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Aspen Fidelis Reliability Software Quantifies Financial Benefits Across the Plant Asset Lifecycle

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Summary

ARC Advisory Group recently met with executives of AspenTech to discuss the Aspen Fidelis Reliability discrete event software simulation tool. This is just one of the product offerings in the company's burgeoning and increasingly high-profile Asset Performance Management (APM) suite of plant asset management software solutions.

Through its capability to construct plant models and run multiple scenarios analyzing the impact of variables such as equipment capacities, operating logic, and production schedules on system-wide performance over time, Aspen Fidelis Reliability software can help EPCs and owner-operators gain confidence in their designs and improvement efforts and realize significant financial benefits across the different phases of the plant lifecycle.

In the chemical, oil, and gas and other process industries, EPC firms are tasked with designing and developing increasingly large and complex installations. EPCs face the challenges of highly competitive bid situations and then delivering those projects within tight budgets and timeframes. After start up, plant owner-operators face challenges related to ensuring efficient operations and maintaining or renewing assets over a period that can stretch into decades.

In both cases, solutions such as Aspen Fidelis Reliability can provide significant value through discrete event simulation. The AspenTech solution constructs plant models and runs multiple scenarios to analyze the impact of variables such as equipment capacities, operating logic, and production schedules on system-wide performance over time. In this manner, Aspen Fidelis Reliability can help EPCs and owner-operators alike gain confidence

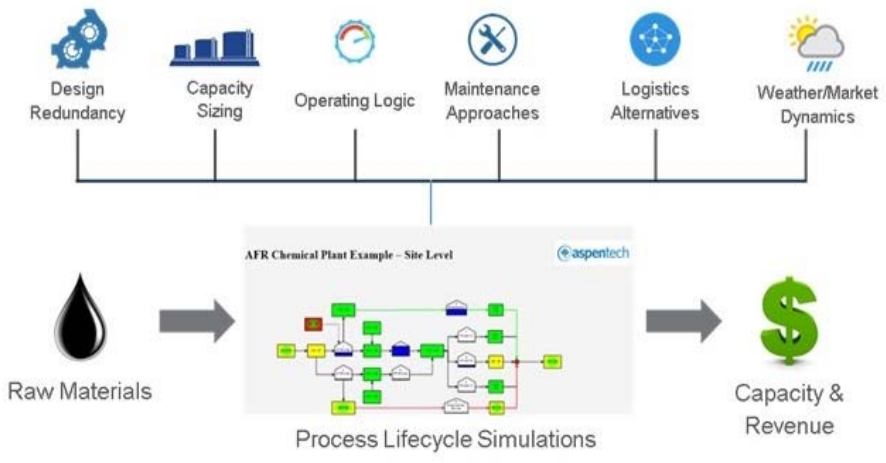
in their designs and improvement efforts and realize significant financial benefits across all phases of the plant lifecycle.

Meeting Process Industry Needs

The 2016 acquisition of Fidelis Group, LLC of Lake Jackson, Texas, brought the Fidelis Titan product into the AspenTech fold. The Fidelis Titan discrete event simulation tool was targeted at the process industries when launched in 2001. With most simulation software at that time used for business operation and discrete manufacturing applications, the Fidelis owners perceived a gap in the market for a tool that could meet the specific needs of process industry operations. The company developed Fidelis Titan from the ground up with that goal in mind. Success followed with its adoption by both EPCs and owner-operators, including the likes of AMEC, KBR, WorleyParsons, Chevron, Dow Chemical, and Saudi Aramco.

Aspen Fidelis Reliability, as the simulation software is now called, forms part of AspenTech's Asset Performance Management (APM) suite, where it joins products such as Aspen Mtell, Aspen ProMV, and Aspen Column Analytics.

Rather than just focusing on equipment reliability like most asset management solutions, Aspen Fidelis Reliability is designed to evaluate an entire system's ability to (reliably) meet production targets and make money. It does this by analyzing the impact of variables including equipment capacities, design configurations, operating logic, supply chain options, and even the vagaries of the weather on plant performance.



Aspen Fidelis Reliability Software Evaluates System-wide Performance by Analyzing the Impact of Multiple Variables on Plant Output

This system-wide approach to process plant issues considers the inherent interconnectivity of process equipment as well as the often complex interplay of the previously mentioned variables.

For example, should an owner-operator need to upgrade a heat exchanger, this system-wide approach would also evaluate the impact (positive or negative) on upstream and downstream equipment.

Model and Simulate

Discrete event simulation works by modelling a system as a series of events that take place over time. For example, for supermarket checkout station configuration (a popular application of the technique), the owner would want to ascertain the optimum number of checkout stations that should be operational at a given time: too few stations would increase queuing time, negatively impacting customer satisfaction; but too many would negatively impact store profits due to increased payroll costs.

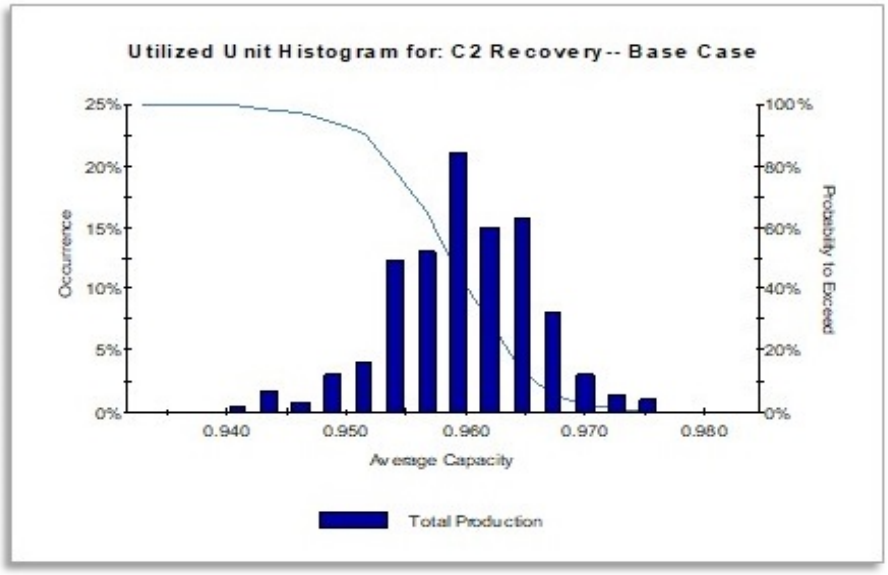
The built model would include diagrammatic representations of customers and checkout stations. By running the simulation of "queuing-serving-leaving" events, the queue lengths and customer service times can be ascertained for, say, a week of operation. Performing that in software is clearly easier and more cost-effective than trying out various physical configurations of the operation.

A typical Aspen Fidelis Reliability software model depicts the process plant diagrammatically with representations of raw material inputs (e.g., ethane), processing units (e.g., polyethylene unit), intermediate and final storage units, as well as blocks representing demand of the final products (e.g., polyethylene, polypropylene).

To simulate a modelled system, Aspen Fidelis Reliability uses the Monte Carlo simulation technique, which is based on repeated random sampling to obtain numerical results. This assigns random values to model variables – for example, process downtimes and equipment repair times – based on probability distributions. According to the company, since this approach considers the uncertainty inherent in complex systems, it can provide better solutions than approaches based on deterministic analysis in which fixed values are used for model variables. In accordance with Monte Carlo principles, the simulation is run hundreds of times to assess probabilistic performance,

such as the probability that a process unit's capacity utilization will exceed its target value.

Aspen Fidelis Reliability is designed to enable users to get insights into the future performance of the system and analyze and quantify the value of plant improvement opportunities. Especially useful is the software's ability to allow users to understand why a future scenario looks a certain way by providing a list of the top 20 system sensitivities resulting from a change action.



After Developing the Model, the Monte Carlo-based Simulation Is Run to Assess Probabilistic Performance

A particularly powerful feature of Aspen Fidelis Reliability is its flow optimizer, which enables the flow inside the model to dynamically change based on a selected objective function. For example, with revenue as the objective function and feedstock transferable to three different process units, flow is directed first to the highest margin unit, depending upon any constraint conditions.

Applications Across the Lifecycle

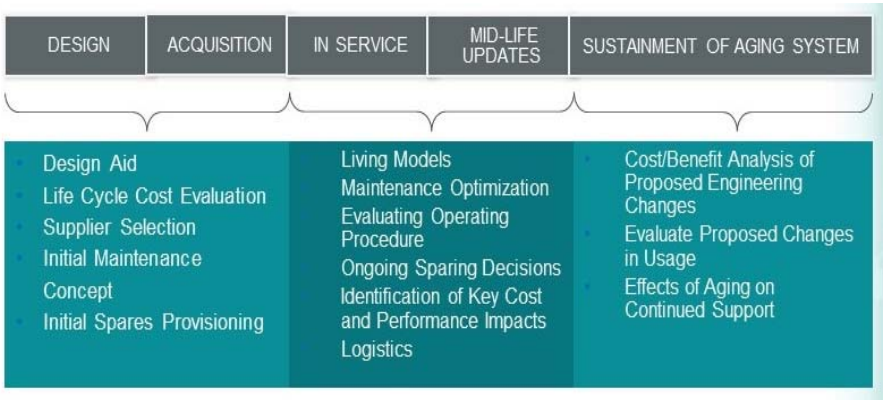
Aspen Fidelis Reliability software can be applied in both the design and operational phases of the plant, which means adopters of the software fall broadly into the two camps of EPCs and owner-operators. For large capital projects, EPCs must often specify their use of the simulation tool as part of

the RFQ, since this would help ensure that facility design decisions would be made based on solid data via tested models, rather than abstract ideas.

Once the plant is built and process operations started, the owner-operator can use Aspen Fidelis Reliability to test and validate ongoing improvement efforts, such as new equipment installations, flow redesigns, revised raw material and finished-goods schedules, and modified maintenance strategies.

Dow Chemical, a long-time user of Aspen Fidelis Reliability, created a System Performance and Reliability group in 2002 to assess in a structured way the potential and viability of projects across the design/operate/maintain phases of both large and small Dow plants across the globe.

In one application for a multi-plant integrated site, Dow Chemical wanted to understand the relationship between on-site inventory levels of key intermediates and overall productivity of the complex. By building a model of the site in Aspen Fidelis Reliability and running various simulations, the System Performance and Reliability team could determine the probabilistic production rates at different inventory levels and, accordingly, recommend expanding intermediates' storage capacity to realize a production increase and an investment return (NPV) of $21 million.



Aspen Fidelis Reliability Software Applications Span the Design-Operate-Maintain Phases of the Plant Lifecycle

For the industrial gases division of Saudi Arabia's SABIC, the goal was to increase plant reliability after successive lightning strikes brought down the main and backup power feeds one day last May, completely halting production for more than 24 hours.

Modelling the plant in Aspen Fidelis Reliability involved specifying critical plant assets along with attributes such as failure rates and repair times. The

simulation output revealed that, under current operating setup and conditions, there was a slight possibility of another total plant shutdown occurring. This was not a risk SABIC was willing to take, and it has since reviewed maintenance processes and added operating capacity, based directly on information provided by the AspenTech simulation tool.

Product Integration Opportunities

While Aspen Fidelis Reliability is currently a standalone product in AspenTech's APM suite, the company pointed to opportunities for value-added integration with other AspenTech software products.

For example, via the integrated developer environment within Fidelis, an alert from Aspen Mtell (the company's machine learning-based prescriptive maintenance solution) could be input to Fidelis to update an existing model and run a new simulation. This functionality currently requires coding within the developer environment, but at a later date, could possibly be configured with the click of a button.

Integration possibilities with AspenTech's Process Engineering suite include a connection with Aspen Capital Cost Estimator so that progressive model construction in Aspen Fidelis Reliability could provide useful information on related cost impacts, such as adding another storage vessel or more pumps.

For the process simulation tools, Aspen HYSYS and Aspen Plus, which differ from Aspen Fidelis Reliability in that they provide static snapshots of a process, rather than dynamic system behavior over an extended period, users could take the model structure built in these solutions and have it automatically implemented in Fidelis to reduce model design time.

And the Aspen Petroleum Scheduler (part of the AspenTech Manufacturing and Supply Chain product suite) could provide schedules and yields as inputs to Aspen Fidelis Reliability to obtain a more realistic view of future refinery production.

Conclusion

As process plants become larger and more complex and organizations face continuing pressures to rein in both capital and operating expenses, the insights into future performance afforded by the Aspen Fidelis Reliability discrete event software simulation tool can help EPCs and owner-operators

design, operate and maintain facilities with improved confidence. According to AspenTech, project experiences reveal financial benefits that can range from millions of dollars from simulating major equipment, to hundreds of millions of dollars from simulating multi-plant site complexes.

Discrete event simulation is less well known and understood in the process industries than in sectors such as discrete manufacturing, logistics, and retail operations. Hence, as AspenTech looks to grow its installed base for Aspen Fidelis Reliability, efforts to build awareness and educate customers on the workings and benefits of this simulation technique can help Aspen Fidelis Reliability gain traction in the market and make it a very significant part of AspenTech's Asset Performance Management product suite.

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