



OFFICE OF INSPECTOR GENERAL

UNITED STATES POSTAL SERVICE

Seeing the Future: Augmented Reality and the Postal Service

RARC Report

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Executive Summary

Augmented Reality (AR) is a technology that enables mobile devices to superimpose related, digital content on top of a real-world view. AR is promising new technology which is already helping some large companies increase efficiency. The U.S. Postal Service — always looking for ways to keep up in today's increasingly fast-paced world — has been experimenting with AR for years, but primarily for marketing purposes. There may be additional opportunities for the Postal Service to expand its use of AR into its supply chain to improve operational efficiency in several areas.

AR essentially adds a digital layer of information on top of real world images. For example, in 2013, a furniture company created an AR (app) to go with its catalog. Customers could place the catalog anywhere in their homes, activate the app on their mobile device, and see exactly how furniture would look and fit in their room through the camera's screen. AR moved the showroom to the customer's home, and the company saw increased engagement, especially among new customers. More than 8 million customers downloaded the app within the first few months of the catalog's release. This year, the furniture company printed and distributed 217 million AR-compatible catalogs worldwide, including 20 million mailed to homes in the United States.

This paper identifies 10 specific ways in which the Postal Service could apply AR in its operations:

Highlights

This issue brief identifies 10 opportunities in which the Postal Service could apply Augmented Reality (AR) in its operations to improve mail processing, delivery, and customer experience.

The Postal Service should consider exploring some of those opportunities to evaluate their operational feasibility and financial viability.

1. Provide more accurate spatial information and assist with visualization when placing processing equipment in a plant.
2. Direct employees to needed items in a stockroom, reducing employee training and work time.
3. Direct employees to stored items ready for shipment, as DHL recently piloted with positive results.
4. Guide letter carriers to pack trucks in a way that maximizes capacity while also protecting fragile items.
5. Assist postal employees when performing maintenance on unfamiliar or new vehicles by displaying step-by-step instructions.

6. Provide driving directions to letter carriers, helping them avoid traffic congestion or other hazards.
7. Provide critical route information to new or substitute carriers about the location of hazards, hard-to-find mailboxes, or interior offices.
8. Confirm the identity of recipients using AR facial recognition technology.
9. Help customers determine what size box they need.
10. Allow recipients to estimate when their carrier will arrive.

As the Postal Service embarks upon changes in its facilities and vehicles, it may want to explore some of these AR applications and harness their potential. Of course, this requires careful planning, adaptive experimentation and real investment. One potential strategy is to experiment in implementing AR technology in selected pilot tests to demonstrate the operational feasibility and financial viability of the technology. AR has the potential to improve the Postal Service's mail processing, equipment maintenance, and delivery operations, as well as enhance the customer experience. It is worth exploring.

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Observations

Introduction

Augmented Reality (AR) uses an electronic device — typically a mobile device — to add a digital layer of information on top of real world images. These devices allow a user to view images and digital information in real-time through the device’s camera or lens. Unlike virtual reality, which provides a completely fictitious image, AR enhances the user’s view of the real world with computer-generated images. This system allows a user to see a view of their surroundings incorporating many more details. It could have major implications for the logistics market and the postal supply chain. AR could innovate the way the Postal Service moves, packs, and delivers mail and packages to create a more efficient delivery system. We explore some of these opportunities in this issue brief.

How It Works





This paper focuses on opportunities to use AR through mobile devices, like smartphones, tablets, and wearable devices. More stationary devices, like gaming consoles and desktops, can leverage AR as well, but employees in the shipping supply chain are more likely to use smaller devices because of the mobility they provide.

When users access AR through their smartphone or tablet, they see the layer of AR information superimposed on top of the live camera image on the screen. The technology requires the successful coordination of four components: (1) software, (2) a mobile device with a camera, (3) an AR application (app) loaded onto the mobile device, and (4) an Internet connection.

The underlying back-end software is very important for a successful AR application. The software stores a catalog of AR-recognized objects as well as computer-generated images, GPS data, video, and audio. Organizations typically outsource

development of the software to companies that specialize in AR programming. Users access the software’s information through an app on their AR-enabled mobile device. Once the app is downloaded, it connects the user to the software over the Internet and superimposes the digital content over the real life images visible through the mobile device’s camera.

Figure 1: How Augmented Reality Works

<p>Mobile Device with Camera</p>		<p>The user opens an AR app on her mobile device.</p>
<p>AR Application</p>		<p>The AR app accesses the device’s camera and sends what it sees for interpretation by AR software.</p>
<p>Software</p>		<p>The software interprets the image and relays information back to the user’s screen.</p>
<p>Internet</p>		<p>The Internet facilitates the communication between the software and the app.</p>

Part of what makes AR such a unique tool is that users are able to interact with the digital information presented on top of the real-world view using voice commands, a keyboard, or a touch screen. AR-enabled devices use GPS, compasses, accelerometers, and other sensors to understand their location in relation to other objects.¹ The device determines where to place the digital content based on this technology.

New, wearable devices — like AR glasses — more naturally integrate computer-generated images with real life. Many companies currently offer AR glasses, and the technology is continuing to develop with a shift in focus from consumer products to AR wearables focused on business operations.² On its own, a wearable device can recognize some images and automatically display information, but the addition of a Bluetooth connection enables access to the full range of information available from a mobile device.³

Early versions of AR had shortcomings, such as the need to focus continuously on a single, scannable object without any movement, which could be difficult for a user. Any disruption caused the image to shake or flicker. Other devices and apps placed the AR information on the same part of the screen at all times, sometimes blocking the user's view of the world. However, AR's capabilities are expanding rapidly as technology advances. Now, some AR programs take into account what a person sees and places the digital content into the scene in a realistic way so that it does not obstruct the user's view of the real world.

Background

AR originated with a researcher at Boeing, who used the technology in 1990, to communicate to those who were laying cable wires during construction, eliminating the need for complex user manuals.⁴ In 1997, another researcher explored AR's potential uses in the medical, manufacturing, research, mechanical operation, and entertainment fields. Americans may be familiar with the use of AR on televised football games. It is used to mark the first down lines and play drawings.⁵

Posts around the world have begun recognizing the benefits of AR, mostly in the marketing field. They have used AR technology to both market their own products and services and to incentivize mailers to try to use AR in their advertisements.

U.S. Postal Service's Adoption of AR

The U.S. Postal Service has been incentivizing mailers to incorporate AR into mailing campaigns since 2012.⁶ The Postal Service's promotions program offered a 2 percent discount on postage to business mailers using First Class Mail or Standard Mail letters, flats, or cards to communicate their message using mobile integrated technology, including AR, during the promotion period.

The Postal Service has also incorporated AR in its own marketing campaigns. In 2013, the Postal Service collaborated with Blippar, a company that offers AR services, to bring one of its stamp collections to life. When scanned through the app, the AR-enabled stamps become animated, and users can visit the Postal Service app or sign up to receive more information about the connection between digital and hard copy mail. The AR works on certain holiday stamps that were available in 2013 and 2014.

1 Alexis Madrigal, "How DARPA's Augmented Reality Software Works," *Nextgov*, May 30, 2014, <http://www.nextgov.com/defense/2014/05/how-darpas-augmented-reality-software-works/85477>.

2 Tom Emrich, "Six Wearable Tech Trends Coming Out of CES 2015," *We Are Wearables*, Jan. 13, 2015, <http://www.wearables.com/blog/2015/1/13/six-wearable-tech-trends-coming-out-of-ces-2015> and Stephen Cass, "CES 2015: Industrial Augmented Reality Takes Center Stage," *IEEE Spectrum*, Jan. 9, 2015, <http://spectrum.ieee.org/tech-talk/consumer-electronics/gadgets/ces-2015-industrial-augmented-reality-takes-center-stage>.

3 Most AR glasses use Bluetooth low energy, which is a type of Bluetooth that uses considerably less power to run than classic Bluetooth, meaning it can work through machines powered by small, coin-cell batteries. For more detail, see "The Low Energy Technology Behind Bluetooth Smart," *Bluetooth*, <http://www.bluetooth.com/Pages/low-energy-tech-info.aspx>.

4 Tom Caudell, "AR at Boeing (1990)," *Boeing Inc., USA*, <http://www.idemployee.id.tue.nl/g.w.m.rauterberg/presentations/hci-history/tsld096.htm>.

5 Jennifer Shore, "Where did Augmented Reality Come From?," *Mashable*, Sept. 24, 2012, <http://mashable.com/2012/09/24/augmented-reality/>.

6 "U.S. Postal Service Planning 2012 Holiday Mobile Shopping Promotion," *U.S. Postal Service*, July 18, 2012, http://about.usps.com/news/national-releases/2012/pr12_084.htm.

Figure 2: AR Stamps and Holiday App



Pictured are the 2013 Gingerbread House stamps and the accompanying AR app.

devellops AR software, hosts the “USPS AR” app. Over 10,000 people have downloaded the app on Android devices.

During the 2014 holiday season, the Postal Service produced and mailed two “2014 Holiday Playbooks” to all residential addresses. The first playbook described how users could scan any blue mail collection box to receive extra digital content using the “USPS AR” app. The second playbook gave users the opportunity to watch a behind-the-scenes video from the Postal Service’s national holiday commercial. The app received mixed-to-positive reviews from customers on the Apple and Android app stores.

International Posts’ AR Initiatives

Foreign Posts have also used AR to engage their customers in a digitally interactive way. Royal Mail produced the first AR-enabled stamp in 2010. When scanned by a Royal Mail-created app, the stamp directed users to a video of a British actor reading the poem *Night Mail*.⁷ Similarly, the Dutch post, TNT Post created a stamp that, when scanned, displayed model skyscrapers, allowing people to see 3D images of the buildings.

The Swedish postal service PostNord AB created an AR game in 2011 to interact with its customers.⁸ The game, called “Sweden’s Safest Hands,” allowed users to win actual prizes by carrying virtual parcels around Sweden using their smartphones. The game used the phone’s internal GPS, accelerometer, and compass to track how efficiently and safely the user could transport the virtual parcel. PostNord AB rewarded participants with prizes like movies and cameras. The app became the number one download in the entertainment section of the Apple App Store Sweden and was one of the top ten most downloaded apps in the country during the campaign.⁹

⁷ “First ‘Intelligent’ Stamp Put on Sale by Royal Mail,” *BBC*, September 3, 2010, <http://www.bbc.co.uk/news/uk-11172864>.

⁸ “Swedish Post: Sweden’s Safest Hands Challenge,” *DigitalBuzzBlog*, October 3, 2011, <http://www.digitalbuzzblog.com/swedish-post-swedens-safest-hands-augmented-reality-challenge-app>.

⁹ Janghyuk Lee, “Sweden’s Safest hands (Trygga Händer) – Mobile Campaign,” *Korea University*, Sept. 2, 2013, <http://www.slideshare.net/bodycombat/internet-marketing-cases-2012-h2>, slide 37.

In 2014, the Postal Service collaborated with the *Amazing Spider-Man* movie to create a multichannel marketing campaign featuring Spider-Man delivering packages. The Postal Service featured images from the campaign on trucks, commercials, and direct mailings. The mailpiece instructed recipients to download the then-new Postal Service-created AR app named “USPS AR.” Aurasma, a company that

Video 1: Sweden’s Safest Hands

Common Implementation Considerations and Benefits of AR

There may be opportunities for the Postal Service to implement AR in its supply chain to improve operational efficiency in several areas. These potential applications share certain investments and implementation considerations, as well as benefits.

Investments

There are three major costs to using AR in the postal supply chain: development and maintenance of the back-end software, the purchase of AR-enabled devices, and the price of batteries to power the devices. First, the Postal Service would need to develop the software that runs on the back end of the AR app to enable various AR functions. Each use of AR requires a custom software program and an item catalog so that the AR device will be able to identify the correct information to overlay in each scenario. The development of each software program is a one-time investment, but there could be additional costs associated with keeping the database active and up to date. In the advertising environment, maintaining an AR application generally incurs a monthly charge, ranging from around \$20 to thousands of dollars per month to create and maintain an entire campaign. The same varied pricing system would likely apply for operational uses, depending on the amount of information that would need to be stored.

The most significant investment is the AR-enabled devices. Many of the applications highlighted in this paper would require AR glasses. These glasses range in price; simple versions cost \$400 per pair, while more advanced versions can run up to \$1,500 per pair. It is likely that the Postal Service could buy these glasses in bulk, which may make each pair less costly, but the purchase would still require a sizeable capital investment.

To decrease the number of glasses needed, letter carriers could access AR functions through existing Mobile Delivery Devices (MDDs). In 2014, the Postal Service began deploying 75,000 MDDs to letter carriers throughout the country to provide more detailed parcel delivery and route information to supervisors and recipients. MDDs include many functions, such as package scanning and GPS capabilities.¹⁰ In addition to their package scanner capabilities, the MDDs have a camera, can operate over the wireless networks of multiple carriers, and could possibly run an AR app.

Finally, the Postal Service would need to invest in supporting devices and solutions to charge the devices, such as batteries. Many AR glasses require a supporting device, like a smartphone, to run the application while the glasses display the application-produced images. With some adjustments, the existing scanners and MDDs could communicate with the AR glasses. The Postal Service would also need to consider buying extra batteries or power stations, since the devices generally have a battery life of up to 8 hours of periodic use. Although some of the applications discussed in this brief will only require periodic use, others would require the device to be on all day. Continuous use would drain the battery more quickly, requiring replacement batteries throughout the workday.¹¹

Figure 3: Mobile Delivery Device



¹⁰ Adam Mazamanian, "Mail Carriers Get New Mobile Device," *FCW*, March 18, 2014, <http://fcw.com/articles/2014/03/18/usps-mobile-device.aspx> and "USPS to deploy 75,000 next-generation package scan devices," *Post & Parcel*, March 19, 2014, <http://postandparcel.info/60503/news/it/usps-to-deploy-75000-next-generation-package-scan-devices>.

¹¹ "Vuzix Smart Glasses M100 Hands-On," *SlashGear*, January 6, 2013, <http://www.slashgear.com/vuzix-smart-glasses-m100-hands-on-06263466>.

Implementation Considerations

As with any new technology, the Postal Service would need to develop an information technology (IT) infrastructure to fix glitches in the software program, the AR devices, and the batteries. This would require extra training of the IT staff and possibly an increase in staff.

Another implementation consideration is the support the Postal Service may have to acquire from key stakeholders before altering its operations and making capital investments in equipment and software. This includes support needed from the labor force to make changes to workflows. The Postal Service may need to work with labor organizations to change the ways that postal employees carry out their duties. Additionally, some new operations may require approval from the Postal Regulatory Commission (PRC).

Benefits

AR could help postal employees save time and reduce errors. Our research shows that using AR in postal facilities can leverage the accuracy and consistency of a software program to help employees complete functions such as identifying the location of materials, fixing a postal vehicle, or building a piece of equipment. DHL's recent tests demonstrate that AR can effectively help employees complete tasks quickly and in the most efficient order by providing real time instructions and analysis.¹² For instance, AR could not only give mechanics supplemental instruction on how to fix a truck and where to find replacement pieces within a facility, but it also could ensure mechanics work on the vehicles with replacement parts readily available. AR does not rely on human memory, but instead on recorded organizational knowledge, which promotes consistent service and solutions throughout the supply chain.

Our research also demonstrates that using AR could help reduce the learning curve inherent in any postal job. Although the implementation of any new device or process would require training, once the AR system is in place, the amount of time it takes to train new employees in plants and mechanic positions could decrease. For instance, instead of learning how to fix each part of a vehicle, a mechanic would only need to learn how to work the AR device, which is simpler and takes less time. The Postal Service continues to hire new, part-time employees as more experienced, full-time employees retire. Instructions through AR applications could help mitigate the loss of institutional knowledge by providing a single, consistent set of instructions and a continuous level of efficiency. Consistency could also help postal supervisors and managers make more informed decisions about workload and staffing.

Figure 4: Introducing Guy, the Postal Employee with AR Glasses



This is Guy. Throughout this paper, he is going to demonstrate how augmented reality glasses work.

¹² Peter MacLeod, "DHL improves picking by 25% using Augmented Reality application," *SHDLogistics*, January 27, 2015, <http://www.shdlogistics.com/news/view/dhl-improves-picking-by-25-using-augmented-reality-application>.

AR Application at a Glance: Logistics

▶ Application

Help visualize the best way to reconfigure equipment in postal facilities using 3D imaging.

▶ Implementation Considerations

May have limited application as new postal facilities are not currently being built.

▶ Benefits

Ensures all equipment fits in a functional way and prevents need to rearrange equipment.

▶ Example

One construction company is using AR to show clients their new space before construction begins to avoid costly changes once building begins.

Logistics

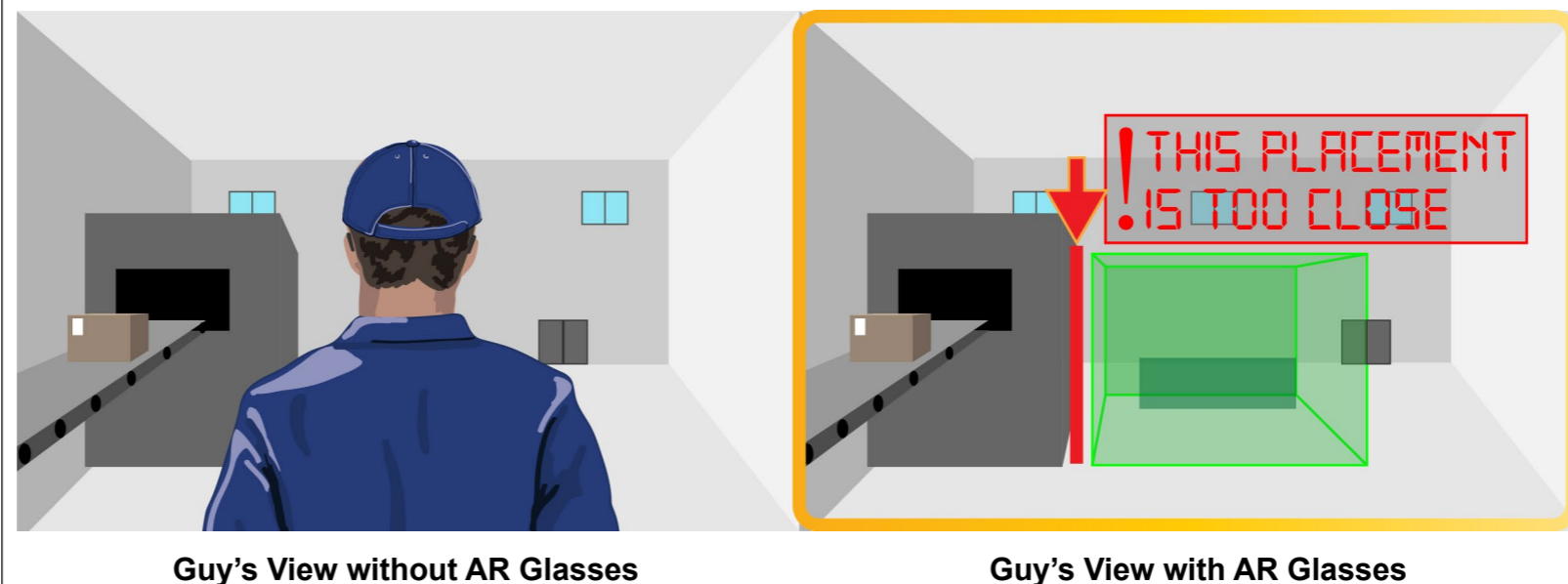
The Postal Service moves millions of mailpieces and packages each day. One of the central uses of AR in logistics involves its ability to give accurate location and spatial instructions. This could be promising for the Postal Service, especially for its ability to efficiently plan facilities, pack trucks, offer forward staging, manage inventory, and maintain equipment.

Facilities Planning

As the Postal Service consolidates sorting and processing plants, post offices, and other postal facilities, it must redesign its existing space. The Postal Service also continues to update its sorting equipment to accommodate the growing number of parcels. AR could help staff reconfiguring equipment within postal facilities by allowing the designers to visualize how the layout might work most effectively. Instead of using a two-dimensional plan, which can be prone to error, AR gives an interactive overlay of the design to show how it would function in a real room.¹³ Construction firm McCarthy Building Companies is using AR to help with logistics planning during their building processes, especially for large, complex facilities like hospitals.¹⁴ AR reduces the number of expensive and time-consuming changes needed for a finished building because it allows clients and the construction team to see and experience what the space will look like before work begins.

In the postal environment, AR could be used to plan the layout of all postal facilities, like plants and post offices, before any of the equipment is ordered or moved.¹⁵ This could prevent costly rearranging of equipment in the future and increase efficiency by ensuring a functional layout. Being able to see what a facility will look like once all the equipment is in place could also give postal employees a chance to give input on any design changes, ultimately creating a more effective work environment.

Figure 5: Guy Reorganizing Sortation Equipment in the Facility Using AR Glasses



¹³ Xiangyu Wang, "Using Augmented Reality to Plan Virtual Construction Worksite," *International Journal of Advanced Robotic Systems*, 4, No. 4 (2007), http://cdn.intechopen.com/pdfs/4246/InTech-Using_augmented_reality_to_plan_virtual_construction_worksite.pdf, p. 501.

¹⁴ David Barista, "Augmented Reality Goes Mainstream: 12 Applications for Design and Construction Firms," *Building Design + Construction*, Sept. 4, 2013, <http://www.bdcnetwork.com/augmented-reality-goes-mainstream-12-applications-design-and-construction-firms>.

¹⁵ DHL, *Augmented Reality in Logistics*, 2014, p. 14.

AR Application at a Glance: Inventory Management

► Application

Tracks inventory trends and guides postal employees to the location of supplies in the stockroom.

► Implementation Considerations

Taking initial inventory of supplies is time and resource intensive.

► Benefits

Better inventory management; quicker location of inventory; reduced training for stockroom employees; enhanced just-in-time method.

► Example

One company experienced a 14 percent productivity increase by switching from handheld to wearable scanners.

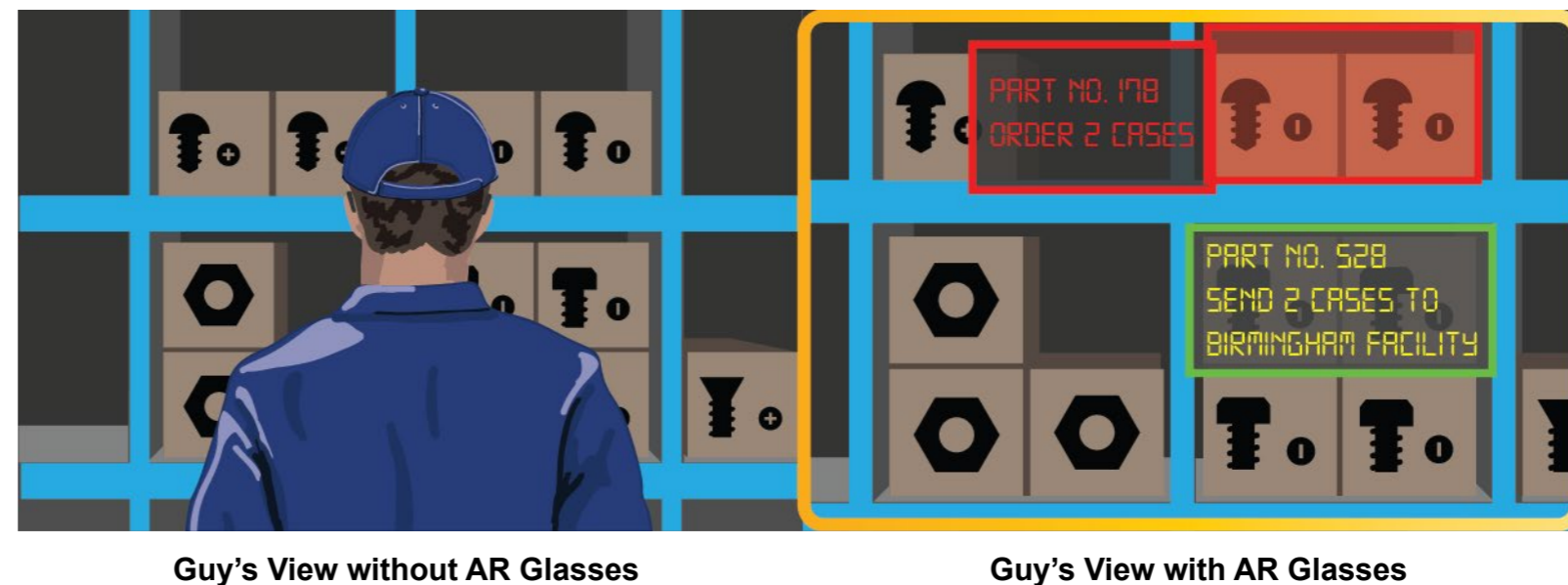
Inventory Management

A key element of the Postal Service's ability to operate successfully is being able to properly maintain equipment and have access to replacement pieces when needed. Local maintenance managers and installation heads are responsible for stockroom inventory management, including replacement parts. The Postal Service currently uses a number of tools, including the Material Distribution and Investigation Management System (MDIMS), to track the location of items in stockrooms, identify the number of items in stock, and use past trends to predict future inventory needs. MDIMS interfaces with more than 25 other inventory management systems to collect and produce this information.¹⁶ The MDIMS system contains more than 90,000 items and fills more than 3.8 million customer orders annually. The system is designed to improve stockroom reliability, efficiency, and inventory accuracy.

The Postal Service could use AR technology to streamline the inventory management process and consolidate the tracking system. Using the just-in-time method, the Postal Service strives to order only enough stock to fulfill current needs.¹⁷ However, recent U.S. Postal Service Office of Inspector General (OIG) audits have uncovered that vehicle maintenance facilities sometimes struggle to keep all necessary items in stock because of availability from suppliers.¹⁸

AR could streamline stockroom inventory processes in two ways. First, it could consolidate the dozens of inventory management systems the Postal Service currently uses into one, AR-reliant program. This consolidation could allow the Postal Service to communicate stock trends more efficiently and effectively. The AR program's ability to record data on the use of inventory across the country could automatically update the stock positioning strategy to ensure that the Postal Service stores inventory where it needs it most.¹⁹ Wearable AR devices would allow employees to record stock changes as they work, without the added step of intentionally scanning or recording stock. Understanding inventory trends gathered from AR could also give insight into other issues, like which equipment components fail most often.

Figure 6: Guy Choosing Inventory with AR Glasses



¹⁶ U.S. Postal Service, "List of MIS Descriptions," <https://about.usps.com/who-we-are/foia/mis-updated-description.pdf>.

¹⁷ "Just-in-time," *The Economist*, July 6, 2009, <http://www.economist.com/node/13976392>. The Postal Service already requires all inventory decisions to consider using the just-in-time method.

¹⁸ U.S. Postal Service Office of Inspector General, "Vehicle Parts Inventory Management – Capping," Report Number DR-AR-14-005, March 26, 2014, <https://www.uspsoig.gov/sites/default/files/document-library-files/2014/dr-ar-14-005.pdf> and OIG, "Vehicle Parts Inventory Management – Pacific Area," Report Number DR-AR-13-003, April 12, 2013, <https://www.uspsoig.gov/sites/default/files/document-library-files/2013/dr-ar-13-003.pdf>.

¹⁹ U.S. Postal Service, "Develop, Finalize, and Implement Inventory Control Plan," http://about.usps.com/manuals/spp123108/html/pp_ps5_004.html.

AR Application at a Glance: Forward Staging

▶ Application

Guides postal employees to locate goods to fulfill a shipment.

▶ Implementation Considerations

Regulatory challenges in expanding the forward staging pilot.

▶ Benefits

Efficient and error-free package location; less time training employees; revenue generation through additional services.

▶ Example

DHL reported 25 percent increase in efficiency of picking process when using AR technology.

Second, AR could change the way postal employees run stockrooms by recording the inventory used, tracking the items needed, and notifying stockroom staff to reorder supplies when they get too low.²⁰ Additionally, AR could track where items are located in a stockroom, reducing the amount of time it takes to train a new employee about where to find items. Using AR glasses rather than the current handheld scanners would also allow employees to do their job more effectively because they would have both hands free to hold items.

Canadian retailer Longo Brothers Fruit Market began using wearable technology in its picking and packing process in 2009. The company reported a 14 percent increase in productivity as a result of switching from a barcode scanner gun to a wearable scanner.²¹ Similarly, the Postal Service could use AR to expedite the picking process in stockrooms and some of the 13 scanning points along its package delivery chain.

Although taking the initial inventory of all items in the stockrooms and storage areas for the AR program could be time consuming and resource intensive, the efficiency gained in the long term could benefit the Postal Service.

Forward Staging

Forward staging is the process in which a company pre-packages goods and stores them close to their final destinations so that they get to the consumer quicker. End consumers order the goods, and then employees, often called pickers, pick the products, label them, and ship the goods to the end consumer.²² The Postal Service is currently implementing a forward staging pilot in the Chicago area, in which a company is storing pre-packaged goods in a Network Distribution Center (NDC).²³ An NDC is a postal facility that serves as a centralized mail-processing center and transfer point for different geographic areas. Expanding forward-staging capabilities in postal facilities could allow companies to process and ship orders more quickly, since the orders would already be at a postal facility. A hands-free AR device, like AR glasses, could make this process more efficient by showing postal employees where in the NDC the items are located, how many need to be picked, and in what order they should be picked to minimize unnecessary movement around the facility. Postal employees could also use AR to help pack goods in an efficient and safe manner.

While the Postal Service does not currently offer warehousing services nationwide, the Postal Service can leverage its Processing and Distribution Centers (P&DCs) and NDCs to offer these services. Warehousing offerings could help small business owners who need minimal storage space, as well as large businesses that ship to specific parts of the country. Outside of warehousing services, P&DCs and NDCs could also benefit from increased efficiency, as they are currently a critical part of letter and package processing.

If the Postal Service were to implement AR eyewear in its facilities, it would not be the first organization. DHL has begun piloting AR glasses in its warehouse operations.²⁴ According to DHL's Director of Trend Research, forward staging clients are beginning to use

Video 2: AR for the Warehouse

²⁰ Ibid. AR would alter the Inventory Control Plan.

²¹ The distribution center employees moved 164 cases per hour using the wearable computer and 140 cases without the wearable computer. Bob Trebilcock, "Using Voice and Bar Code Scanning at Longos," *Logistics Management*, July 1, 2009, http://www.logisticsmgmt.com/view/using_voice_and_bar_code_scanning_at_longos/wms.

²² Ibid.

²³ P. Koviakas, "Mailers Technical Advisory Committee (MTAC) November 18th-19th 2014 Notes," *Mail Systems Management Association*, http://www.msmanational.org/Documents/MTAC_November_2014_Notes%20.pdf?pageId=1851139.

²⁴ Gavin van Marle, "How 'augmented reality eyewear' can give you a smarter view of future logistics," *The Loadstar*, November 26, 2014, <http://theloadstar.co.uk/dhl-google-glasses-big-data/>.

AR Application at a Glance: Packing the Truck

▶ Application

Guides letter carriers in packing parcels and mail bins in the truck.

▶ Implementation Considerations

Makes re-routing more difficult because packages are organized based on a specific route.

▶ Benefits

Ensures truck fits as much mail as possible; protects fragile packages; makes it easier to locate packages within the truck while on the route.

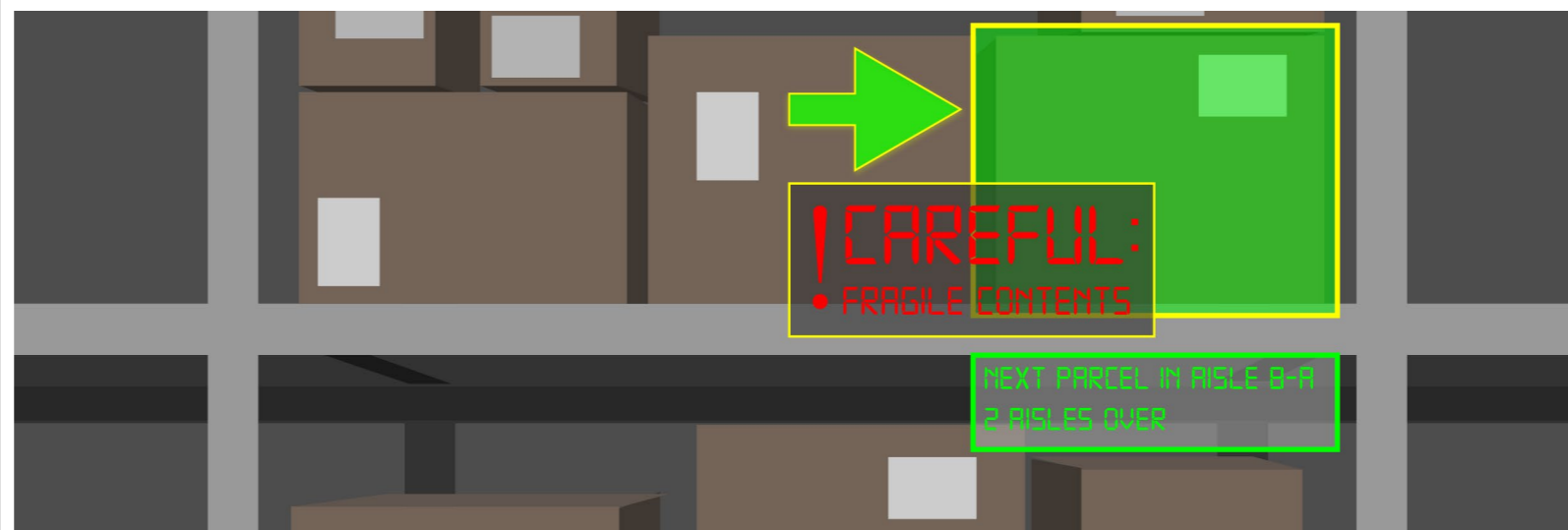
▶ Example

A manufacturing company is developing AR for cargo ships that will allow captains to see through objects that block their view.

AR glasses when they are looking for productivity gains and error reduction.²⁵ One major cost associated with offering warehousing services is the picking process, which DHL estimates to account for between 55 and 65 percent of total cost of running a warehouse.²⁶ In its pilot, DHL reached its goal of reducing the cost of the picking process, achieving a 25 percent efficiency gain.²⁷ Video 2 shows how AR glasses are used in a warehouse to help an employee pick goods, scan the items, and improve safety.

Integrating AR capabilities into postal facilities and potential warehousing and forward staging services could help postal employees locate merchandise and packages efficiently and pack them appropriately. However, the efficiencies that could be gained from some of these opportunities rely on the scale of the Postal Service's network. As the Postal Service consolidates its plants, the volume of mail at existing plants increases, leaving less space for the forward staging of goods.

Figure 7: Forward Staging with AR Glasses



Packing the Truck

Opportunities for the Postal Service to use AR technology in the postal supply chain may extend to letter carriers on their delivery routes. The majority of the Postal Service's fleet is Long Life Vehicles (LLVs), which the Postal Service plans to replace over the next 3 years.²⁸ These vehicles can hold up to 1,000 pounds of mail, a third of the truck's weight.²⁹ Arranging 1,000 pounds of mail so that it can fit into a truck could be time consuming and lead to damaged packages if heavier ones are put on top of boxes with fragile contents. Packing is only made more difficult as the amount of packages and delivery points each carrier must visit increases. According to a Postal Service official, the LLVs were designed to deliver letters, and while they can accommodate some parcels, the trucks are not ready for the 12 percent increase in parcel mail the Postal Service is currently experiencing.³⁰ As the Postal Service explores its options for the "Next Generation Delivery Vehicle," it may have the opportunity to purchase an AR-enabled fleet rather than retrofitting the existing vehicles with AR features. Additionally, the new vehicles may be able

²⁵ Ibid.

²⁶ René de Koster, Tho Le-Duc, and Kees Jan Roodbergen, "Design and control of warehouse order picking: A literature review," *European Journal of Operational Research*, 182, No. 2 (2006), pp. 481–50 and DHL, *Augmented Reality in Logistics*, 2014, p. 13.

²⁷ DHL gave 10 pickers AR headsets, and they picked 20,000 items, completing 9,000 orders in the given test period. Peter MacLeod, "DHL improves picking by 25% using Augmented Reality application," *SHDLogistics*, January 27, 2015, <http://www.shdlogistics.com/news/view/dhl-improves-picking-by-25-using-augmented-reality-application>.

²⁸ U.S. Postal Service, *Request for Information and Prequalification/Sources Sought for Next Generation Delivery Vehicle Acquisition Program*, Jan. 20, 2015, p. 6.

²⁹ Nancy A. Pope, "Long Life Vehicle," *Smithsonian National Postal Museum*, Jan. 2009, <http://postalmuseum.si.edu/collections/object-spotlight/llv.html>.

³⁰ Mike Colgan, "Familiar White Postal Service Trucks Too Small for Increasing Amount of Parcels Being Mailed," *CBS*, January 19, 2015, <http://sanfrancisco.cbslocal.com/2015/01/19/familiar-white-postal-service-trucks-too-small-for-increasing-amount-of-parcels-being-mailed>.

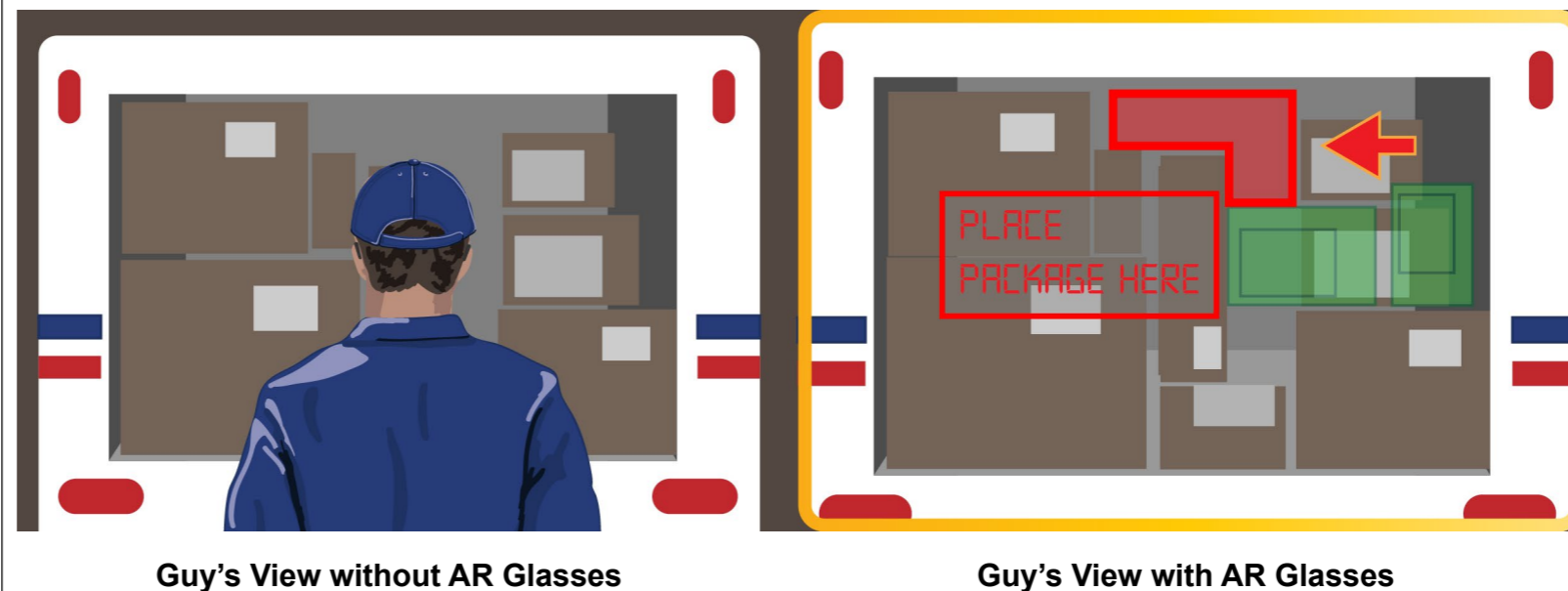
to accommodate more packages than the old LLVs. Once the new trucks are debuted, carriers will have to organize their daily packages and mail differently to fit into the new body.

Currently, each carrier uses his or her own individual method to pack the delivery truck. AR-enabled MDDs could help letter carriers and truck drivers efficiently pack their vehicles and distribute packages accurately by visually directing where packages should be placed in a truck, depending on delivery point and fragility. This could allow letter carriers to fit the most mail into their trucks as possible, reducing trips back to the station to reload, saving the carrier time and the Postal Service money on gas. Rolls-Royce is developing similar technology for cargo ships that will allow a captain to see through deck objects and bad weather to better organize the ship, direct deckhands, and avoid obstacles ahead.³¹

According to a 2015 PRC study, 5.1 percent of a carrier's time on the route is spent loading and unloading his or her vehicle.³² This does not include the time spent initially loading the truck at the beginning of the route, which could be significant. AR technology could tell a carrier where a specific address' mail is located, and, ultimately, could help letter carriers complete their routes more quickly. This could be especially helpful for City Carrier Assistants (CCAs), who, as part-time employees, are often not as familiar as career letter carriers with how to organize mail in a truck for delivery. Reducing the amount of time these carriers take to complete their duties is important, as nearly 16 percent of all hours worked in Fiscal Year (FY) 2014 by CCAs were overtime hours, costing the Postal Service over \$246.5 million dollars.³³

AR technology could also help postal employees at NDCs determine when they have enough mail to load a truck to capacity for a trip to another facility, which is required under the *Network Distribution Center Activation Guidelines*.³⁴ In a 2015 audit report, the OIG determined that shipping small loads of mail in stock containers and not consolidating mail into the correct transport

Figure 8: Packing the Truck with AR Glasses



31 Damon Lavrinc, "Tomorrow's Cargo Ships Will Use Augmented Reality to Sail the Seas," *Wired*, March 27, 2014, <http://www.wired.com/2014/03/rolls-royce-ship-bridge/>.

32 "Report on the City Carrier Street Time Study," (presentation to the Postal Regulatory Commission, January 14, 2015).

33 U.S. Postal Service, *National Payroll Hours Summary Report, Pay Period 20*, 2014, <http://www.prc.gov/usps-reports>. The summary report included information on year-to-date statistics for FY 2014. This number was calculated using the CCA overtime work hours divided by the total work hours.

34 Less-than-full mail transport equipment rolling stock "must be consolidated before loading to maximize container and transportation utilization." U.S. Postal Service, "Network Distribution Center Activation Guidelines," June 15, 2009.

AR Application at a Glance: Fixing the Vehicles

▶ Application

Guides mechanics and machinists in fixing vehicles and equipment; locates replacement parts.

▶ Implementation Considerations

May receive pushback from experienced mechanics.

▶ Benefits

Decreases training time; reduces mechanic hours; provides data on vehicle lifetime trends.

▶ Example

Finnish study found AR users were 13 percent more efficient builders, regardless of experience.

equipment cost the Postal Service \$1.3 million, just in unnecessary transport between NDCs in Des Moines, IA; Pittsburgh; and Chicago.³⁵ AR technology could be used to scan packages ready for transport and collect data about their weight and size. The information, which could then be stored in a database, would alert NDC employees as to when there is sufficient capacity to fill a truck. This would help ensure trips between NDCs would only be completed at the most efficient time, which could save the Postal Service money on fuel and staffing. This could not, however, eliminate all partially full trips between NDCs, as the need to meet delivery service standards may require the truck to make a trip, even if it is not at full capacity.

One potential drawback to using AR to pack the truck for a specific route is that the efficiency comes in carrying out the route in the planned order, taking away some of the possible efficiencies associated with the ability to re-route carriers around traffic incidents or other emergency areas.

Fixing the Vehicles

The Postal Service had roughly 211,000 motor vehicles on the road in 2014.³⁶ Out of this fleet, 140,000 vehicles were over 20 years old and nearing the end of their useful lives.³⁷ The Postal Service's 2015 Capital Plan designates \$500 million for replacing vehicles that are well over their useful life or have prohibitively high maintenance costs.³⁸ Vehicle maintenance costs for the Postal Service includes vehicle maintenance employees, replacement parts, and facility space. In FY 2014, the Postal Service employed 5,252 vehicle maintenance employees.³⁹ Vehicle maintenance employees are one of the only groups within the Postal Service that have had continuous growth since FY 2011.⁴⁰ About 7.5 percent of vehicle maintenance employees' work hours consisted of overtime in FY 2014, costing the Postal Service nearly \$33 million dollars.⁴¹

AR technology could help vehicle maintenance employees fix postal vehicles more efficiently by providing specific, real-time instruction on how to repair any vehicles in the postal fleet, including identifying the location of needed parts. The indexing and warehousing capabilities currently available through AR technology could help a mechanic quickly locate a needed replacement part within the postal facility. AR technology, coupled with a diagnostic system, could then provide specific, visual instructions about how to fix the vehicle's particular problem. In addition to making it easier to repair a vehicle and put it back on the road quickly, the AR technology could also ensure that maintenance employees apply uniform techniques when replacing parts on LLVs or other vehicles. BMW has started to use this AR application in its workshops, equipping mechanics with AR glasses and headphones. The AR app gives employees instructions on fixing the vehicle through headphones, while the glasses show animated components and the tools needed to make the repair.⁴²

As the Postal Service prepares for the acquisition of a new fleet, it opens the door for new technology as well. AR could help smooth the transition for vehicle maintenance employees as the vehicles change to new designs. The AR device would be able to provide step-by-step instructions and diagnostic information for the mechanics, allowing vehicle maintenance employees to learn best practices as they fix and maintain the new vehicles.

35 OIG, *Efficiency Review of the Chicago, IL, Network Distribution Center, Operations and Transportation*, Report Number NO-AR-15-003, January 22, 2015, <https://www.uspsoidg.gov/sites/default/files/document-library-files/2015/no-ar-15-003.pdf>.

36 U.S. Postal Service, *Report on Form 10-K*, <http://about.usps.com/who-we-are/financials/10k-reports/fy2014.pdf>, p. 68.

37 Ibid., p. 31.

38 U.S. Postal Service, *Fiscal Year 2015 Integrated Financial Plan*, <http://about.usps.com/who-we-are/financials/integrated-financial-plans/fy2015.pdf>, p. 5.

39 U.S. Postal Service, *2014 Annual Report to Congress*, <https://about.usps.com/publications/annual-report-comprehensive-statement-2014/annual-report-comprehensive-statement-2014.pdf>, p. 68, and U.S. Postal Service, *2012 Annual Report to Congress*, <http://about.usps.com/publications/annual-reports/2012/annual-report-2012.pdf>, p. 24.

40 Ibid.

41 U.S. Postal Service, *National Payroll Hours Summary Report, Pay Period 20*, 2015. Using consolidated vehicle maintenance employees, dividing overtime hours by total work hours.

42 BMW, "BMW Augmented Reality in Practice," http://www.bmw.com/com/en/owners/service/augmented_reality_workshop_1.html.

Data the AR device would collect during this process could help inform many other postal processes. For example, it could provide a way to catalog problems with postal trucks as they occur, collect data on the average length of time a repair is effective, and create an index that would allow mechanics to assess which parts they need to order.

One challenge the Postal Service could face is resistance from employees who have been working on postal vehicles for years and do not feel that they need AR to tell them how to do their jobs. However, as the Postal Service replaces trucks with new engines and buys new types of trucks, AR programs can help mechanics adjust quickly to fixing new, unfamiliar types of vehicles.

Applying AR technology to mechanical processes has been effective in other organizations. Columbia University pioneered an AR mechanics program, collaborating with the United States Marine Corps, to fix light armored vehicles. In a test, Marine mechanics were able to locate and begin work on tasks 47 percent faster than when they were using repair instructions on a stationary LCD screen.⁴³ Another study from Finland found that groups using AR to build a tractor accessory completed the task 13 percent quicker than a group relying on paper instructions.⁴⁴ The results did not vary among people who had assembly experience compared to those who did not. Regardless of experience, people using AR instruction were more than six times less likely to use an incorrect tool, and the AR group was less likely to install a piece incorrectly.⁴⁵

The Postal Service could implement AR as a tool to realize efficiencies for its vehicle maintenance employees and machinists. For example, if postal vehicle maintenance employees could realize the same 13 percent efficiency as subjects in the Finnish study, the Postal Service could reduce about 1.39 million work hours, saving more than \$39.3 million dollars annually.⁴⁶ The Postal Service would be able to buy \$500 AR glasses for all of its vehicle maintenance employees for a fraction of the money saved.⁴⁷

Figure 9: Fixing the Truck with AR Glasses



Guy's View without AR Glasses

Guy's View with AR Glasses

43 Kristina Grifantini, "Faster Maintenance with Augmented Reality," *MIT Technology Review*, October 26, 2009, <http://www.technologyreview.com/news/415977/faster-maintenance-with-augmented-reality/page/2/>, and Aaron Saenz, "Augmented Reality to Help Military Mechanics Fix Vehicles (Video)," *SingularityHUB*, January 11, 2010, <http://singularityhub.com/2010/01/11/augmented-reality-to-help-military-mechanics-fix-vehicles-video>.

44 Juha Sääski, Tapio Salonen, Marja Liinasuo, Jarkko Pakkanen, Mikko Vanhatalo, and Asko Riitahuhta, *Augmented Reality Efficiency in Manufacturing Industry: A Case Study*, VTT Technical Research Centre of Finland, 2008, p. 8.

45 Ibid.

46 Numbers based on FY 2014, *National Payroll Hours Summary Report, Pay Period 20*, U.S. Postal Service, 2014, available at <http://www.prc.gov/usps-reports>. This calculation took 13 percent of the total work hours for consolidated vehicle maintenance employees, achieving total hours saved, and multiplied that by the year to date hourly rate for total work hours.

47 The Postal Service would need to experiment with this technology and the efficiency gained from using this technology before implementing a large-scale change for all mechanics.

AR Application at a Glance: Driving the Truck

► Application

Provides letter carriers with dynamic routing directions through AR glasses or windshield display.

► Implementation Considerations

Potentially cost prohibitive.

► Benefits

Saves time by re-routing around hazards on the route; increases safety of carrier and vehicles.

► Example

Some car companies offer models with HUD systems built-in.

Delivery

Despite the Postal Service's efforts to hone its operations, it can still face delivery challenges such as route delays and recipient concerns about theft. The Postal Service could streamline the delivery process and address some of these challenges by relying on AR to assist with driver safety and efficiency, locating hard to identify addresses, and verifying recipient identity.

Driving the Truck

The Postal Service has begun using dynamic routing for Amazon package deliveries on Sundays.⁴⁸ When the Postal Service uses dynamic routing, a letter carrier travels a different path each day based on delivery demands instead of following the same fixed route. AR technology could assist dynamic routing efforts by updating routes in real time, helping letter carriers avoid traffic congestion or other hazards.⁴⁹ The ability to change delivery routes could also allow the Postal Service the flexibility to offer location-specific delivery so that letter carriers could deliver directly to the recipient, wherever they are, rather than to an empty home or office. Advanced dynamic routing could help ensure that letter carriers have more balanced loads each day by dividing mail volume evenly across carrier routes, rather than maintaining consistent routes despite variations in workload.

The Postal Service has been successful in its efforts to implement dynamic routing. A recent OIG audit of nine locations using the Dynamic Routing Tool for Sunday deliveries reported that letter carriers that made their own decisions about routes used more miles than necessary to deliver the mail.⁵⁰

Currently, letter carriers may need to reference a map or mobile device while driving to help identify where the next address along their route is located, which could create traffic risks. In 2012, driver distraction was the cause of 18 percent of all fatal crashes.⁵¹ In 2014, accidents involving Postal Service vehicles cost the Postal Service more than \$840,000.⁵²

State and local governments nationwide are increasingly enacting laws and regulations to prevent distracted driving. AR technology can allow a letter carrier to receive dynamic routing instructions through his or her AR glasses or on the LLV's windshield using a head-up display (HUD), allowing them to focus on the road and avoid distractions.

Car manufacturers are currently testing HUDs, which place digital information on the windshield of a car to verbally give the driver directions, alert them to any hazards, and make sure the driver's eyes stay on the road. Some companies claim HUDs are safer than using a smartphone or GPS unit because a driver's eyes do not have to leave the road, but there have been calls for further research into the safety of these systems.⁵³

HUDs may be cost-prohibitive, as prices vary greatly depending on the specifications, ranging from about \$100 to \$3,000, and the HUDs would need to be customized to fit the windshield of an LLV. Since the Postal Service is preparing to replace its existing fleet of LLVs, it could add HUDs to the list of requirements for the new vehicles or ensure that the vehicles' producer makes the vehicles HUD compatible. Before adopting HUDs in LLVs, the Postal Service would benefit from analyzing the costs of the equipment and comparing it with the possible cost savings from efficiency, reduced overtime, and fewer accidents.

48 Cindy Waxer, "Digital SOS: How technology can save the USPS," *Computerworld*, December 8, 2014, <http://www.computerworld.com/article/2855146/digital-sos-how-technology-can-save-the-usps.html>.

49 The idea of dynamic traffic support was also explored in DHL, *Augmented Reality in Logistics*, 2014, p. 16.

50 OIG, *Sunday Parcel Delivery Service*, Report Number DR-AR-15-002, December 5, 2014,

<https://www.uspsigov.gov/sites/default/files/document-library-files/2014/dr-ar-15-002.pdf>, p. 11. The audit also found that by using the Dynamic Routing Tool, the Postal Service could have saved 17,446 hours of operation, which translates to annual operating costs of \$356,736 for the 134 Designated Delivery Units in the Ohio Valley, Northern New Jersey, San Diego, and Dallas areas.

51 Federal Communications Commission, *The Dangers of Texting While Driving*, December 8, 2014, <http://www.fcc.gov/guides/texting-while-driving>.

52 U.S. Postal Service, *Statement of Revenue and Expenses, Redacted Nov. 2014 (FY15)*, 2014, row 745.

53 Bill Howard, "BMW's Full-color HUD: Distraction, Minimizer of Distractions, or Costly Tech Gadget?" *Extreme Tech*, April 4, 2012, <http://www.extremetech.com/extreme/124847-bmws-full-color-hud-distraction-minimizer-of-distractions-or-costly-tech-gadget>.

AR Application at a Glance: Letter Carrier Knowledge

► Application

Provide critical route information to letter carriers unfamiliar with the route.

► Implementation Considerations

Information on individual households needs to be maintained securely.

► Benefits

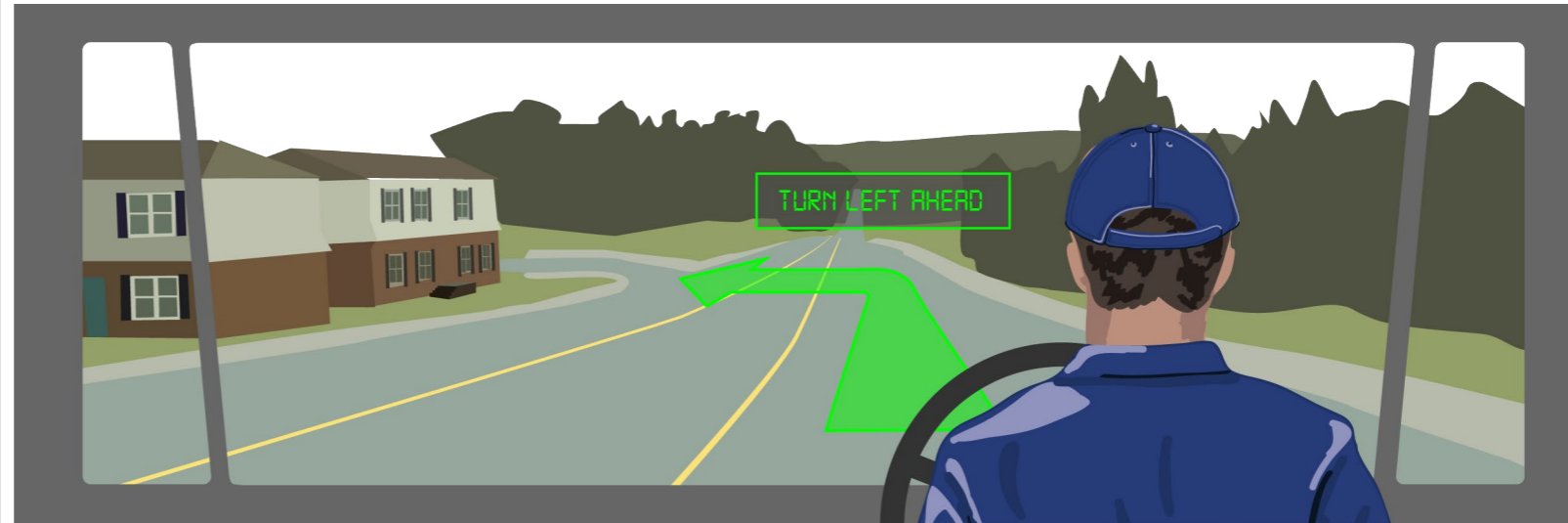
Recipients receive consistent service regardless of carrier; carrier finds addresses more quickly; carrier avoids hazards along route.

► Example

Another delivery company communicates recipient delivery preferences to drivers through a mobile device.

Beyond mail and package delivery, HUD systems could also create safer freight transportation. Semi-truck drivers could especially benefit from certain features, such as the HUDs' ability to alert drivers if they are not looking at the road enough. Car manufacturer General Motors plans to install these systems in half of a million cars between 2018 and 2020.⁵⁴ These systems can alert drivers who may be focusing on something inside the vehicle or are suffering from fatigue while driving.

Figure 10: Driving the LLV with AR



Making Letter Carrier Knowledge Postal Service Knowledge

One of the Postal Service's greatest assets is its ability to deliver to every door, every day. This task requires a large amount of individual letter carrier knowledge about local routes, ranging from the location of hidden drives to which doors have mail slots. Letter carriers build this type of knowledge over years of delivering to the same routes, getting to know the people who live on the route and remembering their delivery preferences. Currently, mapping software can lead a letter carrier to a home or office building, but it cannot direct them to parking, an interior office space, or a mailbox location. AR technology, coupled with data stored in its back-end computer program, could assist letter carriers in providing consistent delivery in an efficient manner.

Letter carriers' MDDs could record where along the route carriers can park the LLV. When a new letter carrier is delivering on the route, the AR technology could alert the carrier where past carriers parked. This type of application is especially useful for new carriers and CCAs. As the Postal Service expands its package delivery offerings, letter carriers may be more likely to have to deliver on an unfamiliar route. Information on how past letter carriers have navigated a neighborhood with sparse parking and hidden drives could minimize the amount of time carriers unfamiliar with the route have to search for parking or delivery locations. This system would be similar to UPS's Delivery Information Acquisition Device (DIAD), which alerts drivers when they have passed a house with a delivery. The device allows customers to reroute packages and share preferences on where deliveries are left.

Currently, letter carriers can use smartphones to identify delivery locations, but technology that can guide a letter carrier past the curb, to the house or office delivery point, is generally uncharted territory.⁵⁵ Without specific guidance on where a house or office is located, letter carriers may have to spend time figuring out house or office numbers that are not clear or finding a mailbox, mail slot, or porch. Letter carriers that regularly deliver to a route would likely not need this information, but substitute carriers could benefit from it. As they learn new routes, letter carriers could use AR technology to collect and store this detailed information as

⁵⁴ Ellie Zolfagharifard, "Giving cars SIGHT: General Motors to fit eye-tracking technology that reveals when a driver is not paying attention to the road," *Daily Mail*, September 2, 2014, <http://www.dailymail.co.uk/sciencetech/article-2740588/Your-car-watching-GM-roll-eye-tracking-technology-knows-not-paying-attention-road.html>.

⁵⁵ Indoor navigation is explored in DHL, *Augmented Reality in Logistics*, 2014, p. 18.

AR Application at a Glance: Identity Verification

▶ Application

Confirms identity of recipient through facial recognition (photo or scanning) for packages requiring delivery confirmation.

▶ Implementation Considerations

Security concerns with photo storage and privacy protection.

▶ Benefits

Provides safer, more secure package delivery.

▶ Example

A Swedish company created an opt-in facial recognition app that allows users to identify strangers using social media.

institutional knowledge that could be shared with CCAs, new, or substitute carriers. A substitute carrier later covering that route could access the information by using AR to scan the same hard-to-identify location. Regular letter carriers could also use AR technology to warn substitute carriers by reporting other information, like houses with aggressive dogs and other hazards along the route. UPS already collects and makes this type of information available for its drivers.⁵⁶ Collecting hazard information could greatly reduce the number of dog attacks and on-the-route injuries carriers suffer. Nationwide, 5,581 postal employees reported dog bites in 2014.⁵⁷ Reducing these attacks will allow letter carriers to be safer on their routes, as well as saving time and money for the Postal Service.

Before implementing this AR application, the Postal Service would need to ensure that details about individual addresses remain secure and are treated as private information.

Figure 11: Finding Hidden Mailboxes with AR



Guy's View without AR Glasses

Guy's View with AR Glasses

Identity Verification

The Postal Service currently offers services that provide an element of security in package delivery. For example, through its Signature Confirmation service, a sender can request that the letter carrier get a signature from the recipient or the recipient's agent accepting the package, while also noting the delivery time and location. The sender can also request to receive a copy of the signature via mail or email. This additional layer of security can be vulnerable to forged signatures, delivery without a signature, and delivery to the wrong recipient.

Facial recognition technology, which can use an AR program to verify an individual's identity by scanning their face, could provide a more secure delivery option.⁵⁸ The Postal Service could create an opt-in offering where senders and recipients interested in this service would give permission to the Postal Service to access their photo through usps.com, where the customer's identity could be verified. The Postal Service would need to recognize the potential privacy implications of facial recognition technology and ensure that users understand the implications of opting in to such a program. To uphold its trusted reputation, the Postal Service would need to take steps to mitigate the risk of the facial recognition information being leaked or used inappropriately.

⁵⁶ Jessica Hullinger, "19 Secrets of UPS Drivers," *Mental Floss*, Dec. 9, 2014, <http://mentalfloss.com/article/60556/19-secrets-ups-drivers>.

⁵⁷ "Postal Service Releases Top Dog Attack City Rankings," *U.S. Postal Service*, May 14, 2014.

⁵⁸ Secured Delivery is featured in DHL, *Augmented Reality in Logistics*, 2014, p. 18.

AR Application at a Glance: Choosing the Correct Box

▶ Application

Customers can match item with an appropriately sized box.

▶ Implementation Considerations

The Postal Service offered this service previously, so may be easier to implement.

▶ Benefits

Fewer postal-provided boxes used, saving money.

▶ Example

The Postal Service offered a desktop-based AR app to help customers determine which box would fit their items.

The Postal Service would not be the first to use this technology. A Swedish app, Recognizr, allows individuals to use AR to identify strangers they encounter. The program is opt-in, and both individuals must use the app in order for the app to identify a person. The user takes a picture of the unidentified person, which then generates a 3D model of the person's face. Facial recognition software then scans the model and locates the person's name and social media accounts.⁵⁹

Under a facial recognition service, a letter carrier would use their MDD to scan the package requiring identity confirmation, which would prompt the AR software program to retrieve a picture of the intended recipient. After confirming the recipient's correct identity when delivering the package, the letter carrier could either take a picture of the recipient as confirmation of their receiving the package or have the scanner confirm that the person in the picture and the person receiving the package were the same through facial recognition technology. This would eliminate the ability to leave a package with a recipient's agent.

To protect the recipient's personal information, the AR device would only produce the recipient's information after a letter carrier scanned a package. Supervisors could monitor the scans to ensure that letter carriers use the system appropriately. The Postal Service would also need to focus on protecting this new data set from hackers or employee misuse.

Customer Experience

In an increasingly mobile world, Americans have come to expect their interactions to be quick and easy, and they try to avoid inconveniences like standing in line or waiting for a package to arrive. The Postal Service could use AR applications to enhance its customers' experience through assistance with packing objects for shipping or acquiring carrier location information for estimates of delivery time. AR applications could make it possible for customers to streamline their interactions with the Postal Service, helping to ensure an efficient and positive experience.

Customers Choosing the Correct Box

In 2009, the Postal Service made its first foray into customer-facing AR experiences with its Virtual Box Simulator, which allowed consumers to determine which Priority Mail box would best fit their item. The AR program required a user to have a webcam attached to his or her computer so that it could view the item the customer wanted to ship. The program also required users to print a U.S. Postal Service icon and hold it under the object so that the Virtual Box Simulator would know where the box should go. Together the webcam and the Virtual Box Simulator created a 3D hologram of different Priority Box sizes so the customer could determine which box was needed to fit the item. After deciding which box fit the shipment, the customer could order free Priority Mail Flat Rate Boxes online, which the letter carrier would deliver to the customer's home. The customer would not have to go to the Post Office to send packages.

The Virtual Box Simulator was widely recognized for its innovative attempt to engage customers.⁶⁰ To help meet customers' evolving needs, the Postal Service could update the program and adapt it to current technology, such as by using the cameras on customers' mobile devices instead of a webcam.

Figure 12: Virtual Box Simulator



59 Clay Dillow, "Augmented Identity App Helps You Identify Strangers on the Street," *Popular Science*, Feb. 23, 2010, <http://www.popsci.com/technology/article/2010-02/augmented-identity-app-helps-you-identify-friend-perfect-strangers>.

60 For a list of awards the Virtual Box Simulator won, see, Rachel Gillett, "Priority Mail Site + Virtual Box Simulator," <http://www.rachel-gillett.com/usps-priority-mail-site-virtual-box-simulator/>.

AR Application at a Glance: Location Information

▶ Application

Recipients can see estimated time of carrier arrival.

▶ Implementation Considerations

Carrier security; possible inadvertent assistance to mail thieves.

▶ Benefits

Recipient more likely to be home to order goods from carrier and receive packages.

▶ Example

Other delivery companies offer confirmed delivery windows.

Letter Carrier Location Information

Mail delivery times can vary, as letter carriers often face activity that changes the schedule, ranging from fluctuations in mail volume, to bad weather, to dog attacks. Mail delivery schedules may become even more fluid if the Postal Service expands dynamic routing to its Monday-Saturday operation.

Some customers value knowing approximately when their letter carrier will arrive at their home or business. On rural routes, customers can buy stamps or money orders and mail packages through their letter carriers, so they might want to plan to be home and available around the time they expect their carrier. Sometimes customers are anticipating a package for which a signature is required, and they would like to plan to be at their home or business. AR technology could help customers plan to be available when their letter carrier arrives by tracking the letter carrier on his or her route through the “USPS mobile” app on a smart device.

Currently, the Postal Service has the ability to determine the location of its letter carriers. This technology could also be used in conjunction with AR to communicate the geographical proximity of the letter carrier to the recipient through a Postal Service app. This function could increase the amount of letter carriers’ sales, as customers may be more likely to purchase from their carrier if they know when the carrier will arrive. This could also help the Postal Service avoid second and third delivery attempts, because customers could plan to be at their home or business when the letter carrier arrives on the first delivery attempt. However, allowing individuals to track a letter carrier’s precise whereabouts may pose a risk to the carrier’s safety or could create a mail security concern, as thieves could track and steal mail as it is delivered.

Conclusion

The Postal Service strives to provide prompt, reliable, and efficient service nationwide. To maximize this effort, the Postal Service could use AR technology as a tool at various points along the supply chain. Implementing this technology could generate greater efficiency and cost savings by reducing employee work hours and minimizing errors. The Postal Service would benefit from exploring these ideas further and experimenting through pilots. A Postal Service AR application could also improve customer service by providing customers with a way to track their mail delivery more closely and providing more efficient, timely service.



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