The Co-bot Floor Cleaning Guide Vol 1

Nilfisk®

01

Introduction – The rise of cleaning robots

Cleaning robots are finally having their day. Autonomous floor cleaners have been available for commercial and institutional settings for several years now. But, until recently, it had been difficult for many organizations to justify the investment in new equipment, especially since cleaning budgets seem to be constantly shrinking.

The cleaning landscape has changed. COVID-19 has exacerbated many of the existing cleaning challenges and also introduced some new ones. Cleaning teams today are faced with responsibilities that go beyond ensuring facilities are cleaned to an acceptable standard to enhance productivity, prevent slip and fall incidents, and make a good impression on customers and visitors. In the world of COVID-19, cleaners are quite literally tasked with ensuring the health and safety of everyone who enters a facility, whether that's a school, an airport, or a warehouse.

The reality is that cleaners need to clean significantly more than they did in the past just to meet today's elevated hygiene standards. In many industries, the routine housekeeping that used to be done once a day is now performed several times per day, while the deep cleaning that typically took place weekly or monthly is now performed as often as daily. The need for enhanced cleaning protocols will likely persist long after the pandemic is over as people will continue to seek reassurance that facilities are safe.

At the same time, the workforce challenges that plague the cleaning industry haven't gone away. Cleaning teams often work at a staffing rate of only 70-75% and the employee turnover rate can be as high as 200%.

These factors combined have led more organizations to embrace autonomous cleaning solutions as a way to stretch their cleaning dollar further.

Global use of cleaning robots is expected to grow nearly 15% every year through 2025, led primarily by increased adoption of floor cleaning machines in industrial environments.

This is the first of a two-part guide that will help you better understand what autonomous floor scrubber dryers are and how they can supplement your cleaning team and provide value for your business.

Here's what you'll find on the following pages:

- An overview of what today's intelligent cleaning solutions look like
- How autonomous cleaning solves challenges and creates value
- How to assess if autonomous cleaning is a good fit for your facility
- A profile of the Nilfisk Liberty SC50 and Nilfisk Liberty SC60 autonomous cleaning robots

The second volume of this guide will provide details on how to integrate autonomous cleaning into your cleaning process

02

Advances in autonomous floor cleaning

Under the hood, autonomous floor scrubber dryers are the same powerful cleaning machines your team likely already uses every day, so you can rest assured you're getting a high level of performance. But four major advances make these machines ideally suited for meeting the needs of today.

Artificial intelligence

What sets modern autonomous cleaning solutions apart from anything you might have seen in the past is that they're intelligent. Using artificial intelligence (AI) technology, robotic scrubber dryers execute complex processes such as navigating real-world environments. These machines incorporate advanced vision-based AI systems that use a multi-layered sensor array to scan and perceive the environment. When an operator drives a route to program the machine, the robot creates a map of the environment that it uses, along with the route, to navigate the facility and safely avoid people and obstacles.

3 features that power the best modern autonomous scrubbers:

- Intuitive and simple mapping, enabling the operators to quickly change cleaning routes, allowing the machine to adapt to the environment rather than requiring the environment to adapt to it
- Sensors that detect and avoid stairs and other abrupt changes in floor height, as well as unexpected obstacles such as people
- Remote monitoring and machine analytics provide insights that help you maximize cleaning performance and efficiency

Safety standards

In 2017, CSA Group and the American National Standards Institute developed the first safety standard for commercial robotic floorcare machines. Known as the Robotic Safety standard, CSA/ANSI C22.2 No. 336-2017 specifies safety requirements for areas such as electrical safety, battery safety, mechanical strength, and construction. A similar standard is currently being developed for European markets.

Safety requirements for commercial robotic floorcare machines:

- Stopping distance
- Obstacle detection/avoidance
- Abrupt surface fall detection
- Critical zone detection
- Parking brakes
- Max speed
- Machine-start audio signal

By designing to these standards, equipment manufacturers ensure that autonomous floor cleaners can work safely without operator oversight, even in spaces where people and unexpected obstacles are present. And by purchasing equipment that complies with these standards, companies can show that they're meeting their legal obligations to keep people safe.

UV-C light disinfection

We mentioned earlier that, under the hood, autonomous floor machines are the same powerful cleaning machines your team uses every day. This is crucial because robotic bells and whistles don't provide value on their own — they need to be paired with performance and efficiency. A new functionality is available that helps maximize the cleaning performance and efficiency of robotic scrubber dryers: UV-C light disinfection.

COVID-19 has raised the bar for basic housekeeping tasks like floor scrubbing. In high-risk and high-traffic areas, such as hospitals, airports, and schools, floors need to be not only cleaned but also disinfected. Scrubber dryers equipped with UV-C technology can simultaneously clean and disinfect, preventing pathogens from spreading and creating health risks.

Data-driven insights

Finally, modern autonomous scrubber dryers harness the power of data and connectivity to help you optimize your cleaning operations. This takes the guesswork out of things like making cleaning schedules, measuring cleaning performance, and determining equipment maintenance needs.

Here's what you can do with the data provided by today's best autonomous machines:

Anticipate the need for maintenance. It's faster, easier, and less expensive to keep your equipment running via preventive maintenance than it is to repair a machine after it has failed. Autonomous machines can alert you to any maintenance issues before they become major problems.

Make data-driven decisions. You can use the data to improve the efficiency of your operations. For example, if you find that the scrubber dryer is stopping frequently because of human traffic, you can adjust the schedule to clean during a time when fewer people are present.

Verify cleaning results live. Using real-time data, you can ensure that the equipment is operating at peak performance and delivering the expected results.

Check the machine status and location. Is the machine working in the right place at the right time? Has it stopped executing its cleaning plan? Using a mobile app, the operator can monitor the machine to make sure it's working as expected.

03

How autonomous cleaning solutions solve challenges and create value

The major challenges faced by the cleaning industry have been the same for a long time: labor shortages, cost pressure, consistency of cleaning, and so on. COVID-19 has made those challenges greater by raising the awareness of cleaning, the expectations for cleaning, and the consequences of failing to meet cleaning requirements.

Autonomous solutions were designed specifically to help organizations meet their cleaning goals. The table below explains how robotic machines solve cleaning challenges and provide value.

Cleaning challenge	How autonomous solutions provide value
Labor shortages It's difficult to find people for cleaning jobs, and employee turnover is high.	Autonomous solutions multiply your workforce. Think of an autonomous scrubber dryer like an additional team member dedicated to scrubbing floors.
Productivity challenges Because cleaning teams are often short-handed, they have difficulty completing all tasks that need to be done.	Autonomous solutions free up your human team members' time so they can spend more time on high-value cleaning tasks. Especially now, with the high sanitation requirements for high-touch areas, gaining even just a few hours of extra time every day is extremely valuable.
High labor costs Labor accounts for as much as 90% of cleaning costs.	Autonomous solutions help you optimize your labor costs, which make up the largest chunk of overall cleaning costs. This doesn't mean that a floor scrubber will replace a human worker, but rather that you can reduce your costs by optimizing your resource usage.

Cleaning challenge	How autonomous solutions provide value
Inconsistency of results Operators typically miss as much as 15% of floor space while cleaning.	Once you program a cleaning route, an autonomous solution will follow that exact same route every time, delivering between 98% and 99.5% coverage and ensuring you always meet your cleaning objectives and maintain hygiene compliance. You can also have the machine calculate the most efficient way to clean a space on its own. This not only guarantees maximum coverage, but also eliminates double-cleaning.
Proof of clean It's difficult to document and analyze cleaning processes and results.	Enhanced cleaning requirements have also brought enhanced documentation requirements. Autonomous solutions generate data so you can easily produce reports of what was cleaned and when. This data also provides insights you can use to optimize your operations, such as by improving scheduling.
High water / detergent / electricity usage Sustainability is becoming a basic requirement.	Autonomous solutions support your sustainability initiatives in a number of ways, from using advanced systems to reduce water and chemical usage to saving energy by operating completely in the dark.

04

Is an autonomous solution right for you?

In the past, autonomous solutions were considered too expensive for many organizations. But, today, thanks to the productivity improvements and labor cost benefits they provide, they're used in a wide variety of facilities.

Typical applications for autonomous floor scrubber dryers:

- Supermarkets and hypermarkets / big-box stores
- Warehouses and distribution centers
- Airports
- Hospitals and other healthcare facilities
- Schools and universities
- Retail malls
- Entertainment and conventions centers
- Office buildings
- Light industry facilities

To determine whether a robotic solution is right for you, look at your jobs to be done and the resources you have available to do those jobs. If your jobs to be done include an employee using a scrubber dryer to clean large open areas (e.g., airport terminals, school gyms and cafeterias, convention centers, retail mall halls) or more complex environments (e.g., grocery stores or warehouse aisles) for at least three or four hours a day, then an autonomous scrubber dryer may be a good fit for you.

Here are some additional questions to ask yourself:

- Is a high standard of clean critical for your business?
- Does your cleaning team struggle to complete all of their tasks on a regular basis? Has COVID-19 created an added burden for your cleaning staff?
- Are you facing time and budget constraints?
- Do you require more consistent cleaning results?
- Do you need documented proof of cleaning?

If you answered "yes" to most of these questions, then it's time to consider an autonomous solution.

05

What can you expect from an autonomous cleaning solution?

Though there are not a large number of autonomous floor cleaners on the market, you still have a choice of equipment. Here are some things that you can – and should – expect from any robotic solution.

1. A return on your investment
2. Third-party certified to robotic floorcare safety standards
3. Flexibility and ease of use
4. Cleaning consistency
5. Digital solutions that provide actionable insights
6. Reliability

1. A return on your investment

While autonomous solutions are more cost-effective than they've ever been, they're certainly more expensive than mops and buckets. Before you make any purchase, do your due diligence to ensure you will get a return on your investment.

Since labor accounts for as much as 90% of cleaning costs, the biggest savings will come from using your human resources more efficiently. Typically, for facilities that are cleaned every day – like shopping malls, airports, and big-box stores – the payback period for an autonomous machine is anywhere from 14 to 36 months depending on use.

Example labor ROI calculation for an autonomous floor scrubber dryer:

- Area to be cleaned: 45,000 ft^2 (4,181 m^2)
- Time to clean: 3 hours
- Cleaning frequency: 7x/week
- Fully burdened labor cost = $22.50 (18.50 EUR)

Labor required for an employee using a walk-behind or rider scrubber dryer to clean this area for a full year:

3 hours x 7 cleanings	=	21 hours/week
21 hours x 52 weeks	=	1,092 hours/year
1,092 hours x $22.50	=	$24,570
Total annual labor costs	=	**$24,570**

If you used an autonomous floor scrubber dryer instead, your employee could perform higher-value tasks at the same time. That means you could essentially double your cleaning productivity during those 1,092 hours while keeping your labor costs the same. If this is the only place you put your autonomous cleaner to work, meaning you only use it part-time, at an illustrative cost between $60,000 and $70,000 for an autonomous scrubber your ROI will be less than 3 years.

2. Third-party certified to robotic floorcare safety standards

Autonomous solutions should not pose a safety risk to people, objects, or the environment. That's why it's important that the machines are third-party certified to the safety standards outlined above.

Third-party certification serves as an independent verdict that the machine is safe. According to Charalambos Freed, Nilfisk's Head of Standardization and Government Relations who also chairs the CSA commercial robotic-floorcare machine standards group, "If a machine is third-party certified according to harmonized standards, the machine is presumed to be compliant with the requirements of applicable safety directives and regulations. That certification offers reassurance that your facilities are safe once you start implementing autonomous solutions in your cleaning operation."

Facts about third-party safety certifications

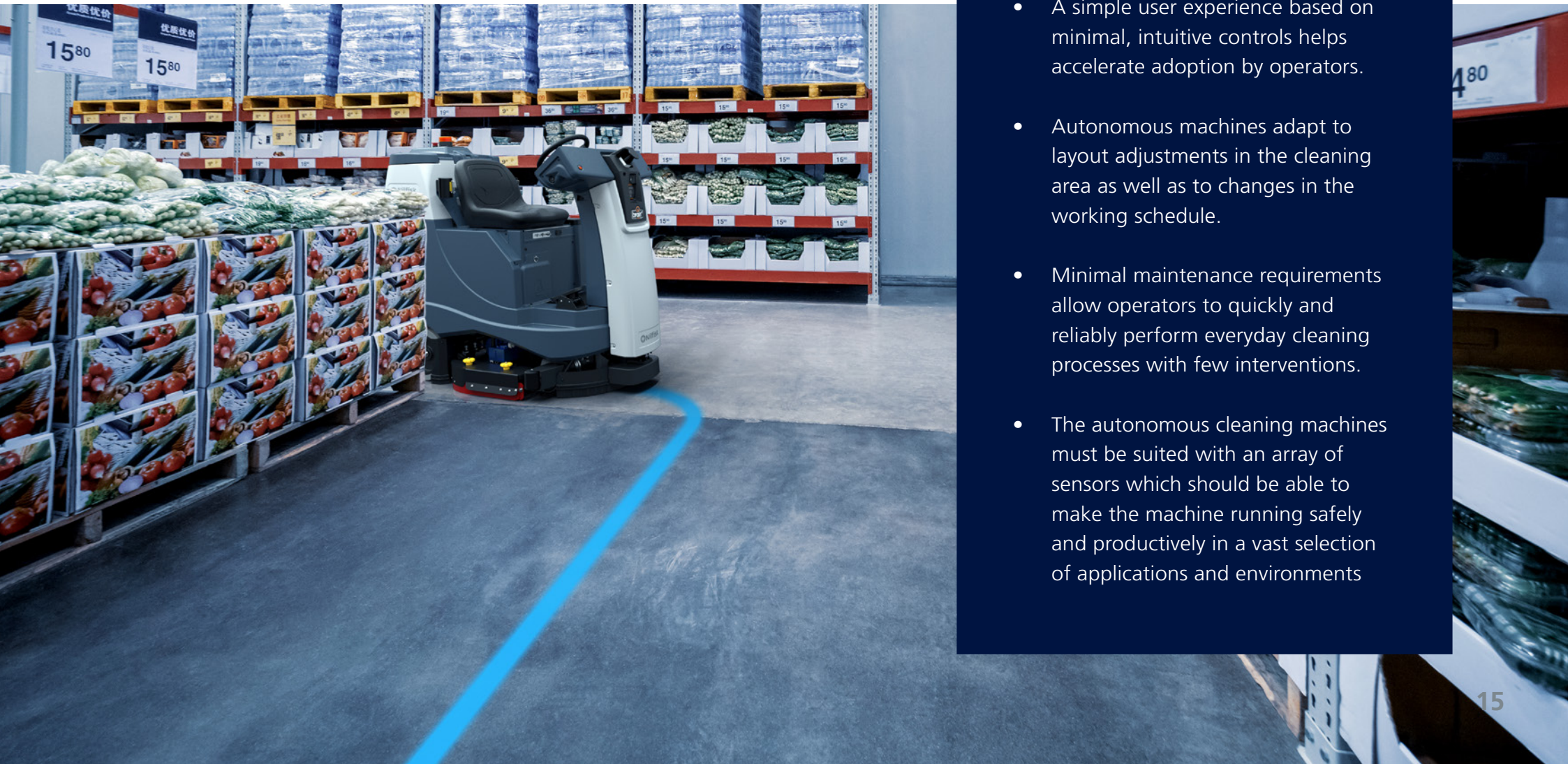
- In the United States, certification is carried out by an independent laboratory, formally accredited by the U.S. Occupational Safety and Health Agency (OSHA).
- In some markets, employers are legally obliged to conduct due diligence on equipment used at their facilities. Failing to comply can lead to product recall, market withdrawal, or fines. Using equipment that meets industry standards is a robust approach to satisfying this legal requirement

3.

Flexibility and ease of use

Autonomous machines should be built for operators, not for engineers. In terms of flexibility, the machine should adapt to the facility, rather than demanding the facility adapt to it.

By prioritizing an autonomous machine which provides an easy user experience, you can ensure you'll continue to achieve consistent results even when there is turnover on your cleaning team.



- Manual and autonomous operations combined in the same product offer a wider usage for many cleaning situations.
- A simple user experience based on minimal, intuitive controls helps accelerate adoption by operators.
- Autonomous machines adapt to layout adjustments in the cleaning area as well as to changes in the working schedule.
- Minimal maintenance requirements allow operators to quickly and reliably perform everyday cleaning processes with few interventions.
- The autonomous cleaning machines must be suited with an array of sensors which should be able to make the machine running safely and productively in a vast selection of applications and environments

4.

Cleaning consistency

An autonomous scrubber dryer should always be a cleaning machine first, and then a robot. It should support frequent floor cleaning, enabling you to clean more space in less time than is feasible with non-autonomous equipment. If the machine doesn't deliver superior cleaning results, then the ROI calculation will never work out to your advantage.

- Autonomous machines follow the same cleaning path and provide the same results every time.
- Autonomous machines adapt to changing cleaning needs. Once you've selected the cleaning parameters, the scrubber dryer will use the perfect amount of chemical and solution each time.

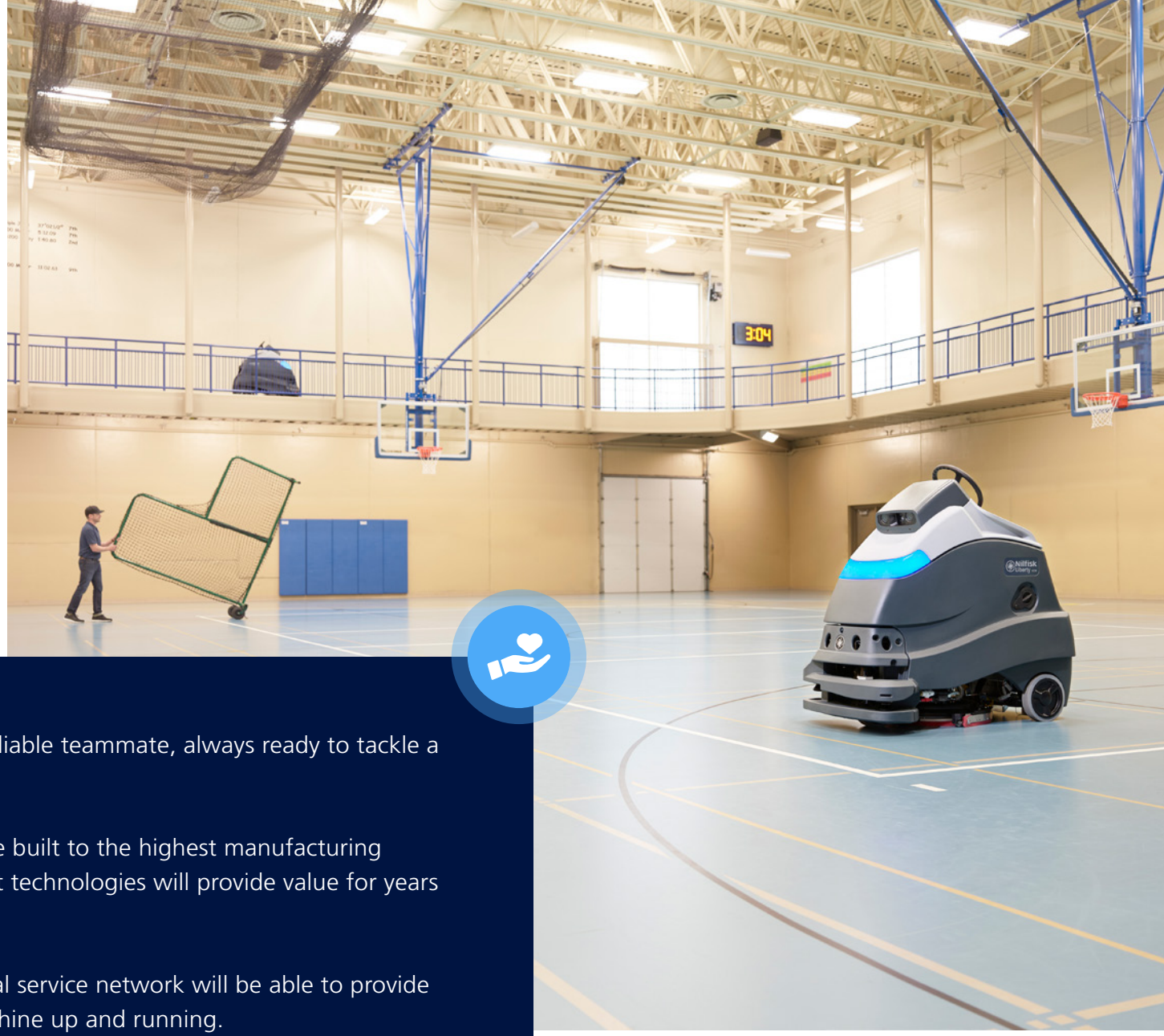
5. Digital solutions that provide actionable insights

There is no shortage of data in this world. But many organizations are unable to effectively use their data. Make sure your autonomous solution not only captures data about your cleaning processes to provide proof of clean, but also has the ability to turn the data into actionable insights you can use to optimize your operations.

- Operators receive notifications via their mobile phones so they can keep track of the machine while it is cleaning.
- Cleaning reports provide customers with proof of clean.
- Preventive maintenance alerts minimize downtime.
- Data can be used to optimize cleaning operations.
- Dedicated apps allow supervisors to manage the entire autonomous fleet from their phones.

6. Reliability

Every hour an autonomous scrubber is working is an hour's worth of labor-free cleaning productivity. And every hour it spends out of commission is an hour lost. If the machine stops working on the job because of too many failures, or if your staff must repeat the job manually because of poor cleaning quality, your cleaning efficiency will decline.



- Autonomous machines are a reliable teammate, always ready to tackle a cleaning job.
- Robotic scrubber dryers that are built to the highest manufacturing standards and feature the latest technologies will provide value for years to come.
- Equipment suppliers with a local service network will be able to provide service quickly to keep the machine up and running.

06

How to prepare your organization for an autonomous scrubber dryer

The key to realizing the benefits of automation is planning. To borrow a phrase from Ernst & Young, planning is what "makes the difference between success and disappointment."

In the second volume of this guide, we'll detail the technical aspects of implementing an autonomous cleaning solution. Here, we'll discuss three steps you should take before you welcome a robot onto your cleaning fleet.

Get buy-in from all stakeholders

Getting buy-in from all stakeholders is arguably the most important step in implementing an autonomous solution. In fact, if you can't get buy-in, you probably shouldn't be considering autonomy at all. Without buy-in from leadership, you won't be able to make the investments (e.g., in high-quality equipment and training) needed to make the project a success. And without buy-in from cleaning staff, you might find that the brand new robot you just bought spends most of its time sitting in storage.

Every stakeholder plays an important role in making the transition to autonomy a success:

Leadership. Leadership sets the example. If the project is important to them, it will be important to everyone else. Get buy-in from this group by demonstrating not only the cost savings, but also the other values that autonomy provides. For example, it boosts your brand by establishing the company as a forward-thinking, innovative organization.

Supervisors and site managers. As the ones who plan and oversee cleaning operations, supervisors and site managers need to champion the solution to ensure adoption by their teams. Get buy-in from this group by communicating about how an autonomous solution will help them meet their key performance indicators (KPIs) and also benefit the people they manage.

Operators. The last and most important group is the operators – the ones who will work with and alongside the machines on a daily basis. Get buy-in from this group by showing them how the machine will make their jobs easier (e.g., it gives them more time to finish their work) and by providing them with the information, training, and support they need to be able to use the machine with ease and confidence.

Assign roles and responsibilities

An autonomous cleaning machine is like an additional member of your cleaning team, and it will only be as successful as the team itself. We recommend thinking carefully about your team to determine who is the best fit to create cleaning routes and operate the machine. For example, although creating cleaning routes is easy for people comfortable with adopting new technology, it may be daunting for someone who isn't. On the other hand, **even people with low tech proficiency can operate the machine** once a cleaning route has been created.

Set goals

As with any new initiative, you won't be able to assess the success of adopting an autonomous cleaning machine unless you define what that success looks like.

The goals for implementing a robotic scrubber dryer should fall into two categories: cleaning KPIs and automation KPIs.

Since every implementation is different, there are no hard and fast rules for setting goals. Yours will depend on your facility and on your current cleaning processes. The table below provides some examples to help you get started.

Sample cleaning KPIs	Sample automation KPIs
Performance metrics • Square feet cleaned per FTE • % of tasks completed • Occupant / customer satisfaction ratings • Quality audit results • ATP levels • Dust levels	• Training hours • Usage (i.e., amount of time the robot is used vs. amount of time it's available) • Employee perceptions • Machine downtime
Financial metrics • Overall cost of cleaning • Water, detergent, and electricity usage	

07

Autonomous cleaning solutions from Nilfisk

Nilfisk has been in the cleaning equipment industry more than **100 years**. In that time, we've focused on developing state-of-the-art technology to help our customers clean more effectively, more efficiently, and more sustainably.

Nilfisk introduced two machines to the market: the Liberty SC50, a stand-on autonomous scrubber dryer, the Liberty SC60, a ride-on autonomous scrubber dryer. From high-traffic warehouses and airports to schools and supermarkets, these machines empower cleaning teams to accomplish more every day.

Nilfisk Liberty SC50

The stand-on Nilfisk Liberty SC50 was developed in collaboration with Carnegie Robotics. It was designed for full autonomy and developed to deliver consistent results with minimal oversight.

Typical applications

- Entertainment and conventions centers
- Hospitals and healthcare facilities*
- Supermarkets
- Retail malls
- Airports
- Schools and universities
- Office buildings

Key features and benefits

Superior cleaning results. The Liberty SC50 was based on the Nilfisk Advance 1500 stand-on scrubber dryer. It provides up to 6 hours of runtime and 55,000 square feet (5000m²) of coverage on a single charge.

Multiple cleaning modes. Nilfisk offers three distinct cleaning modes on its autonomous solutions:

- CopyCat – Drive a route once and the machine will perfectly replicate both the cleaning path and the cleaning process every time.
- Fill-In – Drive the perimeter of a space and the machine will automatically calculate the best route to clean every inch within that perimeter.
- Manual – For ad hoc cleaning, the machine works just like a regular scrubber dryer.

Safety certifications. The Liberty SC50 is third-party certified to North American and EU safety standards:

- Third-party certified to CSA/ANSI C22.2 No. 336-2017
- cETLus Mark of Approval
- Third-party global IEC certification
- Third-party approval in Europe for presumption of conformity to the applicable safety directives and regulations
- *The SC50 is EMC certified

Agility. Compact and highly maneuverable with a tight turning radius, the Liberty SC50 also adjusts in real time to route changes and unexpected obstacles.

Simplicity. The Liberty SC50 is easy and intuitive to learn and use. Compared to a traditional scrubber dryer, it has only three additional buttons: Play, Record, and Stop.

Sustainability. Nilfisk's best-in-class sustainability technologies are available on the Liberty SC50:

- SmartFlow – Automatically adjusts water and detergent flow according to the speed of the machine
- EcoFlex – Adjusts water and detergent flow according to the demands of the job and enables low-chemical and water-only cleaning
- REV – Uses Nilfisk's patented random orbital technology to clean more efficiently using less solution

Integrated UVGI module. The Liberty's optional integrated UVGI (ultraviolet germicidal irradiation) module uses UV-C light to disinfect floors at the same time as the machine is removing dirt and debris. This combination of solutions delivers reliable, effective cleaning and disinfection in spaces where hygiene is critical, such as hospitals, supermarkets, airports, and schools.

Nilfisk Liberty SC60

Designed for large spaces, the ride-on Nilfisk Liberty SC50 was developed in collaboration with Brain Corp. It has the market's largest scrub deck, exemplary runtime, and minimal downtime requirements.

Typical applications

Warehouses and distribution centers

Hypermarkets and big-box stores

Light industry facilities

Entertainment and conventions centers

Key features and benefits

Superior cleaning results. The Liberty SC60 was based on the performance-oriented Nilfisk BR755/ Advance Advenger ride-on scrubber dryer.
It provides best-in-class productivity and runtime. A cylindrical scrub deck version is available, which provides light debris sweeping in addition to scrubbing.

Multiple cleaning modes. Nilfisk offers three distinct cleaning modes on its autonomous solutions.

- CopyCat – Drive a route once and the machine will perfectly replicate both the cleaning path and the cleaning process every time.
- Multi-plan - Link and assign up to six pre-recorded cleaning plans per tag location. Once a planned job is finished, the SC60 will begin the next one.
- Manual – For ad hoc cleaning, the machine works just like a regular scrubber dryer.

Safety certifications. The Liberty SC60 is third-party certified to robotic safety standards.

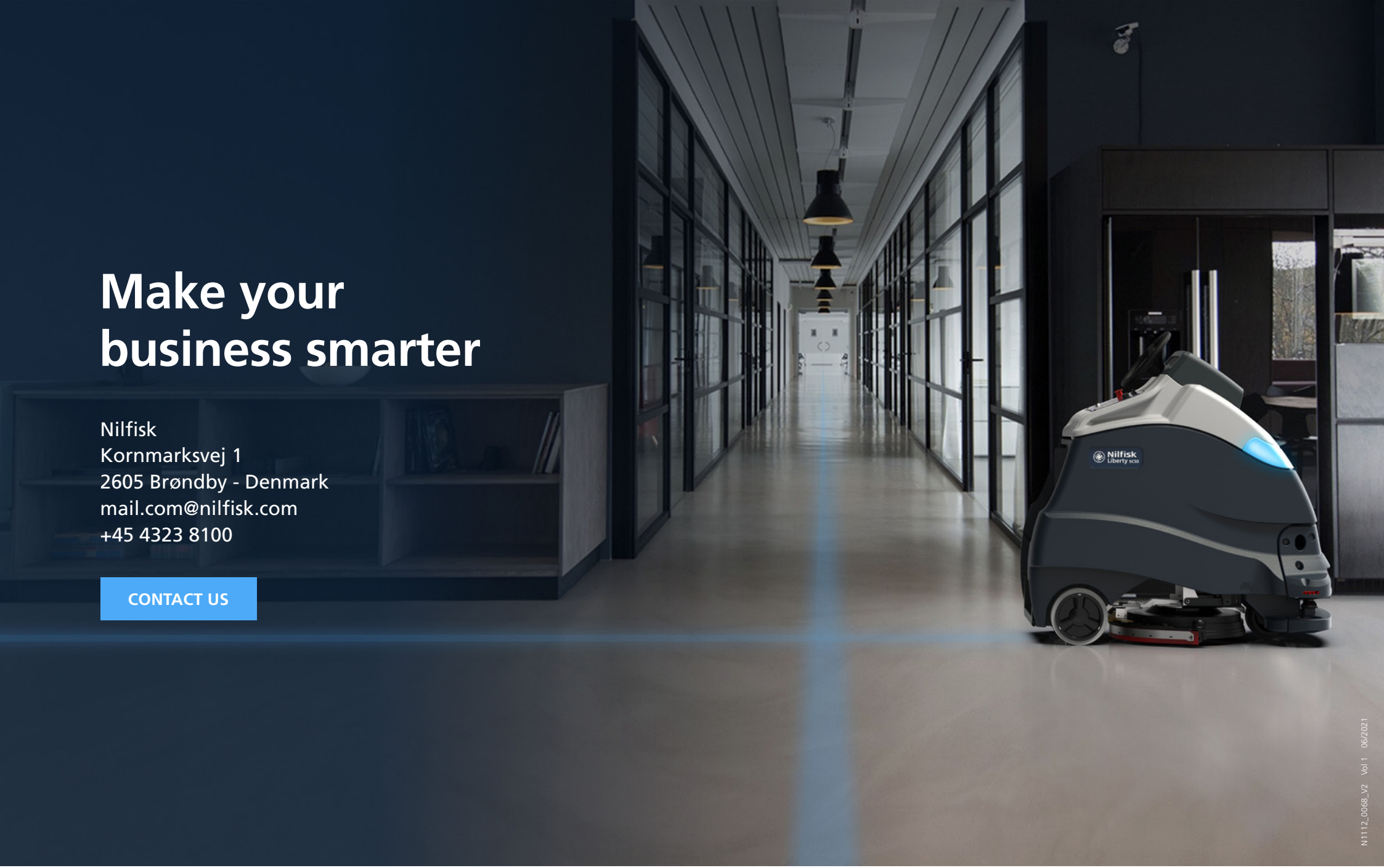
- Third-party certified to CSA/ANSI C22.2 No. 336-2017
- cETLus Mark of Approval
- Third-party global IEC certification
- Third-party approval in Europe for presumption of conformity to the applicable safety directives and regulations
- The SC60 is EMC certified.

Simplicity. The Liberty SC60 is easy to learn and use. It has an intuitive touch screen that guides the operator step-by-step through the creation and playback of cleaning plans, delivering the best user experience on the market.

Sustainability. Nilfisk's best-in-class sustainability technologies are available on the Liberty SC60:

- SmartFlow – Automatically adjusts water and detergent flow according to the speed of the machine
- EcoFlex – Adjusts water and detergent flow according to the demands of the job and enables low-chemical and water-only cleaning

Visit the Nilfisk website to learn more about autonomous cleaning.



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N1112_0068_V2 Vol 1 06/2021