SOFTWARE REVIEW

ProChain Project Scheduling, Version 1.0

Steve Cotterell examines the philosophy and use of the Theory of Constraints in ProChain Software

Did you hear the one about the road builders who brought their main road project in almost ten weeks ahead of schedule and within budget? Well, no, it's not really funny. In fact Balfour Beatty's competitors probably aren't laughing at all because it's true and Balfour Beatty did it! They were then able to go forward and win further new contracts by quoting almost unbelievably short lead times. At the Theory of Constraints (TOC) International Symposium in London on the 11th of May, Phil Baylis, Balfour Beatty's Business Improvement Manager, explained that in an environment where projects are nearly always late, over budget and not within original promises, a major factor in their achievement of this apparent miracle was their use of the TOC tools embodied in the Critical Chain project planning methodology.

ProChain, from Creative Technology Labs., is a scheduling and decision support add-on that's used with Microsoft Project versions 4.1 and 4.1a for Windows 95 and Windows NT. It also works with Project 98 but with some differences in the way it handles projects, caused by additional features found in Project 98. You would use Microsoft Project to take care of the data management, display, enquiry and reporting functions and ProChain to do the scheduling and help with other management aspects of your plan.

To understand how ProChain works, you must have a good understanding of both the critical chain scheduling concepts and the Theory of Constraints. The software, which is delivered on one HD diskette and occupies just 1 Mb of hard disk space, is accompanied by two slim plastic binders. One contains the Users Guide and the other, 'Critical Chain Concepts', explains the ideas behind this method of project management. Although only sixty pages long, this document adequately explains the theory. I found parts of it fairly heavy going, and, not being a great fan of jargon, phrases like 'A resource may be considered a strategic leverage point' leave me cold.

A much better explanation is given in Eliyahu M. Goldratt's book 'Critical Chain' (published by The North River Press, ISBN 0-88427-153-6). This book is written as a 'business novel' and is a much easier read. As well as telling a moderately entertaining story, it explains all the theory that you need to know in a light, easily digestible way. Most of the examples and situations written about are traceable to real people and events, so we're told. Harry Cather mentioned this book in his article 'Is the Critical Chain the missing link?' (Project Manager Today, November/December 1997), in which he discussed the theories and project management techniques set out in it. Although this is a software review, not an evangelical piece for the TOC, a brief summary of these ideas is needed as a preface to discussing the ProChain software.

In traditional project management methods, some 'safety' time is normally included when calculating the duration of each task to allow for uncertainties. It's said that up to three times the period that presents an even chance of on-time completion is usually allocated, to give an 80% percent chance of on-schedule completion. The knowledge that there is so much safety built into the task can lead to various time-wasting practices.

The first is that people won't be motivated to make an immediate start on the task. Why should they? There's plenty of time! Consequently, all the safety time can be wasted at the start of the task so that, if problems are encountered, the task over-runs. Delays in a task often result in demands for additional resources, a lowering of specification and the passing on of only part of the job. Subsequent lowering of the specification of the

remainder of the task can mean that work done on the succeeding task is wasted and must be restarted. When a task is finished late, the people working on the succeeding task are still likely to expect the full allocated period to work on it.

Uncertainties about when a task will be passed on may mean that those scheduled to continue with it are unprepared, or are working on another project which they're reluctant to leave. Should a task be completed early, people can be reluctant to announce the fact. The reward for early completion of a task is often a reduction
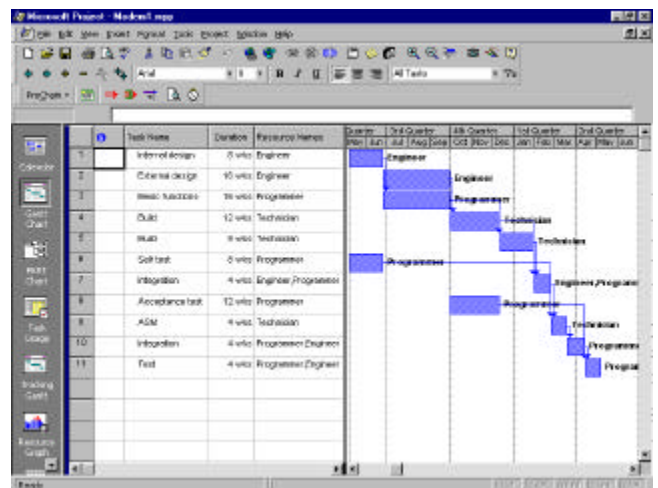
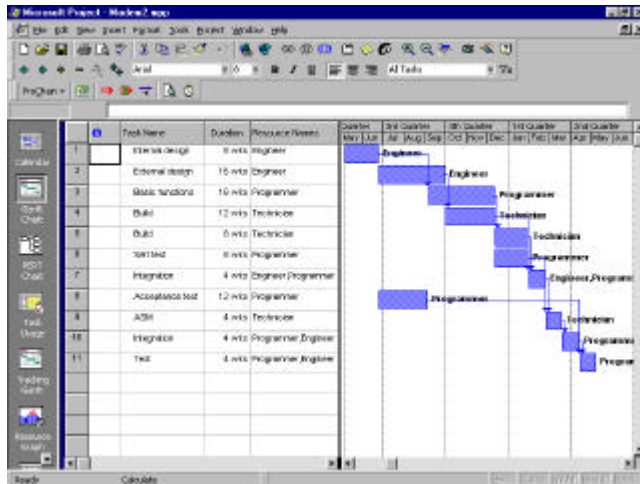**Step 1 - Enter the schedule into Microsoft Project as usual**

in the period allowed next time. Multitasking, or attempting to work on several projects at once by switching between them, wastes the time needed to make the change between tasks each time it happens.

This list is hardly exhaustive, but it illustrates the main point being made - jobs are seldom passed on early and therefore early delivery of one task can't be used to offset lateness on another. Lateness, however, is always passed on and the lost time can't be made up without cutting the specification or increasing the resources allocated to subsequent tasks, if possible. Any lateness on the critical path affects the whole project.

Eliyahu Goldratt's solution to this problem was to reconstruct the schedule,

cutting out the 'padding' of tasks with safety time, and establishing the 'Critical Chain'. This is done by drawing the schedule as normal and resolving any resource contentions ('levelling the load') by identifying tasks requiring the same resource simultaneously. One of the

Step 2 – Using ProChain, "Level the Load".

conflicting tasks is then brought forward until the conflict disappears. The critical chain is the term used to describe the series of tasks that determines the overall project duration when both precedence and resource dependencies are taken into account. His next step was to create a set of four 'buffers' or aggregated periods of safety time established to protect blocks of tasks. The most important of these is the 'project buffer'. This sits at the end of the project, after the final task, and protects the delivery date of the whole project. All start dates are calculated as late starts, projecting back from the beginning of the project buffer.

Because the safety periods have been removed from individual tasks, any over-running task on the critical chain will immediately cause the use of some of this buffer, signalling to the Project Manager that his attention is required to a problem. Compare this to the traditional solution, where the Manager would probably not become aware of the problem until the task's individual safety time is exhausted. The other big advantage gained by using this method is that if a task finishes early, the time saved is available to the project as a whole.

'Feeding' buffers are established wherever non-critical tasks connect with the critical chain. They protect the critical chain from delays in non-critical project areas, and act as an early warning system of problems in those areas. 'Resource' buffers can usually best be described as

'wake-up calls'. They are placed before critical tasks to alert resources not involved with the previous task, of their impending involvement. Creative Technology's justification for not putting a resource buffer before every task is that, where a resource is scheduled to carry out more than one consecutive task, he or she will be aware of the proximity of the succeeding tasks.

The last type of buffer used is the 'strategic resource' buffer. This is used to ensure that areas experiencing bottlenecks are kept working to their full capacity. Most organisations have at least one resource who's output determines the throughput of the entire organisation. Where this resource has to be shared between several projects, each project schedule would place a strategic resource buffer in front of any task using this resource. This would help protect the bottleneck from delays in the project, and thus keep work available to it as scheduled. It would also serve as an early warning of impending problems in maintaining the supply of work.

Once the project has been scheduled, it is updated by collecting and analysing how much work remains to be done on any task in progress. In this way the likely start dates of successor tasks can be established and early warning can be given of likely problems. Rescheduling the entire project should seldom be necessary and should be avoided if possible.

The ProChain software installation, which must be done after Microsoft Project has been installed, presented no difficulty. The immediate indication that ProChain is present, once you start Project, is the existence of the ProChain toolbar containing just seven buttons. This toolbar can be anchored to an existing toolbar or any edge of the screen or allowed to float anywhere on the screen.

The first step in managing any project is to schedule it. To this end you use Project's own tools to enter the basic project schedule data including the tasks, resources and dependencies. At this stage you need to bear in mind that the project will be managed using ProChain. It's important that you add only logical task dependencies and that the project ends with a single, final task.

When the logical Gantt chart is complete, you use a button on ProChain's Project Scheduling Options dialog box to 'Level the Load' and remove all resource contention by placing tasks at their latest possible starting points. Resource availability and requirements, task priorities and dependencies are all taken into account. ProChain repeatedly processes the schedule, searching for the best possible set of options. You can opt for either a simple search or a maximum search. Unless you're using a slow machine or have a large schedule, it's probably better to let ProChain consider every possible combination and produce the most effective schedule it can because the additional time taken for a maximum search doesn't seem significant.

While using the Project Scheduling Options dialog box, you'll have noticed that it contains useful information about your project's status. Besides recording the project status date, it displays the
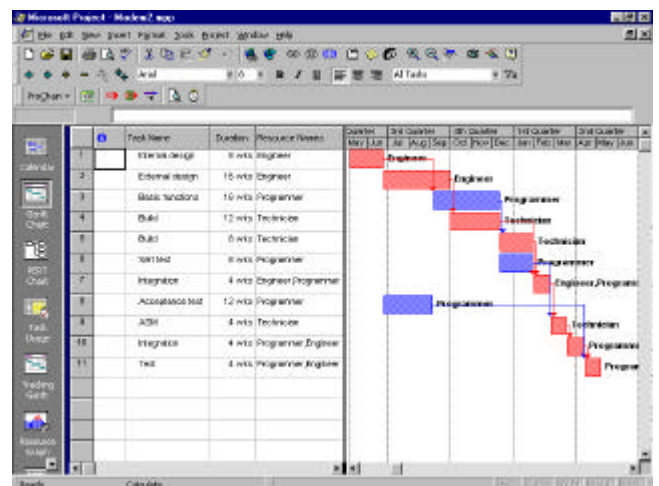
Step 3 - ProChain calculates the critical chain.

number of tasks and critical chain tasks the schedule contains, and how many resources are overloaded. A dick on the Network Data button displays more information about your schedule, including the last task finish date and information about tasks without predecessors or successors and task constraint details. As the information in these boxes is updated in real time, it can

give you a useful overview of your schedule and reassurance that it's properly constructed (or not, as the case may be!).
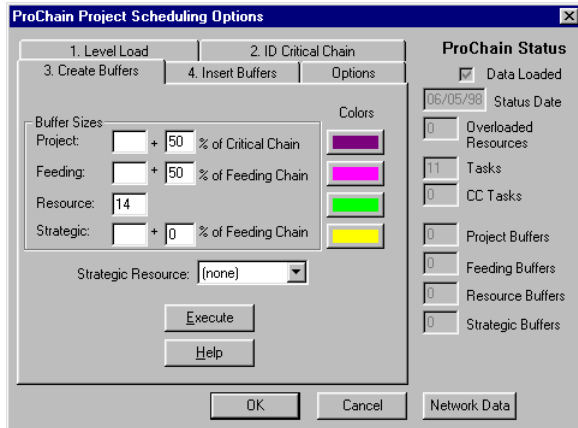
At this point it's necessary to figure out the critical chain. ProChain does this automatically, doing the best job it can. During our tests we couldn't find fault

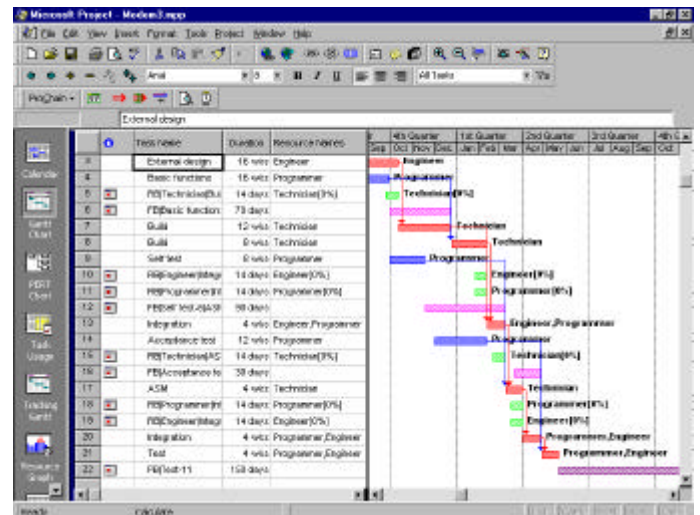**Step 4 – Decide on the sizes of your buffers.**

but, should you not agree with ProChain's analysis of the situation, you can manually toggle individual tasks on and off the critical chain. You can choose how to display the schedule, colouring the critical and non-critical tasks to distinguish between them. Five new filter options are added to Project's menu at installation. One of these, Critical Chain, can be used to suppress the display of all non-critical tasks. The other filters relate to resource and non-resource buffers, scheduled tasks and strategic tasks.

In Goldratt's book, there's an illustration of a schedule with a dotted line linking all the tasks on the critical chain. ProChain doesn't have this facility and we think that it would be a useful feature, especially where large schedules are involved.

It's now time to define the parameters for the buffers to be used. Besides selecting the colour for each buffer, you must decide how big the default size for each buffer type should be. For resource buffers, you enter the number of days you want included in the buffer. The manual suggests a default of fourteen and initially, it probably makes sense to go along with that figure. When entering durations for the project, feeding and strategic buffers, you can enter a specific number of days and/or a percentage of the total duration of the chain of tasks that the buffer terminates. The manual proposes that 50% of the chain length is a sensible figure. However, in future scheduling operations you'll have the benefit of your

own experience to draw on and may choose alternative buffer durations.

For people who want to be involved in higher mathematics, there's an option to calculate the length of your buffers according to a far more sophisticated method. Some people may find that method useful but we're sure that the vast majority will be happy using the percentage method outlined above. Setting default buffer lengths doesn't prevent you from making adjustments to the duration of individual buffers after they've been created - they're all editable. If your project includes the use of a strategic resource, it's at this point that you tell ProChain which resource it is, to enable strategic buffers to be put in the right places.

Once the buffers have been created and if necessary, edited, they must be inserted into the schedule, moving tasks as early as possible to fit the buffers. This is also an automatic process, requiring no more from you than a click on the 'Execute' button. The end of the project is the end of the project buffer and it's helpful to display the appropriate date there. This can be done using Project's Format Bar option to display the Finish Date to the right of the bar. Unfortunately, during tests we noticed that, if the project over-runs and the project buffer is completely used up, the length of the bar doesn't grow, nor does the end date change. Apparently, this is only so on Project 98 systems and on earlier versions the date does change. Creative Technology is currently investigating and, we're told, this problem shouldn't exist in the new version available during June (more about this later) because the date display will be automated.

Because ProChain uses its own algorithms to calculate your schedule updates, it is important that you use ProChain's own project scheduling and

update features rather than Project's. If, in a moment of lapse, you use a Project scheduling feature, it is likely that the tasks and buffers in your plan would be erroneously moved from where ProChain had placed them. It would be best if ProChain disabled those Project features that you should not use but, unfortunately, this isn't the case. We therefore think that it's particularly important that you save your work regularly and keep backups so that should the worst happen, you can restore a recent, unspoilt copy of your plan.

Updating your schedule is an easy two-stage process. Having pressed the ProChain toolbar Update Tasks button, you first edit the project status date to reflect the date upon which the update data was collected. ProChain then cycles you through all the tasks where it calculates that updating is required. You merely enter the remaining duration of each task. ProChain won't let you enter progress out of order, nor will it let you enter progress on a task that it judges cannot have started because the predecessor task has not finished. When you've finished, ProChain automatically updates the schedule. Work done is noted on the tasks and, if any task is falling behind schedule, the appropriate buffer begins to be consumed, signalling that attention needs to be paid to a potential problem.

Step 5 – Create and insert the buffers.

The only way to signal that you've actioned the start of a resource buffer is to write a screen note against it or manually change the bar's shape, pattern or colour according to a code of your own devising. Once resource buffers have been fully consumed, they disappear from the screen.

Multiple projects can be entered, each with its own ending task or all proceeding towards a single ending task. It's probably not practical, however, to treat each of a group of projects as part of a single large project because of practical management difficulties. The main objective of the new version of ProChain - ProChain Plus - is to comprehensively handle resources which are used across multiple projects. The standard version will handle up to twelve projects and other versions can handle higher numbers of projects. A single project version will also be available. We haven't yet seen a review copy of this product, so we're not yet able to comment on it.

TOC philosophy is a major step for an organisation, frequently requiring a complete change of attitude between both workers and management. It requires an adult attitude on both sides, and those organisations that operate a blame culture, with everyone covering their backs and

RIGHT TO REPLY

Thank you - a good review. While the ProChain software is extremely well designed and easy to use the reviewer has quite correctly also judged it in context of its ability to well support and implement the TOC Critical Chain methods.

The review points out that there are substantial benefits that can be gained by using Critical Chain methods to schedule and manage projects. ProChain is designed to help to understand these methods and to support their effective implementation.

The point made about the possibility that MS Project's scheduling facilities might move something previously scheduled by ProChain have been addressed in the latest version together with a number of other new and additional facilities.

We are constantly looking for ways to improve the product. This is reflected in the new ProChain Plus "sister" product which is about to be launched. ProChain Plus comprehensively deals with the handling of multiple project environments and shared resources.

ProChain is developed in the USA by Creative Technology Labs LLC.

It is distributed and supported in Europe by Focus 5 Systems Ltd.

Besides Project's reports, ProChain provides two reports of its own which list the resource and non-resource buffers, giving the status of each. There are also several advanced ProChain configuration options and data modification routines which a few people may find useful. For example, it's possible to change the durations of all the tasks in your schedule at one go, by entering a percentage figure. If you entered 66%, all task durations would be cut by a third (and you would probably be lynched!). We were impressed with the quality of the context-sensitive on-line help available at the touch of a button.

Focus 5 Systems Ltd. have been the European distributors for ProChain since June 1997, devising TOC implementation plans, training staff and supplying the software and support. Right now there are ten serious users, another ten in the process of implementing the system and another 25 or so examining the product. Understanding and achievement of the
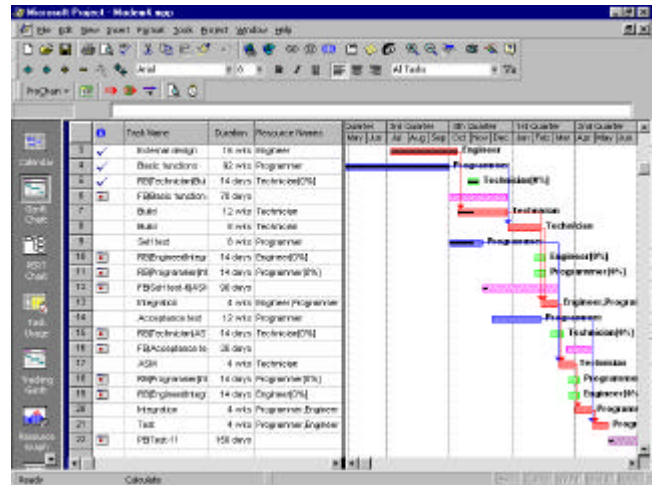
Step 6 – Progress the project by entering remaining durations.

looking for others to blame for their own failings can't use it. Where improvements in the workflow are achieved, this advantage must be passed on to everyone for, if those who made the productivity improvements were rewarded with redundancy, trust in the management would be destroyed and the TOC wouldn't work there again.

At £449.00 plus VAT for a single machine version (with pro-rata reductions for multiple user licences), price isn't an issue. It seems certain that significant improvements in project lead times can be achieved by using the TOC. It is the TOC and the psychology behind it that is the driving force, with ProChain being a useful tool that supports and enables it.

For further information, please contact:

USA:	UK/Europe:
Creative Technology Labs LLC	**Focus 5 Systems Ltd**
Tel: +1 (703) 4 90 8821	Tel: +44 (0)181-959 7403
Fax: +1 (703) 494 1414	Fax: +44 (0)181-959 7449
Email: ProChain@aol.com	Email: ProChain@mcmail.com
Website: http://www.prochain.com	Website: http://www.Focus5.mcmail.com

Call us about books now available on the subject:

Project Management in the Fast Lane by Robert C. Newbold

Critical Chain by Dr Eliyahu Goldratt