Addressing Availability Challenges in Manufacturing

Maintenance and Repair Challenges

Avoiding downtime, especially unplanned downtime, is a fundamental goal in any industrial operation. When unplanned downtime occurs, no value is being produced, but direct and overhead costs continue to accumulate, directly impacting a company's bottom line. The Real Cost of Downtime in Manufacturing research (Machinemetrics – May 2018) shows that planned and unplanned downtime costs the average plant between 5 and 20 percent of its productive capacity. Maintenance teams are under tremendous pressure to keep equipment running smoothly, avoid any interruptions, and perform maintenance and repair tasks quickly, efficiently, and right-first-time. Compounding the challenges are a number of further factors:

- Industrial processes are becoming increasingly automated end-to-end, with minimal work in process, so any break-downs tend to have an immediate impact across the value stream and supply chain
- Equipment is getting more and more sophisticated, requiring broader skillsets and increased experience levels to perform the maintenance and repair tasks required properly and efficiently
- Positions for industrial maintenance technicians, which are most vital to preventing downtime, are becoming increasingly hard to fill. Experienced technicians are retiring, while too few skilled young technicians are entering the workforce to replace them. The lack of skilled maintenance technicians is part of a larger industrial skills gap that is expected to result in an estimated 2.4 million positions unfilled between 2018 and 2028. This will have a potential economic impact of 2.5 trillion USD, according to the 2018 Deloitte and The Manufacturing Institute "Skills Gap and Future of Work Study" (November 2018).

To keep operations up and running amid this myriad of challenges, more companies are turning to Augmented Reality (AR) and Informed Reality (IR) solutions to support efficient maintenance and repair operations with digital work instructions and remote assistance capabilities.

Saving Time and Money with Informed Reality

Obviously, maintenance and repair operations play a critical role across the industrial sector. Proper and disciplined execution of maintenance activities has proven to be very effective at preventing breakdowns, reducing unplanned downtime, and promoting safe operations. The challenge is to execute maintenance and repair activities accurately, consistently, efficiently, and with sufficient documentation along the way.

Maintenance and repair operations may not be effective -or even safe- when established procedures are not being followed, important steps are being skipped, improper activities are being performed, or activities are being performed improperly. So, while performing complex and possibly high-stakes maintenance or repair tasks, technicians should:

- Have quick and easy access to relevant and up-to-date checklists
- Have quick and easy access to step-by-step work instructions that are easy to understand and specific to the maintenance or repair operation being performed
- Have quick and easy access to any reference materials needed
- Be able to quickly and easily confirm and document any tasks performed
- Be able to quickly and easy communicate any issues found that may need further follow-up
- Be able to quickly and easily call in the support of a "remote expert" whenever needed

Unfortunately, not all breakdowns can be avoided. And when they happen, they often require in-depth, expert analysis and support to trouble-shoot and resolve quickly and effectively. That's where the ability to quickly and easily call in the support of a remote expert, and providing that expert with a first-person-view of the situation through see-what-I-see functionality, becomes critical. Here are just a few examples of the benefits of a modern remote assistance solution such as Remote Eye by Wideum Solutions SL:

- Instead of implementing a suboptimal or ineffective fix, resulting in further downtime, quality, or even safety issues, a modern remote assistance solution can bring the expert on-site virtually in a matter of minutes.
- Instead of having to wait for the equipment vendor to come all the way on-site, often traveling internationally, both parties can resolve most issues through a remote "see-what-I-see" problem-solving session, saving significant time and money in the process.
- Instead of your maintenance supervisor or engineering manager needing to rush over to the plant at three o'clock in the morning, they can hop on a quick screen-sharing session, see through the eyes of the local technician, and provide any real-time guidance and problem-solving support needed remotely.

None of this takes away the need for maintenance and repair technicians to be well-educated, well-trained, and motivated to do a top-notch job, of course. But, hopefully, the above examples manage to illustrate how leading companies are saving significant time and money with modern solutions for digital work instructions and remote assistance.

Many of the above described capabilities can be supported with mobile devices such as smart phones and tablets. But, as technicians need their hands to perform most of the work they do, it is much more efficient, and safer, to empower them with hands-free and voice-controlled solutions such as Informed Reality with smart glasses. Informed Reality is a breakthrough technology, offering simple but highly effective solutions for many of the challenges surrounding industrial maintenance and repair operations. It provides the ability to connect shop floor technicians and field engineers with critical information and remote expertise. And the ideal type of smart glasses for industrial maintenance and repair operations are simple but robust "informed reality" devices such as Iristick.Z1, RealWear HMT-1, or Vuzix M300 as they support all the necessary capabilities without distracting or obstructing the technician's view.

SMART GLASSES CAN IMPROVE THE AVAILABILITY RATE BY UP TO 20%.

In the next paragraphs, we will examine three different solutions: see-what-I-see synchronous communication, asynchronous communication of digital work instructions, or a combination of both.

Synchronous Communication

Commonly referred to as "see-what-I-see" remote assistance, Remote Eye is a modern and very powerful way to call in specialized expertise anytime, anywhere. This solution makes it easy to establish a connection between one or more remote experts, viewing things through laptop, desktop, or tablet computer, and the "deskless" technician who is using a mobile or wearable device on the shop floor or in the field. The figure one below demonstrates an example where a field engineer is using smart glasses to call in the help of a remote expert.
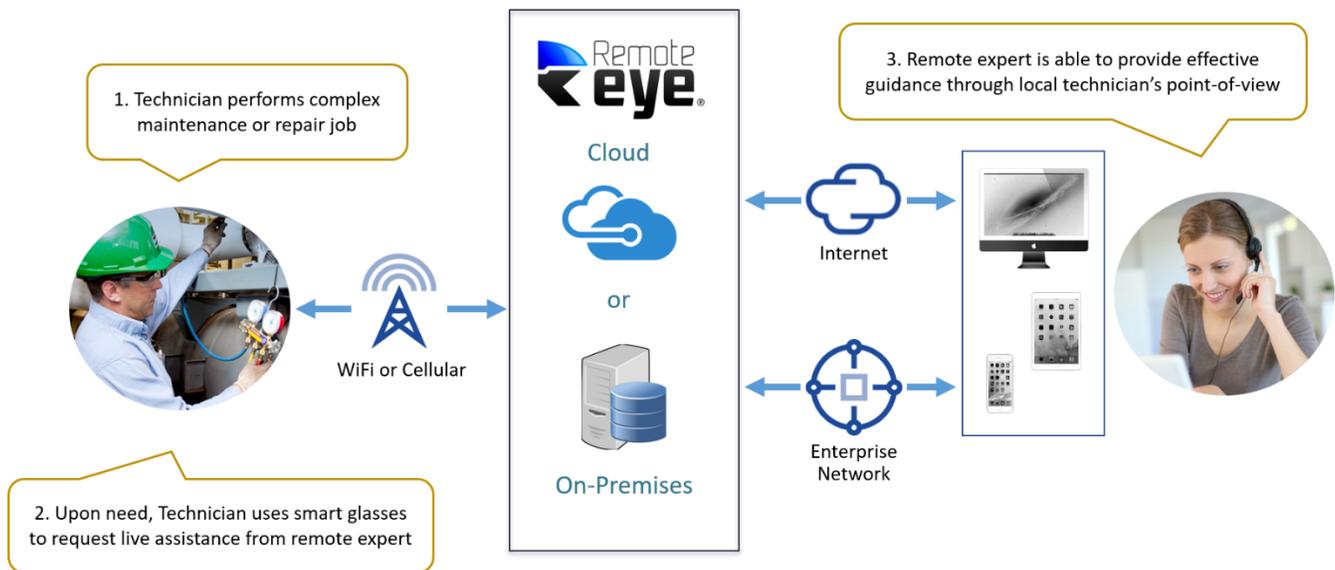

Figure One: Synchronous Communication Set-Up with Wideum Remote Eye

Whenever a new and/or complex - and typically urgent - problem arises, the shop floor technician or field service engineer can instantly connect with one or more remote experts anywhere in the world to collaborate in real-time on a faster diagnosis and better solution. Thereby decreasing maintenance and repair downtime, while saving a lot of money on travel cost and lost productive capacity.

"We have implemented Remote Eye to assist our on-site technical staff. It is an effective and easy to use system, great to ensure the diagnosis and to support remotely in troubleshooting."
Marius Suteu, Technical Director, Commercial Marine Division, Navico

This type of solution provides powerful capabilities, including:

• Technician and remote expert(s) are sharing views and communicating in real-time and hands-free
• If needed, multiple remote experts – eventually from different places around the world - can provide support simultaneously, working as a team
• Remote experts can easily share any relevant documents, pictures, or video with the local technician
• Remote experts can "screenshot" or take video of anything the local technician is seeing, and add notes or directions to the images in real-time for the local technician to follow along
• Remote experts can zoom in remotely to highlight important details, and direct the local technician's attention using a "red-dot"

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Asynchronous Communication

Using a modern solution for digital work instructions on mobile devices and smart glasses, such as Proceedix, technicians can execute standardized maintenance and repair procedures with step-by-step guidance, confirmations, and documentation, while being able to call in the support of remote experts as illustrated in figure two below.
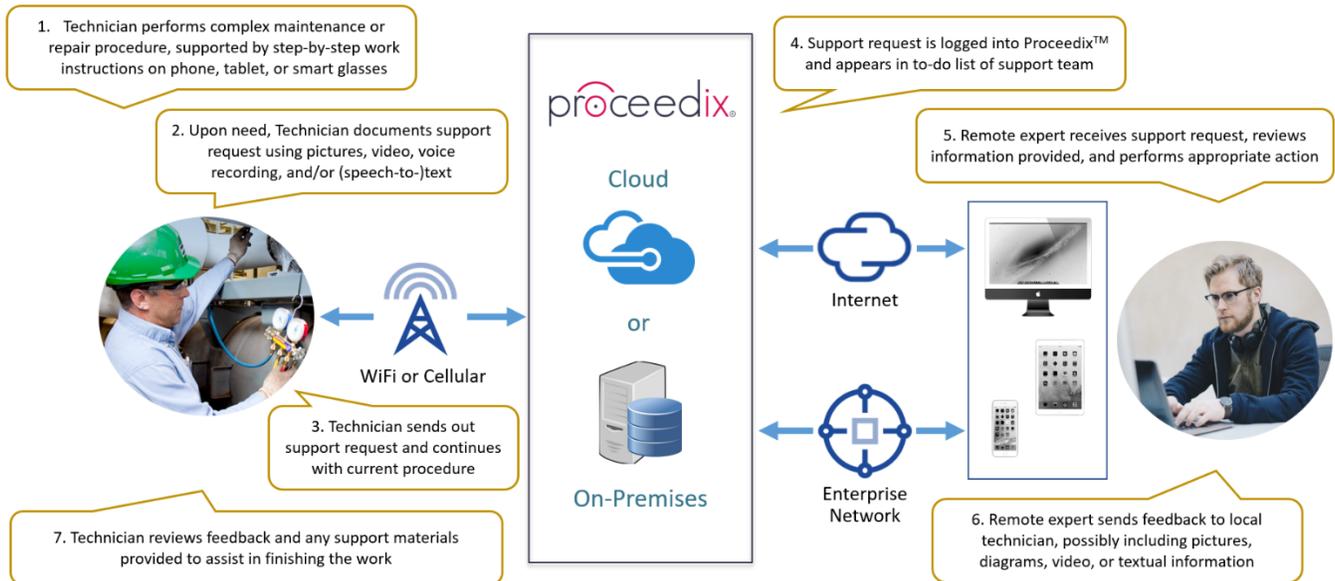

1. Technician performs complex maintenance or repair procedure, supported by step-by-step work instructions on phone, tablet, or smart glasses

2. Upon need, Technician documents support request using pictures, video, voice recording, and/or (speech-to-)text

3. Technician sends out support request and continues with current procedure

4. Support request is logged into Proceedix™ and appears in to-do list of support team

5. Remote expert receives support request, reviews information provided, and performs appropriate action

6. Remote expert sends feedback to local technician, possibly including pictures, diagrams, video, or textual information

7. Technician reviews feedback and any support materials provided to assist in finishing the work

WiFi or Cellular

Cloud
or
On-Premises

Internet

Enterprise Network

Figure Two: Asynchronous Communication Set-Up with Proceedix

Using Proceedix, technicians perform complex maintenance and repair procedures using step-by-step instructions shown on mobile devices or smart glasses. Difficult or risky steps can be highlighted and explained in as much detail as needed with text, pictures, and video. Every step performed is automatically logged and time-stamped for documentation and analysis. And any issues needing the support of an expert resource, can be easily documented, sent out, and logged. As soon as the support resource completes the requested action, the requesting technician receives a notification and any relevant feedback or input, which he or she can then use to be able to continue and finish the job.

This type of solution provides powerful capabilities such as:

- Step-by-step instructions on what to do and how to do it effectively, efficiently, and safely
- Access to any visual aids and digital reference materials needed without having to carry around any manuals or paper drawings
- Easy and possibly automated documentation of any activities performed and tools or materials used
- Digital and possibly automated collection of any relevant values (e.g. gauge readings) for documentation and analysis
- Easy documentation and sharing of any action items needing immediate or future follow-up

Two Complimentary Solutions

The integration of digital work instructions, as supported by Proceedix, and remote assistance capabilities, such as provided by Remote Eye, on mobile devices or smart glasses is especially powerful.
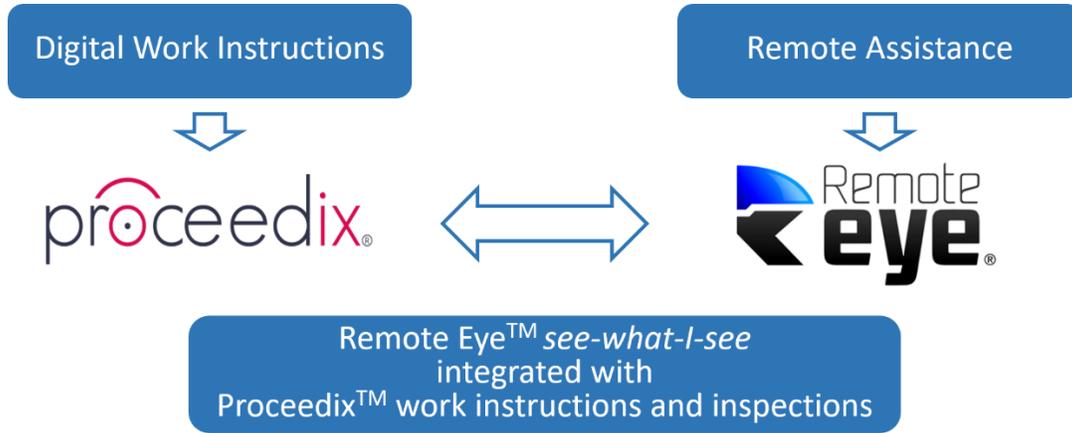

Figure Two: Two Complementary Solutions

Figure Four below illustrates how a technician would use a combination of digital work instructions and remote assistance capabilities in performing complex maintenance or repair activities.
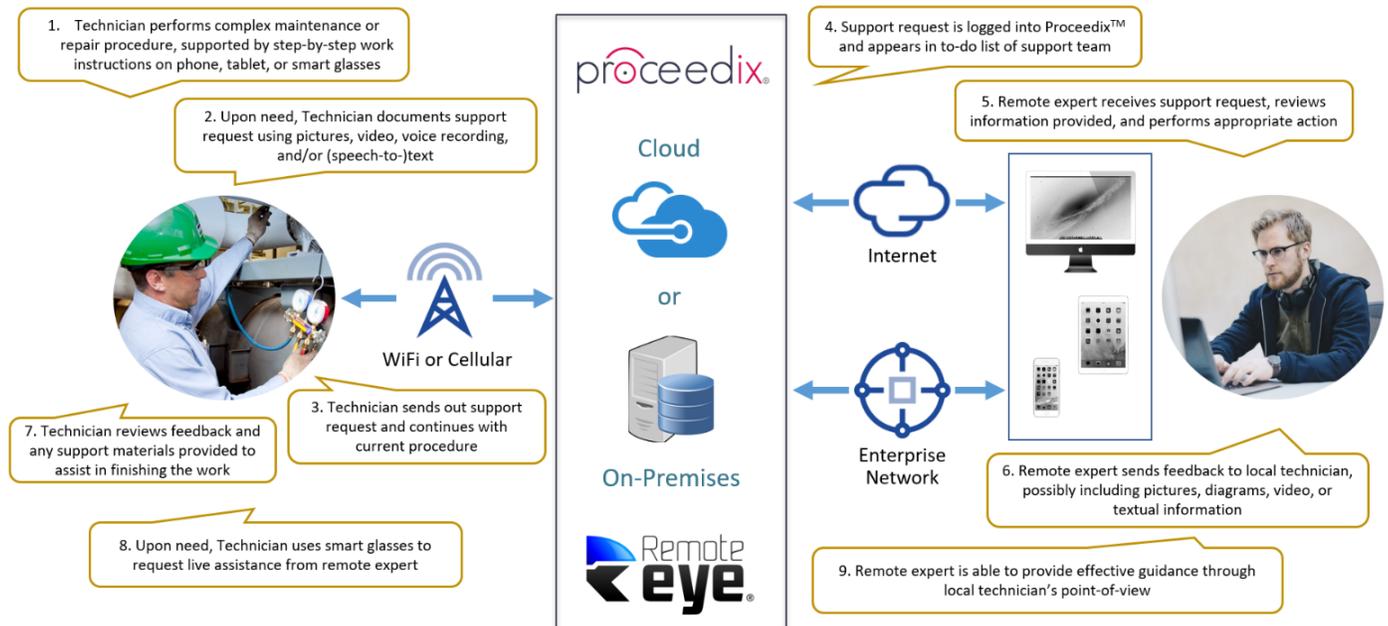

Figure Four: Combining digital work instructions and remote assistance capabilities

This approach combines the best of both worlds, providing the benefits of live remote assistance("synchronous communication"), as provided by Remote Eye whenever needed, and the digital work instructions, documentation, and action request capabilities provided by Proceedix ("asynchronous communication").

Maintenance and Repair Uses Cases

Use Case	Pain Points	Solution Description	Benefits
Industrial maintenance and repair operations	• Effective preventive maintenance is key to minimize equipment downtime, but achieving compliance with established maintenance schedules and procedures can be challenging • Detailed visibility in maintenance activities performed is often lacking • Equipment breakdowns can have major consequences and typically needs to get addressed and resolved as fast as possible • A lack of skilled technicians to maintain ever increasing amounts of increasingly complex equipment	• Remote Eye enables live and hands-free collaboration between remote experts and local technicians to get issues resolved quicker and better • The Proceedix platform allows the creation and management of effective maintenance procedures. • Activities can be scheduled, possibly based on integration with an existing computerized maintenance management system (CMMS), and assigned to specific technicians • Detailed tracking and documentation of any activities performed, which can be analyzed to support training and continuous improvement	• Improved compliance with established maintenance procedures • Improved visibility into maintenance procedures performed: *who-what-when-where-how-how long?* • Faster time to resolution • Reduced travel cost for in-person visits by remote experts
Value-Added Services	• Due to the increased competition between manufacturers, it has become really important to come up with new ways to improve customer satisfaction	• Offer remote assistance solution and include smart glasses to the customer as part of the service level agreement bundle such support contracts	• Create a whole new set of conditions for better and more profitable service provision • Reduce customer service/support calls length and cost • Increase sales due to better customer service, satisfaction and support

"With Remote Eye in smart glasses we offer our customers a premium after-sales service, which our customers greatly appreciate due to the savings in time and money in the resolution of issues and during the commissioning of our equipment."
Esteve Roura, Service Technical Director, Comexi Group Industries SAU

| Knowledge and information sharing management | • Field service workers must halt their work to get how-to instructions or guidance from the device
• Their concentration and progress are disrupted, resulting in delays and errors in the production of goods | • Allow hands-free access to relevant documents in image file formats on the hands-free devices
• Capture and edit a freeze frame of the video call, type notes and send it back to the field technician
• Knowledge base asset creation such as video recordings and images for future use | • Free field service workers from tedious paper-based tasks or hand-held devices and empower them with unprecedented information and interactivity
• Improve your employees training by showing them important processes or accompanying them during the execution |

Return on Investment

Good data is pretty hard to come by, and very dependent on a company's specific circumstances, but - according to a quick Internet search - the average manufacturer deals with up to 800 hours of downtime per year, or more than 15 hours per week, which represents a tremendous cost and lost revenue potential While your costs may not come anywhere close to this, even losing a few hundred dollars per hour can add up quickly and end up having a significant impact on your bottom line.

Obviously, the most direct impact of downtime is a loss of production capacity. Using smart glasses with informed reality solutions such as digital work instructions and remote assistance, companies have managed to very significantly improve their availability rates, resulting in dramatically increased OEE.

Let's illustrate the impact of improved availability with a simple example.

Calculating the "true cost of downtime" can get rather complicated, so we'll try to illustrate the financial impact of equipment availability with a simple example. Let's imagine a medium-sized manufacturer in the (semi) process industry, such as e.g. plastics or packaging, with annual sales revenue of $100 million and net operating income of 15%. If, by using modern technologies such as Proceedix digital work instructions and Remote Eye remote assistance solutions, this company would manage to decrease unplanned downtime with just 10%, and as a result also decrease overall scrap -i.e. increase overall yield- with 10%, this would result in an OEE improvement of 0.5%. This additional productive capacity can be turned into additional sales and operating profit.

Using remote assistance and digital work instructions on smart glasses, a 10% improvement in availability and quality could provide an estimated 1.6% in extra operating profit per year and an approximative return on investment of 139% after just 3 years.

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This results in the net present values (NPV) and ROI numbers shown in figure five.
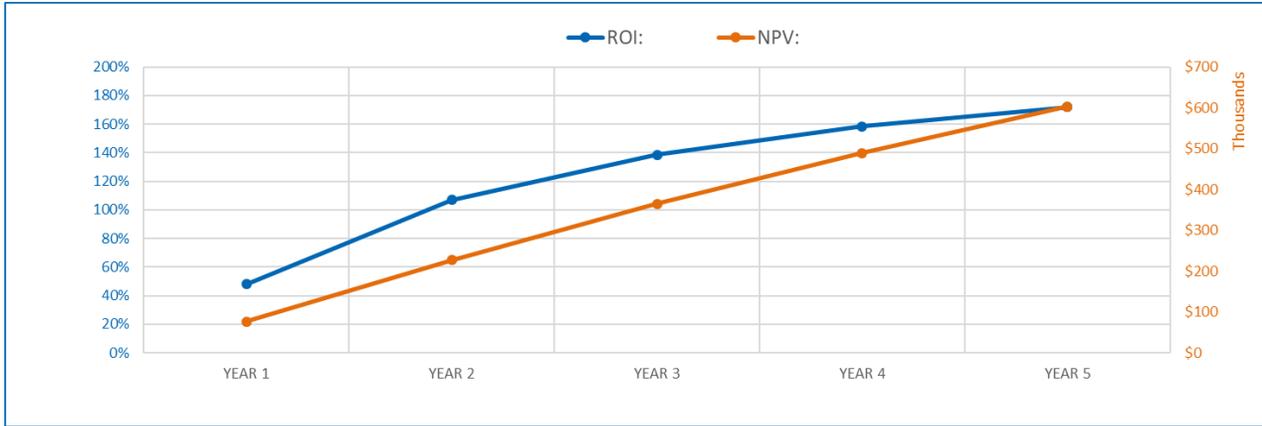

Figure Five: Five-Year NPV and ROI Calculation

(To calculate OEE based ROI of smart glasses implementations in manual assembly environments, read our white paper: "Smart Glasses on the Shop Floor: ROI Assessment based on OEE Improvement".)

About Gemba Systems Inc.

Gemba Systems Inc. helps companies navigate the complex and fast-evolving landscape of Smart Manufacturing and the Industrial Internet of Things. We offer guidance, tools, and hands-on support in the selection and implementation of those industry 4.0 technologies that will best support our clients' most critical business processes, and the people who perform them. We are especially excited about the step-change benefits of informed and augmented reality solutions on smart glasses, and support companies with use case assessment, proof-of-concept, pilot projects, and full deployments.

For more information, please visit www.gemba.systems or
to receive your own use case ROI, contact us at alain@gemba.systems.

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Proceedix is a trademark product of Augnition NV