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ROLLING OUT AUGMENTED REALITY IN THE FIELD

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IT MIGHT TAKE TWO hours for an experienced field technician to fix a broken MRI. But a pair of smart glasses that displays step-by-step instructions in the tech's field of vision could help shave as much as 50% from the time it takes to diagnose the problems and make needed repairs.

Smart glasses and other augmented reality (AR) technologies overlay digital images onto real-world environments in real time. Companies with large field service organizations are using AR to reduce the length of service calls and, as a result, improve productivity, lower costs, and boost customer satisfaction. Leading innovators also see AR as a way to accelerate the training of new technicians, as the more experienced techs retire and take institutional knowledge with them when they go.

The need is immediate, but today's AR does not work in every situation. Very few AR applications are truly plug and play. Companies are still figuring out how to use AR effectively to produce the best return on their investment. Even so, AR is one way for a company to distinguish its field technician corps from the competition's. In the long run, companies that don't adopt it could lose customers to organizations that do.

Because AR lacks established standards, field service units must identify and pilot uses that fit their specific workforce and must gather frequent feedback on what works and what falls short. Field service leaders need to follow a specific change management plan, modify current operations to accommodate new processes and job responsibilities, and get buy-in from technicians and clients.

The Boom in AR in the Enterprise

Expectations for enterprise AR applications are high. Smart glasses and other AR gear supplement or replace training manuals and even trainers. They also provide real-time troubleshooting tips in such business functions as R&D, design, and manufacturing.

Overall, according to BIS Research, commercial AR is expected to generate worldwide revenues of $48.3 billion by 2022, a compound annual growth rate of 87.1% from 2015 through 2022. Over the same period, enterprise-specific AR solutions are forecast to grow even faster—at a CAGR of 96.3%.

The implications for field services are especially compelling. In addition to accelerating repair processes, AR lets technicians spend less time on the road by allowing them to complete more repairs on the initial visit. One of AR's biggest benefits is the flexibility it provides: field service units can put low-experience technicians to work on complex repairs that in the past only specialists and experts could handle. That flexibility optimizes cross training and cuts labor costs, lowering overall operating expenses. (See the sidebar, "How One Field Service Organization Uses AR to Cut Costs and Cross-Train.") In our client work, we have seen relatively inexperienced technicians use AR to complete tasks on equipment they have not worked on before, and they required only slightly more time than a veteran technician. (See Exhibit 1.) To perform the same tasks without AR, novice technicians would need weeks of training, and the likelihood of errors and return trips would be significantly higher, as we saw with one client.

Field service organizations can use AR to deal with an anticipated technician shortage—the result, in part, of the aging workforce. In the US, according to the Bureau of Labor Statistics, the average age of people who work in installation, maintenance, and repair occupations is 42.7 years. The average age of electrical and electronic repair technicians—many of whom work in the field—is even higher. Close to 45% are at least 45 years old, and more than 15% are older than 55, according to Adecco.

HOW ONE FIELD SERVICE ORGANIZATION USES AR TO CUT COSTS AND CROSS-TRAIN

IBM wanted to reduce the time field technicians were taking to service and repair equipment they had not worked on before. Improving cross-training was part of the company's broader goals: to make its field service organization more productive, streamline operations, and provide better customer service.

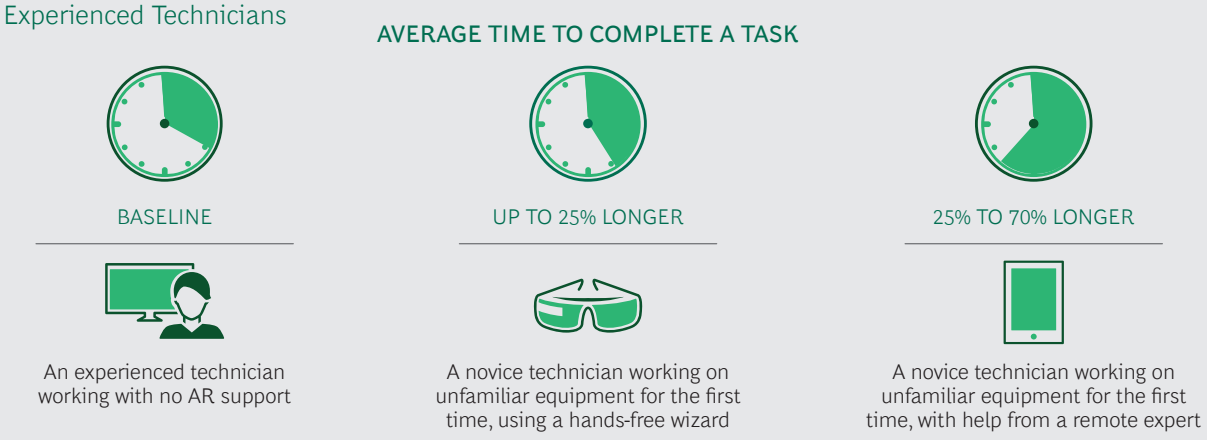
From the outset, the company understood that hitting those goals would not be easy. The technicians had differing experience levels, and they worked on both simple and highly complex equipment. Furthermore, work conditions in the field vary widely—from tiny spaces in computer clean rooms with good Wi-Fi connections to dimly lit facilities with spotty internet access.

The company tested two AR systems to help novice technicians learn how to repair new-to-them laptop models faster: one system used smart glasses that displayed a step-by-step repair manual, and the other connected a worker in the field with a remote expert.

Tests showed that technicians who used either of the AR systems could, with no previous training, complete their work in only slightly more time than it took a trained technician. Furthermore, the trials revealed that to maximize the systems' full potential, different software was required in different work settings. The company also determined that specific business cases had to be created for specific work scenarios, but each should include goals for error reduction, efficiency, and training. Regardless of the use case, unless the AR system was easy to learn and use the first time and every time, users would reject it.

IBM launched a smartphone-based remote-expert solution to increase innovation and differentiation, and AR is now an embedded standard in its support-as-a-service solution.

EXHIBIT 1 | Even Without Normally Required Extensive Training, Novices Work Almost as Quickly as Experienced Technicians



Source: BCG analysis.

AR can help companies preserve the accumulated knowledge of long-tenured workers by capturing their expertise and transferring it to less experienced techs on the job. In addition, it could help companies retain veteran employees who are no longer interested in working in the field, having them serve as office-based experts on a full- or part-time basis or as contractors after they retire.

AR Technology's Uses and Challenges

AR for field services encompasses a range of equipment and systems, each specific situation and use dictating which setup works best. And, because the technology is still in its infancy, significant technical and nontechnical hurdles remain.

Technology and Applications. Working with our clients, we have found that today, smartphones and tablets are the most common AR gear, used by more than 90% of technicians. AR apps for smartphones and tablets can be used to overlay a schematic onto a real-world environment, for example, onto a broken engine part. Think Pokémon Go for technicians.

Italpresse Gauss, an Italian heavy-machinery manufacturer, created an AR system that lets field service technicians point a tablet at a part of one of their machines to get augmented data and maintenance documents that help them diagnose and repair faulty components. Remote engineers with virtual-reality headsets help guide technicians working in the field. The company maintains that the technology lets technicians address service requests faster, reduces down time, and makes equipment more productive.

Wider use of smart glasses is expected as prices for the devices drop. Smart glasses' biggest advantage over existing AR hardware is their ability to project step-by-step instructions, field service manual pages, and other "wizards" into a technician's field of vision, allowing for hands-free work. At BMW, AR smart glasses that display 3D car engine animations and instructions help mechanics determine what needs to be fixed and which tools they'll need.

Technicians can use the camera embedded in smart glasses to connect in real time with a remote expert who can see what they see and can then make recommendations for repairs. At TAE Aerospace, an Australian manufacturer of engines and aircraft components, technicians wearing AR smart glasses are "walked" by remote experts through problems encountered in the repair process, a setup the company says reduces downtime and costs.

Technicians interact with AR systems using eye tracking, voice controls, gestures, or a keyboard or joystick. Although much of the content of AR applications is displayed as text or schematics, it can be presented in the form of icons and maps as well.

As the computer vision and artificial intelligence on which AR is built continue to evolve, it will be possible to use the systems in more and different ways. For example, experienced techs could use the technology to record themselves making repairs so that novices could later use the recordings to guide them through the same maneuvers.

Use Cases. In field service settings, selection of the ideal hardware and software depends on the equipment being worked on, the environment in which the technology is used, and most of all, the technician's experience level. Our client work has shown that technicians are most likely to benefit from self-directed AR that uses prepared content for routine, regularly performed tasks. Remote support is most beneficial for harder tasks and for infrequent maintenance or repair procedures. (See Exhibit 2.)

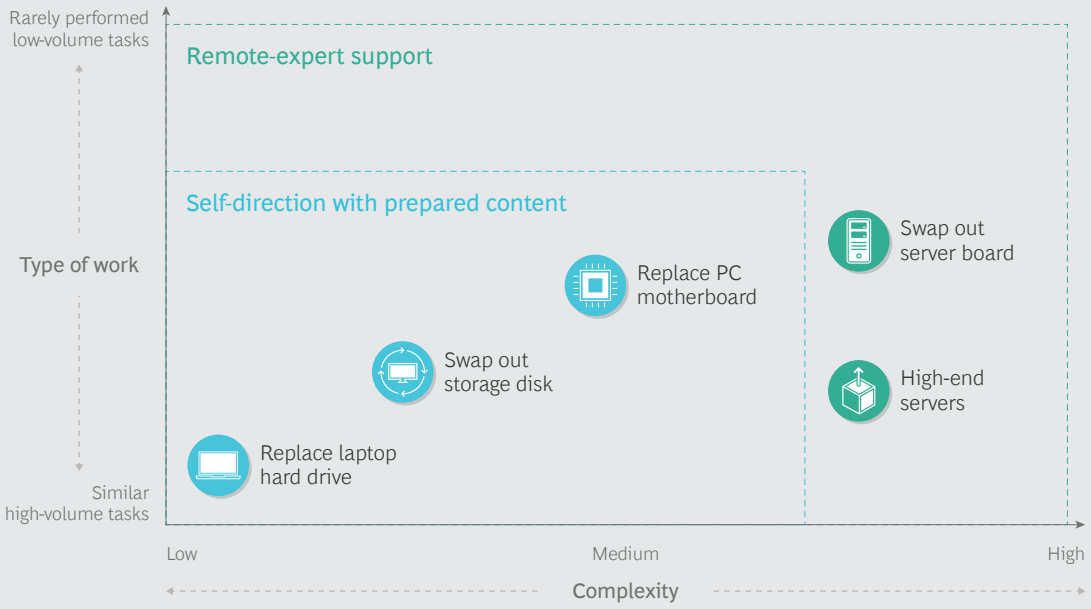
Since experience plays a key role, it's helpful to divide technicians into three groups: novices with no significant experience or training, experienced technicians, and experts with deep knowledge of select equipment and those who might be regularly asked to train other personnel.

Novices benefit most from using AR with step-by-step guidance for work on equipment that is new to them and for problems they haven't encountered before. In both situations, AR quickly brings them up to speed, enabling them to execute repairs like an expert technician and, as a result, to lower labor costs. Should an experienced technician get stuck on a repair, AR can help by providing information that identifies problems faster, reducing error rates and the need for additional client visits and lowering costs. AR benefits expert technicians by allowing them to share their knowledge more efficiently and effectively with less-experienced coworkers, capturing it in the AR-related instructions, guides, and trainings that the organization creates or providing expertise on the fly for remote AR systems.

Some use cases have greater bottom-line impact than others. (See Exhibit 3.) Regardless of the impact of individual use cases,

EXHIBIT 2 | The Type of Task and the Situation Dictate the Best AR Solution

As tasks become more infrequent or difficult, it's more effective for technicians to move from self-directed AR systems to systems that connect them to remote experts



Source: BCG analysis.

the technology addresses field organizations' most pressing strategic challenges: how best to maintain their knowledge base, operate more efficiently, and deliver high-quality work that keeps clients happy.

Challenges. Technical and nontechnical hurdles must be surmounted before those benefits can be realized at their full potential. Some of the technology that AR systems use is in its infancy. For example, depth-sensing technology, which measures distances between objects, is not quite perfected. AR software's tracking, which allows annotations to appear exactly above the real-world object being repaired, is not as accurate as needed for making high-precision adjustments. Creating content for AR systems can be time consuming and costly, as can building applications in-house.

The use of AR in field settings presents other challenges. Many applications need internet access, but not all locations—for example, basements and other underground installations—that service techs visit have reliable connectivity. Poor or inconsistent lighting inhibits detection, while an overly bright environment can make it difficult or impossible to read instructions.

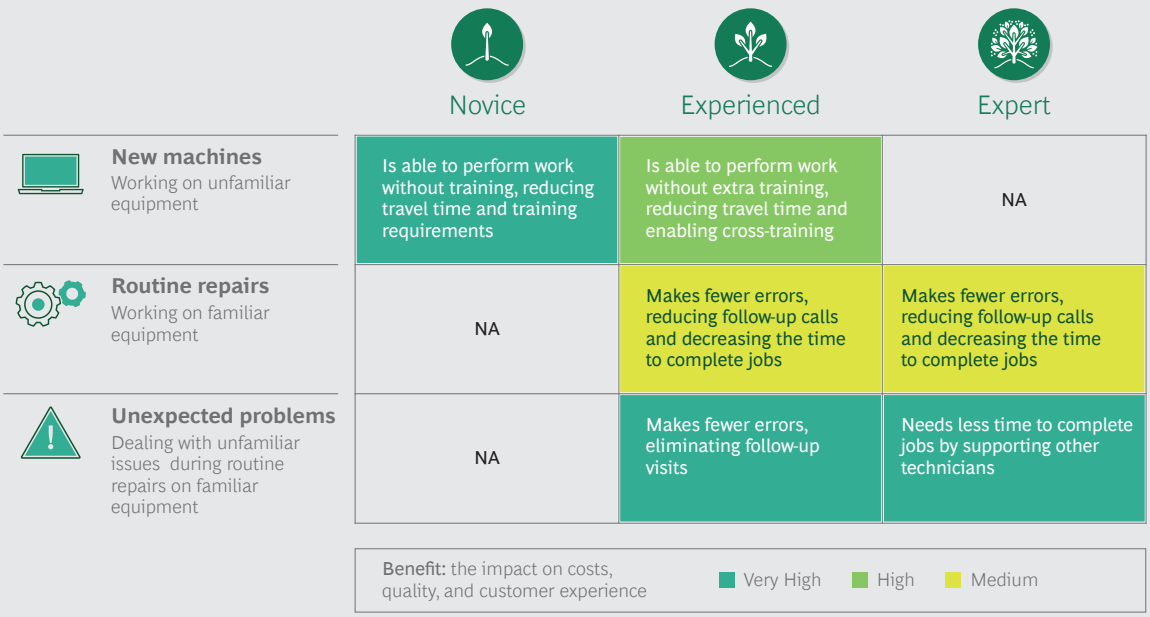
Field service organizations that adopt AR face cultural challenges as well. Employees accustomed to certain approaches—particularly highly experienced workers who have spent years doing things in a certain way—may resent needing to learn new skills. In addition, customers may be reluctant to have techs use unfamiliar tools on their equipment.

Five Steps to Successful AR Implementation

Given the hurdles, field service organization leaders can't just give technicians smartphones or smart glasses with AR apps and say they have implemented AR. To maximize the technology's full potential, field service organizations have to reconfigure the ways they operate. Defining a new operating model means updating the organization's structure, processes, and job descriptions, as well as determining how to support AR product management, content development, and remote workers. The following steps are integral to the success of such a restructuring.

Adopt a new talent structure. Key parts of restructuring field service operations to

EXHIBIT 3 | AR Affects Operations Regardless of the Technician's Experience Level



Source: BCG analysis.
Note: NA = not applicable.

accommodate AR are the redefinition of existing jobs and the creation of new ones. For example, an organization that plans to use AR to connect field technicians with remote experts will need to remove the experts from their field assignments and update their job descriptions to reflect their new assignments and schedules. Likewise, job descriptions for technicians who remain in the field should reflect the new equipment and procedures they use. New roles can be carved out for technicians who create the step-by-step instructions, diagrams, and other content used with AR applications.

Identify and define use cases. As part of the change program, organizations should run pilots for several AR use cases to see which would be the most beneficial. It's not uncommon for a single field service unit to have multiple use cases, especially if its workforce includes novice, experienced, and expert technicians. Use cases may also be distinguished by the type of client, location, work, and environment in which the work is done. Because AR's impact varies depending on the circumstances, pilot projects should be narrowly defined to measure their effectiveness.

Use agile ways of working and run pilots. Using agile to run pilot projects takes some of the guesswork out of an AR rollout and speeds up the process. Agile takes a multidisciplinary test-and-learn approach to developing new products and services. Among other methods, it can include scrum teams that develop minimum viable products. (See "Taking Agile Way Beyond Software," BCG article, July 2017.) A company can pilot AR in an agile way with a subset of its field service force and collect feedback to refine specifications and work out glitches. For a pilot to be meaningful, senior management must provide support and oversight, which could take the form of a steering committee and regular check-ins.

Measure KPIs and ROI. AR pilots should assess the KPIs that the organizations want to change and also determine by how much they should change. KPIs could address such metrics as speed, error rate, number of return visits to complete repairs, client satisfaction, training requirements, and level of experience needed to complete the work. Pilots should also include a target ROI. The investment side of the equation should measure the costs of changing equipment, training, and operations. The return side should measure such milestones as reduced costs and improved service.

Encourage technicians to change. Technicians who pride themselves on their ability to solve problems in the moment may need coaching to help them change the way they work, especially if the revised job involves unfamiliar technology. Leadership can try to explain AR's benefits, but running pilots that expose technicians to new systems is the best way to turn skeptics into believers. If that is not enough, a company might need additional KPIs that incentivize technicians to work with the new system or a remote-expert teammate. For some reluctant technicians, additional coaching and training may be in order.

Field service organizations can use AR to reduce time spent on maintenance and repairs and in the process, lower costs and improve customer service. As tempting as it may be simply to snap up the latest new thing, field service organizations must first find the right AR systems for their particular situations. Running pilots is a sure way to understand what systems work best, how the organization would benefit from them, and what support technicians might need to get started. In the end, the best AR is the system that best fits technicians' needs.

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