviation. Possible distributions include the Beta, Gamma, Log Normal and the Truncated Normal (constrained to values above zero). A number of ground-up loss values should then be simulated.

Syndicates should then calculate the loss to the contract for each of the values sampled from the distribution. The loss estimate will then be the average of these.

A fuller explanation of this methodology will be given in the RDS workshops.

#### Method 4: Stochastic Sampling

## **Other Modelling Methods**

Method 5 : 'Maximum Line'

An alternative approach to estimating losses, in the absence of adequate exposure data, might be to base loss estimates on the specific terms of the contract or treaty. Examples where this might be used include 'Per Risk Excess of Loss' and 'Liability' contracts.

In using this approach, typical Gross Loss estimates will assume the total exhaustion of the relevant policy or treaty limits. Particular regard should be paid to occurrence and peril sublimits in this context. Partial exhaustion of limits may be justified with reference to historical losses, market share data, or expected ground-up loss estimates. Where material to the final result, the methodology and assumptions used should be described using the commentary facility in the RDS Reporting Software.

## Method 6 : 'Market Share'

In the absence of adequate exposure data, it may be necessary to estimate Gross Losses by considering the proportion of the total Industry Loss that will be borne by the syndicate. This proportion might be determined with reference to historical loss experience or the share of total market premium income received.

This method is applicable where there is a wide distribution of homogeneous exposures, say from a direct residential or workers compensation book. Business accepted through a binder or proportional reinsurance treaty might also be assessed using this method.

# **Example Contracts**

## **EVENT DESCRIPTION**

**GROUND UP DAMAGE FACTORS** 

	COUNTY					
	X Y Z					
RESIDENTIAL	20%	10%	2%			
COMMERCIAL	10%	5%	1%			

INDUSTRY LOSS VALUES

INDUSTRY	INDUSTRY LOSS
RESIDENTIAL	10,000
COMMERCIAL	5,000

# **Direct & Facultative Example**

## **D & F EXAMPLE CONTRACT**

INSURED PROPERTY	C1
COMMERCIAL	
TIV in X	100
TIV in Y	0
TIV in Z	0
TOTAL COMMERCIAL	100
RESIDENTIAL	
TIV in X	0
TIV in Y	0
TIV in Z	0
TOTAL RESIDENTIAL	0
TOTAL INSURED VALUE	100
DEDUCTIBLE	20
LIMITS	30

The following sections apply the illustrated methods to a variety of contract types.

All calculations use the damage factors from the example event, shown in the table opposite.

The Direct & Facultative example contract (shown opposite) is a 30 xs 20 contract that covers property C1.

Property C1 is a commercial property located in county X with an insured value of 100.

The event description provides a damage factor for commercial property in county X of 10%.

The expected ground-up loss can be determined as

100 x 10% = 10

The expected ground-up loss can be seen to be less than the contract Deductible, so there will be no loss to the contract if this method is used.

'Zero or Total' Loss Estimate

**Bathwater Estimate** 

The 'Zero or Total' Loss formula is:

#### EXPOSED VALUE x DAMAGE FACTOR

In this case the insured value is greater than the Deductible and the Limit, so the Limit should be used in the 'Zero or Total' Loss formula. Therefore, the Loss Estimate is equal to

30 x 10%

= 3

Spike Method Estimate	In this example the insured value is and the sum of the Deductible and Li	greater than the Deductible mit.
	The spike method formula is:	
	EGUL x [((TIV-D)/TIV) <sup>2</sup> -((TIV-D	-L)/TIV) <sup>2</sup> ]
	Inputting the values from the contract	t, the formula becomes:
	= 10 x [((100-20)/100) <sup>2</sup> -((100-20)/100) <sup>2</sup> -((10	0-30)/100) <sup>2</sup> ]
	= 3.9	
Stochastic Sampling	The expected ground-up loss estim distribution with a mean and stanc expected ground-up loss could produ	ate is 10. Sampling from a lard deviation based on the lice the following 20 values:
	6, 29, 5, 0, 7, 1, 0, 40, 0, 0, 61, 1,	, 0, 31, 46, 0, 0, 1, 1, 18,
	Applying the contract terms on each values:	value produces the following
	0, 9, 0, 0, 0, 0, 0, 20, 0, 0, 30, 0,	0, 11, 26, 0, 0, 0, 0, 0, 0
	Which have an average of :	
	4.8	
	which is the loss estimate for this me	thod.
Maximum Line	For this contract there is adequate loss estimate by other means; howe can still be calculated.	data available to calculate a ver a maximum line estimate
	The Limit for this contract is 30, whic loss to the contract.	ch is the initial estimate of the
	The syndicate should then con assumption of a ground-up loss of at	sider whether the implicit least 50 is reasonable.
Market Share	This method should not be used for a	a single risk.
Summary	Summarised below are the range of of this example.	possible outcomes in respect
	EXPECTED GROUND-UP LOSS	10.0
	LOSS ESTIMATES	
	BATHWATER	0.0
	ZERO OR TOTAL LOSS	3.0
	SPIKE METHOD	3.9

# **Binding Authority Example**

#### BINDER EXAMPLE CONTRACT

INSURED PROPERTY	ALL RESIDENTIAL
COMMERCIAL TIV in X TIV in Y TIV in Z TOTAL COMMERCIAL	0 0 0 <b>0</b>
RESIDENTIAL TIV in X TIV in Y TIV in Z TOTAL RESIDENTIAL	155 49 56 <b>260</b>
TOTAL INSURED VALUE	260
	•

The example Binding Authority ('Binder') contract is shown opposite, with a Deductible of 1 per risk covered. There are no individual limits for each risk.

The binder covers residential property in counties X, Y, and Z.

The contract has deductibles that are applied to individual risks. Therefore it is necessary to calculate the loss estimate for each risk in turn, then sum the results to produce a loss estimate for the contract.

The first step is to calculate the expected ground-up loss for each risk. This is shown in the table below.

	ID	τιν		DAMAGE FACTOR	EXPECTED GROUND UP LOSS
	R1	50	х	20% =	10
	R2	40	х	20% =	8
Х	R3	30	х	20% =	6
	R4	20	х	20% =	4
	R5	10	х	20% =	2
	R6	5	х	20% =	1
	R7	20	х	10% =	2
	R8	10	х	10% =	1
v	R9	10	х	10% =	1
T	R10	5	х	10% =	0.5
	R11	2	х	10% =	0.2
	R12	2	х	10% =	0.2
	R13	20	х	2% =	0.4
	R14	20	х	2% =	0.4
7	R15	10	х	2% =	0.2
2	R16	2	х	2% =	0.04
	R17	2	х	2% =	0.04
	R18	2	х	2% =	0.04

Summing the expected ground-up loss column produces the expected ground-up loss for the Binder of 37.

## **Bathwater Estimate**

**Other Methods** 

Summary

As the deductibles are per risk, the estimate needs to be calculated per risk as shown in the following table :

	ID	EXPECTED GROUND UP LOSS		DEDUCTIBLE		LOSS ESTIMATE
	R1	10	_	1	_	Q
	R2	8	_	1	=	7
х	R3	6	_	1	=	5
	R4	4	_	1	=	3
	R5	2	-	1	=	1
	R6	1	-	1	=	0
	R7	2	-	1	=	1
	R8	1	-	1	=	0
v	R9	1	-	1	=	0
'	R10	0.5	-	1	=	0
	R11	0.2	-	1	=	0
	R12	0.2	-	1	=	0
	R13	0.4	-	1	=	0
	R14	0.4	-	1	=	0
7	R15	0.2	-	1	=	0
-	R16	0.04	-	1	=	0
	R17	0.04	-	1	=	0
	R18	0.04	-	1	=	0

Where the expression for the loss estimate produces a negative result, the loss estimate is zero.

Summing the Loss Estimate column produces a loss to the contract of 26.

Other methods such as the "Zero or Total' Loss' and 'Spike' methods might be used, but their impact is unlikely to justify the additional effort, given the low Deductible and absence of a per risk Limit.

Also, given the homogeneous nature of most binders, particularly residential properties, a Market Share method may be appropriate.

Summarised below are the range of possible outcomes in respect of this example.

EXPECTED GROUND-UP LOSS 37.0

#### LOSS ESTIMATE

BATHWATER

26.0

# **Catastrophic Excess of Loss Example**

## CAT XL EXAMPLE CONTRACT

CAT XL EXAMPLE CONTRACT		The example Catastrophic Excess of Loss ('Cat XL') contract is
		shown opposite. It is a 250 xs 250 treaty for all the commercial properties that appear in the example insured properties.
INSURED PROPERTY		
COMMERCIAL TIV in X TIV in Y	240 220	The deductibles and limits apply to the contract as a whole, so the methodologies should be applied to the portfolio rather than to each individual risk.
TIV in Z TOTAL COMMERCIAL	170 <b>630</b>	The expected ground-up loss can be calculated by applying county damage factors to the insured values of each county.
RESIDENTIAL TIV in X	0	The expected ground-up loss, EGUL, can be determined as
TIV in Z TOTAL RESIDENTIAL	0 0	TIVS IN X X COUNTY X DAMAGE FACTOR
TOTAL INSURED VALUE	630	+ TIVS IN Y X COUNTY Y DAMAGE FACTOR
CONTRACT DEDUCTIBLES CONTRACT LIMITS	250 250	+ TIVS IN Z X COUNTY Z DAMAGE FACTOR
		= 240 x 10% + 220 x 5% + 170 x 1%
		= 36.7
		EGUL = 36.7
Bathwater Estimate		The contract is a 250 xs 250, therefore the contract is not exposed under the Bathwater method
'Zero or Total' Loss Estima	ite	The 'Zero or Total' Loss estimate is calculated using the formula
		EGUL x MIN(TIV – D,L) TIV
		The insured value is 630. This is larger than the sum of the Deductible and the Limit.
		Substituting the values into the formula gives :
		= 36.7 × 250 / 630
		= 14.6
		as the loss estimate.
Spike Method Estimate		The deductibles and the limits apply to the contract as a whole, which allows this method to be used.
		The total insured value is greater than the sum of the Deductible and Limit, so the formula for the loss estimate is
		EGUL x (((TIV-D)/TIV) <sup>2</sup> -((TIV-D-L)/TIV) <sup>2</sup> )
		Substituting the values into the formula gives :
		= 36.7 x $(((630-250)/630))^2 - ((630-250-250)/630))^2)$

= 11.8

11.8

Stochastic Sampling	Once the expected ground-up loss has been necessary to sample around the expected gro then apply contract terms.	calculated, it is und-up loss, and	
	RDS workshops.	be given in the	
Maximum Line	For this contract there is adequate data available to calculate a loss estimate by other means; however a maximum line estimate can still be calculated.		
	The Limit for this contract is 250, which would in loss of 500, which is extremely unlikely, given event description.	mply a ground-up the TIV and the	
	Partial exhaustion of limits may therefore reference to historical losses, market share da Possible Loss estimates.	be justified with ata, or Maximum	
Market Share	A market share approach cannot generally be u	ised for Cat XL.	
Summary	Summarised below are the range of possil respect of this example.	ole outcomes in	
	EXPECTED GROUND-UP LOSS	36.7	
	LOSS ESTIMATE		
	BATHWATER	0.0	
	ZERO OR TOTAL LOSS	14.6	

SPIKE METHOD

# **Risk Excess of Loss Example**

#### **RISK XS EXAMPLE CONTRACT**

MIN	МАХ	AVERAGE	NUMBER OF RISKS
0	10	5	200
10	20	15	75
20	30	25	30
30	40	35	15
40	50	45	3
DEDUCTIB	LE PER RISK		10
LIMIT PER	RISK		10
OCCURREI	NCE LIMIT		30

ALL RISKS ARE COMMERCIAL

The example Risk Excess of Loss ('Risk XS') contract is a 10 xs 10 with an occurrence Limit of 30.

The first step is to allocate the risks geographically. This can often be done using the risk profile that is contained in the contract, shown opposite.

In this example the risks are allocated using the following assumptions :

COUNTY ALLOCATION			
Х	30%		
Y	20%		
Z	10%		
OTHER	40%		

Which can then be used to find the assumed number of risks in each property band, in each county, as shown below:

AVERAGE	х	Y	Z
5	60.00	40.00	20.00
15	22.50	15.00	7.50
25	9.00	6.00	3.00
35	4.50	3.00	1.50
45	0.90	0.60	0.30

As information regarding each risk is unavailable, it is necessary to deal with each band's average value.

It is necessary to find the expected ground-up loss for each property band, for each county, calculated by multiplying the average value by the county damage factor.

In the following table, the entries are the expected ground-up loss for each county, for each property band.

	COUNTY			
AVERAGE	Х	Y	Z	
5	0.50	0.25	0.05	
15	1.50	0.75	0.15	
25	2.50	1.25	0.25	
35	3.50	1.75	0.35	
45	4.50	2.25	0.45	

Multiplying this table by the assumed number of risks in each property band in each county and summing the results gives a total Expected Ground-up Loss of 145.

The expected ground-up loss for each property band in each county is less than the Deductible, so the loss estimate using this method is zero.

#### **Bathwater Method**

### 'Zero or Total' Loss Method

Using the formula :

### EXPOSED VALUES x DAMAGE FACTOR

The following table can be produced :

	EXPOSED	PER RI	SK LOSS ES	TIMATE
AVERAGE	VALUES	Х	Y	Z
5	0	0.00	0.00	0.00
15	5	0.50	0.25	0.05
25	10	1.00	0.50	0.10
35	10	1.00	0.50	0.10
45	10	1.00	0.50	0.10

Where the table entries are the calculated Loss Estimates for each property. The exposed values have been calculated by considering the average property value in each band, along with the Deductible and Limit.

Multiplying the loss estimate per risk, by the assumed number of risks in each county determines the Loss Estimate for the each band, in each county.

	BAND LOSS ESTIMATE			
AVERAGE	Х	Y	Z	
5	0.00	0.00	0.00	
15	11.25	3.75	0.38	
25	9.00	3.00	0.30	
35	4.50	1.50	0.15	
45	0.90	0.30	0.03	

Summing the table entries produces a loss estimate of 35.06. This is higher than the occurrence Limit of 30.

The loss estimate is therefore 30.

It is necessary to apply the method to each property band, for each county.

Using the formula EGUL x  $(((TIV-D)/TIV)^2-((TIV-D-L)/TIV)^2)$  for every entry in the expected ground-up loss table produces the following table :

	PER RI	SK LOSS ES	TIMATE
AVERAGE	Х	Y	Z
5	0.00	0.00	0.00
15	0.17	0.08	0.02
25	0.80	0.40	0.08
35	1.14	0.57	0.11
45	1.33	0.67	0.13

Multiplying this table with the geographical distribution of risks table produces loss estimate for each band:

	BAND LOSS ESTIMATE			
AVERAGE	Х	Y	Z	
5	0.00	0.00	0.00	
15	3.75	1.25	0.13	
25	7.20	2.40	0.24	
35	5.14	1.71	0.17	
45	1.20	0.40	0.04	

Summing all entries produces a loss estimate of 23.6, which is less than the occurrence Limit of 30.

The loss estimate is therefore 23.6.

Spike Method

Stochastic Sampling	This method can be used, although it is to use this method to calculate a 'per risk county.	important to remember loss estimate' for each	
	Further information on this approach wil workshops.	I be given in the RDS	
Maximum Line	For this contract there is adequate data available to calculate a loss estimate by other means; however a maximum line estimate can still be calculated.		
	The occurrence Limit for this contract is 3 of this Limit would imply that at least th ground-up losses of at least 20 had a appear unreasonable given the average number of higher value properties	30 and total exhaustion ree individual property risen, which does not levels of damage and	
Summary	Summarised below are the range of respect of this example.	possible outcomes in	
	EXPECTED GROUND-UP LOSS	145	
	LOSS ESTIMATES		
	BATHWATER	0	
	ZERO OR TOTAL LOSS	30	
	SPIKE	23.6	
	MAXIMUM LINE	30	
### H 'EVENT SUBSET' SUBMISSIONS BY SYNDICATES WITH LOSS MODELLING SOFTWARE

Optional Submission of 'Event Subset' Results	Although Lloyd's does not currently require syndicates to make use of loss modelling software, the April 2004 RDS exercise includes a request, for those syndiates that are able, to submit modelled results against a number of events ('Event Subsets') from within the event catalogues of the three main software providers.
	Those syndicates that are able to submit modelled results against the 'Event Subsets' advised by AIR, EQECAT or RMS are kindly asked to do so. Standard output files should be submitted, showing mean expected Gross Loss figures for each event in the Event Subset.
	Details of the 'Event Subsets' and the required output files have been developed in collaboration with the modelling companies and syndicates should contact them in the first instance.
	Syndiates' submissions will be used to assist Lloyd's in the benchmarking of the specified events for California Earthquake and Florida Windstorm. They will <u>not</u> be used as part of the assessment of the risk posed by individual syndicates (i.e. they will not be used in assessing compliance with Franchise Performance guidelines or as input to Lloyd's Risk Based Capital system).
Breakdown of Results by Business Type	To assist Lloyd's in its understanding of the make-up and different characteristics of business written in the market, syndicates are also asked to split results by broad business type. It is recommended that results should be split between 'Direct & Facultative', 'Treaty' and 'Binder'. Other splits are acceptable, as long as the total loss figures for each event can be readily derived for each syndicate.
	Lloyd's intends to provide feedback and 'benchmarking' analysis to participating managing agents. Any such analysis will be anonymous, to protect confidentiality.
Future Reporting	For 2005, future RDS reporting will be based on an increased number of events, for each peril region.

# **REALISTIC DISASTER SCENARIOS** APRIL 2004

### **SCENARIOS AND EVENTS**

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## 1 USA WINDSTORM

Assume a US\$60 billion insured loss arising from a windstorm in the United States.

Syndicates are recommended to consider either a windstorm in the Gulf of Mexico or a tropical windstorm that transitions into a frontal system which strikes the North East of America, towards New York.

The methodology and assumptions used by the syndicate should be described using the commentary facility in the RDS Reporting Software.



## 2 MARINE EVENT

Scenarios (report both events and complete the questionnaire) Syndicates should return a marine loss scenario for both of the following two incidents. This increased reporting requirement has been introduced in recognition of the greater loss potential posed by cruise vessels and because of the differing characteristics of the two scenarios. In both scenarios, excess layers of liability, hull and cargo should be included based on maximum Aggregate exposures. In addition to completing a return for both scenarios, syndicates should complete the Marine Questionnaire issued with the RDS Reporting Software (see below for further details).

# Marine Collision in Prince William Sound

A fully laden tanker calling at Prince William Sound is involved in a collision with a cruise vessel carrying 500 passengers and 200 staff and crew. The incident involves the tanker spilling its cargo and loss of lives aboard both vessels.

- Assume 70% tanker owner / 30% cruise vessel apportionment of negligence and that the collision occurs in US waters.
- Assume that the cost to the tanker owner and cruise vessel of the oil pollution is US\$2bn. This would lead to oil pollution recoveries on the International Group of P&I Associations' General Excess of Loss Reinsurance Programme (IG Reinsurance Programme) of US\$1bn and US\$0.6bn respectively.
- Assume 125 fatalities, 125 persons with serious injuries and 250 persons with minor injuries: with average compensation of US\$1.5 million for each fatality, US\$2.5 million for each person with serious injuries and US\$0.5 million for each person with minor injuries.

The following diagram illustrates the structure of losses to the tanker and cruise vessel owners on the IG Reinsurance Programme.



Shaded areas represent the losses to the Programme.

### **Major Cruise Vessel Incident**

A U.S. owned cruise vessel is sunk or severely damaged with attendant loss of life, bodily injury, trauma and loss of possessions. Claims to be heard in a Florida court.

Assume 500 passenger fatalities and 1,500 injured persons with average compensation of US\$2 million for each fatality and US\$1 million for each injured person. In addition, assume an additional Protection and Indemnity loss of US\$500 million to cover costs such as removal of wreck and loss of life and injury to the crew.

The following diagram illustrates the structure of losses on the IG Reinsurance Programme.



Shaded areas represent the losses to the Programme

**Marine Questionnaire** 

It is recognised that a standard and comprehensive approach to the management of aggregate exposures has not yet been developed for the marine market. To help Lloyd's understand the nature of this challenge and identify possible approaches that might be taken, a questionnaire has been included with the April 2004 RDS exercise. This questionnaire should be completed by all syndicates that submit a Marine RDS.

The questionnaire is divided into three sections:

- Profile of marine policies (general and RDS specific)
- Current management of risk
- Appetite for and feasibility of developing a system to aid assessment of marine exposures.

The first section of the questionnaire is largely based on the Marine RDS and therefore we recommend that the Marine RDS should be completed prior to the questionnaire. All three sections should be completed. Additional instructions and guidance are included in the guestionnaire software.

## 3 NORTH SEA – LOSS OF MAJOR COMPLEX

Assume a total loss to all platforms and bridge links of a major North Sea Complex.

Include property damage, removal of wreckage, liabilities, loss of production income and capping of well.

Syndicates should use the commentary facility in the RDS Reporting Software to name the complex and to provide details of modelling assumptions.

## 4 AVIATION COLLISION

Assume a collision between 2 aircraft over a major city, anywhere in the world, using the syndicate's two highest airline exposures.

Assume a total liability loss of up to US\$4 billion: comprising of up to US\$2 billion per airline and any balance up to US\$1 billion from an Air Traffic Control liability policy(ies) and/or a Major Product Manufacturer's product liability policy(ies), where applicable.

Consideration should be given to other exposures on the ground. Assumptions should be stated clearly using the event commentary facility in the RDS Reporting Software.

Syndicates should include details of the following information in their return :

- the city over which the collision occurs;
- the airlines involved in the collision;
- the airline policy limits and syndicate's line and exposure per policy;
- maximum hull value per aircraft involved;
- maximum liability per aircraft involved;
- name of each product manufacturer and the policy limits applicable to it; and
- name of the air traffic control authority and the policy limits applicable to it.

## 5 MAJOR RISK LOSS

Assume a loss to the syndicate's largest single risk that results in the total exhaustion of policy limits, including a 'PML failure', together with any other potential interests which may arise from additional perils (business interruption or liabilities) or other methods of acquisition (e.g. Per Risk Excess of Loss).

The methodology and assumptions used by the syndicate should be described using the commentary facility in the RDS Reporting Software.

## 6 SATELLITE RISKS

Scenarios (report all three events)

Syndicates should return satellite loss information relating to each of the following three events, if one or more of these events produces a loss in excess of the 'de-minimis' standard described in section B.

A satellite schedule will be distributed along with the RDS Reporting Software to enable syndicates to complete a full return for the generic defect and launch failure scenarios.

**Proton Flare** 

A proton flare is a vast outpouring of protons that can result in permanent damage to semiconductor devices, particularly solar array cells. A large proton flare could result in a significant number of satellites losing some of their power generating capability.

Satellite orientation, age and make will also determine how a proton flare will affect a satellite. However, a single large proton flare (or a number of smaller flares in close succession) has the potential to affect all geostationary satellites and could result in a loss of power by all satellites.

For the purposes of this RDS it should be assumed that either a single anomalous large proton flare or a number of flares in quick succession results in a loss to all satellites in geostationary orbit. All live exposures in this orbit will be affected by the proton flare. Syndicates should assume a 5% insurance loss to all affected policies.

The loss under this RDS will therefore be:

#### (Insured Satellites Value) x (Loss to Policy)

Therefore if a syndicate's share of an insured satellite is US\$10,000,000, the loss to the syndicate would be calculated as :

US\$10,000,000 x 5%

=US\$500,000

Syndicates should note that under this RDS, "Total Loss Only" policies, component specific policies and policies not covering power losses will not be triggered.

### **Generic Defect**

An undetected generic defect in a number of operational satellites has the potential to cause significant losses to the space insurance market. During the time it takes for a generic defect to emerge, many more satellites of the same model/variant may have been launched.

For the 2004 RDS return, syndicates should report against those satellites that are in the following model/variant groups :

- A2100, A2100AX and A2100AX2
- Boeing 376HP (HS-376HP) and 376W
- Boeing 601 Modified and Boeing 601HP (HS 601HP)
- Boeing 702 (HS 702), Boeing 702 Modified and 702 MP
- Boeing GEM (HS GEM) and Modified
- Eurostar E2000, E2000+
- Express A, AM, M
- Insat 2 and Insat 3
- LS 1300 (FS 1300), LS 1300 (GOES- NEXT), LS 1300 HL (Extended)
- Spacebus 3000B2, Spacebus 3000133
- Star 1 (Starbus)
- Star 2

For the purpose of this RDS, syndicates should assume the following damage levels when calculating their gross and net exposures for each model/variant group, for launches which have occurred in the last five years :

Period Remaining on Policy	Percentage of Satellites that suffer a Total Loss
Greater than 24 months	100%
18 months – 24 months	80%
12 months – 18 months	60%
6 months – 12 months	40%
Under 6 months	20%

The results should be calculated by taking the sum of the model/variant group exposures within each time period and multiplying them by the respective percentage (e.g. 20% of the total exposure for the Eurostar E2000, E2000+ model/variant group that have less than 6 months left on their policy).

Syndicates should report full details (using the RDS Reporting Software) of their largest potential Net Loss due to a generic defect in a single model/variant, as listed above. Syndicates should also complete the satellite generic defect schedule for all model variants shown. When completing this schedule, please include Aggregate Exposure, Gross Loss, Net Loss and the number of satellites for each model/variant on the list.

Syndicates should assume that all satellites affected are considered to suffer a constructive total loss.

The names of satellites within each group to be considered will be issued with the RDS Reporting Software.

### Launch Failure

For this RDS, syndicates should assume that a launch failure leads to the total loss of the satellite(s) on launch.

Only policies that include launch risks will be affected by this scenario.

Launch failures should be assumed to occur as at 1 April 2004.

Below is the current list of the future proposed commercial launches to all orbits during the 12 month period from 1 April 2004 to 31 March 2005.

Syndicates should report their largest Net Loss for a launch (by launch number). Syndicates should note that four satellites are scheduled together on launch FL00573 and two satellites on launch FL00382.

In order to enable Lloyd's to assess the market's potential loss in the event that more than one satellite is rescheduled on to the same launch vehicle at a future date, syndicates are required to complete the satellite launch schedule distributed with the RDS Reporting Software.

When completing this schedule, please include Gross and Net Loss figures.

Launch No.	Satellite	Date	Vehicle	Туре
FL02178	SUPERBIRD 6	16/04/2004	ATLAS IIAS	BOEING 601 MODIFIED
FL02549	DIRECTV 7S	02/05/2004	ZENIT 3 SL (SEA LAUNCH)BLOK DM-SL	LS-1300 (FS-1300)
FL02313	AMC-11 (AMERICOM 11)	19/05/2004	ATLAS IIAS	A2100A
FL00723	SPACEWAY 1	/06/2004	ZENIT 3 SL (SEA LAUNCH)BLOK DM-SL	BOEING 702 MODIFIED
FL01723	XTAR-EUR	/06/2004	ARIANE 5 ECA	LS-1300 Unknown
FL02486	TELESAT ANIK F-2 (WILDBLUE 2)	/06/2004	ARIANE 5G PLUS	BOEING 702 MODIFIED
FL01325	TELSTAR 8	/07/2004	ZENIT 3 SL (SEA LAUNCH)BLOK DM-SL	LS-1300 HL (EXTENDED)
FL02456	SATMEX 6 (MORELOS 4)	/07/2004	ARIANE 5G PLUS	LS-1300 X (FS-1300 X)
FL02460	AMAZONAS 1	/07/2004	PROTON M/BREEZE M (8K82KM)	EUROSTAR E3000S
FL00724	SPACEWAY 2	Q3 2004	ZENIT 3 SL (SEA LAUNCH)BLOK DM-SL	BOEING 702 MODIFIED
FL01470	WORLDSAT 2	Q3 2004	PROTON M/BREEZE M (8K82KM)	SPACEBUS 4000
FL02413	TELSTAR 18 (APSTAR 5)	Q3 2004	ZENIT 3 SL (SEA LAUNCH)BLOK DM-SL	LS-1300 (FS-1300)
FL02540	AMC-15 (AMERICOM 15)	/08/2004	PROTON M/BREEZE M (8K82KM)	A2100AX
FL02598	IPSTAR-1	/09/2004	ARIANE 5GS	LS-1300 SX (FS-1300 SX)
FL00623	EROS B1	Late 2004	START 1 (SL-18)	OFEQ/OFEK 3
FL01792	M2A-F1	Late 2004	DELTA IVM +5,4	LS-1300 (FS-1300)
FL02589	INMARSAT 4-F1	/10/2004	ATLAS V 431	EUROSTAR E3000GM
FL00872	THURAYA 3	Q4 2004	Unspecified	BOEING GEM MODIFIED
FL02233	MTSAT 1R	/11/2004	H-2A2022	LS-1300 (FS-1300)
FL02255	TRAILBLAZER LUNAR MISSION	Q4 2004	DNEPR 1	
FL02489	XM-3	/11/2004	ZENIT 3 SL (SEA LAUNCH)BLOK DM-SL	BOEING 702MP MODIFIED
FL00573	GLOBALSTAR D9-1	/12/2004	DELTA II 7420-10	LS-400 GLOBALSTAR
FL00573	GLOBALSTAR D9-2	/12/2004	DELTA II 7420-10	LS-400 GLOBALSTAR
FL00573	GLOBALSTAR D9-3	/12/2004	DELTA II 7420-10	LS-400 GLOBALSTAR
FL00573	GLOBALSTAR D9-4	/12/2004	DELTA II 7420-10	LS-400 GLOBALSTAR
FL02490	GALAXY 5R (PANAMSAT LIGHT 2)	/12/2004	ARIANE 5GS	STAR 2
FL00382	YAMAL 203	/01/2005	PROTON	YAMAL 200
FL00382	YAMAL 204	/01/2005	PROTON	YAMAL 200
FL01756	WILDBLUE 1 (ISKY 1)	/01/2005	ARIANE 5G STANDARD	LS-1300 Unknown
FL01572	INSAT 3D	/02/2005	GSLV 2	INSAT 3
FL01753	TELKOM 2	/02/2005	ARIANE 5G STANDARD	STAR 2
FL02531	DIRECTV 8	Q1 2005	Unspecified	LS-1300 (FS-1300)
FL02447	SLES 1	Q1 2005	ARIANE 5 Unspecified	
FL02374	APSTAR 6	Early 2005	LONG MARCH 3B-4 (CZ-3B-4)	SPACEBUS 4000

## 7 LIABILITY RISKS

Scenarios (report largest Net Loss)	Syndicates should return a liability loss scenario based on one of the following, selecting whichever scenario provides the highest Net Loss to the syndicate.
US Laddering	A US 'laddering' scenario involving improper conduct by firms in connection with initial public offerings. This conduct results in a combined Securities Exchange Commission (SEC) class action, with the litigation involving the syndicate's 5 largest assureds to the full slip limits.
UK Pensions Mis-selling	A UK pensions mis-selling scenario, involving the syndicate's 5 largest assureds to the full slip limits.
Failure/Collapse of a Major Corporation	A failure/collapse of a major corporation, involving the syndicate's 5 largest assureds to the full slip limits.
Failure of a Merger	A failure of a merger, involving the syndicate's 5 largest assureds to the full slip limits.
Failure of a Construction Project	A failure of a construction project, involving the syndicate's five largest assureds (for example, architects, surveyors and engineers) to the full slip limits.

## 8 POLITICAL RISKS

This RDS is designed to capture the effects of a series of attritional losses arising from unrelated causes. The aim of this RDS is to test the cumulative potential loss effect of a series of losses against the available horizontal reinsurance protection.

Where syndicates have already designed internal disaster scenarios on this basis, they should enter the data in the relevant screen. For syndicates that have not designed a tailor-made scenario, the following methodology should be adopted when completing the return.

For your largest exposed country assume a deteriorating political and economic environment in the country in question causing losses to the top 10 individual risks as at 1 April 2004 from differing non-aggregating causes. The following classes of business should be specifically included: political risks, contract frustration, aircraft repossession/CEND (Confiscation, Expropriation, Nationalisation and Deprivation of project assets), credit risks and financial guarantee exempted classes. Relevant exposures within the property and cargo classes should also be included. All political risk specific reinsurances should be added, together with other specifics as may be applicable, being war and/or cargo. Whole account reinsurances should be included as applicable.

#### **ALTERNATIVE RDS: A** 9

Syndicates should list two further realistic events not listed above for scenarios numbered 9 and 10.

For example, syndicates with substantial exposures to :

- earthquakes outside of California, New Madrid and Japan;
- a major flood incident;development of long-tail liabilities; or
- terrorism outside of Manhattan,

could use the 'Alternative' scenarios to report these.

## 10 ALTERNATIVE RDS: B

A further alternative scenario, as described above.

# 11 SECOND EVENT

Syndicates should model on an 'as if' basis the occurrence of Hurricane Andrew in the immediate aftermath of a Northridge earthquake.

Both events should approximate to a US\$20bn Insured Industry Loss.

Syndicates should assume that these events fall in the same reinsurance year and that there has not been sufficient time between events to purchase additional reinsurance protection.

## **Overhauled RDSs for Florida Windstorm and California Earthquake**

Development of New Events	New RDSs have been developed which will provide a more comprehensive and consistent assessment of risk to syndicates and Lloyd's from both the Florida Windstorm and California Earthquake scenarios. Lloyd's has been assisted in this process by AIR, EQECAT and RMS. The prescribed assumptions for the events within these scenarios have been arrived at following a detailed review of data provided by each of these companies.
Events Defined by Industry Loss	The revised RDSs for Florida Windstorm and California Earthquake have been defined with reference to the expected ground-up Industry Loss that they will generate for Commercial and Residential property insurance, after allowance for the take-up of relevant insurance cover.
	The assumed levels of Industry Loss have been determined after consultation with the market and catastrophe loss modelling companies, based on a target return period of 250 years (i.e. having an exceedance probability of 0.4%). Lloyd's has chosen these levels as US\$70bn for a Florida Windstorm and US\$54bn for a California Earthquake.
	However, it should be noted that divergent views exist between the three modelling companies as to the return periods that should be attached to these Industry Loss levels. In view of these divergent opinions, the continuing development of catastrophe loss modelling technology and the infrequent occurrence of major catastrophic events that can be used to calibrate the models for higher return periods, the new RDS events should be described with reference to the level of Industry Loss that they will generate.
Events Specified at County Level	To provide consistent guidance to managing agents, the events have also been specified at county level, in terms of the expected distribution of property values across each state and the ground-up damage factors that should be applied.
Defined Event 'Footprint'	The Footprint for each event has been defined with reference to those counties that are subject to a damage factor greater than zero, as detailed in the 'Aggregate Footprint' column of the Event Damage Factor Tables. By using this specified Footprint, a consistent assessment of potential exposures can be undertaken.
Use of Modelling Software	Syndicates may use catastrophe loss modelling software, as produced by AIR, EQECAT or RMS, to model their expected loss exposures. Lloyd's recognises results produced through the appropriate use of these packages for submission under the RDS exercise, provided that the reporting requirements within the RDS Reporting Software are met and that all relevant exposures and lines of business are included in the return.
	Event IDs can be obtained from AIR, EQECAT and RMS, for the events within their event catalogues that correspond to the assumptions prescribed by Lloyd's.
Two Events for Each Peril	As a result of the RDS overhaul, the number of events relating to the Florida Windstorm and California Earthquake peril regions has been increased from one to two. This will provide a fuller assessment of the potential exposures that a syndicate and the market may have. It is also designed to reduce the risk of a syndicate developing a bias towards exposures outside the Footprints of the specified RDSs.

# 12 FLORIDA WINDSTORM

### **Distribution of Florida Property Values**

The map below illustrates Lloyd's assumptions for the distribution of property values within Florida, which are also detailed in the Event Damage Factor Tables.



### **Major Ports**

Below is a table of the main ports in Florida, which syndicates should consider in assessing their potential exposures. They should also have regard to exposures in smaller ports that fall within the Footprint of the events.

Port	County
Jacksonville	Duval
Miami	Miami-Dade
Palm Beach	Palm Beach
Panama City	Bay
Port Canaveral	Brevard
Port Everglades	Broward
Port Manatee	Manatee
Pensacola	Escambia
Tampa	Hillsborough

### **Major Airports**

Below is a table of the main international airports in Florida, which syndicates should consider in assessing their potential exposures. They should also have regard to exposures in smaller airports that fall within the Footprint of the events.

Airport	County
Fort Lauderdale/Hollywood (FLL)	Broward
Miami (MIA)	Miami-Dade
Orlando (MCO)	Orange
Tampa (TPA)	Hillsborough

### FLORIDA WINDSTORM – EVENT ONE

### Miami-Dade Hurricane Event

A US\$70 Billion ground-up property Industry Loss from a Florida Hurricane landing in Miami-Dade County.

#### ⊕\_\_\_\_ampa Osceola $\odot$ Clearwater Brevard Hillsborough St.® Polk Indian River Petersburg (Ĵ Manatee Hardee Okeechobee St. Lucie Highlands DeSoto Sarasota D STAT UNIT Ē ES Martin Charlotte Glades Lake Okeechobei FLORIDA Atlantic Palm Beach £ Lee Ocean .Hendry 🚯 Port Airport Ocral Springs of Florida 25% Broward Fort Lauderdale Collier Pembroke Ground-Up Pines Straits Residential 6 13% Hollywood Demage Factor Within County 🕀 🖞 iami THE BAHAMAS 0% S. Dothan GEORGIA Jacksonville Monroe 'EA Tallahassee Palm Coast Gainesville Priando Venice Ladv Lake Gulf of Mexico EU ORIDA Freeport Ci Im Miami

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#### **Insured Industry Loss Levels**

Syndicates should assume the following components of the loss.

Residential Property	US\$47,000,000,000
Commercial Property	US\$23,000,000,000
Workers Compensation	US\$1,000,000,000
Auto	US\$2,000,000,000

Syndicates should consider what other lines of business would be affected by the event. Particular consideration should be given to losses arising from :

Marine Specie/Fine Art Personal Accident Aviation Liability

### **Event Footprint**

The map below illustrates the Footprint and damage levels for the Miami-Dade Hurricane Event, which are also detailed in the Event Damage Factor Table.

### Exclusion of Contingent Business Interruption Losses

Lloyd's recognises the difficulties involved in modelling losses from Contingent Business Interruption (CBI) covers. Syndicates should therefore exclude CBI losses from this event. Future development work is planned to address this issue.

### Miami-Dade Hurricane Event Damage Factor Table

COUNTY	COUNTY	PROPERTY VALUE	AGGREGATE	GROUND-UP DA	MAGE FACTORS
NAME	NUMBER	DISTRIBUTION	"FOOTPRINT"	RESIDENTIAL	COMMERCIAL
Alachua	001	1.2%			
Baker	003	0.1%			
Bay	005	0.9%			
Bradford	007	0.1%	1000/		
Brevard	009	2.6%	100%	0.01%	7.000/
Broward	011	11.0%	100%	12.70%	7.30%
Cainoun	015	0.7%	100%	0 020/	0.36%
Charlotte	015	U.1%	100%	0.83%	0.30%
Clav	010	0.770			
Collier	019	2.0%	100%	1 33%	0.96%
Columbia	023	0.2%	10070	1.0070	0.3070
Desoto	027	0.1%	100%	0.37%	0 10%
Dixie	029			0.00.00	
Duval	031	5.5%			
Escambia	033	1.6%		1	
Flagler	035	0.2%			
Franklin	037				
Gadsden	039	0.2%			
Gilchrist	041				
Glades	043		100%	1.20%	0.40%
Gulf	045	0.1%			
Hamilton	047	- 404	1000/	2.200/	5 2001
Hardee	049	0.1%	100%	0.08%	0.02%
Hendry	051	0.1%	100%	1.82%	0.83%
Hernando	053	0.0%	100%	0.110/	0.020/
Highlanus	055	U.4% 7.0%	100%	0.1170	0.03%
	050	1.070	10070	0.02 /0	U.U I /0
Indian River	061	0.170	100%	0.07%	0.02%
Jackson	063	0.2%	10070	0.01 /0	0.0270
Jefferson	065	0.2,0			
l afavette	067				
Lake	069	0.9%			
Lee	071	2.8%	100%	1.30%	0.70%
Leon	073	1.3%		1	
Levy	075	0.1%			
Liberty	077				
Madison	079	0.1%			
Manatee	081	1.5%	100%	0.12%	0.04%
Marion	083	1.3%		- 200/	- 1001
Martin	085	1.1%	100%	0.36%	0.19%
Miami-Dade	086	14.0%	100%	22.20%	15.10%
Monroe	087	0.8%	100%	0.66%	0.34%
Nassau	089	0.3%		+	
Okacoshohee	003	0.9%	100%	0.18%	0.04%
Orango	095	0.1/0	10070	U. 10 /0	U.U+ /0
Osceola	090	0.5%	100%	0.01%	
Palm Beach	099	10.0%	100%	1.89%	1 28%
Pasco	101	1.5%	100%	0.01%	1.2070
Pinellas	103	6.0%	100%	0.03%	0.01%
Polk	105	2.4%	100%	0.02%	
Putnam	107	0.3%			
Santa Rosa	113	0.5%			
Sarasota	115	2.6%	100%	0.01%	0.01%
Seminole	117	2.4%	100%	0.06%	0.01%
St. Johns	109	0.8%			
St. Lucie	111	0.9%	100%	0.81%	0.28%
Sumter	119	0.1%			
Suwannee	121	0.1%			
Taylor	123	0.1%			
Union	125	0.49			
Volusia	127	2.4%			
Wakulla	129	0.1%		+	
Walton	131	0.2%			
vvasninninn	1.3.3	1 1%			

### FLORIDA WINDSTORM – EVENT TWO

### **Pinellas Hurricane Event**

**Insured Industry Loss Levels** 

A US\$70 Billion ground-up property Industry Loss from a Florida Hurricane landing in Pinellas County.

The map below illustrates the Footprint and damage levels for the Pinellas



### **Event Footprint**

Syndicates should assume the following components of the loss.

Residential Property	US\$45,000,000,000
Commercial Property	US\$25,000,000,000
Workers Compensation	US\$1,000,000,000
Auto	US\$2,000,000,000

Syndicates should consider what other lines of business would be affected by the event. Particular consideration should be given to losses arising from :

Marine Specie/Fine Art Personal Accident Aviation Liability

### Exclusion of Contingent Business Interruption Losses

Lloyd's recognises the difficulties involved in modelling losses from Contingent Business Interruption (CBI) covers. Syndicates should therefore exclude CBI losses from this event. Future development work is planned to address this issue.

### Pinellas Hurricane Event Damage Factor Table

COUNTY	COUNTY	PROPERTY VALUE	AGGREGATE	GROUND-UP DAMAGE FACTORS	
NAME	NUMBER	DISTRIBUTION	"FOOTPRINT"	RESIDENTIAL	COMMERCIAL
Alachua	001	1.2%	100%	0.21%	0.16%
Baker	003	0.1%	100%	0.03%	0.02%
Bay	005	0.9%			
Bradford	007	0.1%	100%	0.15%	0.09%
Brevard	009	2.6%	100%	0.59%	0.49%
Broward	011	11.0%			
Calhoun	013				
Charlotte	015	0.7%	100%	3.40%	1.05%
Citrus	017	0.7%	100%	2.14%	1.67%
Clav	019	0.6%	100%	0.25%	0.18%
Collier	021	2.0%	100%	0.17%	0.13%
Columbia	023	0.2%	100%	0.01%	
Desoto	027	0.1%	100%	1.69%	0.82%
Dixie	029		100%	0.04%	0.01%
Duval	031	5.5%	100%	0.14%	0.10%
Escambia	033	1.6%			
Flagler	035	0.2%	100%	0.72%	0.45%
Franklin	037				
Gadsden	039	0.2%			
Gilchrist	041		100%	0.05%	0.03%
Glades	043		100%	0.40%	0.27%
Gulf	045	0.1%			
Hamilton	047				
Hardee	049	0.1%	100%	3.14%	1.40%
Hendry	051	0.1%	100%	0.13%	0.08%
Hernando	053	0.6%	100%	6.00%	3.28%
Highlands	055	0.4%	100%	1.27%	0.72%
Hillsborough	057	7.0%	100%	16.30%	13.40%
Holmes	059	0.1%			
Indian River	061	0.8%	100%	0.12%	0.08%
Jackson	063	0.2%			,-
Jefferson	065				
Lafavette	067				
Lake	069	0.9%	100%	4.00%	2.68%
Lee	071	2.8%	100%	0.66%	0.35%
Leon	073	1.3%			
Levv	075	0.1%	100%	0.75%	0.34%
Liberty	077				
Madison	079	0.1%			
Manatee	081	1.5%	100%	32.80%	22.00%
Marion	083	1.3%	100%	1.43%	0.89%
Martin	085	1.1%	100%	0.02%	0.01%
Miami-Dade	086	14.0%			
Monroe	087	0.8%			
Nassau	089	0.3%	100%	0.04%	0.02%
Okaloosa	091	0.9%			
Okeechobee	093	0.1%	100%	0.37%	0.26%
Orange	095	6.5%	100%	3.38%	2.46%
Osceola	097	0.7%	100%	4.48%	3.48%
Palm Beach	099	10.0%			
Pasco	101	1.5%	100%	9.60%	6.70%
Pinellas	103	6.0%	100%	27.20%	19.30%
Polk	105	2.4%	100%	12.50%	9.20%
Putnam	107	0.3%	100%	0.98%	0.50%
Santa Rosa	113	0.5%	100%	1.35%	0.09%
Sarasota	115	2.6%	100%	10.90%	11.60%
Seminole	117	2.4%	100%	1.87%	1.63%
St. Johns	109	0.8%	100%	0.03%	0.01%
St. Lucie	111	0.9%	100%	2.84%	1.45%
Sumter	119	0.1%	100%	3.60%	2.04%
Suwannee	121	0.1%			
Taylor	123	0.1%			
Union	125		100%	0.06%	0.03%
Volusia	127	2.4%	100%	1.30%	0.81%
Wakulla	129	0.1%			
Walton	131	0.2%			
Washington	133	0.1%			

# 13 CALIFORNIA EARTHQUAKE

### Distribution of Property Values in California

The map below illustrates Lloyd's assumptions for the distribution of property values within California, which are also detailed in the Event Damage Factor Table



### **Major Ports**

Below is a table of the main ports in California, which syndicates should consider in assessing their potential exposures. They should also have regard to exposures in smaller ports that fall within the Footprint of the events.

Port	County
Long Beach	Orange
Los Angeles	Los Angeles
Oakland	Alameda
Port Hueneme	Ventura
Richmond	Contra Costa
San Diego	San Diego
San Francisco	San Francisco
Stockton	San Joaquin

### **Major Airports**

Below is a table of the main international airports in California, which syndicates should consider in assessing their potential exposures. They should also have regard to exposures in smaller ports that fall within the Footprint of the events.

Airport	County
Los Angeles (LAX)	Los Angeles
San Diego-Lindbergh (SAN)	San Diego
San Francisco (SFO)	San Francisco
San Jose (SJC)	San Jose

### **CALIFORNIA EARTHQUAKE – EVENT ONE**

### Los Angeles Earthquake Event

Insured Industry Loss Levels

A US\$54 Billion ground-up property (shake and fire-following), Industry Loss from an earthquake originating from the Elsinore Fault in Los Angeles.

The map below illustrates the Footprint and damage levels for the

Los Angeles Earthquake Event, which are also detailed in the Event Damage



Factor Table.

### **Event Footprint**

Syndicates should assume the following components of the loss.

Residential Property	US\$24,000,000,000
Commercial Property	US\$30,000,000,000
Workers Compensation	US\$5,000,000,000
Auto	US\$1,000,000,000

Syndicates should consider what other lines of business would be affected by the event. Particular consideration should be given to losses arising from :

Marine Specie/Fine Art Personal Accident Aviation (except Hull) Liability

Exclusion of Contingent Business Interruption Losses	Lloyd's recognises Contingent Busines exclude CBI losses address this issue.	the s Inter from t	difficulties rruption (CB this event.	involved I) covers. Future dev	in Sy /elo	modelling ndicates sho pment work	losses ould the is planr	from refore red to

**Exclusion of Aviation Hull Losses** 

Lloyd's also recognises the difficulties involved in estimating the Aviation Hull losses that would arise from an earthquake, and syndicates should therefore exclude such losses from their RDS return for this event.

### Los Angeles Earthquake Event Damage Factor Table

COUNTY	COUNTY	PROPERTY VALUE	AGGREGATE	GROUND-UP SHAK	GROUND-UP SHAKE DAMAGE FACTORS					
NAME	NUMBER	DISTRIBUTION	"FOOTPRINT"	RESIDENTIAL	COMMERCIAL	RESIDENTIAL	COMMERCIAL			
Alameda	001	5.0%								
Alpine	003									
Amador	005	0.1%								
Butte	007	0.4%								
Calaveras	009	0.1%								
Colusa	011									
Contra Costa	013	3.2%								
Del Norte	015									
El Dorado	017	0.4%								
Fresno	019	1.5%								
Glenn	021	0.1%								
Humboldt	023	0.3%								
Imperial	025	0.3%	100%	1 83%	0.45%					
Impenai	025	0.2 %	100%	1.03 %	0.45%					
linyo Karn	027	1.20/	1000/	0.110/	0.000/					
Kelli	029	1.3%	100%	0.11%	0.23%					
Kings	031	0.2%								
Lake	033	0.1%								
Lassen	035									
Los Angeles	037	30.0%	100%	9.60%	12.40%	0.16%	0.10%			
Madera	039	0.2%								
Marin	041	1.2%								
Mariposa	043									
Mendocino	045	0.2%								
Merced	047	0.3%								
Modoc	049									
Mono	051	0.1%								
Monterey	053	1.0%								
Nana	055	0.4%								
Nevada	057	0.3%								
Orange	057	10.0%	1000/	15 60%	17 50%	0.200/	0 1 4 0 /			
Orange	059	10.0%	100%	15.00%	17.50%	0.20%	0.14%			
Placer	061	0.7%								
Plumas	063	0.1%	1000/	10.100/						
Riverside	065	3.4%	100%	10.40%	11.10%	0.12%	0.05%			
Sacramento	067	3.0%								
San Benito	069	0.1%								
San Bernardino	071	3.8%	100%	7.35%	8.70%	0.04%	0.02%			
San Diego	073	8.0%	100%	2.24%	2.34%	0.01%				
San Francisco	075	3.6%								
San Joaquin	077	1.1%								
San Luis Obispo	079	0.8%								
San Mateo	081	3.0%								
Santa Barbara	083	1.3%	100%	0.04%	0.29%					
Santa Clara	085	6.5%								
Santa Cruz	087	0.8%								
Shaeta	080	0.3%								
Sierra	003	0.070								
Siekiyou	002	0.1%								
Siskiyou	095	0.1%								
Solano	095	0.8%								
Sonoma	097	1.3%								
Stanislaus	099	0.9%								
Sutter	101	0.1%								
Tehama	103	0.1%								
Trinity	105	1								
Tulare	107	0.6%								
Tuolumne	109	0.1%								
Ventura	111	2.4%	100%	1.04%	1.67%					
Yolo	113	0.4%								
Yuba	115	0.1%								

### **CALIFORNIA EARTHQUAKE – EVENT TWO**

### San Francisco Earthquake Event

A US\$54 Billion ground-up property (shake and fire-following) Industry Loss from an earthquake originating from the San Andreas Fault (North) near San Francisco.

#### **Event Footprint**

The map below illustrates the Footprint and damage levels for the San Francisco Earthquake Event, which are detailed in the Event Damage Factor Table.



**Insured Industry Loss Levels** 

Syndicates should assume the following components of the loss.

Residential Property	US\$27,000,000,000
Commercial Property	US\$27,000,000,000
Workers Compensation	US\$5,000,000,000
Auto	US\$1,000,000,000

Syndicates should consider what other lines of business would be affected by the event. Particular consideration should be given to losses arising from :

Marine Specie/Fine Art Personal Accident Aviation (except Hull) Liability

Exclusion of Contingent Business Interruption Losses	Lloyd's recognises the difficulties involved in modelling losses from Contingent Business Interruption (CBI) covers. Syndicates should therefore exclude CBI losses from this event. Future development work is planned to address this issue.
Exclusion of Aviation Hull	Lloyd's also recognises the difficulties involved in estimating the Aviation Hull
Losses	losses that would arise from an earthquake, and syndicates should therefore

exclude such losses from their RDS return for this event.

### San Francisco Earthquake Event Damage Factor Table

COUNTY	COUNTY	PROPERTY VALUE	AGGREGATE	GROUND-UP SHAK	E DAMAGE FACTORS	GROUND-UP FIRE	DAMAGE FACTORS
NAME	NUMBER	DISTRIBUTION	"FOOTPRINT"	RESIDENTIAL	COMMERCIAL	RESIDENTIAL	COMMERCIAL
Alameda	001	5.0%	100%	10.70%	12.80%	0.39%	0.25%
Alpine	003						
Amador	005	0.1%	100%	0.04%	0.09%		
Butte	007	0.4%	100%	0.01%	0.03%		
Calaveras	009	0.1%	100%	0.03%	0.11%		
Colusa	011		100%	0.30%	0.79%		
Contra Costa	013	3.2%	100%	5.20%	5.60%	0.15%	0.14%
Del Norte	015						
El Dorado	017	0.4%	100%		0.01%		
Fresno	019	1.5%	100%	0.32%	0.86%		
Glenn	021	0.1%	100%	0.07%	0.30%		
Humboldt	023	0.3%					
Imperial	025	0.2%					
Invo	027						
Kern	029	1.3%					
Kinas	031	0.2%	100%	0.18%	0.62%		
Lake	033	0.1%	100%	0.30%	0.62%		
Lassen	035			,.			
Los Angeles	037	30.0%					
Madera	039	0.2%	100%	0.30%	0.88%		
Marin	000	1 2%	100%	11 30%	13 60%	0.44%	0.28%
Marinaaa	041	1.270	100%	11.30 %	0.00%	0.44 /0	0.2070
Mandaaina	045	0.2%	100%	0.06%	0.09%		
Merced	045	0.2%	100%	0.00%	0.2276	0.010/	
Madaa	047	0.3%	100%	1.20%	1.04%	0.01%	
NIODOC	049	0.4%					
Mono	051	0.1%	1000/	0.05%	7.400/	0.000/	0.040/
Monterey	053	1.0%	100%	6.25%	7.40%	0.28%	0.21%
Napa	055	0.4%	100%	1.75%	2.20%	0.07%	0.06%
Nevada	057	0.3%					
Orange	059	10.0%					
Placer	061	0.7%	100%	0.09%	0.17%		
Plumas	063	0.1%					
Riverside	065	3.4%					
Sacramento	067	3.0%	100%	0.37%	0.89%		
San Benito	069	0.1%	100%	19.50%	21.20%	0.84%	0.20%
San Bernardino	071	3.8%					
San Diego	073	8.0%					
San Francisco	075	3.6%	100%	24.80%	28.20%	4.24%	2.24%
San Joaquin	077	1.1%	100%	1.04%	1.60%	0.01%	
San Luis Obispo	079	0.8%	100%	0.08%	0.34%		
San Mateo	081	3.0%	100%	31.80%	46.40%	3.14%	1.74%
Santa Barbara	083	1.3%					
Santa Clara	085	6.5%	100%	19.90%	19.90%	0.90%	0.50%
Santa Cruz	087	0.8%	100%	18.40%	19.80%	0.91%	0.37%
Shasta	089	0.3%					
Sierra	091						
Siskiyou	093	0.1%					
Solano	095	0.8%	100%	2 78%	3 14%	0.08%	0.04%
Sonoma	097	1.3%	100%	1.90%	2.72%	0.07%	0.06%
Stanislaus	099	0.9%	100%	1 10%	1.65%	0.0170	0.0070
Sutter	101	0.0%	100%	0.22%	0.55%		
Tehama	103	0.1%	10070	0.22 /0	0.0070		
Trinity	105	0.170					
Tuloro	105	0.6%	100%	0.119/	0.20%		
Tuolumno	107	0.0%	100%	0.11%	0.39%		
Venture	109	0.1%	100%	0.01%	0.00%		
Vela	117	2.4%	100%	0.700/	1 500/		
	113	0.4%	100%	0.70%	1.58%		
1 Y LINS	115	111%	100%	11.16%	11.37%		

# 14 NEW MADRID EARTHQUAKE

This event is based upon the New Madrid earthquakes of 1811/1812. The map and table below illustrate the Modified Mercalli Intensity of the earthquake. As a guide, the estimated Industry Loss from this event would be US\$35 Billion.

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### Seismic Zone

#### New Madrid

### Moment Magnitude

7.4

State	Counties	Modified Mercalli Intensity (MMI)
Arkansas	Craighead, Cross, Jackson, Mississippi, Poinsett	9 - 10
Arkansas	Clay, Crittenden, Greene, Lawrence, Lee, Monroe, St. Francis, Woodruff	8 - 9
Arkansas	Arkansas County, Independence, Lonoke, Phillips, Prairie, Randolph, White	7 - 8
Arkansas	Cleburne, Desha, Jefferson, Lincoln, Sharp	6 - 7
Arkansas	Baxter, Chicot, Cleveland, Conway, Drew, Faulkner, Fulton, Grant, Izard, Pulaski, Saline, Stone, Van Buren	5 - 6
Illinois	Alexander	6 - 7
Illinois	Massac, Pulaski	5 - 6
Kentucky	Carlisle, Fulton, Hickman	6 - 7
Kentucky	Ballard, Calloway, Graves, McCracken	5 - 6
Missouri	Dunklin, New Madrid, Pemiscot	8 - 9
Missouri	Butler, Mississippi, Ripley, Stoddard	7 - 8
Missouri	Scott	6 - 7
Missouri	Bollinger, Cape Girardeau, Carter, Howell, Oregon, Shannon, Wayne	5 – 6
Mississippi	Coahoma, De Soto, Quitman, Tate, Tunica	7 – 8
Mississippi	Benton, Bolivar, Marshall, Panola, Tallahatchie	6 – 7
Mississippi	Alcorn, Calhoun, Grenada, Humphreys, Lafayette, Leflore, Pontotoc, Sunflower, Tippah, Union, Washington, Yalobusha	5 – 6
Tennessee	Dyer, Lake, Lauderdale, Tipton	8 – 9
Tennessee	Crockett, Fayette, Gibson, Haywood, Obion, Shelby	7 – 8
Tennessee	Hardeman, Madison, Weakley	6 – 7
Tennessee	Carroll, Chester, Henderson, Henry, McNairy	5-6

The MMIs in this scenario are average values for the counties and have been grouped in steps of 1. The information is sorted by State, then by MMI group, followed by County.

Syndicates should have regard to the lines of business in section  ${\sf F}$  when completing this scenario.

## **15 EUROPEAN WINDSTORM**

This event is based upon the European storm Daria (90A) affecting Northern Europe but with higher wind speeds reaching peaks of 54 metres per second. As a guide, the estimated Industry Loss from this event would be US\$23 Billion.



### Region

### Northern Europe

### Peak Wind Speed

54 metres per second

Country	Area	Max Windspeed (m/s)
Belgium	All except Brussels	40-50
Belgium	Brussels	30-40
Denmark	All	30-40
France	Nord, Pas-de-Calais	40-50
France	Brittany, Loire, Ile-de-France, Central France	30-40
France	Rest of France	<30
Germany	Mecklenburg-Vorpommern, Niedersachsen, Schleswig-Holstein	40-50
Germany	Baden-Wurttemberg, Brandenburg, Bremen, Hamburg, Hessen, Nordheim- Westfalen, Rheinland-Pfalz, Saarland	30-40
Germany	Bayern, Berlin, Sachsen, Sachsen- Anhalt, Thuringen	20-30
Ireland	All	30-40
Luxembourg	All	30-40
Netherlands	Delta, Northern Netherlands	40-50
Netherlands	Central & Southern Netherlands	30-40
Norway	Atlantic & Southern Norway	20-30
Sweden	Southern Sweden	30-40
Sweden	Rest of Sweden	<30
UK	SW England	>50
UK	Rest of England, and Wales	40-50
UK	Scotland	30-40
UK	Northern Ireland	20-30

Syndicates should have regard to the lines of business in section  ${\sf F}$  when completing this scenario.

## 16 JAPANESE EARTHQUAKE



This event is based on the Great Kanto earthquake of 1923. As a guide, the estimated Industry Loss from this event would be US\$23 Billion.

#### Moment Magnitude

7.9

Prefecture	Modified Mercalli Intensity (MMI)
Chiba, Kanagawa, Shizuoka	9 - 10
Saitama, Tokyo, Yamanashi	8 - 9
Gumma, Ibaraki, Nagano, Tochigi	7 - 8
Aichi, Gifu, Niigata	6 - 7
Fukui, Fukushima, Ishikawa, Mie, Shiga, Toyama	5 - 6

Syndicates should have regard to the lines of business in section F when

### completing this scenario.

## 17 TERRORISM

Syndicates should complete both of the following hypothetical terrorist attack scenarios :

# TRIA Event (covered by Terrorism Risk Insurance Act 2002)

The Midtown Manhattan area, New York, at 11:00am on 1 April 2004 suffers a 2-tonne bomb blast attack causing:

Zone	Impact Description	Damage Zones	Property Damage	Fire Loss
1	Collapse and Fire Following	Inner zone, radius 200m	100%	10%
2	Massive debris damage to surrounding properties	400m radius	25%	2.5%
3	Light debris damage to surrounding properties	500m radius	10%	1%

Radii measurements are taken from the Empire State Building as a reference point.

The perpetrator is a foreign terrorist group and the terrorist attack falls within the definition of an 'Act of Terrorism' as set out in TRIA.

**Non-TRIA Event** 

The same scenario as above, but the perpetrator is a domestic terrorist group and the event is not covered by TRIA.

### **PRESCRIBED ASSUMPTIONS**

Number of Deaths and Injuries	1,000 blue/white-collar worker deaths in total and 2,500 injuries in total; syndicates to determine a worst case split across lines of business (WCA, PA, Group PA etc.) and document assumptions using the commentary facility in the RDS Reporting Software. The following percentage split should be used for non-fatal injuries:	
	- 14% life threatening	
	- 35% moderate	
	- 51% minor	
Business Interruption	Overland/underground transport systems are partially damaged, leading to significant business interruption exposure for a period of 3 months.	
Affected Classes of Business	All possible affected business classes should be included in the calculations, such as Contingent Business Interruption and Specie/Fine Art.	
TRIA Recoveries	The business class, 'Outwards R/I: TRIA Recoveries' is included within the 'Exposure' screen to assist in the completion of the return. LORS Code N1631 has been assigned to the 'Reinsurance' screen to facilitate entry of this information.	
	It is appreciated that, due to the wording of TRIA, some managing agents may have difficulty in calculating their group deductible where affiliates are involved. Managing agents are therefore asked to outline their assumptions using the commentary facility in the RDS Reporting Software.	
Fire Following	Taking 'Fire Following' into consideration, syndicates should assume the same damage zones with the appropriate fire loss percentage applied (see table on page 67). Syndicates should assume that all property policies are impacted, given the New York state ruling that property policies cannot exclude fire. Any assumptions concerning Fire Following Terrorism are to be documented using the commentary facility in the RDS Reporting Software.	
Number of Events	The TRIA event and the non-TRIA event should each be assumed to be a single occurrence.	
'CBRN' Status	It should be assumed that there is no Chemical, Biological, Radiological or Nuclear hazard exposure arising from these events.	

### **CALCULATION METHODOLOGY**

#### **Address Level Data**

Zip code data

Those syndicates that hold risks at address level should apply the appropriate mean damage ratio for each damage zone as detailed in the table on page 67. The 'Fire Loss' percentages represent the proportion of the total damage that can be allocated to fire-following covers.

Those syndicates that record their exposures on a 5 or 9 digit zip code basis will not be in a position to locate exposures accurately within each zone. An allocation of Aggregate exposures should therefore be applied. Syndicates that record their exposures on a 5 digit basis should use the table below, which summarises the proportion of each zip-code that lies within each damage zone.

Zip Code	0m - 200m	200m - 400m	400m - 500m
10001	6%	7%	4%
10016	3%	10%	8%
10018	2%	9%	7%

For syndicates that record their exposures on a 9 digit zip-code basis, an electronic version of this file, which provides data on a more detailed basis, can be obtained from Loss Modelling on request.

**'Best Estimate' Basis** Syndicates should report losses on a 'Best Estimate' basis to allow the meaningful aggregation of the results at market level. The loss should be reported after selecting the relevant event on the 'Scenarios / Events' screen, entering loss details using the 'Exposures' screen.

**'Pessimistic Estimate' Basis**To highlight the importance of data quality, and to enable Lloyd's to gain a greater understanding of the uncertainty arising from imprecise data, all syndicates should also report losses on a 'Pessimistic Estimate' basis. This figure should be based on the assumption that all data within a relevant zip-code, that is not identified at the street address level, should be assumed to lie within the damage zone with the highest damage factor. It should be noted that where a syndicate holds all data at the street address level, its 'Best Estimate' and 'Pessimistic Estimate' figures will be the same.

Pessimistic losses should be reported using the commentary facility for both the TRIA and non-TRIA events. Those syndicates that do not hold risk data at address level should use the following criteria:

#### Zip-code level

Assume that all of the syndicate's exposure within the zip-code lies in the highest damage zone within the zip-code.

### Above zip-code level

Apportion all county, state and country exposures to zip-code level using appropriate assumptions, such as 'market share' or 'industry database proportions' and detail these using the commentary facility in the RDS Reporting Software. Syndicates should then assume that all of their exposure in the zip-code lies in the highest damage zone within the zip-code.


## **TERRORISM WORKED EXAMPLE**

	Below is a worked exprevious page illustration the scenarios.	ample using that the concer	ie Terr htric da	orism event. amage zones	The di that ar	agram on the e affected by
'Best Estimate' for Zip Code 10001	For this example, only exposures in zip-code 10001 are considered, which are assumed to have a total insured value of 100.					
	Taking account of the zones, it has been es an insured value of 6 an insured value of 7 has an insured value	e proportion of stimated that th , the zone with , and the zone of 4.	the exp e inner a radi with a	oosure that lie zone with a us between 2 radius betwe	es withi radius 200m a een 400	n each of the of 200m, has nd 400m has Im and 500m
Calculating the Aggregate	The Aggregate exposure can be calculated by applying a 100% damage factor to each zone as illustrated below :					
	AGGREGATE CALCULATION					
	INS Inner zone, Radius 200m	SURED VALUE IN ZO	NE x D	AMAGE FACTOR 100%	= EXPE =	CTED DAMAGE
	400m radius 500m radius	7.0 4.0	x x	100%	=	4.0
				AGGREGATE		17.0
	Given the maximum le expected loss to the section G.	evel of ground- affected contra	up loss acts by	s, syndicates applying the	will the e metho	n calculate the ods outlined in
Expected Ground-up Loss Calculation	The Expected Ground-up Loss can be calculated by applying the zone damage factors, detailed on page 67, to each zone as illustrated below :					
	EXPECTED GROUND UP LOSS CALCULATION					
	INS Inner zone, Radius 200m	SURED VALUE IN ZC 6.0	NE x C	AMAGE FACTOR 100%	= EXP =	ECTED DAMAGE 6.0
	400m radius 500m radius	7.0 4.0	x x	25% 10%	= =	1.8 0.4
		TOTAL EXP	ECTED G	ROUND UP LOSS	3 <u> </u>	8.2
	Once the expected gr calculate the expected outlined in section G.	ound-up loss h d loss to the af	as bee fected	n determinec contracts by	l, syndio applyin	cates can then g the methods
Pessimistic Estimate for Zip Code 10001	The pessimistic estimate can be calculated by allocating the Insured Value for the entire zip-code to the zone with the largest damage factor.					
	INS	URED VALUE IN ZON	NE X DA	MAGE FACTOR	= EXPE	CTED DAMAGE
	Inner zone, Radius 200m 400m radius	100 0	x x	100% 25%	=	100 0
	500m radius				=	0
	TOTAL EXPECTED GROUND UP LOSS 100					
	Once the pessimistic calculate the expected outlined in section G.	estimate has d loss to the af	been fected	determined, contracts by	syndic: applyin	ates can then g the methods

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