

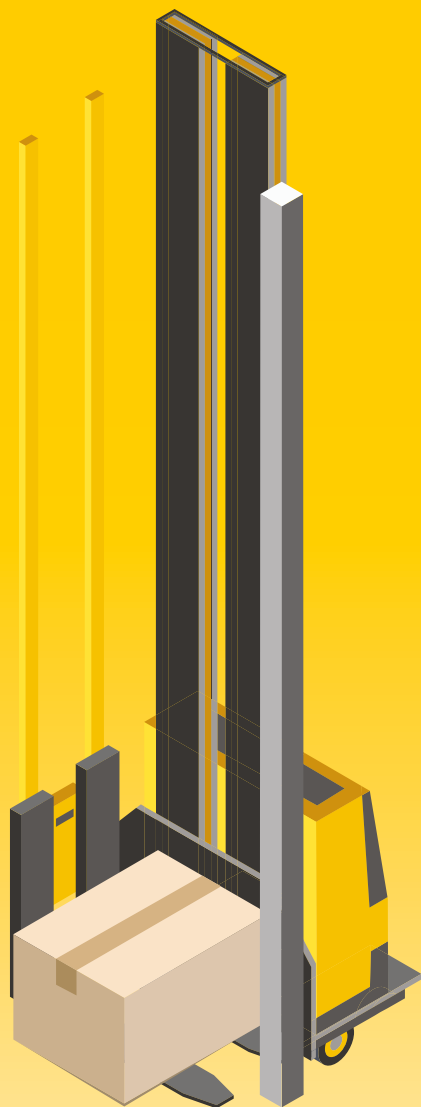
**DHL'S VISION FOR YOUR
WAREHOUSE OF THE FUTURE**



DHL WAREHOUSE OF THE FUTURE **AUTONOMOUS VEHICLES TECHNOLOGIES GUIDE**



AUTONOMOUS VEHICLES



From trucks to last-mile delivery robots, self-driving vehicles are transforming logistics by unlocking new levels of safety, efficiency, and quality.

Automated guided vehicles (AGVs) are extremely convenient for transporting large and heavy auto parts as well as for sequencing operations. They can support autonomous parts picking, full-pallet picking, and put-away processes.

BENEFITS

AGVs can:

- Increase put-away productivity
- Improve safety
- Minimize time wasted during employee movements

Guide

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INNOVATION HIGHLIGHT AUTO-MOBILITY: NARROW AISLE ROBOTS



WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

- Relevant in a large variety of auto-mobility warehouses where space is scarce
- Highly beneficial in slow-moving warehouses with limited rack location changes

Target site profile

- Warehouse size: **>2,000m²**
- N° of SKUs: **Any**
- Order lines per hour: **>400**
- Local labor cost /hr: **>€10**
- Storage type: **Racks only**

Potential benefits

- **15%** increase in **put-away** productivity
- **8%** increase in **replenishment** productivity



DESCRIPTION

Narrow aisle robots can semi-autonomously drive to the correct picking or putting-away location and simultaneously adjust to the required height to perform put-away or picking on the storage racks.

BENEFITS

They semi-autonomously drive and lift pallets to the next rack location for a clear increase in put-away and picking efficiency.



INNOVATION HIGHLIGHT AUTO-MOBILITY: INDOOR ROBOTIC TRANSPORT – BIN FOCUS

WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

- Relevant in large warehouses where operators must cover long distances
- Highly beneficial in fast-moving warehouses for small items (e.g. I2M supermarket, distribution centers)

Target site profile

- Warehouse size: **>10,000m²**
- SKU volume: **<5dm³**
- Transfer distances: **>100m**
- Local labor cost /hr: **>€10**
- Storage type: **Shelves/
Ground**

Potential benefit

- 1 robot can **save >2.5–3h** travel time per 8h shift



DESCRIPTION

This robot can autonomously navigate the warehouse, allowing operators to continue picking while picked items are already on their way to being packed.

BENEFITS

Indoor robotic transport solutions with a bin focus take on the task of transporting goods in the warehouse. This reduces operator travel distance and physical strain.



INNOVATION HIGHLIGHT AUTO-MOBILITY: INDOOR ROBOTIC TRANSPORT – PALLET FOCUS



WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

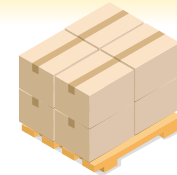
- Relevant in large warehouses where operators must cover long distances
- Highly beneficial in fast-moving warehouses for small items (e.g. I2M supermarket, distribution centers)

Target site profile

- Warehouse size: **>10,000m²**
- SKU volume: **>10dm³**
- Transfer distances: **>100m**
- Transfer weight:: **500-1,000kg**
- Local labor cost /hr: **€10**
- Storage type: **Racks/Ground**

Potential benefit

- 1 robot can **save >2.5–3h** travel time per 8h shift



DESCRIPTION

Indoor robotic transport solutions with a pallet focus boost labor efficiency and consistency. They are flexible and autonomously transport pallets within the warehouse.

BENEFITS

These solutions compliment manually operated forklifts and help with picking and put-away productivity. They also make on-site transportation safer, easier, and more productive.



INNOVATION HIGHLIGHT AUTO-MOBILITY: **ASSISTED PICKING ROBOT – BIN FOCUS**

WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

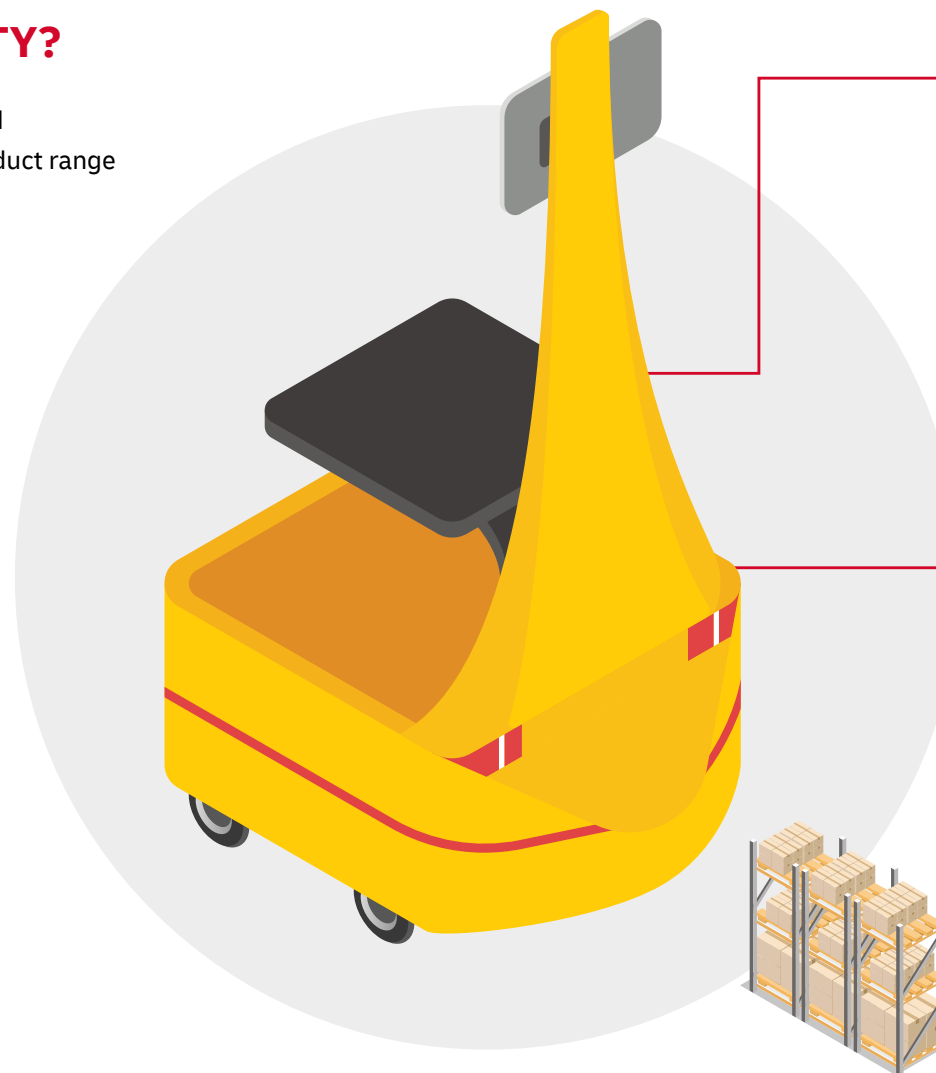
- Relevant in large warehouses – pre-assembly and aftermarket – featuring high output and a big product range
- Quicker return on investment in medium/high-income countries

Target site profile

- Warehouse size: **>5,000m²**
- N° of SKUs: **>10,000**
- Order lines per hour: **>400**
- Local labor cost /hr: **€10**
- Storage type: **Library/Case Shelving/
Flow Rack**

Potential benefits

- **30%–180%** increase in units picked per hour
- **80%** decrease in training time



DESCRIPTION

Assisted picking robots with a bin focus integrate with your warehouse management system (WMS). They can navigate their way to each picking location and display information on the item to be picked. Once this item has been placed in the bin, they autonomously move to the next location.

BENEFITS

This type of robot immediately improves productivity by reducing travel time and optimizing the picking flow. It will also reduce physical strain on the operator without compromising safety.

INNOVATION HIGHLIGHT AUTO-MOBILITY: ASSISTED PICKING ROBOT – PALLET FOCUS



WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

- Relevant in central distribution warehouses and in I2M cross docks
- Reduces the training requirement for material-handling equipment (MHE) operators and improves worker safety

Target site profile

- Warehouse size: **>2,000m²**
- N° of SKUs: **>10,000**
- Order lines per hour: **>350**
- Local labor cost /hr: **€10**
- Storage type: **Racks/Ground**

Potential benefits

- **5-30%** increase in units picked per hour
- Reduces MHE requirements



DESCRIPTION

The operator steers this type of robot to the picking location and then steps off to activate 'Follow me' mode. This means the operator can stop focusing on moving the vehicle and instead focus on the picking process.

BENEFITS

Assisted picking robots with a pallet focus help reduce the time spent moving push carts and forklifts around. They also increase picking efficiency and safety.



INNOVATION HIGHLIGHT AUTO-MOBILITY: GOODS-TO-PERSON ROBOT



WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

- Relevant in aftermarket warehouses when picking light and small parts with high turnover (e-commerce)
- Greatly optimizes the required space as it does not require direct shelf access

Target site profile

- Warehouse size: **Any**
- N° of SKUs: **2,500**
- SKU weight: **<5kg**
- Order lines per hour: **350**
- Local labor cost /hr: **>€10**
- Storage type: **Shelves only**

Potential benefits

- **200%** increase in productivity (picking)
- **50%** increase in put-away productivity

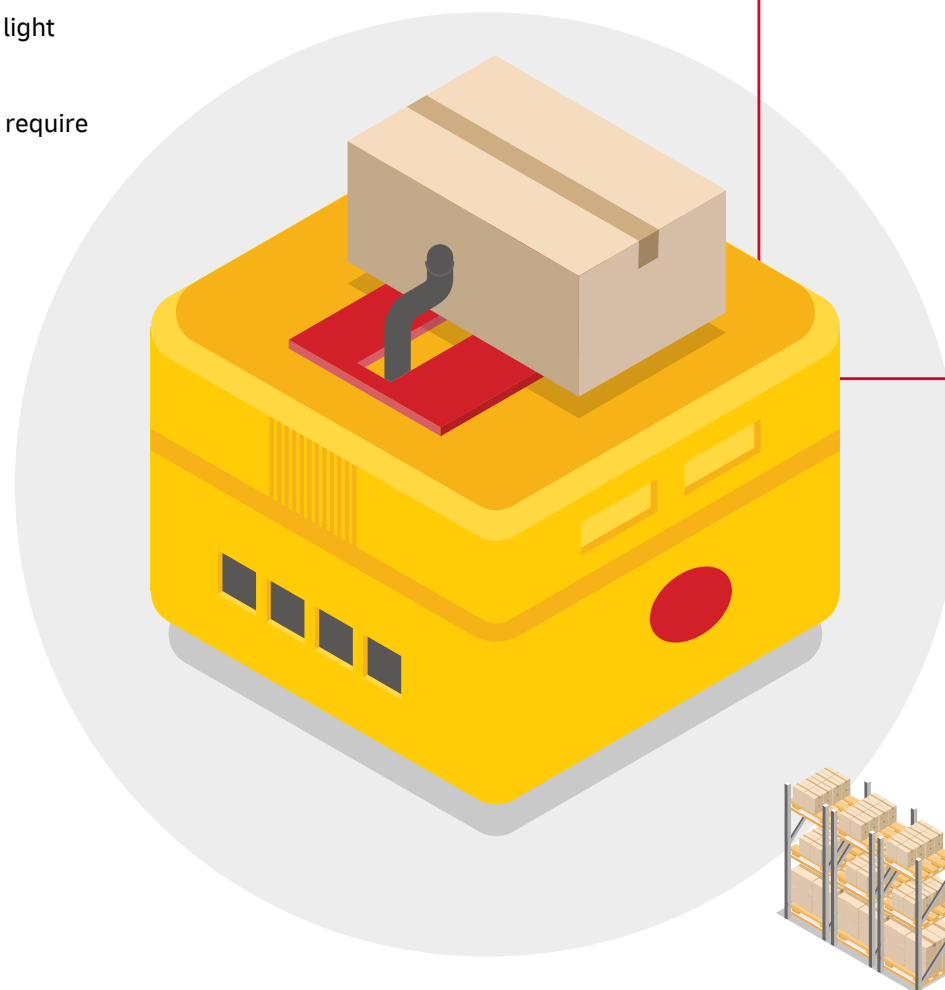


DESCRIPTION

These autonomous robots can move shelves to the operator. Sensors help with safe navigation and machine-learning software ensures improved task allocation.

BENEFITS

Goods-to-person robots reverse the picking process, reduce operator travel distance, and make the picking process less tedious.



INNOVATION HIGHLIGHT AUTO-MOBILITY: INVENTORY ROBOT - MEERKAT



WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

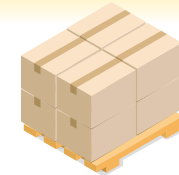
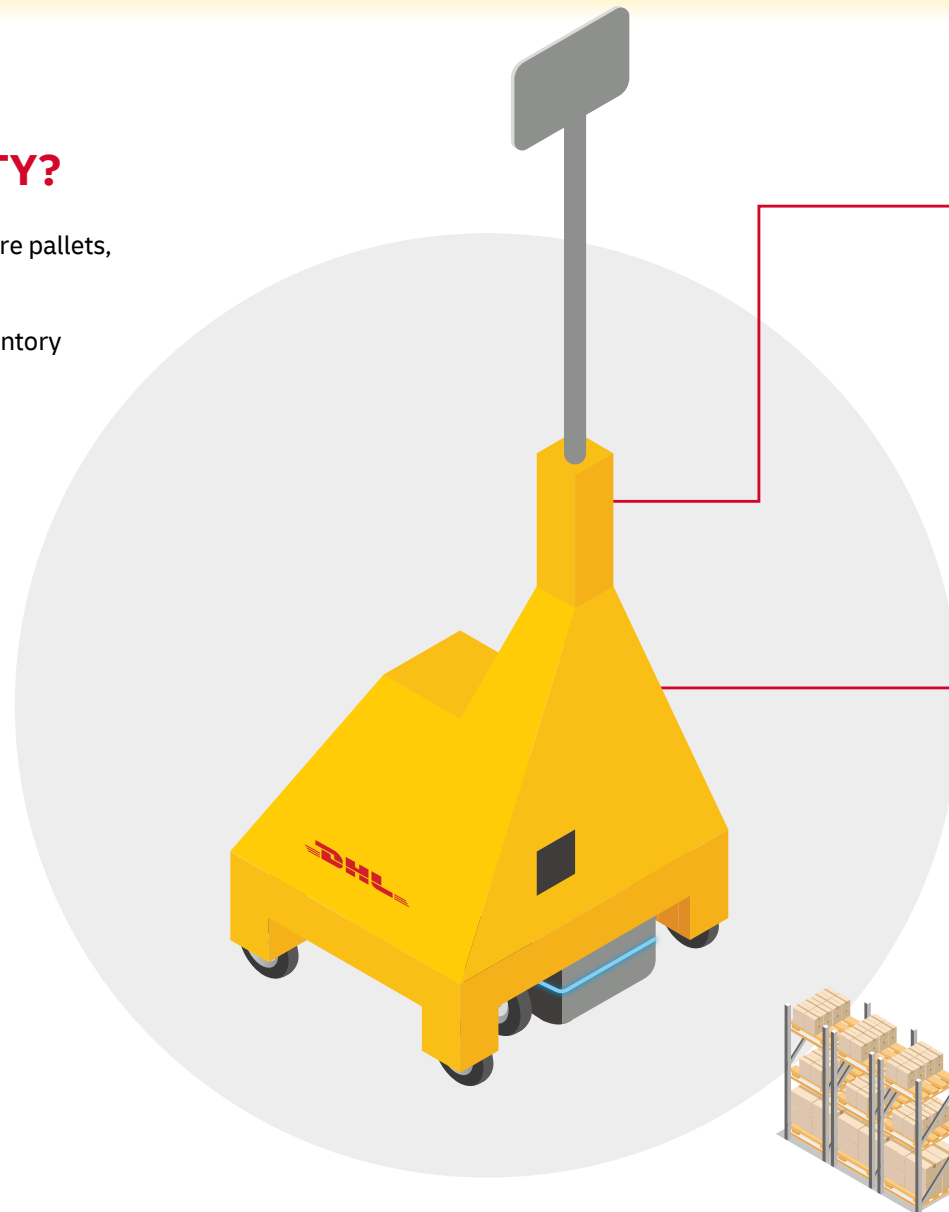
- Relevant in large fast-moving warehouses that store pallets, such as consolidation and deconsolidation centers
- Extremely beneficial with high bay storage, as inventory checks can be done without a forklift

Target site profile

- Large volume of single-entry pallet racking
- Pallets to be stored with labels facing the aisle
- Local labor cost /hr: **€10**
- Storage type: **Racks**

Potential benefits

- **60%** reduction in inventory labor
- **2%** increase in picking efficiency



DESCRIPTION

The automate, air powered telescopic mast raises to the level where the stock check is required and analyzes each location using a set of cameras, lasers and scanners.

On the ground the fully autonomous robot maneuvers around. Batteries and onboard computing do all calculations in real time.

BENEFITS

Inventory management robots take over inventory checking and barcode scanning. These are repetitive, time-consuming, high-risk tasks traditionally conducted by operators working at heights.

INNOVATION HIGHLIGHT AUTO-MOBILITY: AUTOMATED INVENTORY SYSTEM

WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

- Relevant in a wide range of space-constricted auto-mobility warehouses such as an assembly plant inventory facility or urban distribution center (DC)
- Highly beneficial for fast-moving parts picking

Target site profile

- Manufacturing environment with dynamic sequencing operations
- Aftermarket DC with high output
- Order lines per hour: **>400**
- Storage type: **Pallets or bins depending on vendor**

Potential benefits

- **<50%** increase in storage density
- **>90%** reduction in picking labor requirements



DESCRIPTION

AutoStore is a unique and simple solution that uses robots and bins to quickly process small parts orders. It provides better use of available space than any other automated system thanks to its unique design that enables direct stacking of bins on top of each other and storage of multiple SKUs in a single bin.

BENEFITS

This system automates picking processes, decreasing turnaround time, improving operating margins, and increasing throughput across the entire supply chain.

INNOVATION HIGHLIGHT AUTO-MOBILITY: CLEANING ROBOT



WHY IS THIS TECHNOLOGY RELEVANT TO AUTO-MOBILITY?

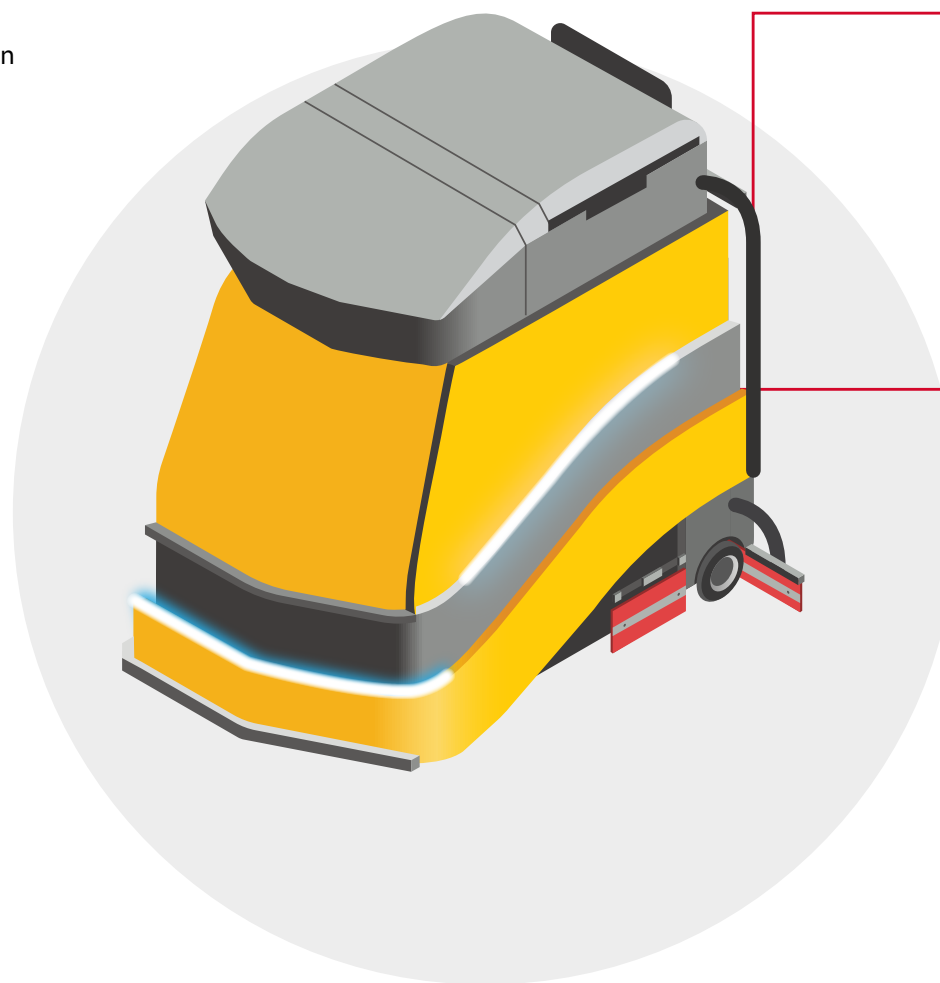
- Clean during quiet times, such as at night, and on an ad-hoc basis
- Achieve consistent, high-quality results with fully transparent monitoring and control tools

Target site profile

- Facility size: **>18,750m²**
(40% cleanable area)
- Power and fresh water supply
- WiFi/4G connection and coverage

Potential benefits

- **40 – 70%** increase in productivity
- Cleans at **>1,200m² ph**
- Full transparency via web-based interface
- Happy employees!



DESCRIPTION

This robot cleans autonomously from your specified starting position to your specified end position. It can be used in manual mode as well. The operator must position the robot and drain/refill the tank.

BENEFITS

Automated cleaning frees your personnel to undertake more value-adding activities. You can realize cost efficiencies by reducing human labor requirements. Using a cleaning robot also paves the way for the smooth and secure operation of other robotic solutions.

LET'S BUILD A BETTER FUTURE

DHL offers extensive expertise in the integration of new technology within auto-mobility logistics. We have the experience and breadth of capability to help you innovate, pilot, and implement new levels of efficiency in your operations, locally and around the globe. Let's build a better future together.



1. WAREHOUSE AUTOMATION

Driven by rapid technological advancements and greater affordability, robotic systems are entering the logistics workforce and adopting collaborative roles in the supply chain.



2. AUTONOMOUS VEHICLES

From trucks to last-mile delivery robots, self-driving vehicles are transforming logistics by unlocking new levels of safety, efficiency, and quality.



3. UNMANNED AERIAL VEHICLES (UAVs)

UAVs or 'drones' can be used for intralogistics and surveillance operations, especially operating safely in remote, potentially dangerous-to-access locations.



4. WEARABLES

Wearables such as ring scanners, smartwatches, and exoskeletons have the potential to overcome current limitations such as physical barriers and the strength and visual capabilities of your workforce.



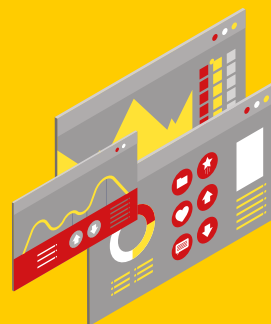
5. AUGMENTED REALITY (AR)

By adding virtual layers of contextual information onto a heads-up display or other digital device, AR empowers workers by providing the right information at the right time and in the right place.



6. INTERNET OF THINGS (IoT)

IoT has the potential to connect virtually anything to the internet and data from connected objects can be used to generate actionable insights that drive change and new solutions.



7. BIG DATA

With a vast degree of digitalization, unprecedented amounts of data can be captured from various sources. Thanks to the power of big-data analytics, businesses can make decisions based on better information.

WE'LL HELP YOU SHAPE THE JOURNEY AHEAD

- Need to find out more about the warehouse of the future? Want to understand how other industries are responding to trends? Contact your dedicated sales manager today.
- Read our other publications on battery logistics and e-commerce.
- Discover the latest trends and innovations by taking a personalized tour of a DHL Innovation Center, located in Trosdorf, Germany, Singapore and Chicago, USA.

For more information, contact us at auto-mobility@dhl.com

DHL'S VISION FOR YOUR WAREHOUSE OF THE FUTURE



To discover more about our full range of warehouse technologies, contact your account manager or send us an email at auto-mobility@dhl.com

WE NEVER STOP

DELIVERING EXCELLENCE TO THE AUTO-MOBILITY INDUSTRY

The future belongs to those who think ahead. Innovation is more important than ever. DHL aims to be the auto-mobility industry's most trusted global partner for high quality logistics solutions and innovations addressing the supply chain challenges of today and tomorrow.

CONNECTING

Sharing our unparalleled global reach

Bringing your company closer to customers, suppliers, and partners across all markets in over 220 countries and territories around the world.

INNOVATING

Adding to your competitive edge

Carefully tracking the most significant technology, business, and social trends to assess their impact and explore their benefit to your business.

POWERING

Accelerating your business growth

Driving the industry forward to help tackle the key challenges of our times, we're your proactive partner ready to help you reap the rewards of business growth.

PIONEERING

Keeping you ahead of the curve

Taking the lead as a logistics trailblazer to help you and us stay at the forefront of the auto-mobility industry.





GET IN TOUCH TODAY

Take the next step and contact your account manager
or send us an email at:

auto-mobility@dhl.com

