The Application of Success Probabilities, Success Driven Project Management/SDPM, and Some Critical Chain Concepts to the Oil & Gas Industry in Brazil

Russell Archibald, Principal, Archibald Associates, USA
Vladimir Liberzon, General Director, Spider Project Team, Russia
Peter Berndt de Souza Mello, Director, X25 Treinamento e Consultoria, Brazil

ABSTRACT

This paper presents the practical application of range estimates for activity durations and/or resource requirements to produce success probability trends, which is a basic advance included in Success Driven Project Management/SPDM. SPDM has been used in Russian speaking countries for the past 15 years and includes concepts equal to certain critical chain features; all concepts underlying SPDM will be described briefly. Recent experience in applying SPDM to projects in the oil and gas industry in Brazil will be described, and open discussion of all aspects of SPDM will be encouraged.

THE NEED FOR MANAGING UNCERTAINTIES, RISKS, AND RESOURCE RESTRICTIONS IN PROJECTS

Most complex projects and programs today involve many uncertainties and risks, plus many restrictions on availability of money, skilled people, materials, equipment, and other key resources; projects in the oil and gas sector in Brazil are no exception to this statement. The need is to be able to plan, schedule, monitor and control these projects while reflecting these uncertainties, risks, and restrictions in a practical and realistic manner in the project plans, schedules, execution methods, and progress reports. The concepts and approaches described here have been developed and applied over the past 15 years, primarily in Russia and former Soviet Union countries, to satisfy this need. They are now being applied successfully in western European countries, Brazil, and elsewhere.

The term Success Driven Project Management/SDPM (Liberzon and Archibald 2003), (Liberzon 1996, 2000, 2001) refers to an integrated approach that incorporates 1) range estimates of work scope, activity duration, resource requirements; 2) calculation of activity durations based on work scope and resource productivity information; 3) calculation of the Resource Critical Path/RCP by taking into consideration all schedule constraints including resource and financing constraints in both the forward and backward passes of network analysis; and 4) predictions of the probabilities of achieving user defined target schedules and costs.

We will first describe the underlying principles and methods upon which SDPM has been constructed and then provide a short history related to its development and emphasis on resource planning and schedule optimization. SDPM will be compared briefly with the basic concepts of the Critical Chain method, and present a comparison of the use of Monte Carlo methods with using a range of three estimates to predict success probabilities. Finally we will describe our experience in the field in applied SDPM to projects in the oil and gas industry in Brazil. A few basic conclusions from this experience will then be presented.

SUCCESS DRIVEN PROJECT MANAGEMENT/SDPM METHODOLOGY

SDPM is based on a set of indicators measuring project performance and forecasting its final success, in addition to producing detailed planning, scheduling and control reports. The SDPM information system supplies the project management teams with the following information:

During the planning stage:

1. Project target dates, costs and material requirements that could be achieved within the user defined probabilities of success,
2. Probabilities of achieving target project (and project phase) goals (scope, time, cost, and material requirements) – “success probabilities”, and

3. Quantified time, cost and material contingency reserves that should be assigned to support achieving project goals with the necessary or desired probability.

During execution and control:

1. Current probabilities of achieving various project goals,
2. Success probability trends that are used for determining necessary corrective actions (it is worth mentioning that these trends depend not only on project performance but also on changes in project risk characteristics), and
3. Current remaining contingency reserve quantities.

During project execution the project manager monitors and controls the current success probability and its trends. This trend information is the most useful for evaluating and estimating project performance and deciding if and what corrective action is necessary.

The SDPM methodology is based on the *resource critical path* approach. This approach has some common features with the Critical Chain/CC and the theory of constraints (Goldratt 1997) and includes:

- Calculating the resource critical path *taking into consideration all schedule constraints including resource and financing constraints*,
- Calculating and managing the *contingency reserves* (analogue of CC project buffer but with significant and important differences),
- Calculating *resource constrained assignment floats* and determining *critical resources*, and
- Project risk simulation and calculation of the *success probabilities* to achieve given dates and costs,

Table 1 presents a comparison of SDPM method with those of CCPM, and highlights a number of similarities and differences between the two approaches.

By controlling current values and trends of the project success probabilities the project managers have powerful tools that make project performance analysis very informative. It is reported to be even easier than the traditional Earned Value methods.

SDPM	CCPM
Resource Critical Path/RCP: Project schedule is calculated by taking into account **all schedule constraints** including availability of human resources, financing, equipment & materials. **Activity and resource assignment reserves** are determined (with related total floats that are calculated by comparing **forward and backward resource constrained schedules**). We do not agree that a single "drum resource" always exists. In different phases (project stages) "drum resources" may be different.	**Critical Chain:** Identifies **one "schedule drum resource"** that defines the "schedule constraint" and one "critical chain" of activities. Creates the schedule for this resource and tries to adjust other resource assignments to this schedule. Another recommendation is just to take into account resource dependencies in the leveled schedule and then to determine the Critical Chain.
Many potential resource critical paths and paths with small floats may exist. "Feeding buffers" are not created, but the methods calculate recommended dates that postpone the planned time of activity execution until the probability that it will postpone critical activities reaches the user defined value. Feeding buffers are not necessary because we do not suggest "protecting" any chain. **Project time and resource buffers are necessary**, however, as **contingency reserves** for reliably achieving project target dates.	**Critical Chain is the only single sequence that shall not change during project execution.** So other paths that enter CC shall include "feeding buffers" that defend CC from the potential change. These feeding buffers may postpone planned dates of CC activities creating the time holes in CC.
Risk evaluation and prediction: Using risk simulation (any approach – Monte Carlo or three estimates) project target dates and costs to achieve **user defined "success probabilities"** are calculated and recommended. Target parameters are specified by the user and the software calculates the probability of the project successfully meeting these targets: "success probabilities."	CCPM recommends using 50% probability estimates for task durations and collecting all extra time reserves of activity duration estimates into a project buffer that is created at the end of the critical chain. This is the "chain buffer." Feeding buffers protect this path "that shall never change." CCPM states: 1) that it is not right to forecast activity dates,

The differences between target dates and costs and those planned in the current schedule are called the "project buffers." The **Project time buffer i**s the difference between the finish date of the project finish milestone succeeding all project paths and the project target completion date. Time and cost buffers may be also created and calculated for specific project phases. SDPM recommends using optimistic schedule dates to set plans for project performers.	and that people shall know only about the next activity start dates. People will be informed when necessary to start their work. 2) that forecasting the project finish date also is considered as the wrong approach, and shall not be used because of Parkinson's Law. CCPM says nothing about cost! No cost buffers, nothing at all.
Progress Evaluation and Decision-Making: Project performance and buffer penetration (or usage) are estimated by monitoring the **trends of the success probabilities.** Performance is satisfactory if success probabilities are rising, which means that buffer penetration is lower than expected and planned. New risks that may appear are taken into consideration when current success probabilities are estimated.	Buffer penetration is estimated qualitatively – a red zone means that it is too high, yellow – large enough, green – low. The approach is linear – if one third of the project duration is behind then one third of the buffer may be safely utilized. There is nothing that may be calculated, but there are discussions on approaches that may be used. Again – nothing about cost, only schedule.
Type of Risk Simulation: Once more – this method does not depend on approaches to risk simulation. We recommend Monte Carlo for small projects and the 3 scenarios approach for large projects. Accuracy does not matter much but precision is necessary for reliable trend estimates. We suggest management by trends, not by status.	CCPM uses 50% probability estimates for time only.
Project Portfolios may be planned as one large project. Projects within a portfolio may have different priorities that define where resources will be used first when a conflict occurs. These priorities can be confirmed by portfolio performance simulation optimizing portfolio success probability criteria.	CCPM: Projects in the portfolio shall be pipelined to avoid multitasking. It is better to perform them in sequence one after another. How to define the order is not discussed.
Periodic schedule and cost performance evaluation: The SDPM approach is based on regular recalculations of the project and portfolio schedules, costs, and success probabilities and their trends using computer software to carry out well-defined methods.	Recalculations shall be minimized; the target – simplicity. Regular adjustment of the current schedule is called firefighting and blamed as unnecessary complexity. It is stated that CCPM is about human behavior, and it is declared as a paradigm shift – with no planned dates of activity performance, people are free to finish the work as soon as possible.

Table 1. SDPM compared to CCPM

Need for Integrated Information: Effective project planning and control requires that the information regarding project scope, schedules, resources, finances *and related risks* be integrated at detailed and summary levels. This requirement has been recognized for many years but it has not often been achieved in practice.

Integration Methods Used in SDPM: Integrated scope, schedule, financial and risk management for projects is achieved in the SDPM approach using these methods:

1. Scope is defined systematically using appropriate multiple breakdown structures that inter-relate all project information. The work scope or volume is estimated for each task, work package, or activity, together with the types of resources required and the planned rate of usage or resource productivity for each activity.
2. Sequential, logical dependencies of work and deliverables are defined using appropriate network planning methods.
3. Resources are:
    a) defined as consumable and renewable; they can be utilized and produced on project activities,
    b) estimated as independent units, units in teams or crews, or interchangeable units within assignment pools;
    c) assigned to project activities; and
    d) considered as constraints when their limits of availability are reached in calculating the project critical path, **in both forward and backward pass calculations.**

4. Activity durations are calculated, when appropriate, by combining work scope or volume with resource usage or productivity rates.
5. Risks are calculated by simulating risk events and using a range of three estimates where appropriate for 1) work scope and volume, 2) resource usage and productivity rates, 3) activity duration when estimated directly, and 4) calendar variation for weather and other factors, to produce predicted probabilities of success in meeting the desired target schedule dates and budgets.
6. Project schedules are produced in the usual manner by processing the network plans, but most importantly the true resource critical path is calculated to reflect logical and all schedule constraints, including resources, in both the forward and backward pass calculations of the network plans. This has become known as the **resource critical path/RCP** to emphasize that resource constraints have been used in determining which activities are truly critical to project completion, and in the calculation of available float or allowable delay.
7. Actual expenditures of time, money, and resources are compared with plans, schedules and budgets to enable effective project monitoring and control.
8. The current probabilities of success in all areas (schedules, resources, financial) are calculated, and their trends are determined and presented graphically through analysis of frequently revised and retained project plans. Initially the desired targets for project dates, costs, and material or other resource requirements are calculated based on the desired probabilities set by the project manager and planner. When the target data are set, then the system calculates and the project planner evaluates the probability of their successful achievement.

Risk Simulation and Assessment in SDPM: Risk assessment can be accomplished in the SDPM approach using either Monte Carlo methods (many repetitions using random number generators) or using range estimates, usually three: optimistic, most likely, and pessimistic. The choice of which method to use in a specific situation depends on several factors, as presented in Table 2.

Using Monte Carlo	Using 3 Estimates
Inputs: Three estimates are collected on activity durations and probability distributions are assumed. Risk events are identified and their probabilities estimated. Conditional links are used in the more advanced software as the results of risk events that may happen with predefined probabilities.	**Inputs:** Three estimates are collected on activity durations and costs. Risk events are analyzed. Three project scenarios are created: Optimistic (10% probable, including realization of some positive opportunities), Most Probable, and Pessimistic (90% probable, including realization of some negative threats). These scenarios may include different activities due to risk events that may happen in each scenario.
Process Methods: Project execution is simulated many times with different activity durations defined by random number generator; risk events happen with their probabilities also defined by random number generator. After a certain predefined number of iterations the process stops. The probability curve is determined by the number of cases in each duration interval.	**Process Methods:** Three scenarios are calculated (with resource leveling and project budgeting). Using three point estimates (optimistic, most probable and pessimistic) the probability distribution is restored using a probability curve of some predefined shape. Spider Project uses the shape that depends on the number of activities on RCP and total number of project activities. But this shape does not matter much. Any reasonable shape may be used including triangular.
Completion Date: Project finish date is forecast by finding the point where a vertical line divides the area under the probability distribution curve in the desired proportion. If the required probability to meet the target is 70% then the area to the left shall be 70% of the total area under the curve.	**Completion Date:** Project finish date is forecasted by finding the point where a vertical line divides the area under the distribution curve in the desired proportion. If the required probability to meet the target is 70% then the area to the left shall be 70% of the total area under the curve.
Progress Evaluation: During project execution the process is repeated periodically for estimating project performance by comparing current probabilities to meet targets with the prior probabilities (success probability trends). Rising success probability (positive trend) means successful performance, negative trends show problems.	**Progress Evaluation:** During project execution the process is repeated periodically for estimating project performance by comparing current probabilities to meet targets with the prior probabilities (success probability trends). Rising success probability (positive trend) means successful performance, negative trends show problems.
Pro: More accurate than 3 estimates, can show complex curves with more than one maximum.	**Pro:** Fast and precise. The distribution may not be correct but the results are repeatable, with consistent errors. This

Con: 1) Time consuming – each iteration requires project leveling that for large complex project can take minutes; the necessary number of iterations for the desired precision is not known but is large enough (thousands at least) that makes it impractical for large complex projects – the resulting precision is low. 2) Activity durations are correlated by Spider Project if these activities are performed by the same resources, but most packages do not take this into consideration. So the results look accurate but actually are wrong. 3) Project execution will depend on the performance: people are likely to apply some corrective actions and will change priorities when they meet problems – this is not considered. The same consequence is produced: the results are not as accurate as they appear to be.	means that the success probability trend analysis will be reliable. **Con:** Estimations are less accurate (we suggest making forecasts more pessimistic to take into account the unknown unknowns). It is better to know that we plan projects based on estimates that we know may be not accurate than to rely on inaccurate estimates that only look correct.-
Using a Summary Model: To be able to apply MC to the large projects sometimes people use it with a high level summary model. This approach loses links between activities and cannot simulate resources properly. Accuracy is very low.	**Summary Model Not Required:** The three estimates model does not provide or require any capacity to summarize complex projects in a simplified, summary form.
Merge bias is a known problem for risk simulation. For Monte Carlo simulation it exists in the high level models. These models that are usually used for large projects simulate work packages or phases rather than activities. These phases may consist of many parallel paths merging at the end, and thus the merge bias within the summary work packages is not considered. During project execution a problem (delay, failure, etc.) often leads to corrective actions to modify future execution of parallel paths, and such corrective actions are not considered using Monte Carlo. Simulation that treats parallel paths as though they are independent leads to erroneous estimates.	**Merge Bias:** In the 3 scenario approach estimations are made for the project as a whole. Merge bias inside the project is ignored. However, for project portfolios the probabilities are calculated considering each project as independent. Within portfolios, the probability that two projects will finish before a given date is calculated as the product of the individual project probabilities. If there are obvious parallel independent paths within a specific project, the project may be considered as a portfolio of subprojects, and the merging bias will thus be taken into consideration by calculating the probability of two or more subprojects meeting a specified completion date as the product of the probability of each independent path. Actually the merge bias impact does not matter much because the accuracy of the probability distribution is not as important as precision of the success probability trends.

Table 2 Comparison of Using Monte Carlo Versus Using 3 Estimates in Risk Simulation

THE PROJECT PLANNING CULTURE IN RUSSIA: EMPHASIS ON RESOURCES

Project planning in Russia has a lot of Soviet Union roots: The USSR created an economy that tried to plan everything, to create norms and standards common for the whole state, and to balance resources of the industries, enterprises and countries. The main problem with this approach is the lack of competition. People tried to achieve the planned figures and that's all. Their salaries did not depend on the profits. Even if the goods that were produced were not sold people received the full salaries because they have done what was planned.

Universal Coding System: The State created the list of materials that have a coding system that shall be used anywhere. There were state norms for resource productivities on any and every type of work, norms for material and energy consumption for each unit of work for typical activities, unit costs, etc. Every plan should be based on these norms. Nobody could pay or receive more than what was defined by these norms.

This economy was not effective, but the methods that were used for resource management were very good. Each and every Soviet enterprise had a special department that was called the Scientific Work Organization that reminds one of contemporary Quality Management Departments. These departments studied work processes, established corporate norms, and implemented process improvements.

The Use of Norms and Standards: Modern Russia lives in a market economy but uses many methods and approaches from the Soviet era that became a part of the Russian planning culture. One of the main differences between project planning approaches in Russia and abroad that is obvious for Russian managers is this universal use of the norms and standards. There were state norms in construction and resource banks useful for data exchange between enterprises (the same codes, the same norms, the same estimates). These data banks are available and useful for every conceivable type or category of projects: all types of facilities design and construction, information systems and technology, new product development, pharmaceutical product development, military/aerospace, financial services, R & D, international development, and others. For Russian project managers it is just unbelievable that Western PM software does not include activity volumes – quantities of work to be done in physical units (meters, tons, pieces, IT modules, etc.). All norms are based on volumes – material requirements per unit of activity volume -- with unit costs and resource productivities defined as the volume of work that is done per one hour. Even today in construction and some other industries workers are paid per volume of work that was done. Activity duration is usually calculated basing on volume of work to be done and the total productivity of assigned resources. The PMI PMBOK Guide calls this approach “parametric estimation of activity duration” but only the Russian PM software Spider Project supports this approach together with the usage of the corporate norms in the project planning.

Russian Resource Planning and Schedule Optimization: Russians have always paid a lot of attention to resource planning and schedule optimization. Spider Project calculates the Resource Critical Path (later also called Critical Chain) since 1993 and creates resource constrained schedules that are much shorter than the schedules created for the same projects by other packages. Russians have the impression that foreign PM software developers just do not try to improve resource constrained scheduling at all. It looks like nobody in the West plans projects with resource restrictions because the resource constrained scheduling capabilities of the most popular PM software are awfully poor.

EXPERIENCE IN USING SDPM IN THE OIL AND GAS INDUSTRY IN BRAZIL

First Application of SDPM in Brazil: The first known application of concepts from SDPM in Brazil was developed for the Urucu/Manaus Pipeline (Archibald, Mello and Guimarães, 2007). Although risk assessment and simulation of scenarios were carried out using a table of expected resources for that project, the resulting project plan wasn’t applied in the field. At that time, while Petrobras created scenarios using partial data received from the construction sites, the actual work was executed by many private contractors hired under three consortiums, each of them with their own procedures and methods of working. The scenarios influenced some of the contractors but the contracts in place did not require them to comply with the changes in schedules indicated by the SDPM information.

The scenarios built were then used to establish new estimates of people, machinery and materials for the second phase of the project. While the SDPM team on that project did not succeed in bringing the practices to the daily activities (due to legal dependencies that forbid Petrobras from demanding its use from its contractors), it gained visibility from the headquarters for this new approach. It is expected that in future Petrobras projects the contractors will legally be required to increase their planning details to guarantee that scenarios are built and RCP is truly adopted during the course of the projects. Jefferson Guimarães, the planning engineer responsible for bringing SDPM to the Urucu/Manaus Pipeline Project, is now working on creating the new project planning requirements to be included in new contracts.

Adoption by Contractors: As Petrobras has signalled its intention to demand that contractors follow many of PMI best practices and also SDPM Integration Methods, we now have the opportunity of seeing some engineering companies investing in learning SDPM and applying it to their projects. In that direction, Altus and STD are two companies that have just started to adopt the method in Brazil.

At STD, where we are following the implementation closely, the company has been working on the development of a PMO and organizing its portfolio to permit a clear view of the available resources, and to integrate information from all areas related to any project, from acquisitions to sales, accounting and engineering. The success probability trend is becoming the main progress indicator for the projects along with the use of earned value analysis.

Presently their portfolio includes over twenty projects, most of them small to mid-sized projects for oil and gas. City Gates Stations are the main deliverables (these are complex facilities with pipe manifolds, valves, and control systems that connect the high pressure gas pipeline to the lower pressure city gas distribution system.) For each of these City Gates Station projects there is a long list of interfaces with other contractors and-equipment and material vendors. Two of their new projects are using SDPM from the very beginning and all the other ongoing projects (that in fact use some of the same resources) are being reorganized to permit the integration of the necessary information for proper scheduling of their entire portfolio.

It has been found that the main reason for the delays in some of the deliveries of ongoing projects was the unavailability of critical resources (automation, mechanical and electrical engineers) on their expected dates, and because of abrupt re-scheduling due to delays in the work of interfaced contractors and vendors.

Usually the sales department sets a very optimistic date for the arrival of the parts and that soon sets the official completion date expected by the customer (Fig. 1). The customer will pay for the time of the engineers while they are dedicated to the project but, whenever there are delays in the arrival of main parts, the project will be extended, causing a disrupted schedule for the engineers. The extra cost of keeping the engineers available will often compromise the financial results of the project (Fig. 2).

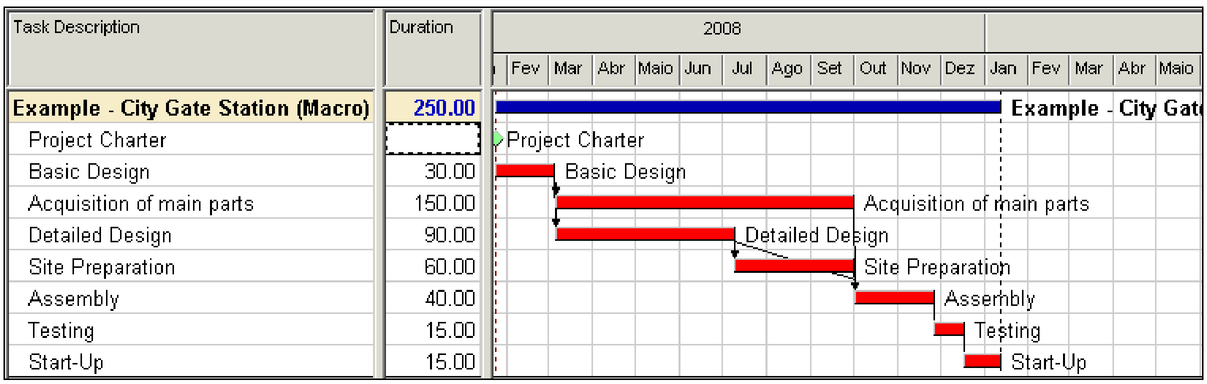

Fig. 1 Acquisition of the main parts sets the basic schedule for the project. Detailed design and site preparation are usually calculated to be finished at the expected time for the arrival of imported parts.

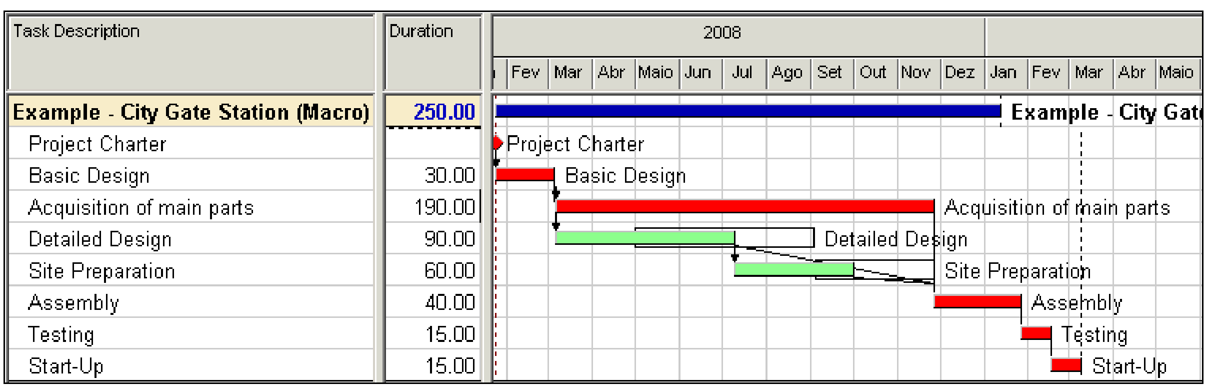

Fig. 2 Due to frequent delays in the arrival of the main parts, we often can calculate floats for the engineers' activities. In the example, the extra 40 days in the arrival of parts can be applied to the detailed design or site preparation. The problem is resolved with the application of SDPM, since we have a couple of changes in the way the projects are conducted:

- Customers will get more realistic dates for the project, created with the simulation of alternative tracks for the project and considering the forecasts of duration and costs of the activities with the use of three estimates;

- Costs for both the company and the customer will also be more realistic. Instead of applying the cost of the engineers and an overhead from previous experiences, the company will administrate the resources in a multi-project view, distributing the idle time of the engineers in different projects.
- Risks will be forecast and the customer will be warned in advance of possible delays in the acquisition of main parts or the limited access to resources due to the optimization of the use of the engineers among the portfolio of the company.
- Overlaps from one project to another will be carefully controlled with a multi-project common resource repository, reducing the loss of productivity when the abrupt rescheduling occurs, as found in earlier projects.

It is very important to notice that most of the projects undertaken by STD are for the same end-customer (Petrobras), but each one is controlled by different administrative personnel. Each project will seek its own success and it is measured not by the end date, but for the difference of time/cost from planned to executed. This means that for most of the cases, it will be better for the customer to have longer, but realistic dates than having un-kept promises for short projects.

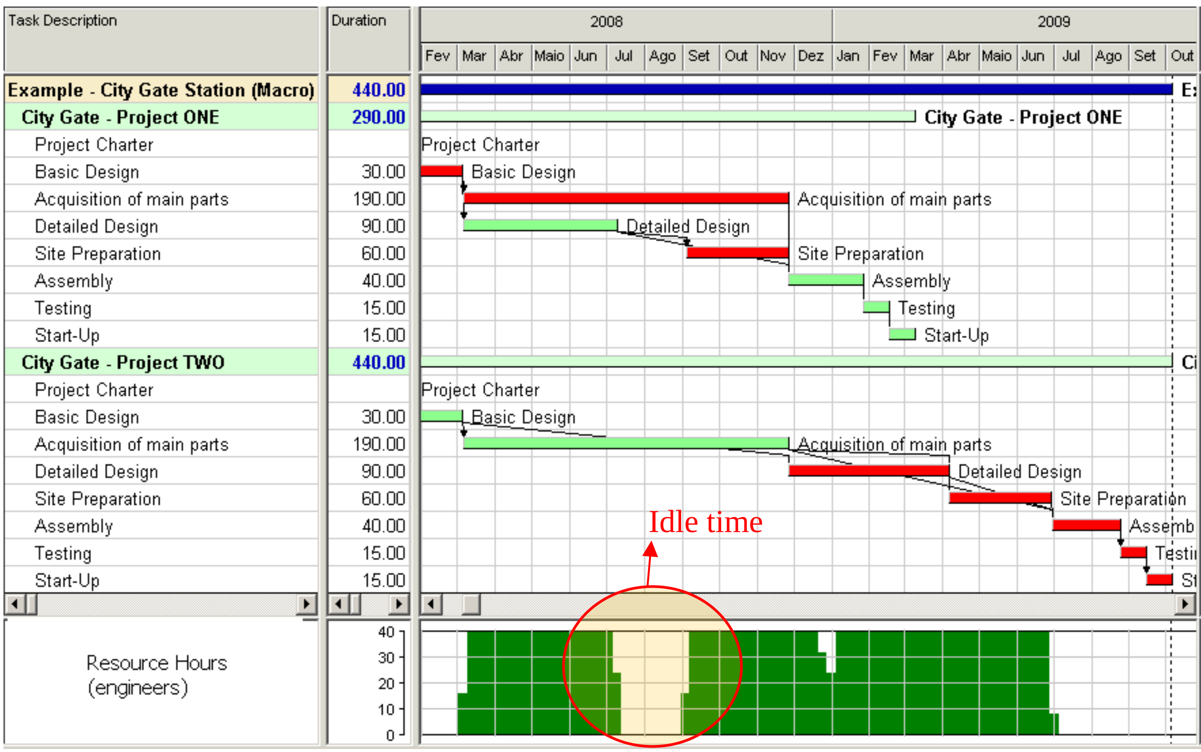

Fig.3 – If Project One maintains the engineers allocated while the main parts are late, Project Two will take longer to be finished (total time of both projects – 440 days)

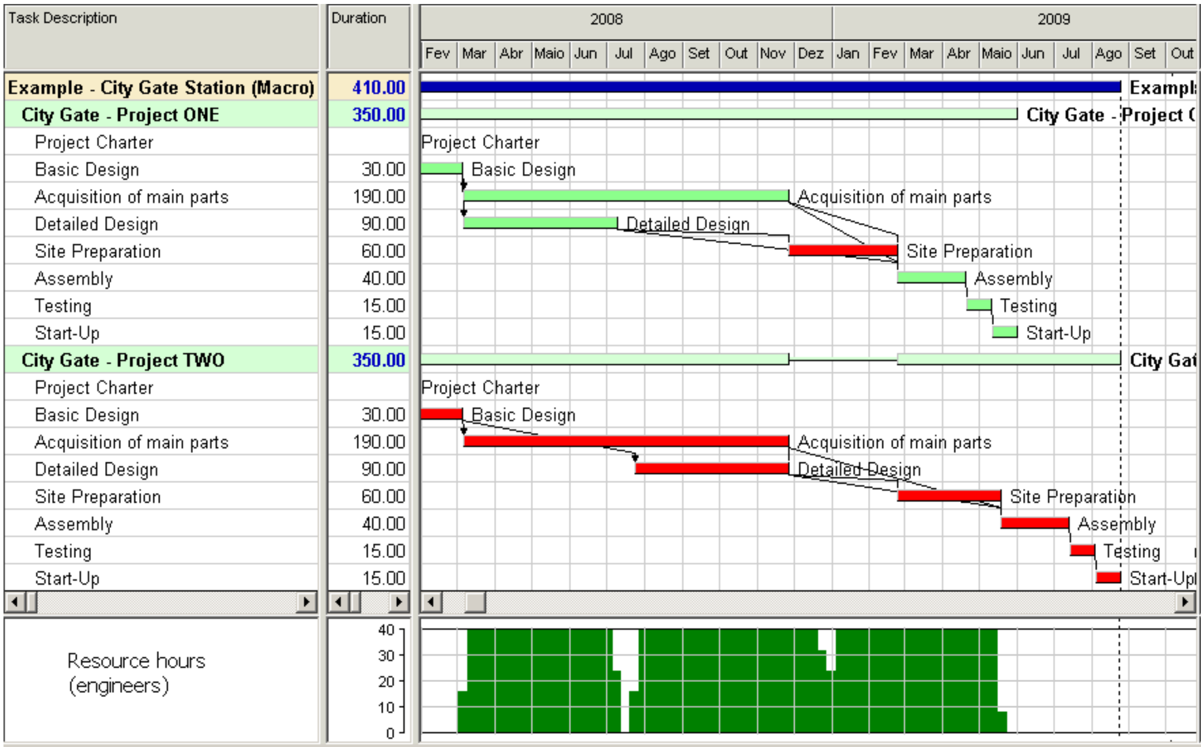

Fig.4 – If Project One shares resources with Project Two, we will reduce the idle time of the engineers and the overall time of the projects will be smaller (410 days). Delays in the arrival of any items will rarely become the reason for change in the delivery dates for the customers.

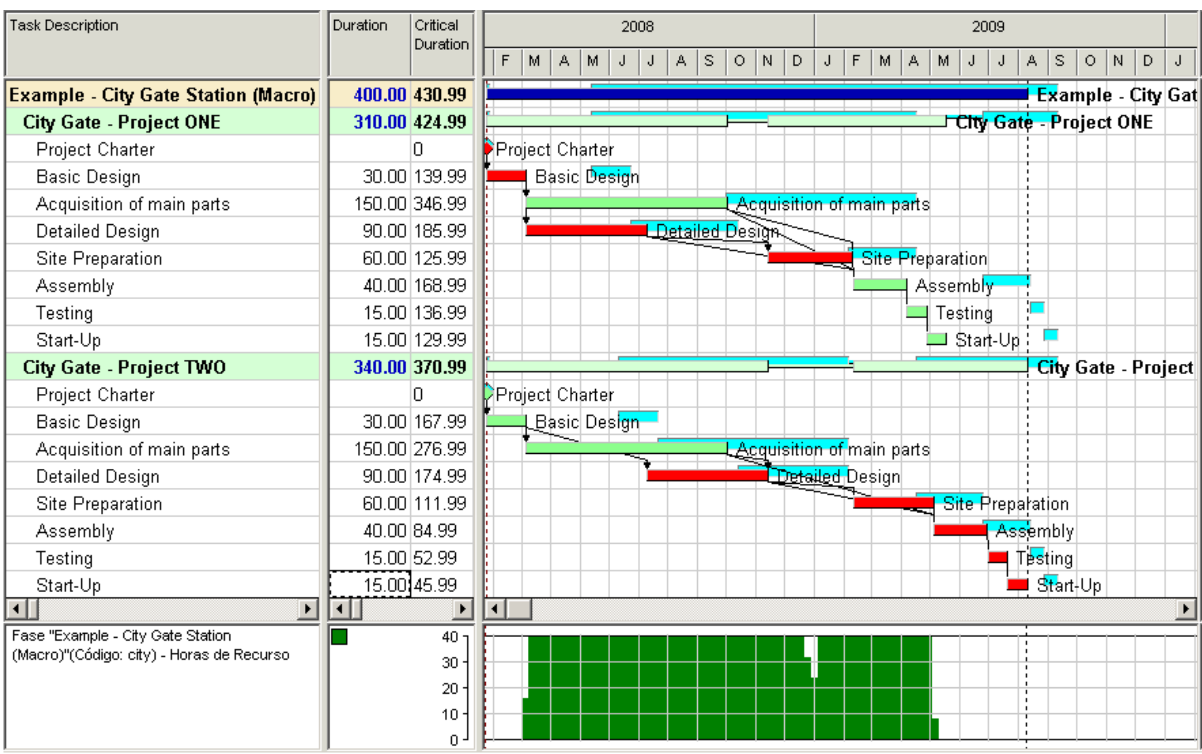

Fig.5 – By simulating the execution of both projects with three scenarios (optimistic, pessimistic and most probable), the company can negotiate the execution of them with a duration from 400 to 431 days (using a 70% risk estimate). In the figure, the blue schedule shows the overall buffers necessary for each project

and the company will set the planned duration of 310 days for the first project and 340 days for the second project, while warning the customer of the related risks and possible delay, as indicated by the critical duration.

Future: The adoption of SDPM in Brazil is in a very early stage but its application seems to be well accepted. The two projects undertaken by STD with the use of SDPM at the time this paper was being written show a greater level of project planning than their previous projects and there is a greater level of participation from the customer too. The first deliverables of those projects are still late from original planning but are less delayed than indicated by the average delays in other projects. There is an ongoing improvement in the scheduling of restricted resources as the projects in their portfolio are gradually expanding the level of detail to meet their needs. The biggest difference can be found in how acquisitions of parts are being controlled. In one of the projects, where 350 parts were identified to be bought, assembled and delivered, the new acquisition plan includes interfaces with functional areas of the company (Fig.6), including actions from the sponsors that usually are required to sign for the most important purchases. Expenses that were already approved in the project manager's budget still demanded final approval of the board of directors.

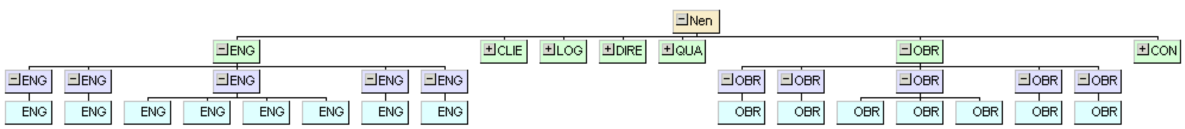

Fig.6 – Acquisition work packages in the schedule now include activities by functional departments, increasing the control over delays in logistics, engineering, quality control, board of directors and other areas that influence the final delivery date of necessary equipment and materials.

Besides Petrobras having signaled that future project plans should contemplate the impact of resource restrictions and three point estimates, the STD strategic planning for 2008 that includes the broad adoption of SDPM will surely open a new era in how projects are being planned and executed in Brazil. The increasing interest of companies in participating in courses and seminars that discuss the aspects of the adoption of Critical Chain or Success Driven Project Management also shows that PERT/CPM will soon become just the first step in creating project schedule plans. Those plans will then have to comply with detailed resource leveling and control of the resource critical path and probably the use of three-estimates or Monte Carlo for improved, more realistic schedules and completion dates.

SUMMARY AND CONCLUSIONS

Summary: This paper has 1) described the basic principles of the Resource Critical Path/RCP and the Success Drive Project Management/SDPM principles, 2) related and compared them to some Critical Chain concepts, 3) explained the historical source of the strong emphasis in Russian speaking countries on resource management and schedule optimization, 4) compared the use of Monte Carlo versus range estimates in predicting various risk outcomes and probabilities of success with alternative project plans, and 5) presented a progress report on the successful application to date of these RCP and SDPM principles plus some aspects of project portfolio management within the oil and gas industry in Brazil.

Conclusions: The following conclusions can be drawn from this discussion:

1. Proper and effective project planning and scheduling requires the identification of the Resource Critical Path as defined in this paper.
2. Risk management and trend analysis of the probabilities of success, as defined in this paper, can and must be integrated into the daily work of project planning, scheduling, executing, monitoring and controlling of any complex project.
3. Project management maturity must be evaluated with respect to both the management processes being applied and the availability of work unit and resource productivity data banks for use by

those processes; the maturity in both of these dimensions appears to be greater in Russian speaking countries than in Western countries at the present time.

4. Evaluating execution progress through probability of success trend analysis, as defined in this paper, is a practical, proven and effective practice using a three-estimate approach; the statistical effect of the merge bias is minimized by concentrating on the success probability trend rather than absolute values.
5. Monte Carlo methods of predicting success probabilities have practical limitations for large network plans and unknown inaccuracies due to merge bias when applied to summary networks.
6. RCP and SDPM are proving to be practical and effective in the field in Brazil.
7. Western PM software developers should include in their products the ability to calculate feasible activity floats reflecting the effects of all resource constraints during the backward pass through the network plan, thereby calculating the resource critical path.

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For additional information on the Spider Project software package visit these Web sites:
Portuguese: http://www.spiderproject.com.br - English/Russian: http://www.spiderproject.ru