Uncovering the Value of As-Built Laser Documentation™ for the Power Industry

A Quantapoint White Paper

ABSTRACT

Meeting Project Objectives Through Quantapoint As-Built Laser Documentation™

Given the reality of today's competitive environment, power producers are beginning to capitalize on the benefits that laser scanning technology that has benefited the chemical process, oil & gas and refining industries for several years. Quantapoint as-built laser documentation (interactive and highly accurate as-built documentation created using laser scanning) has significantly increased the profitability and reduced the risk of both maintenance and modifications for existing facilities. Based on our extensive industry experience and proven track record, Quantapoint has performed an in-depth analysis of the key challenges facing the power industry and the significant value that as-built laser documentation can provide for cost, schedule, quality and safety.

CONTACT INFORMATION

Quantapoint, Inc.
275 Curry Hollow Road
Suite M100
Pittsburgh, PA 15236
Phone: (412) 653-0100
Web: www.quantapoint.com
E-mail: info@quantapoint.com

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QUANTAPOINT WHITEPAPERS

As the acknowledged industry leader in laser scanning technology, Quantapoint has published several papers, some of which are listed below. These are available in the Resources section of www.quantapoint.com.

- Understanding and Specifying Laser Scanning Services
- Seven Things Every Project Manager Should Know About Laser Scanning
- Contract Terms & Conditions for Laser Scanning Services
- Combining 3D CADD with Laser Scanning
- Uncovering the Value of As-Built Laser Documentation for Engineering Firms
- Uncovering the Value of As-Built Laser Documentation for the Power Industry
- Uncovering the Value of As-Built Laser Documentation for the Processing Industries

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Key Challenges Facing the Power Industry for Outage Work

The power industry is becoming more competitive and power companies are facing increasing challenges in the reliable generation of cost-effective electricity. While demand for power is growing, most companies are hesitant to add new units due to cost and regulatory concerns. Instead, with an aging fleet of facilities and limited capital for new investment, power companies are focusing on operational efficiency and upgrading existing assets to remain competitive. This strategy requires significantly decreased outage durations. Whereas until recently, outage durations of 40-days were considered acceptable in the nuclear industry, today world-class generators are approaching 20-day outages while setting records for capacity and availability.

Unfortunately, there are several challenges facing the power industry in improving outage work, which is key to remaining competitive. One major issue is inaccurate and incomplete information on physical dimensions and location of systems, structures, and components (the "as-built documentation" for the facility). Based on our industry experience, Quantapoint has performed an in-depth analysis of the key challenges facing the power industry. The following four challenges were identified as the major roadblocks that prevent power producers from achieving world-class performance during outages.

> "As built data to support the configuration of these two power plants wasn't available to us. We considered traditional methods such as manually collecting the data and reviewing existing engineering drawings, but both of those options would have been time-consuming and subject to error."
>
> - Engineering Manager, WorleyParsons

Challenge 1: Improving Profitability on Capital Projects

Project managers are being pushed to control costs as a means to improve capital project profitability. However, they have also come to expect certain incremental costs on maintenance and modification projects that have to be covered, whether they are budgeted or not. Recreating as-built documentation is one such item that must be completed early in the project to ensure that accurate and reliable information is available for design, fabrication and construction. This is a crucial step in the design process as all subsequent steps are based on this information. Manual measurement processes are time-consuming and error prone, which drives up costs and adds pressure to the project schedule.

> "The average large size revamp project ($50MM total installed cost) requires either a constant crew presence in the field throughout the design phase or a dedicated three- to six-month data collection period to create the as-built documentation we need."
>
> - Piping Designer, Major Engineering Company

Another cost is the need for field fit-up welds to compensate for inaccurate and incomplete as-built documentation. This limits the amount of fabrication work that can be accomplished before the outage and increases the amount of field routing that must be completed during the outage.

There are additional cost savings that can be gained by optimizing the engineer and design processes. However, confidence in the as-built documentation and inability to effectively share this information across geographically diverse teams limits ability to take advantage of some of the non-traditional approaches to reduce engineering costs.

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> "The man-hour rates in India are about 50 percent of that in Houston."
> - Piping Engineer, Major Engineering Firm

Challenge 2: Meeting the Outage Schedule

Given the inherent obstacles associated with field construction, project managers face a significant risk from outage delays. Replacement power and lost opportunity can cost a typical power plant $500,000 per day or more. Inaccurate and incomplete as-built documentation used for designs significantly increases the risk of field rework and changes. This is due to many reasons, such as as-built documentation that assumes all equipment and structures are orthogonal, piping is always round and columns that are always plumb, which is rarely the case in the real world. Additionally, many installed components – such as small-bore piping, conduit, cable trays, ductwork and instrumentation – are often not documented at all. These challenges add not only cost, but also time to projects in the form of rework, field trips and re-design.

> "We plan for one fit-up weld per tie-in across approximately 70 to 80 tie-ins and approximately 150 new pipes on (a typical) project. Only a handful of rewelds can be performed in a given day."
> - Senior Manager, Foster Wheeler

Challenge 3: Achieving Quality Targets

Despite quality improvement initiatives, it is not uncommon for maintenance and modification rework rates to run as high as 5 to 10 percent of a project's total installed cost (TIC). There is considerable pressure to bring this quality metric down, but the lack of accurate as-built documentation and resulting rework or interferences cause constructability issues that keep this rate high.

> "Rework rates are traditionally 6 to 15 percent of TIC."
> - CAD Manager, Major Engineering Firm

Challenge 4: Protecting Safety in Hazardous Conditions

Safety concerns are an issue in any power facility. Inherent safety risks may be increased due to prolonged exposure to any environment where hazards exist. Many believe that any activity that drives up the time spent in the field as a percent of the total project time is bound to negatively impact recordables. Driving the risk factor even higher is the fact that the majority of power companies are self-insured. Given the high cost of both medical and liability issues, companies are always looking for ways to improve safety.

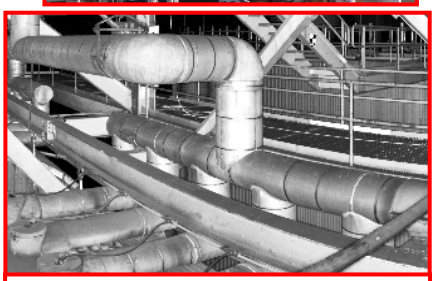
Nuclear plants are faced with the additional hazard of radiation exposure. Radiation protection managers are tasked with drive radiation exposure levels to As Low As Reasonably Achievable (ALARA) and are often faced with balancing the benefits of an exposure accumulated during a walk-down versus potential savings during maintenance and modification activities.

> "In a radiologically controlled area, there are strict guidelines to follow in order to minimize dose rates."
>
> - Project Manager, Exelon

Key Sources of Value for Quantapoint As-Built Laser Documentation

In today's highly competitive environment, power companies are only able to achieve world-class performance and sustainable competitive advantage by seamlessly executing maintenance and modifications on existing facilities. To this end, power companies are beginning to capitalize on the significant benefits of Quantapoint as-built documentation created using integrated laser scanning has offered the chemical process, oil & gas and refining industries for several years.

Quantapoint provides a "turnkey" solution that rapidly integrates billions of facility measurements to create 2D laser scans or 3D laser models that resemble a black-and-white photograph or CAD model, but are actually as-built laser documentation™, with each point representing a highly accurate facility measurement. It is considered by many to be the fastest, easiest and most cost-effective way to obtain consistent and highly accurate as-built documentation for any facility.



Quantapoint 2D Laser Scan
(<u>not</u> a Picture)
Each Point is a Measurement

Quantapoint as-built laser documentation is interactive and can be easily shared across the project team, with an accuracy of one-quarter inch or greater across the entire facility. Quantapoint clients have significantly increased the profitability and reduced the risk for maintenance and modifications in their existing facilities, with clients being able to reduce construction rework by 80%, with a greater than 10 times return on investment.

The value derived from using Quantapoint as-built laser documentation is both immediate and quantifiable. The following example focuses on a typical construction project commissioned by a major U.S. utility and managed by an external engineering firm. Together, these organizations manage approximately five large projects per year with an average total installed cost (TIC) per project of $50 million. The typical outage target is 48 hours, and it requires a crew of 6 people approximately 16 weeks to collect as-built data on-site. Construction teams are comprised of 500 or more people, and the work involves an average of 250 tie-points per job. Their maintenance and modification rework rate is typically 5 percent.

Using our proven track record, Quantapoint has identified the key sources of value as-built laser documentation for the power industry falls into four main categories: cost, schedule, quality and safety. The table below lists these main sources of value and the specific benefits clients receive that provide the value. These are detailed in the following section.

Sources of Value	Specific Benefits
Reduced Costs	• Reduced field trips • Reduced fit-up welds • Improved operation and maintenance reviews • Improved information sharing
Optimized Schedules	• Reduced time to collect as-built documentation • Reduced new design modeling time • Reduced plant downtime
Increased Quality	• Lower rework rates • Increased pre-outage fabrication • Better pipe routing and lifting plans
Improved Safety	• Reduced exposure to hazards

Source 1: Reduced Costs

Quantapoint as-built laser documentation has been proven to reduce costs in both the design and construction phases of large industrial maintenance and modification projects. Project managers point to a number of distinct cost savings, which include:

1. *Reduced field trips*: By collecting more comprehensive and trustworthy as-built documentation, Quantapoint as-built laser documentation practically eliminates the need to return for additional measurements or information. Whether flying engineers back to the job site to capture data that was missed or keeping several designers in the field throughout the design phase, the savings can be considerable.

Quantapoint 2D Laser Scan Comprehensive and Accurate

- Reduced field trips: eliminate 75 percent of return trips → $210,040 in cost savings

> "There is air travel expense 80 percent of the time and at least one day of safety training per project for each crew member. The scaffolding cost per day is typically absorbed by the plant, but is significant since it can equal the number of days for survey work."
>
> - Mechanical Engineer, Major Engineering Company

2. *Reduced fit-up welds*: With Quantapoint as-built laser documentation, prefabricated equipment and pipe require much less incremental fit-up time and costs, such as additional measurements, cutting, cleaning and inspections. Based on customer results, 25 to 50 percent or more of field fit-up welds have been eliminated.

   - Eliminated fit-up welds: 50 percent reduction → $468,750 in cost savings

> "We planned for roughly 2 to3 field fit-up welds per line on the 50 line project. Quantapoint helped eliminate about 25 percent of these welds with better accuracy."
>
> - Piping Designer, Major Engineering Company

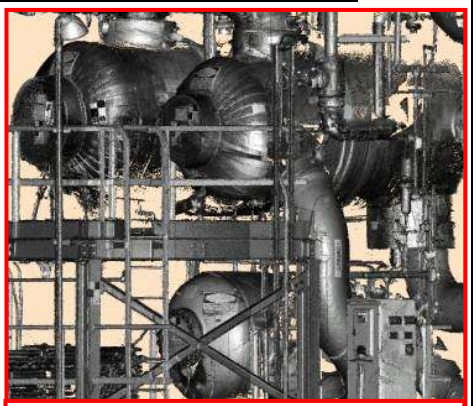
3. *Improved operation and maintenance reviews*: By using Quantapoint as-built laser documentation to help plan required maintenance, a significant amount of time can be saved through better visibility and planning.

   - Decreased budgeted maintenance days: save 0.5 days → $437,500 in cost savings

> "By scanning 360 degrees and a 60-foot sphere the camera is able to capture areas that people either can't reach or simply would not see such as objects high in the air that would require platforms and scaffolding as well as hidden and zero light areas."
>
> - Project Manager, Exelon

4. *Improved information sharing*. Quantapoint PRISM 3D™ software is available that enables users to access the as-built documentation from their desktops, making collaboration significantly easier. For many companies, as-built laser documentation enabled offshore design for the first time on these projects, and it now accounts for up to 25 percent of their design mix. Note that because this is less well validated it is not included in the overall savings estimate.

   - Improved teamwork and offshore design efficiency → $375,000 in cost savings



Quantapoint 3D Laser Model (<u>not</u> CAD) Share Across the Entire Team

> "Quantapoint enabled offshore design work for the first time. We did about 40 percent of our design work offshore at a 30 to 50 percent lower man-hour rate."
> -Project Manager, Bechtel Engineering

Source 2: Optimized Schedules

By embracing Quantapoint as-built laser documentation, companies have been able to meet and improve critical outage schedules in several ways. Whether the time saved is through faster initial data collection, more efficient design or by encountering fewer design issues during construction, the ultimate result is the improved probability of delivering and perhaps even beating the outage schedule.

This improved schedule can also significantly impact an engineering company's ability to capture incentive fees on cost-plus contracts. According to a project controls manager at a large engineering firm, incentive fees can amount to as much as 5 percent of TIC and can represent the factor that pushes a firm to either meet or miss its annual revenue projections.

1. *Reduced as-built data collection time*: This benefit is one of the early reasons project managers use Quantapoint as-built laser documentation. The cost of sending six designers to the field for up to 4 months on a large project can now be avoided. Alternatively, the firm needs only to send one engineer with the Quantapoint team, and Quantapoint delivers the scan to the project team members' desks ready-to-use within 2 to 3 weeks.

   - Reduced as-built data collection time: 16 weeks to 3 weeks → $325,500 in cost savings

> "We estimate that it would have taken 3 months to research existing documentation and to field-verify measurements using [traditional] manual methods."
> - Project Manager, WorleyParsons

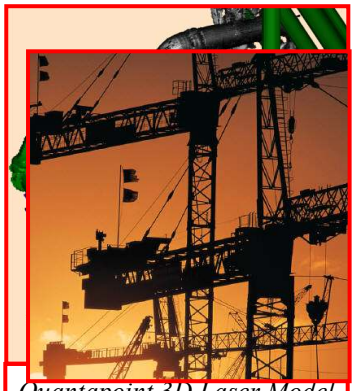
2. *Reduced plant downtime:* By leveraging Quantapoint as-built laser documentation during the design phase, project teams can significantly reduce numerous key risks that could negatively impact the outage schedule. The as-built laser documentation has been used to avoid clashes through multidisciplinary engineering reviews; to identify "proposed routings" for electrical wires and instrumentation cables; to solve field construction issues dynamically; and to review scans of pre-fabricated equipment against the 3D CAD design before going to the field.

   - Reduced plant downtime: cut outage by 24 hours → $200,000 in increased revenue

> "Quantapoint enabled WorleyParsons to keep our overall project on schedule."
> - Manager of Engineering, WorleyParsons

Source 3: Increased Quality

The impact of working with more trustworthy and accurate as-built documentation impacts the entire project lifecycle. Critical quality improvements have been reported across the following areas:



Quantapoint 3D Laser Model with a 3D CAD Model

1. *Lower rework rates*: Many Quantapoint clients have seen their rework rates on maintenance and modification projects fall from 5 to 10 percent or higher to similar levels as grassroots projects at 1 percent. The traditional rework issues that Quantapoint as-built laser documentation helps to mitigate include reducing the need to scrap and reorder materials, eliminating procurement errors as bid with firm specifications, reducing the labor associated with redesigning and re-engineering pipes and equipment, and avoiding the costly expense of idle rigging equipment. Quantapoint as-built laser documentation helps our clients measure rework in individual events, not as percentages ("events, not percents").

   - Lower rework rates: conservative 1 point reduction → $500,000 in cost savings

> "Traditionally, when drafting with paper and pencil, error rates would range around 6 to 15 percent of TIC since the data was so incomplete. Now with the use of the "electronic image of the existing facility", we measure and design correctly to avoid problems when we assemble in the field. This has helped bring revamp rework rates to the same level as CAD grassroots projects at about 1 percent. Also, because we can see everything, we are able to catch and mitigate potential clashes in the design phase. With Quantapoint, there are virtually no clashes."
>
> - Senior Manager, Foster Wheeler Engineering

2. *Increased shop fabrication*: With Quantapoint as-built laser documentation, clients benefit from fewer as-built documentation omissions. They now have the detail required to increase the scope of work done in the shop environment before outages. This includes information on small-bore piping and conduits that are less than inches in diameter, which are typically ignored when plants are re-modeled. In a typical project, 10 to 20 percent of field fabrication is eliminated in favor of less costly shop fabrication.

   - Increased shop fabrication: shift 10 percent from the field → $75,000 in cost savings

> "Using Quantapoint, we eliminated about 15 to 20 percent of field fabrication in favor of shop fabrication."
>
> - Piping Designer, Major Engineering Company

3. *Better pipe routing and lifting plans*: By running automated clash detection against the new design, each engineering discipline can determine where demolition work will overcome an interference issue versus where they need to modify their design or construction plan. Quantapoint clients have reduced construction by days with better routing and lifting plans.

   - Better pipe routing and lifting plans: eliminate 1 construction day → $300,000 in cost savings

> "Quantapoint enabled WorleyParsons to deliver an 'interference free' design and allowed us to keep our overall project on schedule."
>
> - Engineering Manager, WorleyParsons

Source 4: Improved Safety

A key consideration driving many firms to standardize on Quantapoint as-built documentation is safety. Although the rationale supporting improved safety is strong without attaching a monetary value, there are quantifiable business benefits. For the majority of companies that are self-insured, the ability to limit expensive liability suits and medical expenses is a very real potential benefit.

For those that purchase liability and worker's compensation insurance, Quantapoint has been shown to reduce the recordable incidence rates (RIRs), which impacts a plant's EMR (experience modifier rate). The EMR ultimately correlates to the premium paid for insurance. Two estimates are provided below, depending on if the firm is insured by another company or self-insured. Note that because the quantification of the safety benefit is less well validated, the lower value was used in the overall savings estimate.

- Fewer personnel in plant collecting data: insured → $626,791 in cost savings
- Fewer personnel in plant collecting data: self-insured → $248,211 in cost savings

> "Quantapoint beat their REM goal. Their technicians listened carefully to the Radiological Protection Engineer and Health Physicist and ultimately managed the dose as well."
>
> - Project Manager, Exelon

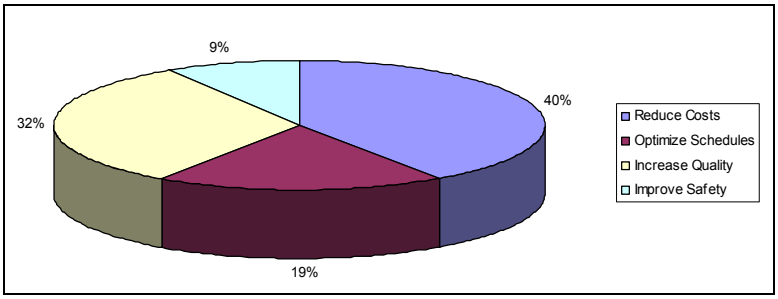
> "Quantapoint impacts the absolute recordable rates or 'how many total hours on a project without an accident'. The amount of hours climbing and otherwise capturing field dimensions under risky conditions were taken out of our hands. The more time out of the field the better."
>
> - Project Manager, Fluor Engineering

Overall Value

Based on the cost savings and productivity gains detailed above, the projected financial benefits for the sample project amount to $2.77 million, as shown in the figures below. As shown below, cost reductions and quality enhancements are the primary value drivers.

Category	Specific Benefit	Value	Percentage
Reduced Costs	• Reduced field trips by 75% • Reduced fit-up welds by 50% • Decreased budgeted maintenance by 0.5 days	$1,116,290	40%
Optimized Schedules	• Reduced as-built documentation collection time by 80% • Reduced plant downtime by 24 hours	$525,500	19%
Increased Quality	• Lowered rework rates by 1% • Increased shop fabrication by 10% • Created better pipe routing plans to save one day	$875,000	32%
Improved Safety	• Fewer personnel in the plant collecting data and less exposed to hazardous conditions	$248,211	9%
	Total	**$2,765,001**	**100%**

Tabular Display of Value by Category



Pie Chart Display of Value by Category

The value was also analyzed by benefit type, as shown in figures below. As shown below, increased revenue represents a fairly small amount of the total value created compared to direct cost savings.

Benefit Type	Value	Percentage
Cost Savings	$2,565,001	93%
Increased Revenue	$200,000	7%
Total	**$2,765,001**	**100%**

Conclusion

Detailed value analysis can help project managers understand how moving forward with or standardizing on Quantapoint can achieve solid business results. To request a custom value analysis for your business, please visit Quantapoint's web site at www.quantapoint.com or contact Quantapoint at 412-653-0100 or info@quantapoint.com.

Quantapoint, Provider of the World's Most Trusted and Accurate As-Built Documentation

- Advanced Technology
  - Patented 3D continuous laser scanning for capturing plant as-built dimensions
    - SceneManager™ technology provides both high resolution and fast data capture
    - Enables as-built data to be displayed as photo-realistic 3D image
  - Designed for plant usage
    - Compensates for temperature and humidity effects, which reduce accuracy
    - Custom mounts to enable difficult scans

- Experienced and Highly Trained Field Crews
  - Extensive expertise in rapid, safe and complete project execution in plants
    - Two man crew can document an entire unit in 2 to 4 days
    - All field crews receive rigorous safety and laser scanning training
  - World's most experienced provider of laser scanning services
    - Dedicated field crews with the most plant laser scanning experience
    - Crews trained to identify and prevent scanning "blind spots"
    - World's largest fleet of laser scanners that can be deployed on short notice

- Proven and Repeatable Work Process
  - Field proven and repeatable work processes that deliver trustworthy and accurate results
    - Equipment calibrated before and during project to ensure precision
    - Data reviewed prior to leaving plant to verify comprehensiveness
  - Advanced algorithms to integrate individual laser scans into as-built documentation
    - Based on real-world laser scanning and plant experience
    - Trust measurement provided to prove trustworthiness and accuracy

- Next-Generation Software and Value-Add Services
  - PRISM 3D™, software that enables the Digital Plant
    - Ensure precision by extracting as-built information from an interactive photo-realistic 3D image
    - Increase design productivity and efficiency through quick and accurate generation of 2D drawings
    - Enhance design and constructability by displaying CAD models with the as-built documentation
    - Ensure clash-free project design and execution using advanced built-in clash detection algorithms
  - Value-add services to help extract greater value
    - 2D drawing generation
    - Link as-built documentation to existing asset data sheets

About Quantapoint

Quantapoint, Inc. provides the world's most trusted and accurate as-built documentation to the processing and power industries. Quantapoint has become the acknowledged industry benchmark for trust and accuracy by offering a unique combination of advanced technology, experienced and highly trained field crews, proven and repeatable work processes, and next generation software. Quantapoint's solutions have helped customers reduce construction rework to less than 1% of total installed cost and typically provide a greater than 10 times return on investment. For more information, please visit the newly redesigned website at www.quantapoint.com.