

GIRO, Friday 14th October 2011, Liverpool
Andrew Hitchcox, CRO Kiln Group

Embedding the internal model

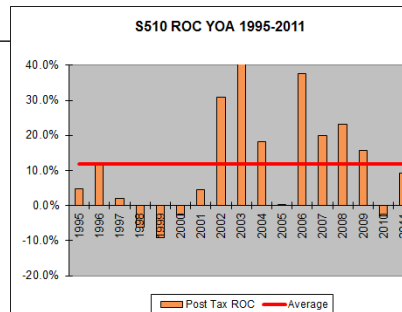
Theme: evidence of the Use Test

© 2010 The Actuarial Profession, www.actuaries.org.uk

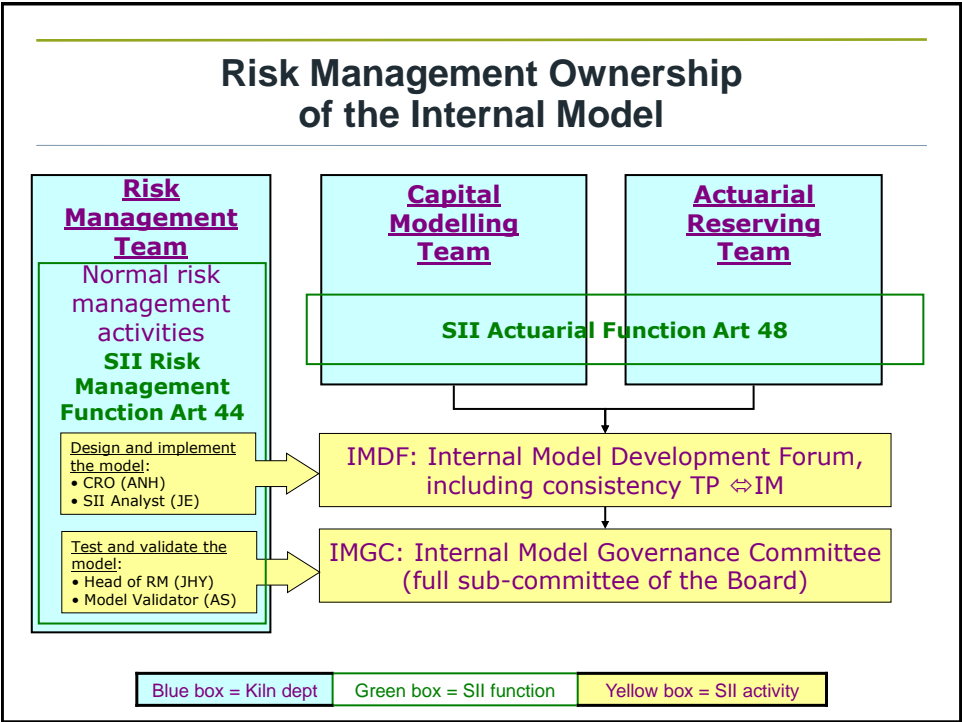
Introduction: Kiln's risk profile

- 5 syndicates: £2 bn of capital under management
- Short tail speciality commercial GI business:
 - no retail customers, no long-tail casualty business
 - > 80% outside the UK

- Risk tolerance very much at the high end of the spectrum:
 - expect high volatility (20% chance break-even or worse)
 - target a high return (target: 8% after tax excess risk-free) (actual average 1995-2011: 12%)



- owned by Tokio Marine Group, who have S&P "strong" rating for ERM
- part of Lloyd's, but not refer to that today: "as if" stand alone



Use Test Grid – the 3 levels

Level	Type of usage	Supporting documentation
Level 1	formal / strategic decisions	formal reports and meeting minutes
Level 2	medium size projects / investigations	Special interest papers
Level 3	day-to-day ad hoc calculations	calculation results and emails

Will show you many extracts from live documents
→ strong evidence of embedding of the model

© 2010 The Actuarial Profession • www.actuarial.org.uk

Overall documentation in the Use Test Report: many uses of the model – Level 1 (formal, strategic)

LEVEL 1 EVIDENCE OF USE TEST									
REGULAR DECISION MAKING EXAMPLES									
No.	Use	Description	Frequency	Documentation	Chair / Committee / Board	Relevant part of the distribution they follow	Was model successfully used?	Any identified limitation of the model?	Used for: a. Risk system b. Decision making process c. Capital assessment and allocation
1	Setting regulatory capital (ICA)	Annual capital assessment for Lloyd's	Annually	Board paper July (SFP submission) Board paper September (updated numbers)	RJK Board, Audit and Risk Committee (ARC)	Tail	Y	N	C
2	Assessing economic capital	Basis of capital assessment for TM Head Office and Ikin board	Annually	RJK Board paper (Sept/Oct) Head office standard form report	RJK Board and HO Committee	Tail	Y	N	C
3	Capital buffer	Business planning tool for possible mid year plan change. Used for Ikin management purposes.	Annually	RJK Board paper (Sept)	RJK Board, Audit and Risk Committee	Tail	Y	N	C
4	Raising capital from capital providers	Ad-hoc activity on a needs basis	Ad-hoc	RJK Board paper	RJK Board, Audit and Risk Committee	Full dist	Y	N	B
5	Approval of business plans	A proposal on business planning requiring Board sign-off	Annually	RJK Board paper (Sept)	RJK Board, Underwriting Board	Full dist	Y	N	B
6	Capital management	Ongoing process of assessing business actually written vs carried capital	Quarterly	RJK Audit & Risk paper (March, May, Sept)	Audit & Risk Committee	Tail	Y	N	A
7	Three year mid-term business plans	Annual (rolling) activity for TMHO	Annually	Not yet completed. Due Oct 2011.	RJK Board, Audit and Risk Committee	Full dist	Y	N	A
8	ORSA	Annual ORSA report with quarterly updates	Quarterly	RJK Board (Dec) RJK ARC (March, May, Sept)	RJK Board, RJK Audit & Risk Committee	Full dist	Y	N	A
9	Evaluation of risk appetite	Annual proposal on risk appetite to be signed off by the ARC	Annually	RJK Audit & Risk paper (Dec)	Audit & Risk Committee	Full dist	Y	N	A
10	Capital allocation	Review of the methodology/ies applied and the implications of the results	Annually	ARC paper (Due Oct/May 2011)	RJK Audit and Risk Committee	Tail/Full dist	Y	N	C
11	Reinsurance decisions	Evaluation of RE purchases Review of Reinsurance programmes (design)	Annually	RJK paper (Sept)	- Reinsurance strategy committee - Underwriters	Full dist	Y	Y	B
12	Six-monthly reporting to TMHO	To help TMHO measure their overall Group exposure and capital responsibilities	Six-monthly	Standard format HO report (TQ rep) March & Oct	RJK Board	Full dist	Y	N	A

Overall documentation in the Use Test Report: many uses of the model – Level 2 (ad hoc, projects)

LEVEL 2 EVIDENCE OF USE TEST									
SPECIFIC USES (in date order)									
No.	Use	Description	Frequency	Documentation	Chair / Committee / Board	Relevant part of the distribution they follow	Was model successfully used?	Any identified limitation of the model?	Used for: a. Risk system b. Decision making process c. Capital assessment and allocation
1	New reinsurance programme for SIBO	SIBO reinsurance purchase. The model was used to gauge the impact on capital of a brand new reinsurance programme for SIBO. Various structures are being considered and modelled and are expected to verify the decision to buy an SL programme	Jul/Aug '11	RJK Board paper (Sept 2011)	RJK Board, Audit and Risk Committee	Full dist	Y	N	B
2	Testing efficacy of reinsurance programmes	Quantitative testing of the effectiveness of Ikin Syndicate/Division's reinsurance arrangements through internal performance. Reinsurer/Divisor/Reinsurer Performance against Capital Model	Jul/Aug '11	RJK paper (11 Aug 2011)	Underwriting Board	Tail/Full dist	Y	Y	A
3	Model changes	RMS version 1.1 upgrade	Apr - Jun '11	RJK ARC paper (March and April 2011) Group State project folder	RJK Board, Audit and Risk Committee	Tail/Full dist	Y	N	C
4	Writing into a business	Act active underwriter deciding to write the business where he could no longer exclude the RBC component.	Jan '11	Group State use test email archive	Act Active Underwriter	Qualitative only	N	The model was not used. The questions asked were too detailed for the model to be able to provide a sufficiently sensitive assessment.	B
5	WAC acquisition	The model was used to evaluate the impact of acquiring WAC and allowed an insight into the impact it would have on the existing business mix and reinsurance programme.	Mar-Apr '11	RJK Board paper (April 2011)	RJK Board	Tail/Full dist	Y	N	B
6	Syndicate merger	Model was used to understand the effects of merging two syndicates (SIO and SOT)	Jan-Mar '11	RJK ARC paper (June 2011) Underwriting Board paper (July 2011)	RJK Board	Full dist	Y	N	B
7	SIOB vs SIOB layer for Canada	Specific reinsurance efficacy study. Investigating the use of reinsurance to save capital	Jan '11	- Group email - Group State projects file	Property underwriter	Tail	Y	N	B
8	New classes of business	The model was used to investigate the impact of new classes of business. Following this three large categories of new business were established: - Cyber (Direct premium risk team) - Health (Property) - Warranty (B Reinsurer risk team)	Jan 2010	Group State Project file Underwriting packs (Sharepoint)	ARC	Full dist	Y	N	B
9	New class of business: Space	A portfolio analysis tool was created using the model to determine a decision regarding Space business in Europe. This was also used in parameterising the new class of business in the model.	2010	Group State Project file Underwriting packs (Sharepoint)	ARC	Full dist	Y	N	B
10	New business: Police scheme for SIBO	The model was used to assess the implications of taking on a new large tender for the insurance for the police authorities.	Aug/Oct	Group State projects file	SIB active underwriter Division	Full dist	Y	N	B
11	Set up of syndicate SIBO	The set up of syndicate SIBO including modelling of Pribate and CIBO	Oct 2009	ARC papers (Oct 2009) The Group and SL reinsurance	ARC Committee since inception	Full dist	Y	N	B
12	Setting up a transfer pricing structure/transfer of business to Bermuda	The model was used to investigate a proposed reinsurance agreement between Ikin Underwriting Limited (UK) and Ikin Reinsurance Limited (BVI Inc). A substantial transfer pricing document was written by Ikin with input and review from Ikin. This model was the primary tool for setting the pricing structure.	Oct 2007	RJK Board paper (April 2007)	RJK Board	Full dist	Y	N	A
13	Underwriting pricing cycle	The model was used to investigate variable capital management strategies to deal with the external pricing environment.	2007	RJK Board (2007)	RJK Board	Full dist	Y	N	A


Kiln's Risk Classification System
- mapping from risk register to Internal Model

Kiln's Risk universe	Solvency II categories	FSA categories	Lloyd's categories	Kiln - Large Categories / Risk register	Appetite	Committee owner	Policy statement	How modelled
Insurance related risks								
• Underwriting risk: <ul style="list-style-type: none">- non-life underwriting risk- life underwriting risk (S308 only)- health underwriting risk (S510 A&H, S807 only)	Underwriting risk: <ul style="list-style-type: none">1. non-life underwriting risk2. life underwriting risk3. health underwriting risk	Insurance	Insurance	Insurance	High	Underwriting Board UMC	Underwriting policy Underwriting guidelines	Internal Model
- Reserving risk	Reserving	Insurance	Insurance	Insurance	Neutral	Underwriting Board UMC DURG		Internal Model (Bootstrap method+ load)
- Reinsurance risk	Reinsurance and other risk mitigation techniques	Insurance	Insurance	Insurance	Mixed	Underwriting Board UMC RSG RISC	Reinsurance policy	Internal Model
Finance related risks								
• Asset-liability (ALM) management risk (technical assets)	Asset-liability management	N/A	N/A	Financial	Low	Investment Committee	ALM policy	Internal Model
• Investment risk: (surplus assets)	Investment			Financial	Low	Investment Committee	Investment policy	Internal Model
- Currency risk	Asset-liability management	Market	Financial Market	Financial	Low	Investment Committee		Internal Model
- Interest rate risk	Market	Market	Financial Market	Financial		Investment Committee		Internal Model
- Asset value risk	Market	Market	Financial Market	Financial	Low	Investment Committee		Internal Model
• Credit risk: <ul style="list-style-type: none">- Credit risk 1: RI recovery	Credit	Credit	Credit	Financial	Mixed	RISC	Credit risk policy	Internal Model

Risk Appetite Framework (extract 1)

RUK AUDIT & RISK COMMITTEE, 01 SEPTEMBER 2011

APPENDIX 4 - UPDATE ON RISK APPETITE POSITION



Risk Appetite Framework

Document level

Management

Document Author

Henry McCarthy

Responsibility

Henry McCarthy

Accountability

Andrew Hitchcock

Date

08/09/2011

State / Version

Draft v.1

Next revision Due

November 2011

Table of Contents

1. Introduction: overview of risk appetite framework.....3

1.1. The overall approach to the management of Risk Appetite at Kiln.....3

2. Risk appetite statements.....4

3. Risk Appetite Dashboards for 2012.....6

3.1. Target ROC for 2012.....6

3.2. Earnings at Risk (EAR) tolerance for 2012.....7

3.3. Capital at Risk (CAR) tolerance for 2012.....8

3.4. Concentration Risk tolerance for 2012: (1) by Risk Category.....9

3.5. Concentration Risk limit for 2011: (2) by Geographical Zone and Penetration.....9

3.6. Concentration Risk Limit for 2012: (3) by Specific Events (SOX).....9

4. Risk Limits/Triggers.....11

5. Reporting.....14

5.1. Example of summary risk appetite report.....15

5.2. The Reporting Process.....16

Live Board document

Submitted 1st Sept 2011

Confidential

Page 1 of 16

05/09/2011

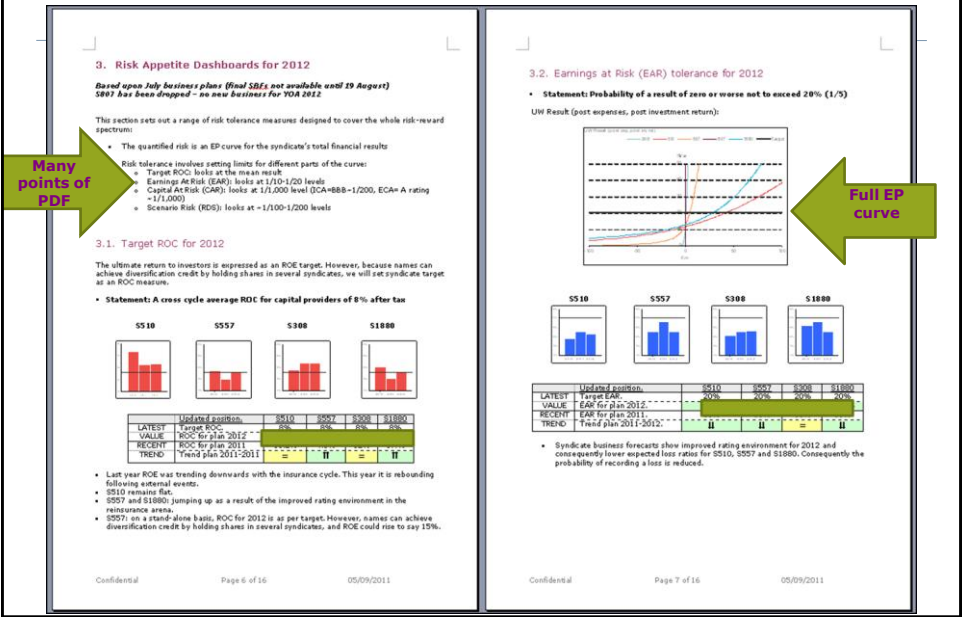
Confidential

Page 2 of 16

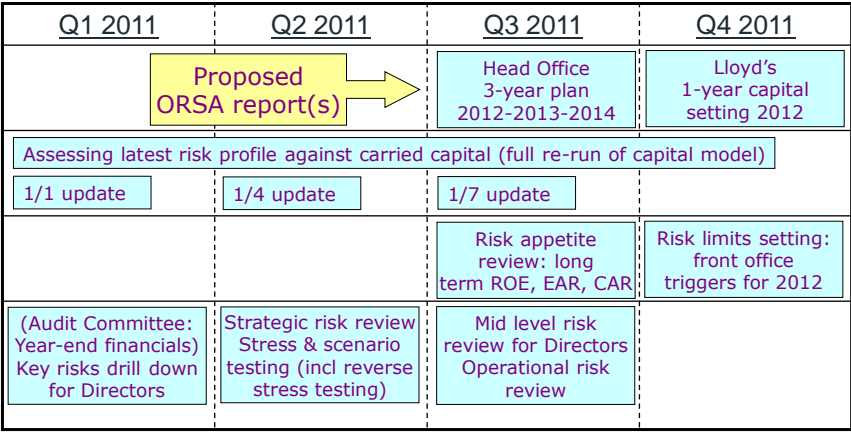
05/09/2011

4

Risk Appetite Framework (extract 2)



Designing the ORSA process (1/3): - current capital planning and risk reporting cycle to Board / Risk Committee



Comment & timeline:

- Above = high level output from Risk Management System
- Most of the above has been in place since 2009

Designing the ORSA process (2/3): - 3 views of capital (actually 7 flavours!)

3 views	6 flavours – existing basis, pre SII	New basis – post SII
Regulatory	(1) ICA: 99.5% VaR DFB Risks to ultimate GAAP reserves	(7) SCR: 99.5% VaR DFB 1-year emergence Tech provs: disc, RM
Rating agency	(2) ECA: 99.5% VaR DFB * 1.35 (3) 99.9% VaR DFB	No change
Economic	(4) Buffer: ECA + 80% TVaR DFM (5) HO carry: 99.9% VaR DFB (6) HO allocation: 99% TVaR DFM	No change

Comment & timeline:

- All of these results calculated by the same underlying model
 - (1)/(2) in place since 2005, (3) in place since 2007
 - (5)/(6) in place since 2008/2009
- (4) in place since 2009: capital providers expect rights issue every 5 years – consistent with risk appetite

Designing the ORSA process (3/3): - 3-year capital plan: trends + shocks

Step 1:

1-year capital calculation: fully stochastic DFA model

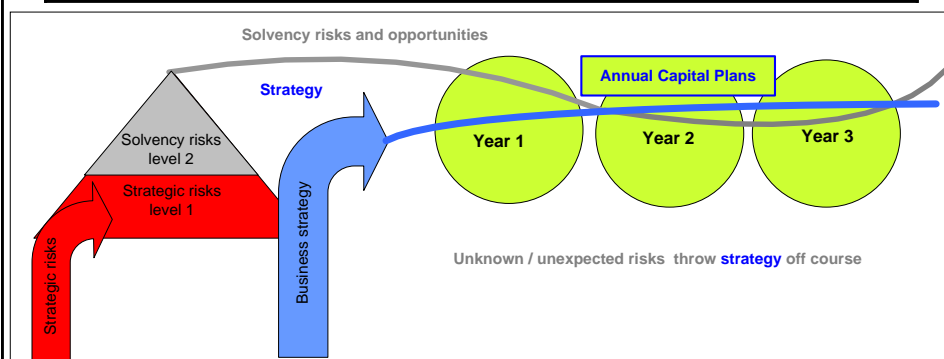
Step 2:

Chain together 3 consecutive 1-year calculations: trends on volume, exposures, PRI, loss ratios, the insurance cycle → financing of preferred path for the business

Step 3:

Apply shocks to central capital forecasts → contingency capital planning

→ studies of plan ROE and variability of ROE



- Special capital modelling Topics from recent quarters include :

- Understanding different risk measures: VaR versus TVAR
- Earthquake risk
- Dependency structures
- Mid sized risks ("second top 20")
- Large loss (non-cat) exposures
- Canadian Business:
 - the exposures and capital & profit
 - Cascadia EQ 1/500 numbers
- Allocation of capital: different approaches
- Future management actions

Regular Model Output (standard quarterly)

Analysis of Modeled Risk Account		2009 Mode		RMS VTY (BLENDED RISK)									
Distance From Break Even													
Gross Result		Property	Reinsurance	Marine	Aviation	Accident and Health	Risk	UW Result Post Exposure					
Gross Premium earned		100,000	1,124,000	108,113	80,102	20,595		100,000					
Gross Underwriting result (mean)		62,310	61,465	32,964	8,352	9,566	7,889						
0.1 n 10 result													
0.1 n 50 result													
0.1 n 100 result													
0.1 n 200 result													
0.1 n 500 result													
Net Result		Property	Reinsurance	Marine	Aviation	Accident and Health	Risk	UW Result Post Exposure					
Net Premium earned		362,229	62,430	130,665	45,213	31,086	26,771	610,243					
Net Underwriting result (mean)													
0.1 n 10 result													
0.1 n 50 result													
0.1 n 100 result													
0.1 n 200 result													
0.1 n 500 result													
Average		UW Result Post Exposure	Investment Risk	"DIME" Exposure	Reinsurance Risk	GAAP Result	Operational Risk	Risk Credits Annual Result	All Risks Annual Result	Stake Post	Modelled Risk Account	Capital Requirement 1/200 risk measure Sum of exposure position PCA	
0.1 n 10 result													
0.1 n 50 result													
0.1 n 100 result													
0.1 n 200 result													
0.1 n 500 result													
Distance From Mean													
Gross		Property	Reinsurance	Marine	Aviation	Accident and Health	Risk	UW Result Post Exposure					
0.1 n 10 result													
0.1 n 50 result													
0.1 n 100 result													
0.1 n 200 result													
0.1 n 500 result													
Net		Property	Reinsurance	Marine	Aviation	Accident and Health	Risk	UW Result Post Exposure					
0.1 n 10 result													
0.1 n 50 result													
0.1 n 100 result													
0.1 n 200 result													
0.1 n 500 result													

Shows how many points on EP curve for all the key risk

Shows many points on EP curve for all the key risk drivers

Reinsurance Strategy Document - overview

Kiln Syndicates

Review of 2011 Reinsurance Arrangements and 2012 Reinsurance Plans
July 2011

Use of the Model

Table of Contents

Syndicate 510 Accident and Health	3
Syndicate 510 Aviation	5
Syndicate 510 Marine & Special Risks	7
Syndicate 510 Property	9
Syndicate 510 Reinsurance	12
Syndicate 510 Enterprise Risk	15
Syndicate 200	17
Syndicate 557	19
Notes and Conclusions	21
Appendix A - Reinsurance Contract Structures	22
Appendix B - Capital Modelling Data	29
Appendix C - Reinsurance Relationships	32
Appendix D - RRS model change	39

Note: written by reinsurance department, not capital modelling team → AOR?!

Kiln

Reinsurance Strategy Document – specific examples

[illegible]

Significant specific case studies in 2011: - examples of ad hoc capital modelling projects

~\$X00m acquisition April - July

Serious numbers!

- An opportunity to write significantly more US XXXXX business – mainly Wind & Flood
- Decision required on which vehicle to write it into – and an understanding of additional ROE and Capital required
- +/-3 week exercise to adjust models and to apply as/if analysis

Syndicate Merger July - August ~£Y00m

- A project to understand the likely effect of merging two syndicates
- Needed to persuade both sets of capital providers

Syndicate XXX – risk mitigation August - September

- An initiative to rearrange the risk profile of syndicate XXX
- A proposed XL RI programme ~\$Z00m has been modelled and its affect on ROE and Capital analysed

“Use of the model → pressure to improve the model”

Year of change	Description of Business area and nature of change	Risks identified /changed
2005	Doubled severity and increased frequency of RMS v5 to reflect post Katrina experience	Cat risk – adjustment applied to external model
2006	RMS version 5 to version 6: increased cost of tail losses by 30% to 50%.	Cat risk – update from external model
2006	Introduced 20% load to US hurricane frequencies to allow for parameter uncertainty.	Cat risk – internal view of external model
2006	Switch from Igloo to Remetrica.	Improved reporting and input output management
2007	Large loss modelling: added in notional shock losses, above and beyond actual recorded historic experience, based upon a consideration of the probability of RDS style losses.	Large loss risk – improved review
2007	For surplus assets, i.e. the FAL, added a model of the risk of the currency of the actual FAL not being matched with the risk currencies of the ECA.	FX risk on capital
2007	Reserving risk: allowed for the probability that, between the ICA submission in September and the setting of year-end reserves in December, a hurricane occurs that increases the amount of the reserves, and hence the amount of the reserving risk.	Reserve risk – the forecast reserves are volatile.
2008	All cat exposures: second model comparisons, i.e. review the results of modelling exposures in AIR as well as RMS.	Cat risk – review of external model
2008	Model the impact of potential uncertainty around PRI forecasts.	Pricing forecasts are
Year of change	Description of Business area and nature of change	Risks identified /changed
2008	Include the impact of an expense run-off provision	Cat risk – improved data and modelling
2009	Market risk: the amount of funds available for investment increased to reflect the incidence of large insurance losses, rather than approximate top level assumption.	Cat risk – improved data and modelling
2009	807 Property cat XL: scaling factors for forecasting i.e. more granularity than portfolio level.	Cat risk – update from external model
2009	Recognition of 50% of reserve surplus.	Reserve surpluses emerge over time
2009	All cat exposures: scaling factors for forecasting of EP curves calculated at quarterly level, i.e. more granularity than annual level.	Cat exposure varies by currency
2009	510 energy: scaling factors for forecasting of EP curves calculated by reference to RDS	Cat risk – improved data and modelling
2010	Rebuild of model to standard format – simplification of lines of business into 2 types	Control around the model
2010	Macro developed to build model from an input template	Flexibility of the model
2010	Split of large losses into data driven and additional	Transparency of the model
2010	Split of catastrophes into exposure based, data driven and additional	Transparency of the model
2011	Update to RMS v11	Catastrophe risk update
2011	Inclusion of technical provision adjustments	Update for changing regulation
2011	Review of correlation structure and approach	Transparency of the model
2011	Development of database of model results and related reporting	Control around the model

History of Changes
2005-2011

“Use of the model → pressure to improve the model”

- Proposed Model Improvement Plan end 2011
- Current changes planned (high priority only)

Ref	Date entered	Description				Assessment		Status	Owner	Project management			Documentation
		Weakness	Description	Category	Approach	Suggested improvement	Complexity of Change			Notes	Project reference	Date Completed	
30	11/01/2011	Misused Capital	One figure for allocated capital based on a blend of methods	Investigate	Change	Review Capital allocation algorithm and risk measures. 3 or 4 risk measured based on each risk available	High	Development	BA	As we need to include this in the database	Capital Allocation		
31	11/01/2011	Investment rate of return modelling structure	Currently simulate lower model of amount of investments (only simple) and a stochastic rate of return	Model	Change	Update risk parameter to be in line with market data	High	On Hold	SC	4% adopted, on hold pending each provision	Rate Assumptions		
32	11/01/2011	Correlation matrix difficult	One large correlation matrix, with many	Model	Change	Review app. off as part of finance pack	High	Review	FI	Have sub matrix, but combine into a large matrix	Correlation		
33	11/01/2011	Full data	Full data correlation matrices are used where an underlying driver cannot be identified	Model	Change	Investigate the use of copulas	High	Review	FI	Develop a full data correlation matrix	Correlation		
34	11/01/2011	For data sources from K26	For data sources from K26	Process	Use	Source as much as possible from K26 to use as K26 for input data	Moderate	Review	TF	Source data being reviewed for data from business already. Progress plan pending stability of K2 version	Model results link		
35	11/01/2011	Results output	Results on uncorrelated models	Process	Change	Review results output to review whether results can be applied	High	On Hold					
36	11/01/2011	Overweight structure	Use of overweight with hidden, no	Process	Change	Review overweight structure	Moderate	Development	TF	With Risk Management project			
37	11/01/2011	Inputs - Expert judgement processes	Inputs - Expert judgement processes not yet using internal	Process	Change	Review inputs to Expert judgement processes with next quarterly update of internal model	Moderate	Review	TF				
38	11/01/2011	Methods	Methods used are appropriate, relevant, appropriate, transparent, up to date, statistical and parsimonious, robust and sensitive	Documentation	Document	Review methods used in the model	Moderate	On Hold	BA				
39	11/01/2011	Assumptions - Expert judgement	Assumptions - Expert judgement	Documentation	Document	Review assumptions used in the model	Moderate	On Hold	BA				
40	11/01/2011	Output results	Output results to the central database at the end of each model run using the internal database	Process	Change	Review the results to the central database at the end of each model run using the internal database	Low	Review	SC				
41	11/01/2011	Summary Risk Analysis	Model lacks a summary of the major components	Investigate	Change	Review the Summary Risk Analysis sheet to identify major components	Low	Review	TF	Summary risk analysis now available from the database - needs testing for data availability			
42	11/01/2011	FAQ documents	FAQ documents written over 1 year ago	Documentation	Document	Review FAQ documents and update	Moderate	Review	TF				
43	11/01/2011	Marine Cat data	At the moment assume a scaled	Model	Change	Review Marine Cat data for Marine, at least the 100k	Moderate	Review	TF				
44	11/01/2011	Non-correlation results in output file	Non-correlation results in output file	Model	Change	Review non-correlation results in the database, we need them for future Lloyd's submissions	Moderate	Review	TF				
45	11/01/2011	Parameter uncertainty	Currently 5% load applied to frequencies	Model	Change	Review 5% load with a dynamic load with a logarithmic, mean = 1 and a var of 20%	Moderate	Review	TF				

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.

