Augmented Reality/Virtual Reality
Quad Cities Manufacturing Innovation Hub Playbook Series

Virtual Reality and Augmented Reality (VR/AR)

How to Use This Playbook

Each Quad Cities Manufacturing Innovation Hub playbook is created with the business growth needs of our area’s small and medium manufacturers in mind. By utilizing the information in the VR/AR Playbook, you are taking the first steps to creating a competitive advantage for your company by innovating in the face of disruptive technologies.

This playbook follows a logical flow to guide you as you learn more about VR/AR (see Fig. 1). Review the sections as they apply to your individual opportunities and resources, either in the order they’re presented or jump around to fit your immediate needs.

Figure 1: VR/AR Playbook Information Flow

This is your toolkit for plugging into the virtual and augmented reality network in the Quad Cities.

Together all eight of our playbooks uplift our regional manufacturers and Department of Defense suppliers through increasing digital readiness, working in concert to accelerate the understanding and investment in emerging technologies and to foster a culture of innovation in the manufacturing industry. We encourage you to review the other playbooks (see appendix for more information) as well.

Whom can I contact at the Quad Cities Manufacturing Innovation Hub with questions?
Email askthehub@quadcitieschamber.com and a member of the Hub team will respond to your question.

About the Quad Cities Manufacturing Innovation Hub and Our Partners

The Quad Cities Manufacturing Innovation Hub assists businesses by offering services such as operational assessments, registry in a regional catalog of manufacturers and suppliers, trade and business-to-business events, access to national marketing, access to subject matter experts through the Chamber’s Critical Talent Network, connections to the Quad City Manufacturing Lab and national research, and training seminars targeted at key technologies. More information on the Hub can be found online here.

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VR and AR in the Quad Cities: At a Glance

What are “virtual reality” and “augmented reality?”
Virtual reality, most commonly referred to as simply “VR,” utilizes computer-generated simulations of three-dimensional images or environments that users can interact with in a seemingly “real” way through wearing special equipment such as VR headsets and hand-held sensors or stepping into immersive multi-screen physical environments. Augmented reality, or “AR,” is less immersive than VR, overlaying computer-generated images on real-world objects and environments, viewed through technology-enabled glasses or with a mobile-device application.

Why do VR and AR matter to the Quad Cities?
Quad Cities manufacturers can achieve greater cost and time efficiencies by utilizing virtual and augmented reality technology to simulate real-world scenarios. These technologies are critical to compete and achieve scale in a global economy of larger and greater-resourced manufacturers. Many area manufacturers are already utilizing and experimenting with VR/AR to better equip their technicians for machine repairs, employee training, architectural development, equipment sales, and more.

What are the biggest opportunity areas locally?
The Quad Cities Manufacturing Innovation Hub has identified four key opportunity areas in VR/AR for area manufacturers:

- **Opportunity #1: Immersive Training and Education.** Area manufacturers have the opportunity to use VR to train employees in virtual, simulated worksite environments.
- **Opportunity #2: Operating and Repair Guidance.** Augmented reality shines in its facilitation of efficient employee guidance while operating or repairing equipment.
- **Opportunity #3: Site, Machine, and Parts Planning.** VR gives manufacturers the opportunity to understand machinery and tooling before it hits the manufacturing floor.
- **Opportunity #4: Sales Engagement.** Virtual reality can also be used as a technical sales tool, offering the ability to view intricacies of machinery before a purchase order is signed.

More information can be found in the Identify Opportunities section on pg. 8.

What are the business benefits of utilizing VR and AR?
Though dependent on the VR/AR opportunity area(s) you pursue, manufacturers witness many benefits from implementing these technologies. These include decreased onsite and field accidents, more efficient repairs, reduced maintenance and rework costs, increased profitability and sales, and more efficient troubleshooting. For a full list of metrics, turn to the Build the Business Case and Begin Implementation section on pg. 17.

Where can I find help to get started?
There are local agencies that can assist you with the development and implementation of VR/AR solutions, hardware, and applications. There are also many free online resources, as well as educational courses offered by Quad City universities and colleges. Go to Find Help on pg. 17 for a full list of area resources to help jump start your use of VR/AR to grow your business.
# Table of Contents

**How to Use This Playbook** ................................................................. 2
Whom can I contact at the Quad Cities Manufacturing Innovation Hub with questions? ...................... 2
About the Quad Cities Manufacturing Innovation Hub and Our Partners .................................................. 2

**VR and AR in the Quad Cities: At a Glance** .................................................................................................................. 3
What are “virtual reality” and “augmented reality?” ......................................................................................... 3
Why do VR and AR matter to the Quad Cities? ................................................................................................. 3
What are the biggest opportunity areas locally? .............................................................................................. 3
What are the business benefits of utilizing VR and AR? .................................................................................. 3
Where can I find help to get started? .................................................................................................................... 3

Table of Contents ................................................................................................................................. 4

**Understand the Technologies** ................................................................................................................. 5
Additional Online Resources ......................................................................................................................... 7

**Identify Opportunities** ............................................................................................................................ 8
Opportunity #1: Immersive Training and Education ...................................................................................... 8
Opportunity #2: Operating and Repair Guidance .......................................................................................... 8
Opportunity #3: Site, Machine, and Parts Planning ....................................................................................... 8
Opportunity #4: Sales Engagement ............................................................................................................... 8
Benefits and Use Cases of VR/AR Opportunities .......................................................................................... 9

**Build the Business Case and Begin Implementation** .............................................................................. 11
Change Management: Building the Case Requires Data and a “Test-and-Learn” Approach ...................... 12
Processes and Frameworks for Implementing VR and AR .......................................................................... 13
Resources Needed: Technology and Staffing .............................................................................................. 14
“Quick Wins” to Get Started with VR/AR .................................................................................................. 16
Metrics for Success: How to Measure Impact ............................................................................................ 17

**Find Help with Regional Assets and Partners** ............................................................................................. 17
Educational Institutions ................................................................................................................................. 17
VR/AR Developers/Agencies with Expertise ............................................................................................... 18
Hiring Solutions ............................................................................................................................................ 18

**Special Thanks** ............................................................................................................................................. 19

**Appendix** ................................................................................................................................................... 19
Glossary: Key VR/AR Terms ......................................................................................................................... 19
Understand the Technologies

In the first section, we take a closer look at the technologies that enable virtual reality (VR) and augmented reality (AR). You’ll gain a better understanding of how VR/AR contribute to your company’s digital technology and innovation strategy through diagrams, frameworks, and definitions of key terms used in the space. This section also details additional online resources for greater understanding.

**Virtual reality**, most commonly referred to as simply “VR,” utilizes computer-generated simulations of three-dimensional images or environments that users can interact with in a seemingly “real” way through wearing special equipment such as VR headsets and hand-held sensors or stepping into immersive multi-screen physical environments. **Augmented reality**, or “AR,” is less immersive than VR, overlaying computer-generated images on real-world objects and environments, viewed through technology-enabled glasses or with a mobile-device application. You may also come across the term “mixed/merged reality,” which refers to a combination of VR and AR.

**Glossary: VR/AR Terms**

Please refer to the glossary in the appendix on pg. 19 for definitions of key VR/AR terminology that is utilized in this playbook. Definitions provided for educational purposes as described by Gearbrain unless otherwise noted.

*Figures 1 and 2:* More than one in three manufacturers expect to adopt VR and AR technologies by 2018, via PwC¹

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**Figure 3. Virtual Reality Simulations: Headsets vs. On-screen**

**Virtual Reality Headset:** using a VR headset to interact with an immersive manufacturing simulation. Photograph (right) showcases what the headset wearer sees within the virtual environment at scale. VR headsets are used individually to create immersive experiences.

**Virtual Reality On-screen:** The photograph (right) showcases the experience of interacting with virtual reality through a series of screens in an immersive “cube” environment that scale to the desired dimensions. These environments do not require specialty headsets, but often utilize 3D-glasses to achieve desired effects. They can also be used in group settings with multiple people viewing the same simulation.

**Figure 4. Augmented Reality via Mobile Device/ Tablet**

The photo (right) showcases an augmented reality application being used on a tablet to overlay important repair and parts information on a piece of equipment. Augmented reality applications are often interactive, allowing operators to see procedures, additional specs, and more.

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Additional Online Resources

There are many online resources for review to deepen your understanding of VR/AR applications, technologies, use cases, opportunities, challenges, and more. We’ve outlined a few below:

- **“For US manufacturing, virtual reality is for real,” from PwC:** Read the whitepaper here. This whitepaper explains how virtual and augmented reality technologies are reimagining America’s factory floors. Based on manufacturer survey data, this report reveals a snapshot of how these technological tools are being used by manufacturers and suggests how their adoption could change in the future. Topics covered include VR/AR adoption, popular applications, and challenges faced.

- **VR Process Simulation by AntAutomation:** Watch the video here. In this video, you’ll see live examples of VR in action in a manufacturing environment, used for process and physics simulation, 3D visualization, virtual commissioning, and operator training.

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Identify Opportunities

Virtual and augmented reality offer many opportunities to small and medium manufacturers in the Quad Cities. The Hub has identified four key areas that can bring greatest benefit to our area’s small and medium manufacturers: expanding reach, deepening engagement, closing sales, and collaboration with peers.

Opportunity #1: Immersive Training and Education
Area manufacturers have the opportunity to use VR to train employees – either onsite or remotely – in virtual, simulated worksite environments. Consider your options in scaling your complex equipment, repair, or other training programs to multiple employees at various locations. VR training is also effective in immersing trainees in high-pressure or otherwise dangerous scenarios where they must choose the correct course of action 100% of the time in order to avoid injury or damages to expensive equipment. In a virtual training environment, such risks are mitigated while also delivering a “hands-on” training environment. There are also AR education opportunities to train employees on-the-job using visual informational assists via augmented reality glasses or similar technologies.

Opportunity #2: Operating and Repair Guidance
Augmented reality shines in its facilitation of efficient employee guidance while operating or repairing equipment. Viewed as a visual overlay to the real world via AR glasses, mobile phones, or tablets, AR expands information about physical equipment that is useful to employees. This includes machine models, serial numbers, repair procedures, operating manuals, and more. AR is especially useful for field technicians when servicing older equipment or unfamiliar equipment among manufacturing facilities or multiple sites, as all needed information is readily accessible and in eyesight. This eliminates the need to carry a parts catalog or training manual.

Opportunity #3: Site, Machine, and Parts Planning
VR gives manufacturers the opportunity to understand machinery and tooling before it hits the manufacturing floor. By creating 3D models that can be explored via virtual reality software and hardware, engineers are able to better predict potential collisions among other equipment, plan for ergonomics of employee operations, and steer clear of potential safety concerns. This lends to cost efficiencies during 3D-mocks in quickly identifying potential problems and course-correcting, vs. creating a part, tool, or bringing in a machine that doesn’t align with existing operations. Using VR, manufacturing design and engineering transforms from reactive to proactive, allowing for entire teams to easily weigh in on the process before any real-world applications are implemented.

Opportunity #4: Sales Engagement
Virtual reality can also be used as a technical sales tool, offering the ability to view intricacies of machinery before a purchase order is signed. In a virtual environment, sales and engineering teams can showcase advantages at any scale. This builds bridges between those designing the technologies and
equipment with less technical buyers. By creating proofs-of-concept in VR, sales prospects are immersed and influenced in a deeper way during design reviews. This also decreases risk throughout projects, as all requirements are clearly articulated and tested in a virtual space that mirrors that of a manufacturing floor.

Benefits and Use Cases of VR/AR Opportunities
In this section, we’ll examine the key benefits of utilizing VR and AR in each of the four opportunity areas (Identify Opportunities) on pg. 8. Below, you’ll also find a case example for each opportunity area that shows how a manufacturer was able to utilize VR or AR to produce results throughout the purchase funnel.

Opportunity #1: Immersive Training and Education

- Train for workplace scenarios that rarely occur without the need for real-world resource allocation or waste. Recreate those environments virtually to help employees learn by doing vs. looking at training manuals or PowerPoint slides.
- Knowledge transfer among outgoing and incoming generations of workers is made simple with VR, as no information is lost with employee churn. By documenting all tasks and creating training scenarios in VR, complicated equipment processes are easily and efficiently passed among operators and technicians. Refresher training in VR is accessible on-demand, too.
- Train employees and teams together that would have to work together in complex day-to-day or emergency scenarios. VR allows for the connection of multiple training environments and participants to act out situations where teamwork is critical.

Case Example: ExxonMobil Partners with EON for Holistic Virtual Reality Training Program
ExxonMobil wanted a holistic training approach that combined effective field training using 3D immersive environments with panel operator training using advanced dynamic process simulators. Partnering with EON Virtual Reality for training development and utilizing its Icube portable VR display screens, ExxonMobil is able to offer interactive field training to employees. ExxonMobil simulates a variety of plant scenarios, such as routine operations, emergency response, abnormal operations, upset scenarios, integrity critical procedures, and low probability-high consequence events in a safe and controlled environment. Employees, either individually or in teams, are repeatedly trained on how to respond to these situations in VR until their actions become second-nature.⁴

Above: ExxonMobil employees in virtual training environments

⁴ Example provided by Frank Botdorf, EON Virtual Reality.
Opportunity #2: Operating and Repair Guidance

- Manufacturers no longer need to rely on employee memories post-training, as AR clears confusion by helping technicians identify problems, models, parts, and repair procedures on-demand. Variability among sites is no longer a challenge.
- Although AR glasses (e.g. Google Glass, Microsoft Hololens) are convenient for your employees using AR in the field or on the manufacturing floor, many companies are taking advantage of this technology using common devices like smartphones and tablets. Using the cameras on these devices, employees can scan the parts or equipment for repair needs and pull up contextual information to proceed, outlined step-by-step in a virtual task list. This offers tremendous cost efficiencies in completing repairs and installations correctly the first time around.
- As machines become “smarter,” embedded with sensors and connected through the “Internet of Things” network, employees armed with AR will also become smarter. Analytics and data shared among machinery and equipment will be delivered simultaneously to operators, allowing them to simply download the prescription and carry out recommended actions through AR guidance.

Case Example: Mercedes Benz Uses AR Overlays for Maintenance and Repair Procedures

Mercedes Benz has deployed a first-of-its-kind AR training experience that allows mechanical technicians to operate repair and maintenance procedures using AR overlays displayed directly to the viewer’s eyes through a pair of specially engineered AR glasses (see image at right). Voice and visual overlays guide the technicians through each step and allow for a hands-free process of repairing a transmission.5

Opportunity #3: Site, Machine, and Parts Planning

- Utilizing 3D-modeling and VR helps manufacturers understand machinery, equipment, and parts before they hit the shop floor. Quickly mock up different proofs-of-concept without paying for a new build each time. VR can also be used in entire site planning in the architectural design phase.
- VR is accessible 24/7 for planning purposes, without having to be inside the facility. Engineers and planners have clear view and influence on the design process from the start, rather than reactively catching up (and increasing project time and investment).
- Increases safety when detecting potential collisions, overlay, ergonomics, or employee accidents ahead of time. It’s hard to detect such issues – especially when equipment, robots, and humans are interacting closely within the same space – when looking at a 2D drawing.
- View sites, machines, and parts on a 1:1 scale individually or as a team, or zoom in to see intricate details. This allows manufacturers to view how tight tooling will fit together, how sensors will work, and other potential issues in programming and design. Overall, VR can help in “de-risking” a project from start to finish.

5 Example provided by Frank Botdorf, EON Virtual Reality.
Case Example: Quad Cities De-icing Chemical Manufacturer Ossian Inc. Plans for New Facility in VR

Prior to breaking ground at its new facility in Walcott, Iowa, Ossian Inc. began building layouts in VR in order to find the best work-paths for equipment and employees. VR simulations of the new facility helped Ossian understand not only where equipment would be placed, but also how to get it into the building and maneuver machinery amongst other objects and employees. The flexibility of VR allowed Ossian to mock up many variations efficiently as layout needs shifted, including simulating catwalks, equipment access points for maintenance, and forklift motion paths and height restrictions. VR allowed Ossian to put their eyes on a real-world scenario at scale before pouring concrete, beyond imagining the feasibility of a facility layout on paper.

Opportunity #4: Engaging Sales Experience

- Display machinery and tooling proof-of-concept details via VR, highlighting advantages to build bridges among engineering, sales staff, buyers, and senior leadership with varying understanding of technology. Answer questions in real time, zooming in on specific parts and inner workings.
- Decrease the risk of conceptualizing during a project, allowing the buyer input and interactivity at multiple phases. This eliminates drastic changes during final designs or, worse, after the machine, tool, or part is built and in-use.
- Get in front of your customers with proactive solutions using VR modeling. Showcase your commitment and accountability by fleshing out 3D prototype models that simulate reach analysis, weld distortion, and other design concerns that may otherwise derail a sale if not addressed efficiently or accurately.

Case Example: Genesis Systems Optimizes Designs and Smooths Sales Process with VR Visualization

Davenport’s Genesis Systems Group is utilizing VR, presented on a Mechdyne grid of curved screens (see image above-right), to improve both how they work with their customers and their internal collaboration. Through VR modeling and prototyping, Genesis customers review robotic designs and dive deeper into their concepts. This gives Genesis the ability to answer insightful questions, and address design requests before product development ever begins. Through using VR, Genesis has found that customer solutions are uncovered and implemented much more efficiently as trust and confidence are boosted through every stage of the sales and development process. Additional benefits witnessed include process streamlining, decreased product development costs, and more cohesive teamwork internally.6

Build the Business Case and Begin Implementation

In this section, we’ll outline the steps to take in implementing VR/AR strategies and tactics within your company, beginning with awareness and change management, through establishing partnerships and building use cases that will save you time and money. We understand that the idea of implementing VR/AR technology is very different from traditional training/education, site planning, repair and maintenance, and sales processes that you may be accustomed to. We understand that the prospect of this degree of change to your manufacturing floor and employee experience is daunting! It is our hope that, through the following content and previous look at the benefits of VR and AR, you’ll feel more

6 http://advancedmanufacturing.org/genesis-systems-teams-with-virtual-reality/
comfortable exploring how you can utilize these technologies achieves efficiencies throughout your company.

**Change Management: Building the Case Requires Data and a “Test-and-Learn” Approach**

For most small and medium manufacturers, the prospect of adopting VR or AR seems risky, as it bucks the status quo and requires learning new technologies and procedures to remain relevant in a digital age. Only through experimentation, learning, and failing fast, can you quickly gain new expertise and experience that will benefit your company in years to come.

It is new technologies, like VR/AR, that are shifting the manufacturing industry – beyond the Quad Cities. New strategies and tactics are emerging, and the only way to survive is to be proactive in your adoption of VR/AR in ways that fit into your current culture and align with your business growth goals.

There are many ways for you to get started along the path to utilizing VR/AR. Use the change management tips below to make the case for change and immediately begin proving results:

- **Understand the business value of each VR and AR separately, and set goals accordingly.** Use our metrics outlined in the Build the Business Case section on pg. 17 as well as your own data research to set realistic expectations of how you will measure the impact and success of integrating VR and AR into your existing funnels. This will help in resource planning if you’re measuring the right benchmarks out of the gate. Focus on one or two main use cases first before building complexity.

- **Focus on getting every employee on board with the benefits of VR/AR through peer education.** Get all stakeholders involved from the beginning via one-on-one conversations with leaders and all-company meetings to drive the vision. Make them as knowledgeable as you possibly can, taking ownership of digital platform initiatives. Innovative companies like GE promote “reverse mentoring” to foster understanding, create mutual empathy, and promote collaboration between disparate generations and team members. In reverse-mentoring scenarios, a younger colleague mentors a more tenured employee as a way of getting everyone up-to-speed quickly with digital technologies and benefits. Turn to Find Help on pg. 17 for more education resources and tips.

- **Keep communication lines open during the trial-and-error portion of experimentation.** Employees should understand that it’s okay to fail, and fail fast, if it’s part of a learning process that eventually leads to successfully implementing new VR/AR strategies. This mindset must be led from the top-down within your company in order for employees to feel like they can experiment and innovate in order to achieve efficiencies. Breed risk-taking early.

Part of change management also lies in understanding and planning for the challenges you will encounter in integrating VR/AR into your existing operations. Below are three challenges we’ve identified through our research and conversations with area manufacturers. Become familiar with the potential roadblocks so you can steer clear of their hindrances early on.

- **Challenge 1: Misunderstanding technology needs.** For many manufacturers, it is unclear if implementing VR and AR solutions requires specialty applications, software, hardware, code-readers, etc. Start small, and refer to the Resources Needed section on p. 14. Keep it simple and conceptually easy to start with, focusing on a single piece of equipment or process use case. Also consider the types of hardware you’ll need, and how they’ll work with your facility conditions.
For example, Ossian Inc. recognized that the Microsoft Hololens could not withstand the dust in their facilities, so they are exploring other AR hardhat options.

- **Challenge 2: Budgeting for hardware/software set-up costs.** Even if starting small and understanding your minimum technology requirements, bringing VR/AR into your facility requires costs in computers (that can handle operating load of VR/AR), the actual hardware (headsets, glasses, immersive cubes, screen panels, etc.), and software. Plan your entire budget out for the course of your VR projects, and investigate your ability to do mock-ups in existing CAD/CAM programs to cut initial costs.

- **Challenge 3: VR/AR technology is viewed as a novelty.** Some manufacturers receive mixed reception from customers and prospects as to the viability of VR/AR as an engineering/design tool. They’re intrigued by the possibility but not convinced of its value or capabilities. For those customers (or your own organization!) on the edge, revisit the possibility of using VR/AR at quarterly intervals as new use cases are presented with concrete results, and as hardware costs decrease over time. Feel free to repurpose the case examples from this playbook, or contact us if you have more specific needs!

### Processes and Frameworks for Implementing VR and AR

Integrating VR/AR into your existing manufacturing processes requires a strategic approach. Utilize the workflows and frameworks below to jumpstart your efforts. The frameworks in this section are presented to aid in your high-level strategic prioritization of VR/AR, and we recommend you search out specific frameworks for each technology and use case chosen to guide your implementation.  

**Framework 1: VR, AR, and MR Use Cases in Manufacturing,** via Zuehlke

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Framework 2: Applications of AR/VR Technologies, via Deloitte

<table>
<thead>
<tr>
<th>Enterprise Category</th>
<th>What</th>
<th>Where</th>
<th>Potential Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidance and collaboration</td>
<td>Provide a worker with visual cues to help her perform tasks such as maintenance, repair, or assembly</td>
<td>Aerospace and defense, automotive, construction, health care providers, industrial products, oil and gas, power and utilities, technology</td>
<td>Improved productivity, streamlined work processes, reduced risk, cross-geographic collaboration</td>
</tr>
<tr>
<td>Immersive learning</td>
<td>Immerse the user in realistic training environments that are normally either high-cost or high-risk to personnel; variations include addressing PTSD, phobias, and other medical issues</td>
<td>Consumer products, health care providers, higher education, and industrial products</td>
<td>Stronger retention of material, reduced risk, cost savings, improved therapeutic outcomes</td>
</tr>
<tr>
<td>Enhanced consumer experience</td>
<td>Enhance customers’ experience by providing customized or unique methods to interact with the company, brand, or its products</td>
<td>Automotive, banking and securities, consumer products, health care providers, industrial products, media and entertainment, and travel, hospitality, and services</td>
<td>Better customer engagement, increased marketing opportunities, increased sales, enhanced brand positioning</td>
</tr>
<tr>
<td>Design and analysis</td>
<td>Enable knowledge workers to assess design ideas virtually and/or analyze data in new formats</td>
<td>Aerospace and defense, automotive, construction, higher education, industrial products, real estate, and technology</td>
<td>Cost savings, increased efficiency, earlier detection of design flaws, new methods to analyze data and generate insights</td>
</tr>
</tbody>
</table>

Source: Deloitte analysis.

Resources Needed: Technology and Staffing

Resources required to manage and implement VR/AR strategies will vary by the use cases you’ve established and which technologies you’ve prioritized. For example, utilizing VR for immersive training to work better with remote employees will yield a different cost structure than planning to use AR for more efficient and accurate machine repairs. As previously outlined, you must create a strategic plan for how VR/AR will augment or replace your current processes in the recommended opportunity areas before jumping the gun and investing in the latest “bright, shiny technology” or hiring unnecessary talent.

Use this general checklist to assist in the process of planning for your hard and soft costs:

- **Hardware**: A significant investment in hardware (and, software as outlined in the following subsection) is needed to implement VR/AR solutions within a manufacturing environment. Luckily, there are many options of varying price ranges for both headset hardware (ambient Google Glass starts at $12.99 for example, while immersive HTC Vive at $600 at time of writing), as well as on-screen simulated environments. Use the table below to begin your decision-making process. Always consider your use case first, tying your goal back to one or more of the four opportunity areas (Identify Opportunities, pg. 8). Also take into account if you plan to use this on an individual basis or in a group environment, as well as if it needs to be mobile/portable, as that will greatly impact your hardware choice(s).

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In addition to the VR/AR headset and/or on-screen set-up, you will likely need a computer with high processing power, retailing from $900-$3,000, if choosing to go the route of immersive headsets like HTC Vive, Oculus Rift, or Microsoft HoloLens. Some manufacturers will already have this processing power and memory readily available on their office PCs if running high-usage CAD/CAM programs. Also consider your needs for motion trackers, mounted displays, sensors, and cameras, depending on your setup and desired hardware.

*Figure 6. VR/AR Hardware Categorization, via Digi-Capital*

### Digi-Capital Reality Matrix

![Reality Matrix Diagram](image)

- **Software:** You will need two types of software, at a minimum, to program and execute your VR/AR projects. The first type coincides with the hardware, e.g., if you are utilizing an Oculus Rift, you will need the software pack that accompanies it. The second type is the software you will use for the actual 3D programming in a virtual space. The most commonly used software for this purpose is Unity 3D, though EON and Unreal Engine (Steam/Valve) are also popular among VR developers. We recommend you research the exact software needed per your device, computing system, and use case.

Use the figure below to jumpstart your hardware and software decision process:

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9 Image provided by Digi-Capital’s Tim Merel via email for playbook use.
Employees and Hiring: Assess your current employees for skillsets in each opportunity area, as well as in individual platforms, to determine if expertise and interest exists. Most manufacturers have in-house talent skilled in CAD/CAM who understand how to work in a 3D space and are ready and able to augment their current skills. However, some local small and medium manufacturers have opted to hire new employees with VR/AR expertise to speed up the implementation process, as well as inject new approaches to innovation within the company. Work with the education and hiring partners listed in Find Help on pg. 18 to find VR/AR with experience, freshly graduated, or as a temporary intern (with, ideally, intent to hire). You may also choose to outsource content development initially as a cost-saver until you have an established, proven use case for VR/AR.

“Quick Wins” to Get Started with VR/AR
Take a page from the playbooks of local manufacturers like Ossian Inc., Genesis Systems, and John Deere that are already up-and-running with VR/AR by following a few of their tips to jumpstart your use of these technologies:

- **Tip 1:** Look to other industries for various use cases in AR/VR and how to scale. Manufacturing tends to be a laggard in adoption of technologies early on, so you may need to find inspiration and guidance in other verticals. Look to healthcare, automotive, gaming, and advertising/marketing as starters.
- **Tip 2:** Brainstorm potential use cases of VR that could eliminate or decrease risk and/or avoid rework and redesign. These are likely the most obvious and simplest ways to implement VR with 3D modeling within your company to save money and time. Also consider using safety data from your company to pinpoint what VR/AR training and educational guidance would be most useful in the near-term.
- **Tip 3:** Test and learn with quick pilots. ExxonMobil takes baby steps in small changes to VR proofs-of-concept in order to determine what level of detail was needed in their training program. The bottom line: just do it, and start experimenting!
• **Tip 4: Work with EICC’s VR lab** in downtown Davenport or its additive manufacturing lab at the Blong Technology Center to brainstorm potential applications of VR/AR, including the use of already existing CAD/CAM files to get your feet wet on virtual product tours. They may recommend partnering with students at their educational lab, or train your current employees via EICC or the EON Innovation Academy to learn new skills.

• **Tip 5: Gain experience through local events and free online resources.** Go to Find Help on p. 18 for local educational and partnership resources, and talk with others actively involved in the VR/AR within our community. There are many free webinars and reasonably priced online courses to get you up-to-speed with your technologies of choice. These resources all help to build the business case if you need to “sell” the idea of using VR or AR to leadership within your company.

**Metrics for Success: How to Measure Impact**

When setting your objectives for VR/AR, you’ll need to tie goals to business impact using metrics for success. Without measuring and benchmarking the performance against traditional strategies, it will be more difficult to consistently improve processes, assess weaknesses, and secure future resources.

- Decrease in accidents on trained scenarios (VR)
- More efficient repairs and installations (VR/AR)
- Reduced maintenance costs and shop-floor collisions (VR/AR)
- Reduced rework on jobs over time (VR)
- Increased profitability on programming tools and fixtures (VR)
- More efficient use of time on redesigns (less total redesigns) (VR)
- More efficient troubleshooting (VR/AR)
- More complete design back-ups (VR)
- Increased sales and more satisfied customers due to involvement in VR process (VR)

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**Find Help with Regional Assets and Partners**

In delivering this VR/AR Playbook, among the seven other playbooks provided by the Quad Cities Manufacturing and Innovation Hub, our goal is to connect you to local resources you need to learn about and implement new technologies that will impact your business and our region in the future. In this section, you’ll find local experts, agencies, consultants, and specialists to help you succeed. Additionally, we’ve outlined national and global resources in some categories if local resources do not exist and/or the national resource is reputable.

**Educational Institutions**

**Eastern Iowa Community Colleges (EICC)**


3D modeling and VR (Games and Simulation program, now an AR program) have been a large part of EICC’s IT program offerings for the past five years. Recently, EICC partnered with EON Reality (see more information below) to offer a VR/AR academy to train content developers. On the horizon, EICC will be opening a for-profit Interactive Digital Center that small and medium-sized businesses can utilize for onsite VR/AR proofs-of-concept and advisory.
The EON Innovation Academy is offered in partnership between EICC and EON Reality. At the Academy, 14 students are current working through a VR/AR development training program. It’s an 11-month program, with four months dedicated to learning technology tools and seven months spent in an internship with an organization working on practical projects. The goal of the EON Innovation Academy is to bring VR/AR expertise to the Quad Cities community through vocational experience in advanced manufacturing applications.

**Udacity**


*VR Developer Nanodegree:* [https://www.udacity.com/course/vr-developer-nanodegree--nd017](https://www.udacity.com/course/vr-developer-nanodegree--nd017)

A national online skills marketplace for technology education, Udacity offers two programs for VR developers-in-training, dependent on student skill level and timeline (see links above). **In the software development course**, students will learn how to make VR experiences more dynamic and responsive to users. They will be exposed to C# programming and use it in the Unity interface. Upon completing this course, students will have learned basic programming constructs such as methods, loops, variables, and using events and how to apply them in a VR environment. **In the nanodegree program**, students will master the core principles of VR development and design, learn to turn creative ideas into high-performance VR applications, and pursue an advanced concentration.

**VR/AR Developers/Agencies with Expertise**

**Victory VR**


From fully customized VR apps (iPhone and Android) to 360-degree virtual videos, Victory Enterprises can help your company explore the world of VR and its capabilities. Victory VR has special experience in educational applications and training, as well as showroom modeling that may be attractive to manufacturers and OEMs. Quad Cities-area manufacturers are welcome to contact Steve Grubbs for additional information and consultation at [steve@victoryenterprises.com](mailto:steve@victoryenterprises.com).

**Hiring Solutions**

**Robert Half Technology**

[https://www.roberthalf.com/technology](https://www.roberthalf.com/technology)

Robert Half Technology specializes in placing application development, systems integration, information security, infrastructure management, networking, database development, help desk and technical support professionals in project, contract-to-hire and full-time positions.

**Chenhall Staffing Services**

[www.chenhallstaffing.com](http://www.chenhallstaffing.com)

In addition to staffing and HR, the Chenhall’s team provides solutions in a wide-ranging area of IT needs. Whether they are simply identifying and placing highly qualified technical experts to fit clients’ staffing needs or serving as a prime or sub-contractor on an operational program, their preferred operating model is to build long-term partnerships and trusted relationships with the common purpose of delivering, sustaining, and supporting quality IT services.
Special Thanks
The VR/AR Playbook was created with the contributions, time, and talent of many members of our manufacturing community. We’d like to extend a special thanks to:

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Appendix
Glossary: Key VR/AR Terms
All definitions provided by Gearbrain for educational purposes.

360-degree VR view: A 360-degree view is the simulation of an altered or augmented environment that surrounds the VR user, allowing them to look around in every direction as they'd be able to in real life.

Aspect ratio: The proportion of the width of your viewing screen to its height is the aspect ratio. This can affect how the images from the VR world appear and whether or not they become distorted. It's all about the proper pixels for the ultimate view.

Augmented reality (AR): Virtual reality creates a whole new and artificial environment, but augmented reality uses the existing environment the user is already in and overlays digital information in the form of a computer-generated image on top of it in real time. This provides a composite view.

Cave: A cave is a virtual reality world projected onto the walls and the ceiling of the room of the user to give the illusion of total immersion.

Cinematic VR: This type of virtual reality utilizes real images from cameras rather than computer-generated graphics for a super-realistic VR experience for the user.

Data glove: Also known as a 'wired glove', this glove is filled with delicate sensors that connect to your computer as you play VR games. The hand movements and gestures lead you through a VR environment.

Directional sound: Oftentimes in VR games or movies, there's an overall background sound, but when the sound seems to come from a specific area, it's called directional sound.

Dollhouse view: A view from above allowing the user to see their entire artificial space to better make decisions regarding their next moves.
**Eye tracking:** While your eyes are on the VR experience, the sensors in the HMD (head mounted display) are carefully tracking eye positioning. If you're playing a VR game, the software will guide your view into a specific direction or use eye motions for other perks the game offers.

**Field of view:** Abbreviated as FOV, field of view is the number of degrees in the VR visual area. The more degrees in the field, the greater and more realistic the VR experience will be.

**Haptics:** You know that cool feeling in VR where it seems like you're actually reaching out and touching or feeling something in the scene? That's haptics. While what you see seems like it's at the tips of your fingertips, it's all an illusion.

**Head mounted display:** Head mounted display or HMD is the hardware that gives the user his or her VR experience. You'll find HMDs in the form of a headpiece, helmet, glasses, or goggles. You will enjoy your VR experience through what you see in the HMD.

**Head tracking:** Head tracking is akin to eye tracking, but uses the positioning of the entire head to help you look in any direction during your VR experience. It's just like looking around in the real world, but through the more advanced technology of VR.

**Immersion:** Placing users in an artificial environment yet making them feel like they're right in with the action is considered immersion. VR creates this immersive playground where the sights, sounds, and perceived feelings surround the user with the perception that they are really there.

**Latency:** Latency feels like the VR is a step behind your head or eye movements. This lag is a glitch that will hopefully be eliminated as VR becomes more and more updated.

**Locomotion:** The movement of the user from one place to another in the VR world – the mechanics to process their navigation.

**Mixed reality:** Mixed reality (MR), is also known as hybrid reality which is the merging of the real and virtual worlds to create completely new environments where the physical and digital objects interact and co-exist in real time.

**Refresh rate:** The series of images and how quickly they get updated in VR is considered the refresh rate. 60+ frames per second is ideal for the best experience with little lag time between frames.

**Simulator sickness:** Sometimes VR can produce a feeling of being ill. When the brain doesn't match up to what the eyes think they're taking in, people can get nauseated. The feeling of spinning, falling, and the like have been known to make users feel anything sick.

**Stitching:** Taking bits of footage from a number of different cameras, stitching combines and edits them together to create a continuous view rather than a patched-together framework.

**Tethered headset:** A tethered VR headset requires a connection to a computer with a high processing power. This strong computing power is needed in order to provide the most life-like VR experiences for the user. Without them, the view will be more pixelated and graphics may lag.