



## The Aspen Fidelis Reliability™ Difference: Minimize Risk, Maximize Profitability

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## Executive Summary

Making the big decisions shouldn't be left to subjective perceptions or over-simplified analysis. Decision-makers need quantifiable, trustworthy answers to make the most profitable decisions possible.

In the past, management of your capital assets was done through gut feel from experienced operators, some rudimentary spreadsheet analysis or simplified reliability, availability and maintainability (RAM) tools. Although these methods provide some benefits, they lack a holistic approach to reliability, design and operations. They lack accuracy and consistency.

In contrast, Aspen Fidelis Reliability uses a system approach to reliability. It allows you to quantify the true value of any design or improvement project, maintenance change, operations improvement or supply chain constraint. Fidelis will give you an accurate, comprehensive bad-actor list, quantified by lost revenue and production — not just by maintenance cost or downtime. As a result, you can more effectively perform lifecycle analyses on assets including asset utilization, maintenance effectiveness, overall equipment effectiveness and much more.

As shown in the real-world examples later in this paper, errors in accuracy using Fidelis versus simple RAM analysis varied from 0.3 percent (\$4.4 million USD) to 2.8 percent (\$40.9 million) in lost production and revenue annually. Simple RAM tools just do not provide the level of accuracy needed to answer the hard questions.

With Aspen Fidelis Reliability, decision-makers can maximize ROI by going beyond the equipment level and accurately predicting future asset performance of the whole system. For accuracy and decision-making, the Fidelis difference is eye-opening!



## The Objectives of Asset Performance Management and Aspen Fidelis Reliability

In the white paper "Seeing Into the Future with Prescriptive Analytics: A New Vision for Asset Performance Management," Robert Golightly of AspenTech describes the objectives of asset performance management as follows:

*"Investor demands to maintain or improve revenue and margins are driving the search for new technologies and application to drive down costs, improve reliability and increase efficiencies. Equipment Failures and process disruptions are creating unplanned downtime that is costing the process industries billions of dollars in lost revenue and profit each year."*

*This is an area where we commonly see corporate initiative cropping up around asset performance management and risk management. What these companies are searching for are ways to improve the accuracy of detection and increase the notification period of these events. With more warning, more options become available - and with options comes the opportunity to mitigate the negative impact of these events."*

Aspen Fidelis Reliability is a great example of one such advanced technology. Fidelis takes capital management and decision making beyond emotional debates and educated guesses and into quantitative analysis with direct feedback on ROI. With this type of elevated insight, managers can make the hard decisions.

- How do I minimize my risk?
- Should we move forward with this major capital project?
- What is the minimal capital investment required to meet my targets?
- How can I improve my plant availability or utilization?
- What will the facility throughput be for various design or operational scenarios?
- Which improvement strategy provides the highest ROI?

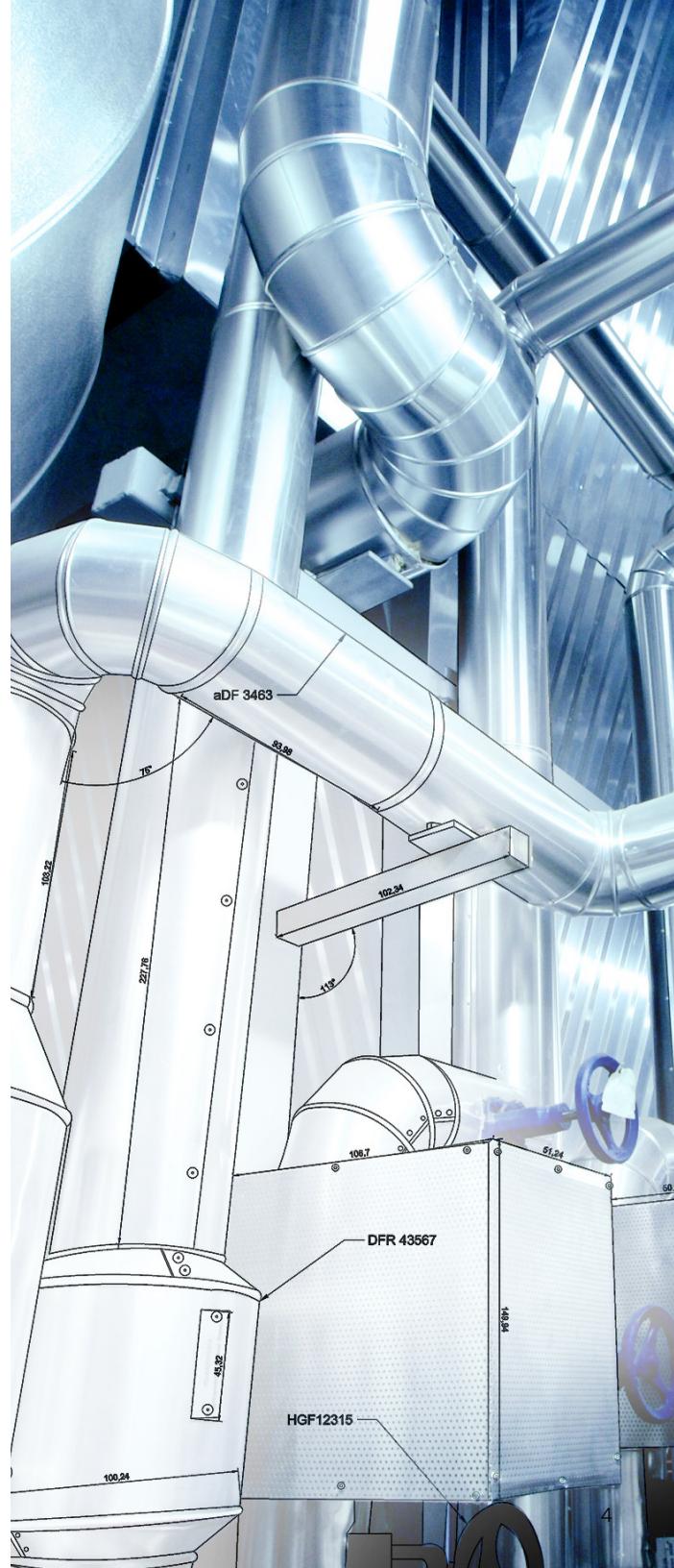
With Aspen Fidelis Reliability, these questions can be answered by going beyond the equipment level, so that decision makers can maximize the economics of business decisions and accurately predict future asset performance of the whole system.

# Traditional Approaches

Simple stand-ins for robust RAM analysis can have huge economic impacts. Conventional approaches lack the sophistication and flexibility to provide the same level of rigor. More often than not, risk analysis is done via intuition from experienced operators.

While this level of wisdom and experience should never be taken for granted, for robust plant-wide analysis, no one person has the foresight to understand how a failure in an upstream process unit will impact total revenue after feeding numerous subsequent process units and tank farms. Other simplistic RAM modeling tools are available, but they lack the capabilities required to include necessary inputs for accurate results.

These tools are specifically marketed towards RAM analysis, but many have no concept of real process flow. Because they lack the flexibility to handle real-world complexities, they require gross oversimplifications. As the examples later in this document will show, the difference in the accuracy of the answers is staggering.



# New Technology and Approaches

Aspen Fidelis Reliability, a Monte Carlo-based, discrete-event simulation program, utilizes statistical sampling techniques to predict the future performance of a system.

The behavior of events in the system (pumps, motors, weather impacts, operational upsets, etc.) are represented by a probabilistic distribution function. Fidelis samples from this curve and derives a time to failure or repair for each event. As each event fails, it influences the associated parent unit which in turn influences the flow sent through the pipes attached to that unit both upstream and downstream. Fidelis tracks the flow through the pipes, actual tank levels, as well as the utilized and available capacities of all units.

In addition, any required custom logic (handle dynamic batching, seasonal changes, alternate flow paths, non-time-based failures, conditional logic or equipment aging) can be incorporated into the model. If you can describe it in words, Fidelis can incorporate it.

Beyond providing significantly more accurate answers, Aspen Fidelis Reliability also excels in terms of ease of use and transparency. The following features help to make the user experience quick and easy to analyze:

- **Validation:** A static animation of the effects of event failures, high or low tank levels, etc. This allows the user to quickly and easily assess the system configuration without running the simulation.
- **Review:** For each simulation run, Fidelis records a live animation of all events, tank events, logic and performance. This allows the user an unparalleled experience in transparency. If for example, you want to see why Unit Z showed a performance dip at time 500 days in lifecycle 30, you can select these parameters in the review dialog and visually inspect what led up to the dip and how the system responded. You can play this review forward or backwards automatically or watch an event by event progression.
- **The Fidelis Iterative Process:** When Fidelis is utilized, the results are never just handed to the final project team. A robust process of validation, iteration and transparency is used. RAM modeling should never be "black magic" or a "black box." Along with result details, validation and review features, and the Fidelis modeling process, the project team has buy-in and clear understanding from Day 1. Once the base case model is validated by all key stakeholders, only then is the model used to quantify alternate cases.
- **Flow Diagram Builder:** Fidelis uses a toolbar drawing control to quickly drop hundreds of objects very easily. It typically requires less than 30 minutes to build the main flow diagram and pipe the feed units together. Inside each unit, you can complete detailed unit level diagrams as well with unlimited nesting.

**Fidelis takes capital management and decision-making from emotional debates and educated guesses to quantitative analysis with direct feedback on ROI.**



Further rounding out this tool is its parent company: AspenTech is a proven market leader and standard-bearer in process optimization. The synergies that exist between AspenTech's Engineering and Manufacturing products and the Asset Performance Management products (such as Fidelis) makes for an optimization package that is impossible to match. Some of the potential integration synergies with Fidelis include:

**Aspen HYSYS® or Aspen Plus®** – Leverage existing flow diagrams and automatically populate starting RAM data from Fidelis.

**Aspen Capital Cost Estimator™** – Improve cost estimates by incorporating statistical variance with uncertainty. In addition, calculate the high-level cost of any initial design.

**Aspen Mett®** – Predict when a real-time failure will occur. Integrate this information into Fidelis to determine the response that will result in the least amount of downtime and revenue impacts.

**aspenONE Process Explorer™** – Using data from the aspenONE Process Explorer dashboard, Fidelis can be integrated to recommend the best course of action given current plant states (tanks, units), update Fidelis data with live reliability data from any historian and update the dashboard with current threats and the Fidelis criticality listing.

**Aspen PIMS-AO™** – Fidelis can assist planners in understanding the likelihood of meeting plans by adding statistical variability and rankings to scenarios.

**Aspen Petroleum Scheduler™ and/or Aspen Plant Scheduler™** – By accessing the generated schedules, Fidelis can integrate dynamic failures to optimize the schedule and tankage. Fidelis can also be used to quantify the likelihood of success for a given schedule and cause of misses to increase equipment utilization (including logistics).



## Analyzing the Impact of Real-World Challenges

Aspen Fidelis Reliability was used to analyze several real-world challenges. In each case, simplistic RAM tools and Microsoft Excel required the user to ignore or oversimplify these challenges. The difference in the level of accuracy between the two methods was calculated.

The results are represented in terms of percentage of accuracy so as to extrapolate the real impact on revenue across multiple industrial verticals. Applying this to real dollars, 1 percent in accuracy would represent \$14.6 million annually at a typical 200 kbbl refinery (at \$20/barrel).

Challenges that were examined include:

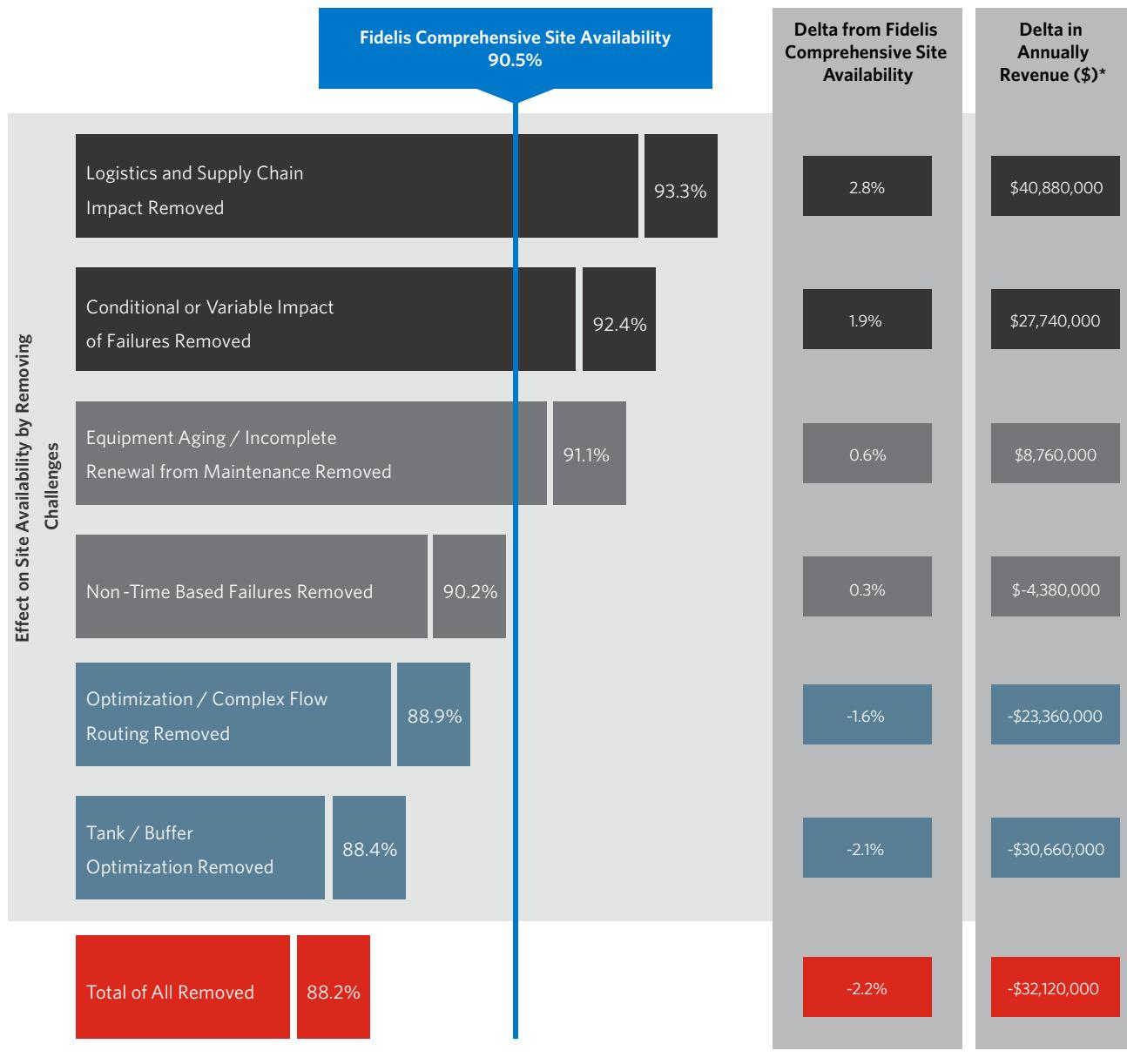
- Flow optimization/complex routing of flows
- Tank/buffer optimization and tank leveling

- Conditional or variable impact of failures
- Impacts from logistics and supply chain
- Equipment aging or incomplete renewal after maintenance
- Non-time-based failures

For the comprehensive model, all six of these real-world challenges were integrated. For each subsequent case, one challenge was systematically removed, and the simulation rerun. In this way, Aspen Fidelis Reliability was able to quantify the delta between robust stochastic modeling and the simplified alternative.

In addition, a case was run with all six real-world challenges removed. This case represents the full impact of ignoring these complexities found in every typical processing and manufacturing facility around the world.

Figure 1: Delta Between Fidelis Modeling and the Simplified Alternative



\* Reference refinery assumed 200 kbbls per day (\$20/barrel)

**Fidelis will give you an accurate, comprehensive bad-actor list, quantified by lost revenue and production — not just by maintenance.**

## Conclusion

You can only make the best decisions and maximize profitability if you have quantifiable answers you can trust. To achieve this level of accuracy, managers need to invest in a RAM tool that can handle the real-world challenges of today's process industries. Aspen Fidelis Reliability is a tool designed to meet these challenges.

On average, RAM simulations using Fidelis on capital projects over the past 18 years have resulted in 5 percent savings in capital costs and production increases of approximately 3 percent — with total monetary benefits ranging from \$1 million USD to more than \$300 million USD.

As the previous analysis shows, small over-simplifications in a simulation can add up to big margins of error. Doing a model the correct way the first time can save millions in design corrections, debottlenecking or overspending on capital.





Technology That Loves Complexity

AspenTech is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets faster, safer, longer and greener.

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