

# **Pelican**

## Enterprise risk management software system

### Technical specifications

June 2018

The background of the entire page is a close-up, high-contrast photograph of mechanical gears. The gears are metallic and show signs of wear, with some teeth blurred due to a shallow depth of field. The lighting is dramatic, highlighting the textures and curves of the machinery.

## TECHNICAL SPECIFICATIONS

Pelican is the most advanced quantitative, fully-integrated enterprise risk management (ERM) system designed to meet the needs of medium to large enterprises. It has a wealth of capabilities and features to ensure that the enterprise can meet or exceed the modern ERM requirements of ISO31000:2018, COSO and other accepted standards.

Pelican is based around the philosophy of quantifying risk and their controls wherever possible. To that end, it incorporates the most comprehensive and powerful quantitative risk analysis capabilities on the market. This allows Pelican to provide precise, unambiguous, and easily understood tools for the effective management of risk.

The technical descriptions provided in this document roughly follow along the lines of the recommendations described in the ISO 3100:2018 standard to more easily track how Pelican meets those needs.

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## RISK MANAGEMENT PRINCIPLES

The purpose of ERM is to preserve and protect the existing value of an entity and to create additional value. One aspect of that value is the creation of monetary wealth, which requires that one efficiently limits exposure to financial risks and makes investment decisions that provide an appropriate balance of risk and reward.

But there are other value dimensions to consider, like performance measures. For example: a hospital strives to deliver the highest possible healthcare; a national grid operator aims for the highest electricity availability; a police force attempts to minimize serious crime, etc. An entity also has value as a good corporate citizen, protecting its workforce and the public from unnecessary danger, limiting its environmental footprint, and maintaining and improving its ethical behavior and reputation.

For ERM to fully succeed, it must be applied across the entire organization and assess the various types of impact that can occur whilst offering consistent and comparable results. This is only achieved if the ERM methodology is organized in a structured and comprehensive manner and tailored to the business.

### Related Pelican features

Pelican provides the following features to apply these principles:

- ✓ Pelican incorporates a hierarchical tree entity structure that allows one to specify the different businesses that collectively form the corporation. Under each business, one may specify other businesses, divisions, departments, etc. in a tree of unrestricted dimension. Projects and sub-projects may also be added at the ends of any branches
- ✓ An unlimited number of different risk consequence types may be defined within the system. These can be quantitative or qualitative. For example: financial loss; health and safety; reputation damage; strategic; operational downtime; and project delay
- ✓ For each entity, one may define a risk appetite for certain types of impact. For example, a financial loss of \$100,000 might be substantial for a small department or project, but insignificant for the head corporation.
- ✓ Other impact types like reputation and environmental damage and health and safety can be specified at the corporation level and inherited by any sub-entity. This ensures that the values of the corporation are shared throughout the organizational structure
- ✓ Sophisticated, automated mapping between different impact types and entity levels ensure that risks and their controls can be ranked in a transparent and consistent manner
- ✓ Pelican is web-based, providing instant access to the latest available information
- ✓ Pelican users are matched to responsibilities and entities so that they see the risk information that is important to them
- ✓ Email alert systems ensure that all users are pro-actively informed of any changes to the status of risks or their controls that is of relevance to them. There is no need to keep logging into Pelican to check on changes in status
- ✓ The Pelican main menu provides a very visible alert of any actions that are required by the user, with a quick drilldown to the actions that are needed, to ensure the user can be maximally responsive

## FRAMEWORK

The risk management framework assigns authority, responsibility, and accountability at different entity levels. It must communicate the added value that risk management brings to each level of the organization and to relevant stakeholders (those exposed to the consequences of risk, those who must make risk management decisions, those who report or monitor risks, and those who have specific duties in the management of risk). This ensures that the stakeholders remain motivated to maintain their interest and participation in the risk management efforts.

The risk management framework promotes the systematic monitoring of risks and incorporating understanding of risk in operations and decisions and helps ensure that risk management efforts are operating effectively.

The risk management framework must also ensure that risks and their treatment are not viewed in isolated silos, but instead provides a means of seeing how a risk from one area of the business can affect others. Correctly structured, risks, their treatment and their consequences are mapped and linked together so that one can see how each business unit is reliant on the efforts of other units, or even external parties, in controlling the risks that threaten their objectives.

Finally, a good risk management framework needs to incorporate documented processes and procedures for the identification, analysis and management of risk. It should also make the experience of previous risk management activities part of the corporate body of knowledge so that past successes can be repeated, and past failures can be avoided.

### Related Pelican features

Pelican provides the following features to set up and maintain your risk (and opportunity) management framework. The following features apply equally to opportunities (random events in which the consequences are desirable):

- ✓ Each person using Pelican is provided with a profile which identifies them to other users
- ✓ Each person is assigned to a business. They can also be assigned to different security groups that give them access to information for a business, division of a business, project, sub-project, etc. The access rights can be to edit or just view the content
- ✓ People outside of the business can also be included (for example, a contractor or consultant). They are allocated to external companies
- ✓ Every part of every risk management strategy is assigned to an individual, including:
  - Monitoring of risk drivers
  - Execution and reporting of controls
  - Execution and monitoring of mitigations
  - Ownership of each impact associated with a risk
  - Responsibility for the overall validity of the risk management strategy and analysis for a risk issue
- ✓ Individuals are assigned the authority for authorizing or rejecting material changes to accepted risk strategies or risk evaluations to ensure consistency and stability

- ✓ Other individuals have the authority to create new potential risk issues, perform analyses, and add them to the Pelican database, with an authorization requirement that depends on their authority level and the magnitude of the risks they describe
- ✓ All actions are logged and can be reviewed in various ways. For example, a log of the actions of an individual can be viewed in their profile, and a log of the changes to a risk driver can be viewed in its analytics
- ✓ Explanatory comments can be attached to actions. For example, if a person rejects the inclusion of a new risk issue into the Pelican database, they can include an explanatory note which is added to the Pelican log
- ✓ Explanatory documents can be added to any component of the risk management strategy. For example, if a control has a certain probability of working one can add a reference document to support that information; or perhaps a control involves a special inspection and testing, and a document can be added explaining the procedure
- ✓ Pelican incorporates different standardized methods for evaluating risk events – a simple method and a more involved strategic method. This provides a consistent approach to describing risks and their consequences, essential for comparison. One can also convert from the simple method to the strategic method automatically. The simple method closely matches how most risks are described in a risk register making it easy to migrate to Pelican
- ✓ Risks that have expired or become redundant are retained within the Pelican database, together with any strategy that was developed for managing them. One can search for these old risks in various ways which allows the business to retain knowledge of previous work instead of starting from scratch
- ✓ Risk management templates can be stored in Pelican. These generic strategy descriptions can be pulled in and adapted to introduce a new and similar risk into Pelican, ensuring that a consistent risk management process is in place – even between different entities. Documents can be attached to the template to describe the rationale for the risk management strategy and how to use the template

## THE RISK MANAGEMENT PROCESS

This section describes how Pelican meets the needs of organizing, implementing and maintaining a corporate risk management process.

### Defining risk criteria

The strategies for risk management must be aligned with the key strategies of the organization. Focusing purely on risks causing financial loss will miss those risks that, for example, would leave the organization in a position that delays or prohibits the longer-term objectives of the business. Careful consideration is required of the different types of consequence that are of importance: financial, of course; delays for projects; loss of reputation; injuries and deaths; loss of critical internal expertise; downtime if the organization provides a service; etc. One consequence can clearly lead to another – for example, a project delay can lead to liquidated damages; high accident rates can lead to loss of reputation; and loss of critical expertise can reduce the strategic options of the company.

#### Related Pelican features

Pelican incorporates a system for specifying the tolerance to risk which allow the management to understand all the threats to the business, not just those that are financial:

- ✓ This tolerance can be defined individually by each entity, with checks to ensure consistency
- ✓ It can also be defined within each entity by different types of consequence. Standard consequence types include:
  - Financial loss
  - Reputation loss
  - Health and safety
  - Project delay
  - Strategic constraint
- ✓ Other custom consequence types can be included, for example:
  - Cashflow interruption
  - Network downtime
  - Environmental impact
  - Human resources availability
  - Morale

### Risk identification

The Achilles' heel of risk management is that one cannot manage a risk that hasn't been identified.

An organization that is serious about its risk management encourages all its employees to be part of the process. Specialists may have the greater involvement in developing and executing risk treatment plans, but there is great value in encouraging every employee to point out potential risk issues that they see.

#### Related Pelican features

Pelican encourages the identification of risks in the following ways:

- ✓ The Pelican smartphone app allows any employee to quickly write a note about a potential risk, perhaps take a photo and record the GPS location. Clicking send then adds that potential issue to Pelican to be investigated, and assigns it to a delegated person to follow up
- ✓ To encourage employees to keep their eyes open, the Pelican smartphone app then reports back when the risk issue is being investigated, and whether it has been promoted to a risk that requires management
- ✓ The employee can also send the potential risk issue information anonymously where reporting the problem could expose them to conflicts with their management or colleagues. The risk issue is then assigned to a central designated person
- ✓ Brainstorming sessions are a great way of quickly collecting a list of potential risk issues. Pelican allows one to enter the information as a brief description to keep such sessions dynamic and avoid struggling with lots of data entry
- ✓ Pelican has a specific process for promoting a potential risk issue to an acknowledged risk, and from there to the development of a risk strategy and assessment of its probabilities and consequences. Each stage is logged, including when the risk issue is rejected as relevant
- ✓ These tools help create an auditable risk identification process which encourages participation from anyone – from the shop floor to the executive suite – to participate, and strongly discourages the dismissal of raised issues without proper consideration.

### Risk assessment methodology

To understand risks well, one needs a systematic method for laying out what might happen if a risk occurs and why. Assessing risks includes evaluating the likelihood or frequency of the occurrence of different consequences, either good or bad, and their possible magnitude. It also involves evaluating the aggregate potential exposure from the portfolio of possible consequences that an entity is exposed to.

The ability to forecast the increasing importance of some risks can be a valuable strategic advantage. The ability to represent the quality of the information being used is also very helpful in avoiding underestimating risk due to lack of information, and in focusing on where it would be most useful to acquire additional information.

Risks are also usually interlinked in some way: the occurrence of one risk can be a driver that changes the chance of another occurring, or the ability to manage another risk. A proper risk framework must consider these inter-relationships. Failure to do so will severely limit the efficiency of the risk management strategy.

### Related Pelican features

Pelican offers a highly flexible system for assessing risk, with the following main features:

- ✓ Pelican incorporates bowtie diagrams that offer a well-structured and flexible method for describing risks and their treatment. They provide a framework for ensuring that people correctly separate out what is a risk event, what are the possible consequences, and what drivers influence the chance of that risk event occurring. The simple, visual ideas of a bowtie diagram bring a great deal of clarity and structure to describing risks that are typically not present in an old-style tabular risk register. Introducing controls and mitigations to the bowtie



diagram explicitly lays out the rationale for the risk management strategy and assigning each element to a responsible individual makes it clear who is doing what, when, and why it is important

- ✓ The Pelican backbone is a numerical system. It allows one to answer questions like – which project is the riskiest? - where are the largest legal risks faced by the organization? - how much capital should be put aside to cover potential financial losses with 90% certainty? - or how has the overall level of risk of the entity changed over the last year? Such analyses are not possible with a qualitative system
- ✓ Pelican can evaluate the aggregate potential exposure from the portfolio of possible consequences that an entity is exposed to. This can only be done methodically and transparently if one uses numbers – qualitative scales like very low, medium, insignificant and catastrophic have no consistent meaning and cannot be readily compared. They also cannot be translated between the risk scales of different entities without considerable approximations. Neither can one evaluate the importance of controls in such a system
- ✓ With Pelican, one can forecast the increasing importance of some risks which can be a valuable strategic advantage. This is possible if one has identified key drivers to those risks – like interest, inflation, and unemployment rates, or cost of materials or energy, or changing tax policy, or changes in law. Feeding these drivers into a risk assessment then allows one to forecast how the threat of some risks will evolve over time and plan appropriately
- ✓ The quality of information always varies very considerably across the portfolio of risks an organization faces. Sometimes, estimates are based on large amounts of data resulting in precise estimates. At other times the estimates are pure educated guesses. Any analysis should acknowledge this difference so that decision-makers can be wary of the less robust information and any subsequent calculations that depend on them
- ✓ Risk events are evaluated and stored internally within Pelican in two ways. The first method uses probability theory to calculate key characteristics: calculated probability, mean potential impact and probability-weighted mean impact values and simulated possible values. The calculated mean values provide a quick method for showing any changes to input information and allows Pelican to produce many of the results used in the management dashboards
- ✓ The second method uses a vector of simulated values, known as a SID, for each component in the database. SIDs are updated automatically if any data that affect them changes. SIDs offer a powerful way of sharing information about every risk and uncertain variable. It allows all of Pelicans modules to interact in a consistent manner, sharing precisely the same risk information
- ✓ A central design component of Pelican is the ability to link risks and uncertainties together. An entity's risk exposure will without doubt be underestimated, along with the value of the risk management strategies, unless risks and uncertainties are properly linked. However, the inter-relationships occur in many ways, requiring different techniques for their evaluation. It is equally important to be able to aggregate risks accounting for their independence. Pelican provides every tool you will need for incorporating these inter-relationships, for example:
  - Pelican bowtie analyses allow you to:
    - Make a consequence from one risk event be the driver for one or more other risk events

- Make the occurrence of one risk event reduce the effectiveness of various controls or mitigations for other risk events
  - Correlate the occurrence of different consequences from the same risk event
- ✓ Pelican includes powerful risk-linking tools within its project risk analysis module, for example:
  - Risk events in the Pelican database that could cause delays can be applied to project schedules. Where a risk event impacts two or more projects, for example a contractor you often use goes out of business, the effect on each project is correlated
  - Inter-connected Primavera project schedules can be imported so that delays in one project or sub-project will be accounted for in other projects they are linked to
  - Factors that increase or decrease the rate at which tasks in a project are completed, like the experience of a welding team, correlate across any task within the project to which they apply
  - Delay risks that can occur multiple times in a task independently (like equipment failure) can be modeled with the independence intact
  - The same delay risk that can occur independently in different tasks (like having to reweld rivets) can be modeled with the independence intact
  - Delay risks that can halt various activities on a site (like a flood or strike) can be modeled to simultaneously impact all ongoing relevant tasks at that site
  - Risks that can add several extra tasks (for example, when a building needs some redesign) at the same can be modeled so that these extra tasks are inserted simultaneously during the simulation
  - The simulation results from the project risk module are stored in a way that retains all the correlation relationships with risk events. This allows Pelican to evaluate the aggregate effect of risks, controls and mitigations across the portfolio of projects
- ✓ Risks imported from the Pelican database retain all their correlations between each other
- ✓ Cost and time simulation results imported from the project risk module retain all their correlations with the risks imported from Pelican into the schedule
- ✓ Simulation results exported back to Pelican retain their correlation, which means that Pelican can perform exact analyses of the effects of risks in its database on all project schedules and other models (for example, discounted cashflow models of the projects) and even provide aggregate scores for those risks and the benefits of their controls and mitigations
- ✓ Random variables in the spreadsheet model can be correlated using a complete set of modern correlation modeling tools called copulas
- ✓ Random variables that change over time (like raw material or energy costs) can be modeled using a wide range of financial time series functions so that appropriate correlations are incorporated between time periods and across different variables
- ✓ Custom dependency models can be built from the ground up using logical functions
- ✓ Various aggregation tools can be used to efficiently retain independence between identically-distributed variables that need to be summed

- ✓ Extreme value tools automatically create the correct dependency relationship between extremes (like lowest and highest, or lowest, 2nd lowest, etc.). These have many applications – for example, in the evaluation of wind or wave shocks to a structure, the size of an epidemic or major accident
- ✓ Forecasts for key random variables (like exchange rate, energy price, raw material cost, weather conditions, inflation rate) that are used in multiple models can be stored in the Pelican system. Any spreadsheet risk model can then link to these forecasts which retains the simulation order. This ensures that the results of the models retain all the correct inter-dependencies, which is critical for correct aggregation. For example, if a business has models to evaluate cashflows for each of its entities in different regions, Pelican ensures that a forecast model of the total cashflow will account for the multiple exchange rate uncertainties and their inter-dependencies, as well as correctly incorporating the influence of shared factors like energy and raw material costs.

### **Risk treatment plans, monitoring and reviewing**

Risk treatment plans lay out which treatment options will be selected and their estimated effectiveness. It informs the relevant people about their roles in that plan, and specific actions that need to be taken and when. They also specify who makes approval decisions about the actions to be taken, and how the plan will be monitored and reported.

#### Related Pelican features

Pelican automatically includes risk treatment plans as follows:

- ✓ Pelican evaluates, compares and ranks the potential benefit of any proposed risk treatment action (control, mitigation), and aggregates the benefit over the portfolio of risks
- ✓ If the cost of controls or mitigations are provided, Pelican can calculate, compare and rank the cost-benefit ratio of each
- ✓ Controls and mitigations are assigned an implementation status:
  - Rejected – not considered viable or cost-effective, but recorded to show it had been considered
  - Under-consideration
  - In the process of being implemented
  - Implemented and working
  - Implemented but not up-to-date, for example an inspection that is overdue
  - Expired – for example, an insurance policy that has not been renewed in time
- ✓ Individuals are assigned responsibility for each control and mitigation action
- ✓ If applicable, schedules can be created for repeated actions with automated alerts to inform people of forthcoming actions that they need to do
- ✓ The Pelican smartphone app can download the tasks assigned to an individual, who can then tick off completed tasks and add notes and photos. The information is then automatically uploaded to Pelican when the smartphone has a Wi-Fi connection
- ✓ Authorization levels are set for approval of risk treatment plans and any subsequent changes

- ✓ An individual assigned responsibility for a risk is informed when a control or mitigation action is overdue or expired
- ✓ When a control or mitigation is no longer in effect Pelican re-estimates the probability and magnitude of its consequences, which then show as changes in the managers dashboards for the relevant entities

## REPORTING

Management at each level in an entity should be able to see how well the risks under their responsibility are being managed. Management aim to ensure that the risk management is cost effective, has broad coverage, is being maintained or improved, and that the information available is of greatest use to decision-makers.

Pelican address these reporting needs as follows:

- ✓ Managers can access the reporting tools through their smartphone, tablet or PC
- ✓ Users with management authorization have access to standard dashboards that provide a wide variety of analytics about risks that are under their responsibility
- ✓ Custom dashboards can also be created using the dashboard editor tool
- ✓ Vose Software can also develop more sophisticated dashboards on request. For example, we can make heat maps based on customer graphics (like a site map, or a process flow diagram). These can be made clickable so that selecting one or more elements filters the list of risks presented
- ✓ Risks and their consequences are displayed in dashboards for the managers of the affected entity and parent entity
- ✓ Moving higher up the entity hierarchy, the risks reported to managers will show severity values adjusted to the scale of the entity. So, for example, a \$100k loss might show as a very large impact for the manager of a small project, but as a very small impact for the CEO of the corporation
- ✓ Standard performance metrics show a track history for variables like:
  - The fraction of controls that fall out of specification
  - The cost effectiveness of the risk treatment plan
  - The number of risks with consequences above a certain threshold
  - The aggregate expected financial loss
- ✓ Custom performance metrics can be easily created by a programmer using a metric editing tool, which can access any information stored in Pelican and even combine it with data from other databases too
- ✓ A manager can filter and drill down through all the information in Pelican. For example, the chief legal officer might filter for the top-ten legal-related risks for a specific region, then select one of the risks and review its risk treatment plan. She might then see that the critical part of the risk treatment plan was the development of an expert testimony and click it to find out who is in charge, then select that person's profile to find out how to contact them, or perhaps read the notes for that control to see the latest update, or even download a draft copy of the expert testimony
- ✓ Pelican includes frequency-impact charts that can be filtered for entity, type of consequence, number of items, etc. These charts can show the probability and magnitude of individual consequences, or for a risk event, before and after the implemented risk treatment strategies. A line drawn between these two points shows how reliant your business is on the functioning of the risk treatment
- ✓ In an ideal world, those exposed to the consequences of risks would oversee implementing and managing the risk treatment. However, in real life we are often dependent on others. Pelican has a unique dashboard that shows how much of your risk management is dependent on other entities within your corporate structure and how much dependency there is on third parties like contractors and consultants

- ✓ People can move on to another job, get sick, retire, have a baby, etc. and if they have important risk management responsibilities their absence can jeopardize the proper execution of your risk treatment plan. Pelican therefore offers a dashboard to show the level of dependency of the risk treatment plan on individuals. This can be used to reorganize responsibilities to even out the workload or to reorganize roles in advance of a planned absence
- ✓ Pelican has a reporting interface to review and compare the risks of projects. It allows the user to quickly see whether a project is forecast to meet its cost and milestone dates, or by how much these might be exceeded
- ✓ Pelican offers an interface in which the manager can interact with risk analysis models that have been developed with the spreadsheet risk module and uploaded into the Pelican system. The manager can quickly review the latest reports and compare against previous reports. New scenarios can also be created depending on the controls that the risk modeler has built into the model

## PROJECT RISK

Projects generally cost more and take longer to complete than predicted. This is not usually because the project schedule is of poor quality – it is because there is a bias in the way that cost and duration estimates are entered into a schedule. Essentially, there are many more 'unlucky' things that can happen in a project making it take longer or cost more, than 'lucky' things that would make the project cost less or finish early. Project risk analysis (PRA) corrects for this bias, producing far more realistic budget and delivery date estimates.

PRA must be able to account for all the uncertainties and risk impacts that could affect the schedule. Since risks can affect the schedule in many ways, the PRA software must offer a flexible and comprehensive set of risk modeling tools. For example, some risks (like a storm of delay in obtaining permits) can stop all the tasks in a part of the project together – called a calendar risk. Other risks could require unplanned extra work to be done. Still other risks may extend the duration of one, or perhaps several tasks, and may do it once (like delay in delivery of a crane) or multiple times (like strikes or floods).

But perhaps the most important capability, and one that is most often overlooked, is the correlation between task durations. Task durations tend to be shorter or longer depending on factors like the efficiency of the equipment, experience and skill of the workforce, and the conditions in which the work is performed. Where tasks share such factors, they will take longer or shorter times to complete in a correlated pattern. It is this correlation that can greatly extend the duration of a project. Most PRA software products require the user to express these correlation patterns by selecting a correlation coefficient between each pair of tasks. However, a relatively small project of 1,000 tasks would require 499,500 such coefficients – an impossible task. Even a summary schedule of just 50 tasks requires 1,225 coefficients, and there is a statistical restriction on what those values can be which is very difficult to achieve. Plus, nobody really knows what the coefficients represent. The net effect is that project risk analysts give up on using correlation, resulting in gross underestimation of the cost and schedule risk. The Pelican PRA module takes a more intuitive, simpler approach – allowing the user to explicitly describe the factors, group them into categories, allowing realistic correlation across a schedule of any size.

### Related Pelican features

Pelican provides the following project risk analysis features:

- ✓ Combined cost and schedule risk analysis
- ✓ Project schedules can be imported from Primavera P6 or MS Project
- ✓ The official master schedule of the project always remains the key reference. Pelican does not allow the user to create a different version of the schedule, only add risk and uncertainty. This avoids the confusion that comes with multiple circulating model versions
- ✓ Upload project risk model to Pelican to allow:
  - Direct comparison of risks and performance across any set of projects
  - Plotting and comparing histogram and S-curves of delivery date and cost distributions in your browser
  - Compare risk-based estimates over the life of the project
  - Automatic updating the PRA as the project evolves or the estimates of relevant risks change

- ✓ One-click synchronization with master schedule
- ✓ Handles schedules of almost any size (50,000+ tasks)
- ✓ Extremely fast simulation (World's fastest)
- ✓ Combining its ability to handle very large schedules and its extremely fast performance means that it is practical to use the project's master schedule. There is no need to produce a condensed version of the schedule, which is what is usually needed for other PRA tools, requiring a great deal of effort to update and many approximation compromises
- ✓ Link risks from Pelican's database into the schedule, with one-click updating
- ✓ Additional project-specific risk register
- ✓ Incorporate productivity factors for correlation, and group them into classes for easy mapping to tasks
- ✓ Risk effects can be described using a comprehensive set of tools:
  - Uncertainty in task scope
  - Single delay and/or cost attached to a task
  - Repeatable delays and/or costs attached to a task
  - Single or repeatable risk of extra work with single or multiple extra tasks anywhere in the schedule
  - Discrete, continuous, or combined risk of change in productivity
  - Single or repeatable, non-overlapping or overlapping shutdown of all tasks on a calendar
- ✓ Risks can be switched on/off in any combination to run scenarios
- ✓ Stochastic Gantt chart to generate scenarios on-screen
- ✓ Variables that can be analyzed:
  - Start date of any task, summary task or milestone
  - Duration of any task, summary task or milestone
  - Finish date of any task, summary task or milestone
  - Schedule-related cost of a task or summary task
  - Cash outlay across the project's duration
- ✓ Comprehensive graphical and statistical results, including:
  - Histogram plots
  - Cumulative ascending plots
  - Pareto plots (combination of histogram and cumulative)
  - Tornado plots showing what is driving the variable's uncertainty. The effect of productivity factors, risk events, scope uncertainty can be analyzed in groups or separately. Tornado plots can be plotted for sensitivity to different schedule layers.
  - Cash outlay by period (day, week, etc.)
  - Cumulative cash outlay by period (day, week, etc.)
  - Scatter plots of outturn cost v finish date (with or without a projection line)
  - Statistical measures like mean and percentiles
- ✓ Reporting templates
  - Create custom report templates and incorporate plots and statistics into the report
  - At the end of a simulation, select report templates to generate consistent up-to-date reports
  - Reports can be stored in various formats including PDF, Excel, Word and various image formats



## CUSTOM RISK MODELING

Many risks have consequences that require custom models to evaluate correctly. For example, a delay to the completion of a capital investment project can affect the timing of cashflows that pay back the initial investment reducing its EBITDA, IRR or NPV. Some types of risk, like the uncertainty in the cost of raw materials, labor, currency exchange rates or energy or changes in a tax regime can affect the returns of multiple investment projects or multiple entity cashflows at the same time in a correlated manner that has an important aggregate effect on the business. Evaluating uncertainty in the revenue streams from assets may involve developing a reliability-based risk model of the critical systems.

To correctly assess the exposure of a business to all risks and uncertainty, one must have a flexible risk modeling system that pulls in the same risk and uncertainty estimates and treats them in a manner that allows the results for each investment or cashflow to be aggregated.

### Related Pelican features

Pelican is the only ERM system that integrates a complete risk modeling environment, with the following tools:

- ✓ Risk impacts and uncertainty forecasts are stored within the Pelican system in a special format that ensures that all Monte Carlo simulation models use the same values for these variables sample by sample
- ✓ Identified risks can be pulled into project cost and schedule risk models, and spreadsheet-based risk models, using this special format
- ✓ Using the same special format, results from cost and schedule risk models can be linked into spreadsheet-based risk models
- ✓ Uncertain forecasts can be created for any number of variables with either expert estimates or by fitting to data using a very extensive set of modeling tools. The simulation results from these models can be stored for use by any other spreadsheet-based risk model. These models can be linked to external market data sources and automatically rerun to ensure that the forecasts are always based on the latest information
- ✓ Uncertainty forecast data can be quickly updated by an analyst if data or assumptions change so any connected model will use the same current official forecast, thereby ensuring complete consistency between the assumptions that all critical models are using
- ✓ Pelican offers a huge range of risk modeling tools within its spreadsheet-based risk module. These include: 130+ distribution types, sophisticated correlation and time series models, all of which can be fit to data using the latest statistical techniques; tools for modeling extremes and aggregates; expert elicitation tools; data viewing tools; advanced probability calculations; stochastic ODE and integration tools; specialist insurance and finance functionality, etc.
- ✓ The spreadsheet-based risk module can run multiple scenarios automatically, of any number of samples and any variation. The different scenario results can be compared with overlay charts and statistics
- ✓ Delay risks to tasks in a project or projects that are stored in Pelican can be analyzed within the project schedule, in combination with other risks for that project, and the actual effect on the project reported back to Pelican. So, for

example, a certain risk might create a delay of 10 days on a task, but that only results in a minimal delay to the project because of where the task sits in the schedule

- ✓ Additional risks specific to a project can be applied to a schedule without having to be placed within Pelican if required. The same applies for spreadsheet-based risk models
- ✓ A complete range of reporting graphs and statistics:
  - Histogram, cumulative ascending and descending, and Pareto plots – multiple simulations can be overlaid
  - Scatter, tornado and spider plots for in-depth behavior and sensitivity analysis
  - Trend plots to analyze forecast behavior over time
  - Comprehensive statistical analysis of input and output variables
  - Data tables of all sampled values from inputs and outputs. Selection of a specific simulated result can be placed back into the model to investigate (e.g. for extremes, unusual results or to investigate hard-to-find model errors)
  - All results can be downloaded to PDF, Word, PowerPoint or Excel format
- ✓ Spreadsheet risk models can be uploaded to the Pelican system where:
  - They can be locked against editing that would alter the logic
  - Authorized users can run different scenarios on the model. The scenario options are only limited by the logic of the model
  - Simulation results are stored with a time stamp along with the model and the different scenarios created. This allows an authorized user to investigate how forecasts have changed over time, or audit past decisions;
  - The models can be set to rerun according to a schedule and automatically store the results. For example, if a model is linked to an external market price database, it can be rerun every day after market close to re-estimate the forecasts
- ✓ Converter tools can translate any risk analysis models that are written with @RISK or Crystal Ball into the Pelican format automatically, so you can retain any key existing models you use

# Information for the IT department

# SYSTEM REQUIREMENTS

## Web application

### Web Server

- System: Windows Server 2008+ 64-bit
- Processor: Pentium or compatible
- Memory: 4GB+
- Hard Drive: 100GB free space
- Software pre-requisites: ASP.NET 4.5+, IIS
- Database: MS SQL Server 2014+

### PC Client

- Screen: Resolution 1024x768 or more
- Browser: IE 11+, Chrome, Firefox
- Mobile Client
- Browser: Chrome; iOS, Android and Windows Phone native browsers

## Project risk analysis module

### PC installation

- System: Windows 7+
- Processor: Pentium or compatible
- Memory: 4GB+
- Hard Drive: 10GB free space, SSD preferred
- Screen: Resolution 1024x768 or more
- Software pre-requisites: .NET 4.5

### Network installation

- As for PC installation, plus shared folder on the network

## Spreadsheet risk analysis module

### PC installation

- System: Windows 7+
- Processor: Pentium or compatible
- Memory: 2GB+
- Hard Drive: 10GB free space
- Screen: Resolution 800x600 or more
- Spreadsheet: Microsoft Excel 2007/2010/2013/2016 (32-bit and 64-bit versions)
- Software pre-requisites: .NET 3.5

### Network installation

- As for PC installation plus shared folder on the network

### Web application integration

- Database: MS SQL Server 2014+
- Database space required: 1 GB

#### Simulation Server (can be on the same system as Web Server)

- System: Windows Server 2008+ 64-bit
- Processor: Pentium or compatible
- Memory: 4GB+
- Spreadsheet: Microsoft Excel 2007/2010/2013/2016 64-bit
- Software pre-requisites: .NET 3.5

#### Power-User Client (Modeler's PC)

- System: Windows 7+
- Processor: Pentium or compatible
- Memory: 2GB+
- Hard Drive: 10GB free space
- Spreadsheet: Microsoft Excel 2007/2010/2013/2016 (32-bit and 64-bit versions)
- Software pre-requisites: .NET 3.5

## DATA SECURITY

Data on the risks that a business faces and their treatment are critical strategic information that must be kept secure.

### Related Pelican features

Pelican provides the following features to maintain the security of your data:

- Pelican is installed on a server within the organization, giving the organization control of its own security
- Access to Pelican is only available to authorized users by an appointed administrator
- Access to Pelican can be granted using Windows credentials or via a hashed and salted login process
- Users are given access to specific individual entities within the entity structure
- Users are given access to specific functionality controlling whether they can edit data, view reports, etc.
- Changes to risk information can require approval by an authorized person before being incorporated into the system. Conditions for when approval is needed are customizable.
- Dashboards and bowtie analyses are assigned different levels of confidentiality, according to a customizable list, and that confidentiality level is shown on-screen
- Printed reports can be customized to display the appropriate confidentiality statement
- Access to risk analysis models is similarly limited by user. A user may be given authority to upload or replace a model, ensuring only trusted risk modelers can submit a model for use
- The API used to communicate between the project risk analysis desktop tool and Pelican, for downloading the latest risk data and uploading the model and results to pelican, require Windows authentication or a hashed and salted login process
- The central database of Pelican can be set to automatically create backups according to any desired schedule and store the resultant backup files to a specific location within the company's network. Pelican can be restored from any backup by an administrator.
- Pelican has been tested for data security by a specialized third-party consultancy firm. A report is available on request.

# SYSTEM RESPONSE TIMES

## Web application

### Web Server

- Depends on system configuration and amount of data
- Typical table access < 1 sec

## Spreadsheet risk analysis add-in

### Model building

- Loading time: typically, 3-6 secs
- Interface opening time: instant
- Interface calculation time: instant, except for some high calculation functions like FFT

### Simulation runs

- Dependent on model size. Typical model of 1000 cells, running 5,000 samples, takes 12 seconds
- Samples/sec remains almost independent of number of samples (as long as Excel has access to sufficient memory)
- Many functions allow for writing models in more efficient code which can speed up the model by up to around 15 times faster, sometimes more

### Report generation

- Typically, 1-2 seconds (10-50 inputs/outputs and 5,000 samples). 4-6 secs for 1,000,000 samples.
- Advanced tornado charts can take 3-4 secs for large sample sizes (1,000,000+)
- Report exporting to PDF, Word, PowerPoint, Excel – typically 5-10 secs depending on report complexity

## Project risk analysis add-in

### Model building

- Schedule import time: typically, 5-10 secs for a 1,000-task schedule
- Interface opening time: instant

### Simulation runs

- Dependent on model size. Simple model of 500 tasks, running 5,000 samples, takes 1.5 seconds. 40,000 tasks running 5,000 samples with complex linking takes 5 minutes.
- Samples/sec remains almost independent of number of samples

### Report generation

- Displaying graphs of results - instant for 5,000 samples
- Template report generation – approx. 30 seconds



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