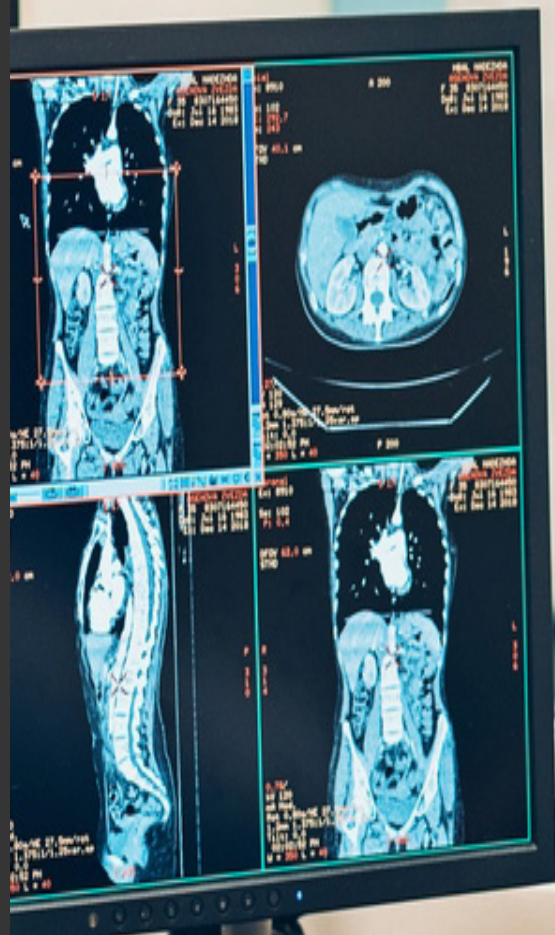



## From Automation to Prediction: The Future of Medical Equipment Management Today

MAY 2022





## From Automation to Prediction: The Future of Medical Equipment Management Today

---

*The conventional process for managing medical equipment is mired in inefficient, labor-intensive and unnecessarily costly practices that go back decades. Glassbeam is the first company to offer a proven, forward-thinking solution to disrupt these outdated approaches. This software as a service (SaaS) offering, marketed as Clinsights™, takes full advantage of artificial intelligence to maximize uptime, minimize parts and labor expenses, and ultimately, provide a new level of control over your fleet of medical equipment, no matter the type of modality or medical device manufacturer.*

*Clinsights™ is a uniquely compelling solution that flips standard medical equipment management practices on their head, transforming them from reactive to predictive. For hospitals, clinics and imaging centers, Glassbeam's solution enhances revenue growth, reduces operational costs and improves the experiences of patients and staff. For independent service organizations (ISOs), it generates new efficiencies across the board, allowing these firms to manage more with less.*

*Glassbeam's initial push into data-driven medical equipment management solutions focuses on imaging equipment, but it's easy to see how the benefits of this offering have broader implications for managing medical equipment generally for other segments such as bio medical and lab diagnostic machines".*

## State of the Market vs. State of the Art

The lifecycle cost of imaging equipment consists of two elements: acquisition and maintenance. The first often attracts much more attention than the second, perpetuating equipment management practices that are inefficient and financially wasteful. Hospitals and like facilities have tacitly accepted comparatively low imaging equipment uptime rates of 96% or 97%. The situation is akin to a person who suffers a broken leg and opts to learn to live with a limp rather than take the steps necessary to regain full mobility. As this examination of real world data regarding imaging equipment practices shows, even incremental improvements in uptime can deliver outsized cost savings.

As it stands, many facilities have defaulted to a traditional maintenance model in which machine failure is first discovered by a radiologist or technician just prior or during an exam. In this scenario, standard procedure is for an in-house clinical engineer or skilled contractor to inspect the machine in person and run diagnostics to determine the root cause. This might take hours or days, depending on the nature of the failure and the engineer's level of expertise. Sometimes the problem is obvious; other times a lot of analysis and testing is involved to uncover it.

In the meantime, machine downtime disrupts typical operations, requiring appointments to be rescheduled and staff to be re-tasked. These and related consequences argue for improving uptime to the IT sector standard of 99.999% or five nines. Unplanned downtime has clear, negative financial implications for equipment owners and service personnel. If, for instance, a facility typically books twelve MRI exams a day and each exam is worth, say, \$630 on average, then a downed machine costs the facility \$7,560 in revenue. This dynamic is only made worse in cases where an inoperative machine requires new parts and/or a lengthy restart procedure, as in the case of x-ray tube replacement on CT Scanner or cold head repair on MRI machine.

**Glassbeam's medical equipment management software, Clinsights™, promises a different, more efficient and economical approach to maintenance and repair.** By leveraging the latest advances in artificial intelligence, this solution predicts machine failures before they happen, minimizing unplanned shutdowns. This capability goes beyond the solutions offered by original equipment manufacturers, in part, because the Glassbeam solution offers real-time performance diagnostics across all brands of equipment, collapsing multiple views of a fleet from a single, comprehensive dashboard, or as Glassbeam would phrase it, 'under a single pane of glass.'

### What Makes a Solution State of the Art?

Big data analytics are woefully underutilized by hospitals, clinics, imaging centers and the service organizations that manage their medical equipment. While most organizations have access to reams of data, few have the tools to render it actionable. Glassbeam has set out to change that scenario.

The Clinsights™ platform was developed from scratch to leverage state of the art IT building blocks. As a third-party solution provider, Glassbeam isn't hampered by legacy systems or organizational silos; rather, it's free to adopt the latest in say, programming languages and database options while still adhering to industry-standard quality specifications. Not only that, but the company has coupled this forward-thinking approach to platform development with second-to-none security standards, so any and all users—from in-house field techs and facility managers to management groups within OEMs or ISOs—can safely take advantage of the system anytime, anywhere.]



“I have a background in the smart buildings space and people often overlook the value of the telemetry and other, related data that can be leveraged for maintenance purposes,” says Bradd Busick, SVP-CIO, MultiCare Health System. “We’ve applied the same level of thinking to medical equipment. We’re leveraging the same type of internet of things (IoT) capabilities at the equipment level to improve uptime and curtail unplanned maintenance or repairs, mainly by predicting failures so we can fix them before they occur.”

One of the key benefits of this approach is that informal, tribal knowledge culled from the collective experience of the engineering team can be routinized, enhanced and made accessible across the facility. Implementing an efficient radiology machine maintenance program requires more than a simple break-fix model involving field techs. Other departments within a facility or independent service organization can benefit from the installed base intelligence provided by Clinsights™, among them, contract management, quality assurance, service marketing, compliance and update handling departments. This expanded visibility best ensures disparate members of an organization pull in the same direction with the overarching goal of providing the best quality of care.

In a Glassbeam-led equipment maintenance model, many of the typical costs associated with unscheduled maintenance are minimized or avoided altogether. The solution maximizes cost avoidance in terms of machine parts (because sub-performing parts can be ordered prior to complete failure), service labor (because the root cause can often be diagnosed remotely and accurately from the Clinsights™ dashboard) and most of all, unplanned maintenance (because predicted repairs can be scheduled outside normal business hours). In a very real sense then, Glassbeam’s solution represents the state of the art when it comes to medical equipment management, generating substantial cost savings.

“You could have \$30 million dollars but IT spending in most healthcare systems is less than 3% of operations even though a downed MRI or CT scanner can have a huge impact on quality of care and the patient experience,” notes Busick of MultiCare Health System.

“Under the old model, I’d have to wait for an unhappy doctor to call me to say an MRI was down as the magnet had quenched. We’ve effectively flipped this model on its head, starting with some of the oldest, most difficult equipment. And what we found pretty quickly, once you get past some of the early noise or alert fatigue, was the ability to discover issues we would have never got, such as a patient table throwing off error logs that would otherwise have gone undetected.”

Without the benefit of a Glassbeam-style solution, it’s standard procedure for clinical engineers to report failures in the form of service bulletins. An engineer might, for instance, note the serial numbers of machines known to have problems with a recent service pack upgrade. Clinsights™ allows for monitoring the parameters associated with these sorts of issues, embellishing the findings of field service personnel and expanding the scope of inquiry. Instances of malfunctions due to software upgrade bugs, say, can be plugged immediately by running fleet-wide analytics to isolate the affected devices.

Glassbeam edges imaging equipment toward the 99.999% uptime standard, in part, by taking a holistic view of the relevant machines. Today’s MRI machines and CT scanners are complex mechanisms. They’re comprised of several critical subsystems like imaging computers, patient tables, cooling systems and rotating sliprings. Monitoring these subsystems in real-time and more importantly, applying predictive algorithms to the data, facilitates the early detection of problems.

**“You could have \$30 million dollars but IT spending in most healthcare systems is less than 3% of operations even though a downed MRI or CT scanner can have a huge impact on quality of care and the patient experience,”**

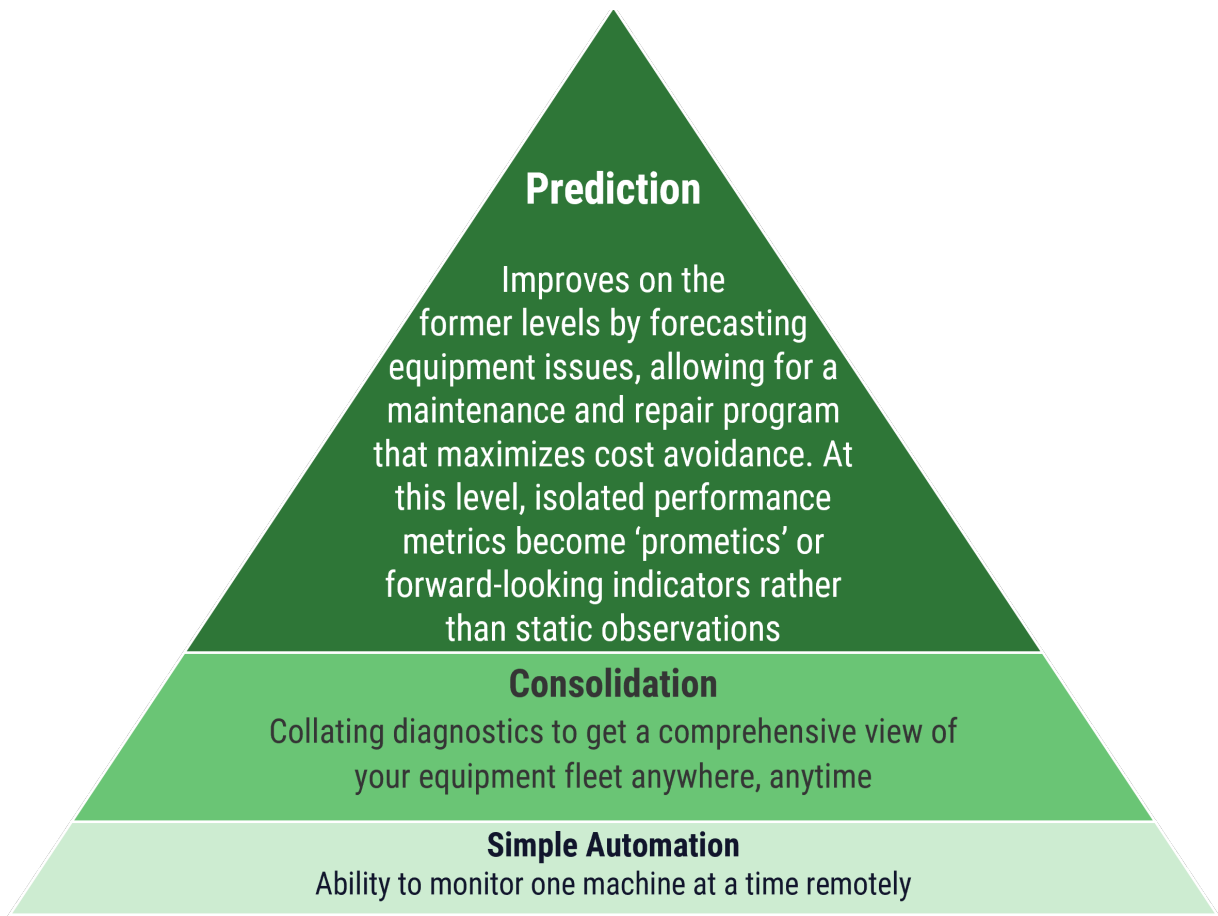
Bradd Busick, SVP-CIO, MultiCare Health System.

By enhancing and expanding the number of data feeds, Glassbeam’s software provides a vital machine data layer to the tribal knowledge or domain expertise offered by clinical engineers. This data layer, enhanced by artificial intelligence and machine learning, generates the type of predictive alerts necessary to instantiate an efficient maintenance and repair ecosystem for these intricate machines.

A leading Molecular Diagnostics company deploys Glassbeam to perform predictive maintenance on their systems. The core component tested with ML algorithms is a key engineering function that is used for Covid-19 PCR testing. Using its patented part failure prediction technology, Glassbeam trained an ML model to predict failure of these testing modules.

The Medical Equipment Management Value Pyramid

Medical equipment maintenance practices over time constitute a pyramid of increasing value.



The Glassbeam Advantage		
Process Step/Impact	Traditional Maintenance	Glassbeam-led Maintenance
Problem discovery	Ad hoc and largely in person, leading to unplanned downtime	Systematic and largely remote, leading to predictive alerts and greater uptime
Maintenance/repair	Unscheduled, generating unexpected costs in terms of lost time/exams, service labor and/or the rush delivery of requisite parts as well as patient and staff satisfaction	Scheduled, allowing facility to avoid the costs associated with traditional maintenance/repair practices
Impact on life-cycle value	Inefficient and less effective means of enhancing life-cycle value as problems are more likely to be detected only when failure occurs, allowing damage to accrue over time, e.g., CT scanner tube arcing	Efficient and effective means of enhancing life-cycle value as problems are detected prior to significant damage accruing

Maximizing Returns on Your Investments

Whether you work for a hospital, clinic or imaging center, or alternately, for an independent service organization, Glassbeam’s Clinsights™ supports a new, more efficient means of maintaining a fleet of medical equipment. This solution allows for the remote monitoring of any number of machines, regardless of brand, from a single dashboard. Key machine parameters such as helium level, magnet pressure, cold head temperature compressor status, tube arcs and aborts on a per machine basis are not only available at the touch of a button but also trended for predictive alerts. Color coded dashboards make it easy to identify and track multiple suspect machines at once.

“In our typical model,” explains Kenney of Brown’s Medical Imaging, “a customer calls into our employee call center, we open a ticket with the customer’s complaint and that ticket goes to a remote support team for evaluation. The team determines the severity of the ticket as well as prepares any triage solutions. From there, the ticket gets transferred to the local engineer for service execution and resolution. And none of that workflow is possible without predictive alerts, i.e., Glassbeam.” He adds: “It’s similar to the way any OEM [original equipment manufacturer] would approach a service call, except we can do it across brands from a unified dashboard.”

Without Clinsights™, Kenney emphasizes, the operational model would collapse for lack of a convenient, cost-effective solution that allows for remote support. The customer call would have to go directly to a field engineer, who, in turn, would have to figure everything out on his or her own, adding to the repair time and associated costs.

Key Clinsights™ Features

Single pane of glass

Provides consolidated data from multivendor, multi-modality fleet

Machine learning algorithms triggered alerts

Based on anomalous values on various types of sensor and log data

Service management integrated with asset utilization

Provides one seamless flow for the entire IDN with drill downs into individual facilities and assets

Remote access (screen sharing)

Enables engineers to view/analyze logs and perform root cause analysis

Secure and compliant

Firewall friendly and secure; encrypted web sockets, audit trains SSO, RBAC and 2FA

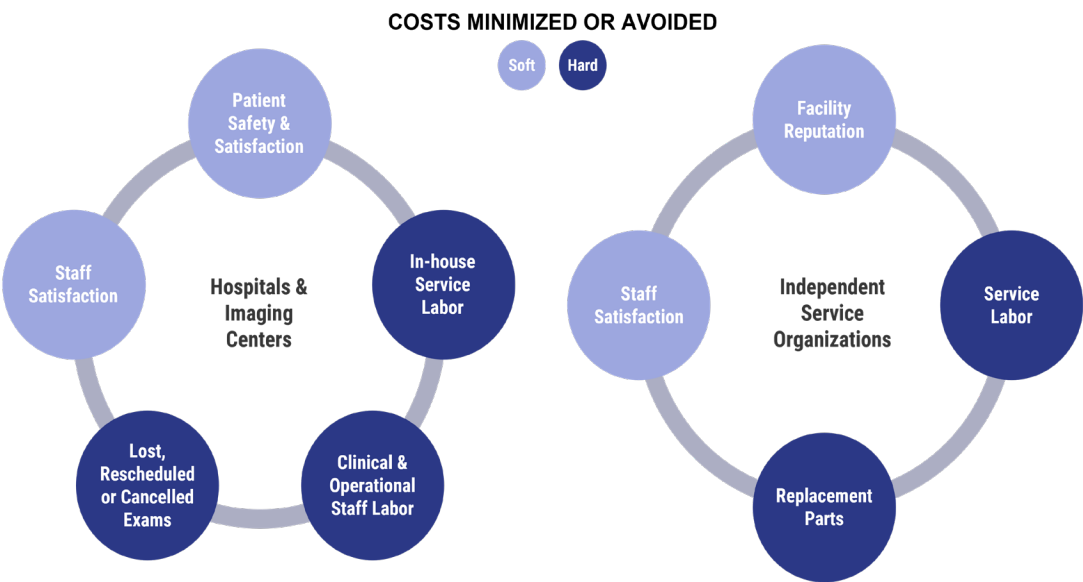
Agentless, deployed on single VM

Sends logs, tickets, DICOM, HL7 messages via secure connection to Glassbeam cloud

The service analytic functions of Clinsights™ maximize operational efficiency and cost avoidance—expenses you or your customers would otherwise have to pay due to traditional, generally reactive medical equipment management practices. The costs minimized or avoided fall into two distinct categories: 1) hard costs, comprised of direct costs in parts, labor and/or lost business and 2) soft costs in the form of patient and staff satisfaction.

Accounting for Cost Avoidance

Hospitals, Clinics & Imaging Centers		Independent Service Organizations	
Hard Costs Minimized/Avoided	Soft Costs Minimized/Avoided	Hard Costs Minimized/Avoided	Soft Costs Minimized/Avoided
<b>In-house Service Labor</b> Labor required to diagnose and repair machine	<b>Patient Safety &amp; Satisfaction</b> Improved uptime best insures against delayed diagnoses that endanger patients or aborts that lead to patients receiving multiple doses of radiation; by the same token, the level of satisfaction among patients is impacted heavily by cancelled or delayed exams, or alternate arrangements required by downed machines, e.g., traveling a greater distance within or across facilities	<b>Service Labor</b> Labor required to travel on-site as well as diagnose and repair machine	<b>Facility Reputation</b> Consistent medical equipment issues can damage the reputation of a hospital, clinic or imaging center, making it more difficult to acquire high-quality staff and secure consistent physician referrals
<b>Clinical &amp; Operational Staff Labor</b> Labor required to accommodate changed circumstances due to downed machine, e.g., adjusting patient schedules, shuttling patients to different floors or facilities, setting up inventory machines or mobile replacements	<b>Staff Satisfaction</b> Level of satisfaction among staff is partly a function of patient satisfaction as well as the uptime rate for key equipment; in terms of the latter, staff tend to be more satisfied working with well-maintained and consistently reliable machines	<b>Replacement Parts</b> Ad hoc discovery of failures often means rush fees and/or delayed delivery, extending downstream revenue impacts	<b>Staff Satisfaction</b> Given that many issues can be resolved remotely rather than on-site, staff can accomplish more with less effort, leading to greater satisfaction
<b>Lost, Rescheduled or Cancelled Exams</b> Every day a machine expected to be operational is idle constitutes a non-revenue-generating machine; the longer the downtime, the greater the cumulative cost			



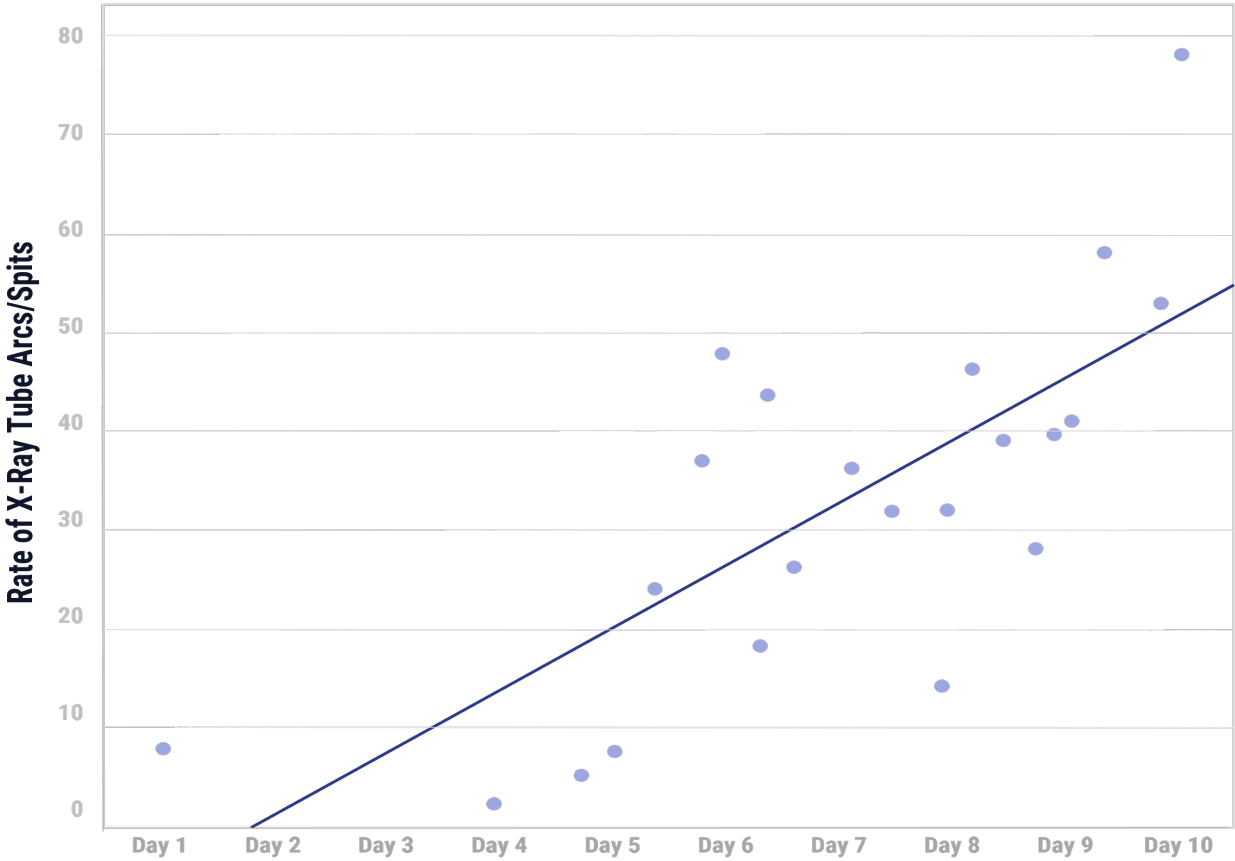
The following illustratives highlight the positive business impacts of the solution in different scenarios. These case studies are based on customer reported incidents and associated cost estimates and together, constitute compelling proof of Glass-beam’s value.

Case Study #1: CT Scanner – Multiple High Voltage Tube Arcing

**Customer Type:** Health system  
**Alert Type:** Emergency alert  
**Estimated Cost Avoidance:** ~\$84,000

Incident Details

The hospital’s clinical engineering department received a Clinsights™ alert from a CT scanner suggesting an issue with the x-ray tube. An engineer pulled the Glass-beam-provisioned data logs and inspected the suspect machine. Based on the logs, the tech confirmed the root cause was a burnt high voltage pin in the tank, resulting in tube malfunction. The engineer cleaned the pin and had a new tank on order to return the machine to working order.



Business Impacts

**Replacement Parts:** Diagnostics indicated the root cause was in the tank rather than the x-ray tube. The replacement tank cost only \$3,000. An inspection without benefit of the Glassbeam solution could have easily resulted in the purchase of a replacement tube at a cost of about \$60,000.

**Cancelled Exams:** Avoided up to three days of unplanned downtime, which could have resulted in a loss of revenue of about \$23,220.\*

\*Estimate is based on the number of machine downtime hours avoided multiplied by the typical number of CT exams of three per hour at this facility for a minimum of eight hours per day of downtime at a rate of \$430 per exam.



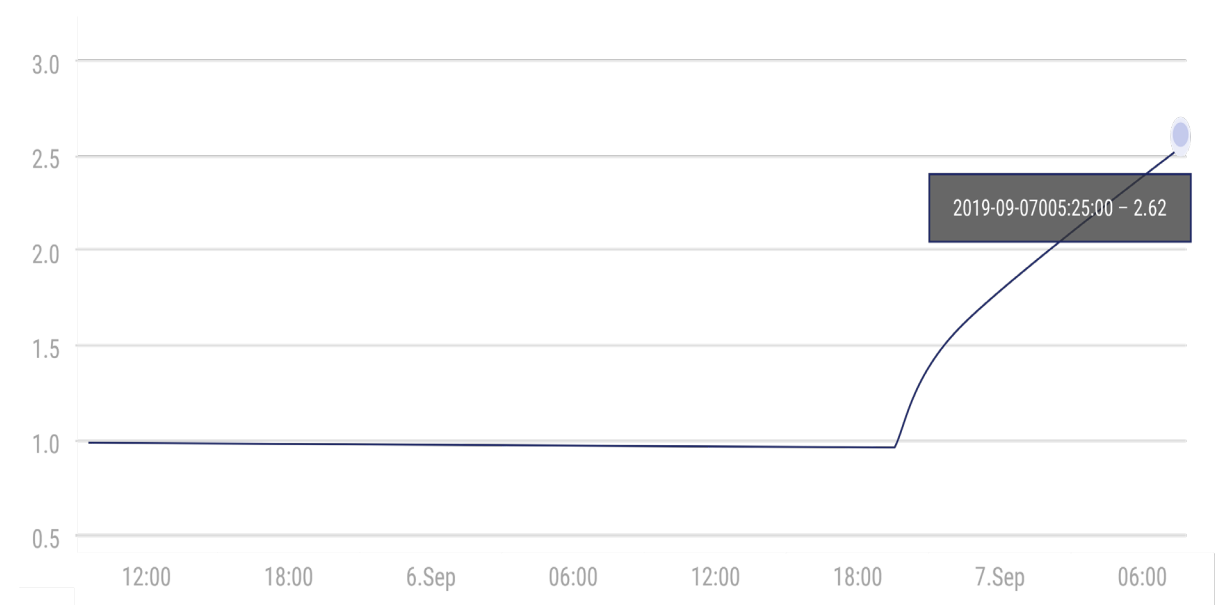
Case Study #2: MRI – Compressor Failure

**Customer Type:** Independent Service Organization  
**Alert Type:** Emergency alert  
**Estimated Cost Avoidance:** ~\$90,000

Incident Details

Late on a Friday night, Glassbeam’s software alerted a contract engineer to a spike in magnet pressure from an MRI at a remote clinic. The engineer inspected the machine and determined the root cause as a failed compressor. A new compressor was ordered, likely avoiding a quench given the timing of the alert and the remoteness of the facility.

Magnetic Pressure (psiA)



Business Impacts

**Replacement Parts:** Without the alert, it’s likely the MRI would have experienced a quench, requiring about \$60,000 to repair.

**Cancelled Exams:** Averted up to three days of unplanned downtime, which would have resulted in a loss of revenue of about \$30,240.\*

\*Estimate is based on the number of machine downtime hours avoided multiplied by the typical number of MRI exams of two per hour at this facility for a minimum of eight hours per day of downtime at a rate of \$630 per exam.

In reviewing dozens of real-world case studies involving Glassbeam’s Clinsights™, no single instance captures the full value of the solution’s service analytics. But assuming these documented cases are nominally representative of machine failures generally, we’ve deduced the following business impacts by modality for a fleet of 300 machines split evenly between MRI machines and CT scanners for a two-year period.

Estimated Cost Avoidance by Modality

Machine Modality			
Business Impacts	MRI	CT	Total Business Impact
Service Labor	\$173,250	\$89,500	\$262,750
Replacement Parts	\$1,473,000	\$1,265,500	\$2,738,500
Exam* Revenue Impact	\$887,670	\$492,750	\$1,380,420
Total Business Impact	\$2,533,920	\$1,847,750	\$4,381,670

\*Estimate is based on the number of machine downtime hours avoided (704.5 for MRI and 365 for CT) multiplied by the typical number of exams per hour at this facility (two for MRI and three for CT) given exam rates of \$630 and \$430, respectively.

On a per machine basis over 12 months, the average savings (in cost avoidance terms) is about \$84,464 for an MRI and about \$6,159 for a CT scanner.



While exact cost avoidance figures vary from scenario to scenario, depending on the size, composition and age of your hospital equipment fleet, the upshot is that Glassbeam's Clinsights™ offers substantial cost savings. As Busick of MultiCare Health System attests, "We anticipate the software will pay for itself in its first full year of implementation. There are very few other technology investments I can say that about."

### From Knowledge to Foreknowledge

In evaluating the market potential of new technologies, we typically apply criteria that harken back to early diffusions of innovation research. These criteria cut across industries and have proven to be predictive of in-market success over the years. Three of the leading criteria—the attributes with the greatest predictive power—are relative advantage, compatibility and problem-solving capacity.

Relative advantage often has the greatest influence on real-world success. This attribute is defined as the degree to which an innovation is considered better or worse than existing alternatives. On that score, Glassbeam's Clinsights™ represents a demonstrable improvement over traditional medical equipment management practices.

In the case of Brown's Medical Imaging, Kenney says, "We acquired Glassbeam's solution because I wanted to add more support for our customers, including application support, with real-time diagnoses without having to add proportionally greater staff. And of course, the trending and tracking element, which helps us predict failures before they happen, is essential to providing better—more efficient and cost-effective—services all around. I've never before been able to archive and trend all the data logs to see the key patterns we need to be proactive. I'd estimate we resolve about 70% of our service calls remotely—that's diagnosis and part ordering—usually in about 40 minutes. That increases our team's productivity and customer satisfaction."

Compatibility usually has the second-greatest influence on an innovation's success in the marketplace. This attribute has to do with the degree to which an innovation is deemed compatible with a business' culture in general and operational model in particular. As the case studies cited earlier show, once integrated into an organization's approach to medical equipment maintenance system, Clinsights™ becomes an essential solution, saving time, effort and expense in a variety of ways.

Lastly, the problem-solving capacity of Glassbeam's solution is integrally related to its relative advantage over prevalent, labor-intensive approaches to medical equipment maintenance. Its ability to turn passive data into predictive alerts is an industry game-changer. "If we didn't have the Glassbeam solution today," opines Kenney of Brown's Medical Imaging, "it would be devastating to our business workflow. We require all of our clients to have it. It's not an option. It's that important. We get, on average, about thirty service calls a week and use Glassbeam on all of them."

After all, when it comes to maximizing investments in medical equipment, the only thing better than machine knowledge is machine foreknowledge.

**"If we didn't have the Glassbeam solution today, it would be devastating to our business workflow. We require all of our clients to have it. It's not an option. It's that important. We get, on average, about thirty service calls a week and use Glassbeam on all of them."**

Andrew Kenney, CT/MRI Operations Manager, Brown's Medical Imaging

## About ROI Rocket

Founded in 2007, ROI Rocket is a leading provider of research-based consulting services in a wide variety of industries, notably, business management, financial services, healthcare and consumer products. We're a debt-free, privately held corporation with offices in Denver, CO, Vancouver, WA, and Jacksonville, FL.

We offer an integrated portfolio of research services backed by rigorous quality assurance protocols. This portfolio includes state-of-the-art consumer and business panels. More than 100,000 new panelists join our base of 16 million+ engaged panelists every month. These panelists are triple-verified, highly engaged and quick to respond.

We pride ourselves on the quality, completeness, and speed of our research support services. These services were developed by Ph.D.-level research experts with more than thirty years of industry experience. This means you can hand your project off to us with the confidence it will be done right.

