

Scheduling in asset-intensive organizations: is there a better way?

Summary

Scheduling is a critical activity in asset-intensive organizations, with substantial economic impact. Done properly, scheduling maximizes the utilization of valuable assets in the production chain, improves organizational responsiveness, and yields substantial economic benefits. Done poorly, the consequences can be severe: deferred production, poor customer/staff satisfaction, and increased costs are among the possible outcomes¹.

Despite its importance, scheduling is usually performed manually or with unsophisticated software tools. Automated scheduling support is available to certain sectors—such as the airline industry—but most of the commonly-used software tools that purport to provide scheduling capabilities actually don't: the user is expected to make all the decisions about how to assemble a schedule. This places limitations on the process itself, and its results:

- ∅ It's difficult, time-consuming, and error-prone;
- ∅ It's not effective in operational environments that change as a result of planned or unplanned events;
- ∅ It doesn't provide any objective measure of schedule quality;
- ∅ It doesn't support collaboration;
- ∅ It perpetuates scheduling folklore, and
- ∅ The process is in somebody's head.

A new generation of scheduling software tools is now available. Actenum ASM is one such tool, and has been designed to directly address the limitations of manual approaches, and yield tangible benefits. Asset-intensive organizations now have the ability to automate and optimize their scheduling processes with an easy-to-use tool, thereby maximizing asset ROI, reducing risk, and achieving predictable and reliable production.

¹ In 2001, Nike's third quarter earnings fell by over 20%, and Nike attributed this in large part to faults in the scheduling software obtained from its supply chain planning supplier.

Introduction

Scheduling deals with the assignment of resources to tasks in a way that satisfies sequencing and timing constraints (usually various organization-specific policies and preferences also have to be accommodated). In an asset-intensive production organization, this means not only scheduling the assets themselves (for example, to assign drilling rigs to appropriate wells), but also scheduling activities that are carried out on the assets (such as preventive maintenance). For example, the Exploration and Production division of an oil company might need to prepare a schedule that satisfies the following requirements: Rig A (*a resource*) is assigned to drill at Well 31 (*a task*) for a three month period (*a timing constraint*), but must be moved to drill at Well 68 by November 7 (*a sequencing constraint*).

In a complex production organization, scheduling is difficult:

1. First, the size and complexity of the set of possible schedule alternatives have to be understood and managed. But as tasks and assets are assembled into a schedule, the number of sequencing/timing constraints that have to be satisfied increases exponentially, leading to many possible schedule alternatives. For example, while scheduling 20 drilling rigs over 50 wells is reasonably straightforward, as additional rigs and/or wells are added the problem becomes intractable.
2. Second, asset scheduling usually operates in an inherently dynamic environment. Any given schedule will only be valid for a short period. Circumstances change because of planned and unplanned events, and rescheduling has to be done. In the rig example outlined earlier, consider what happens if Rig A encounters more complex geology than expected at Well 31, and must be assigned there for an additional month. The production schedule immediately has to be modified in light of answers to questions such as: If Rig A remains at Well 31 past November 7, where should it then be sent? What other rig should be assigned to Well 68 to meet the November 7 date? If Well 68 is ready earlier, is another rig available for assignment to it? What are the possible consequences if Rig A has to remain at Well 31 for even longer?

Besides the need to reschedule on an ongoing basis, there's also a requirement to do so quickly. Schedule updates must be prepared rapidly to allow for effective response and recovery from operational disruptions. This puts scheduling personnel under additional pressure, as well as intense scrutiny from operations management.

The state of the art in scheduling tools

The most widely-used scheduling software tools are Microsoft Project (a single user desktop application with broad applicability) and Primavera P3 (enterprise-class software with more sophisticated capabilities)². People use these tools for a wide range of scheduling situations, from construction projects to software development efforts, and from preparing for plant-wide maintenance turnarounds to determining how a valuable or scarce production resource should be used most effectively.

What's inside these tools from a scheduling perspective? There are interfaces to a calendar, and to catalogs of tasks (all the work that needs to be done), and the resources (people, equipment, and services) needed to complete the various tasks. The user interface provides a variety of ways to interact with these catalogs, and to assemble the tasks and resources in various ways to build a schedule.

But there's not really any scheduling component.

How can this be? Thousands of people build schedules using these software tools every day, and they're getting the job done, aren't they? The answer is that, indeed, they are getting it done, but they are doing it *manually*, and they are probably doing it *poorly*.

The limitations of manual scheduling

Using one of the generally-available scheduling tools, or most of the application-specific scheduling software currently available, requires that the user make all the decisions about how to assemble a

² Other commonly-used tools include Basecamp's web-based solution. Microsoft Excel is also used for scheduling by many organizations, which is extraordinary since it provides no support for scheduling whatsoever. It simply provides an easy way to build and use a simple Gantt chart, with less of a learning curve than Microsoft Project.

schedule, in terms of matching tasks and assets and satisfying constraints and preferences. This reliance on a manual process brings with it several fundamental limitations.

Manual scheduling is difficult, time-consuming, and error-prone.

It is extremely difficult to cope with the large number of possible ways in which scheduled tasks may be combined. For example, preparing a maintenance turnaround schedule for a complex plant can take several person-months of effort. Deferred production and increased costs can result if the schedule is not absolutely bulletproof.

It's not effective in disrupted operational environments.

When planned or unplanned changes occur in the operational environment, rescheduling must be done rapidly to get operations back on track. Yet balancing time pressures against the need for confidence in the reworked schedule can almost deadlock the process: the faster that schedule changes must be done, the lower their reliability. The higher the need for reliability, the longer it will take to reschedule.

It doesn't provide any objective measure of schedule quality.

Once a schedule solution is found, it's usually the only one used (for the reasons explained above). There's no way of knowing whether it will result in increased production, or whether there's another, more effective solution, because there is no tight linkage of the schedule to key production metrics. Alternatives can't be compared to one another and ranked to determine the best. While a particular schedule may allow production goals to be met, the one selected for use is generally chosen by intuition and "gut feel".

It doesn't support collaboration.

A manual approach to scheduling is not suited to teamwork, nor does it allow for much input from the multiple stakeholder groups in a production organization. Usually one group is given responsibility for preparing a schedule which is then followed by the others. This biases any such schedule to that group's goals, rather than those of the organization as a whole.

It perpetuates scheduling folklore.

In many organizations, various scheduling policies arise over time as new approaches are tried, or measures are taken to prevent certain outcomes. These are followed diligently by the individuals who perform the scheduling, yet the policies may have absolutely no basis in reality, and, in fact, represent scheduling folklore. For example, the maxim "don't schedule preventive maintenance on weekends since it costs more to pay the crews" is entrenched in some organizations. With no ability to investigate schedule alternatives or to determine a schedule's influence on production goals, there's no room to investigate the validity of such a statement³.

The process is in somebody's head.

The detailed knowledge of how to prepare the schedule resides with the scheduling staff. This exposes the organization to the possibility of losing that scheduling knowledge if staff retire, take vacation, are injured, or are otherwise unavailable.

Next-generation scheduling tools

Much work has been done in the past few years to address the limitations of manual scheduling. Newly-developed software tools that shorten schedule creation times, and that result in more reliable and more productive schedule solutions are now available to asset-intensive industries. Rather than continuing to place the scheduling burden solely on the user, tools such as Actenum ASM automate the scheduling process, provide user control over the results, and incorporate advances in optimization technology that yield tangible benefits to production organizations.

Automated, interactive scheduling

Harnessing the power of advanced optimization software in the scheduling process provides accelerated creation of schedule solutions. The software is able to perform the "heavy-lifting" of initial schedule creation—to search the set of tasks, resources, sequencing/timing combinations, and preferences/policy requirements—rapidly and efficiently, to assemble a schedule in far less time than required us-

³ Actenum has encountered this well-intentioned maxim during an implementation and, using Actenum ASM, was easily able to show that the value of the increased production resulting from removing the restriction far outweighed the cost of paying shift premiums.

ing a manual approach. What might take days or weeks to complete manually is done in a fraction of the time by Actenum ASM.

At the same time, to enable complete user control over the schedule solution, Actenum ASM provides an interactive capability so that user expertise and judgment may be used to adjust and adapt any schedule to accommodate organizational preferences. In a typical scheduling situation, a user will generate a “first cut” solution automatically using Actenum ASM, and will then manually manipulate this solution to incorporate preferences and to determine their impact.

Disruption management

Actenum ASM is designed to deal with real-world operational changes (when the weather doesn't cooperate, a vital piece of equipment breaks down, or people don't show up when they are expected). Schedules can be updated in real time—at the speed of business—rather than on a manual basis, much more slowly. This provides a smooth and rapid mechanism for coping with disruptions, and reduces the possibility of putting profits at risk as operational circumstances change.

Linkage to key production metrics

By linking the schedule generation process to user-defined key production metrics, Actenum ASM not only assembles a reliable schedule quickly, but also provides insight into how that schedule will impact production goals, costs, resource use, and risk. This allows a user to create multiple schedules, which can be compared and ranked on the basis of organizational goals, to determine the optimal solution.

Actenum ASM also provides the capability to generate “what if?” scenarios, that may be used to assess the relative benefits of changes in the operational environment, such as using additional equipment, and bringing in new hires.

The benefits of the new scheduling tools

The features designed into Actenum ASM overcome the limitations of manual scheduling described earlier.

- ∅ The fundamental problem of coping with the large number of possible ways in which scheduled tasks may be combined is dealt with by the

software, rather than the user. This speeds up schedule creation, increases consistency in the process—and thereby reliability of the schedule solution—and limits the possibility for errors in the schedule.

- ∅ Planned and unplanned changes in production operations no longer need cause concern to the scheduling staff. Since disruption management features are designed into Actenum ASM, rapid rescheduling—taking those changes into account—is easy to perform, and disrupted operations get back on track smoothly.
- ∅ By linking schedules to key production metrics, Actenum ASM enables users to make informed decisions when selecting the most appropriate schedule alternative to drive operational goals.
- ∅ Actenum ASM can be linked to other enterprise applications (such as an EAM/CMMS tool), so that available transactional data concerning assets can be used to drive informed decision-making and improve operational performance.
- ∅ Scheduling folklore can be eliminated from an organization, since the various policies and rules that have evolved over time can be investigated and decisions made about their validity.
- ∅ Actenum ASM embeds knowledge of the scheduling process, and details of the technical/business context in which it's carried out, in a model of specific production operations. This ensures that the scheduling capability is always available, and no longer subject to staff availability. It also means that collaboration between different stakeholder groups is easier than before, since schedule creation may be focused on organization goals, rather than those of a specific group.

Actenum ASM, and tools like it, provide benefits at multiple levels in production organizations.

For Executives

Executives in asset-intensive organizations have to deal with fluctuations in production output that affect revenue and profit targets, and lowered customer satisfaction that arise from missed commitments. It can be difficult to ensure that long-range strategy is supported by operational execution, and to develop an organization that is agile and responsive to market demands. Part of the reason for this is the inability to drive scheduled production in an optimal way:

to be certain that assets are scheduled most efficiently, costs are minimized, and production output is reliable and predictable.

Actenum ASM provides reliable, timely, and actionable scheduling information, which aligns the use of resources and assets with key production goals and metrics. The impact of various scheduling alternatives is always understood, and accelerated scheduling improves response times to operational changes and supply chain variances, yielding predictable operational performance. Daily activities are closely linked to organizational strategy, revenue and profit expectations are met, and customer satisfaction increases.

For Operations Managers

Operations managers want to ensure that effective, stable schedules for maintenance and operations are put in place, so that production output is maximized and predictable. Unplanned changes in daily operations lead to scheduling challenges that are difficult to deal with and that are usually resolved under intense time pressure, without really understanding the implications of the decisions made. A growing concern is the aging of the workforce, particularly in the oil and gas industry. With key operations people retiring over the next few years, managers need to find methods of capturing and applying their expertise in new and effective ways.

Actenum ASM enables operations managers to smooth out the daily variances in maintenance and production. Response times are improved when changes or disruptions occur through the accelerated scheduling capability, and users gain insight into the quality of their scheduling decisions, since they are linked to production metrics. At the heart of each Actenum implementation is a sophisticated business and technical model of specific plant operations, which captures the knowledge of expert users, and supports operational staff in their daily tasks.

For Production and Maintenance Managers

For maintenance and reliability engineers, daily operations require absorbing and processing a large quantity of incoming data on the state of plant equipment, scheduled and unscheduled maintenance activities, and expected changes in production and supply. Production and maintenance schedules have to be updated as operations move

ahead. Changes to planned events (such as maintenance outages) have to be justified to management. This is often difficult to do using existing methods for making scheduling decisions, which do not provide accurate and reliable comparisons of scheduling alternatives, and which don't take key operational metrics into account. In severe conditions, where the operating environment is harsh, breakdowns are frequent and operations have to be restored quickly, putting additional pressure on the maintenance and reliability function.

Actenum ASM reduces the burden on production and maintenance staff by providing them with a tool that assists in making effective and informed scheduling decisions. Schedule alternatives that show impact on key operational metrics can be generated, assessed, and ranked very rapidly, providing for accurate and justifiable decision-making. The ability to deal with unplanned events and operational disruptions, particularly in severe conditions, is particularly valuable allowing fast and effective restoration of production operations when breakdowns occur. And if plant complexity increases through expansion, the operational scheduling model built into Actenum ASM can be enhanced, to provide continued support to production and maintenance users.

Conclusion

Actenum ASM is one of a new generation of scheduling software tools that is now available to asset-intensive industries. By applying the power of sophisticated optimization technology to scheduling, the limitations of traditional manual scheduling approaches are overcome.

Complex production organizations are now able to benefit from a rapid and responsive scheduling process. As the operational environment changes and rescheduling is required, Actenum ASM provides users with insight into the impact of schedule alternatives, and ensures that scheduling is aligned with organizational goals. As well, the scheduling capability of Actenum ASM is always available to the user.

Given the economic benefits that result from improving scheduling practices in asset-intensive organizations, use of Actenum ASM provides a way of maximizing asset ROI, reducing risk, and achieving predictable and reliable production.

About Actenum

Actenum is the leading provider of Asset Scheduling Management (ASM) software for the energy and mining industries. Our solutions increase production uptime through rapid, reliable scheduling of production assets.

During daily operations—even in the most complex, disrupted production environments—Actenum solutions enable you to create optimized asset schedules that are directly linked to user-defined key operational metrics. As a result, you can make informed and effective scheduling decisions that support your production goals, reduce deferred production, and improve operating efficiency.

To speak to an Actenum representative, or to schedule a demonstration, please contact us at 604.681.1262 x 224, or info@actenum.com.

Actenum Corporation
520 - 1385 West 8th Avenue
Vancouver, BC V6H 3V9

T: +1.604.681.1262
F: +1.778.373.2126
www.actenum.com

© 2006 Actenum Corp.

