Semi-AS/RS: Cost-Effective Automated Storage and Retrieval Solution

半自动存取系统Semi-AS/RS:经济实惠的自动化存取解决方案

Agenda议程

1. Market Landscape & Opportunity

市场环境与机遇

Global AS/RS Market Growth全球自动存取系统（AS/RS）市场增长

Market Size市场规模

Efficiency Driver效率驱动

Rising labor costs and demand for accuracy
are key market drivers.

人工成本上升和对准确性的需求是主要驱动力

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Regional Hotspot区域热点
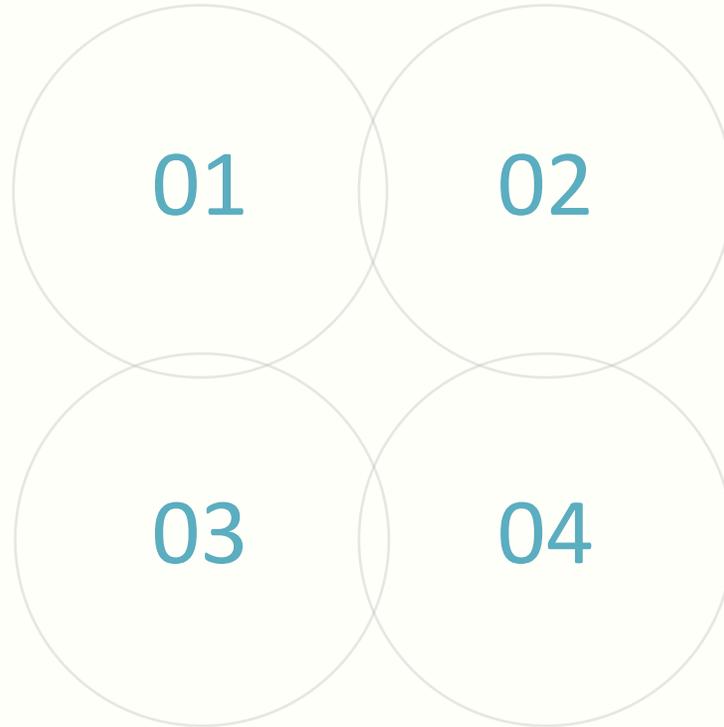
Cost Pressure成本压力

03

04

Industry Challenges & Pain Points

行业挑战与痛点

⊙ **High Capital Investment高资本投资**

Traditional AS/RS requires significant upfront cost, with 42% of companies delaying adoption due to high installation expenses.
传统的AS/RS需要大量前期投资，导致42%的企业因高昂的安装费用而推迟采用。

⊙ **Inflexibility不灵活性**

Fixed infrastructure limits layout changes and scalability, making it difficult to adapt to dynamic warehouse environments.
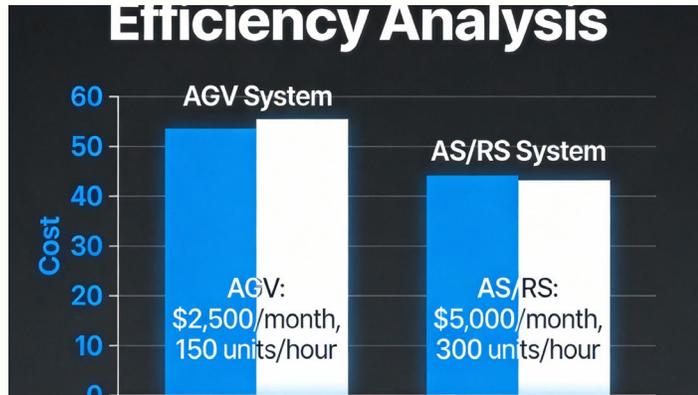固定基础设施限制了布局变更和扩展，难以适应动态变化的仓储环境。

2. Technology Innovation: The Semi-AS/RS Concept

技术创新：半自动存取系统(Semi-AS/RS)概念

AGV vs. AS/RS: A Technology Comparison

自动引导车（AGV）与自动存取系统（AS/RS）：技术比较

AGV: Flexible but Limited灵活但有限

Pros: High flexibility, easier integration. Cons: Lower throughput, navigation complexity in dense storage.

优点：高灵活性，更易集成。 缺点：*吞吐量较低，密集存储中的导航复杂性*。

AS/RS: Efficient but Expensive高效但昂贵

Pros: Very high density and throughput. Cons: Very high initial initial cost, rigid structure.

优点：存储密度和吞吐量非常高。 缺点：*初始成本极高，结构刚性*。

Introducing Semi-AS/RS: The Hybrid Solution

半自动存取系统（Semi-AS/RS）

Flexible + Efficient + Cost Effective
灵活 + 高效 + 经济实惠

The Semi-Automatic Storage and Retrieval System (Semi-AS/RS) is an innovative hybrid solution that combines the future FSD of forkift with robotics.

半自动存取系统（Semi-AS/RS）是一种创新的混合解决方案，将叉车的未来全自动驾驶（FSD）与机器人技术相结合。

aily 工作助手生成

Key Innovations of Semi-AS/RS

半自动存取系统的关键创新点

03

Scalable Architecture可扩展架构

02

System capacity can be increased incrementally, allowing businesses to expand storage and throughput as needed.

系统容量可逐步增加，支持企业根据需要扩展存储和吞吐能力。

Decentralized Intelligence分散式智能

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Vehicles equipped with onboard sensors and decision-making capabilities for real-time optimization and adaptive routing.配备车载传感器和决策能力的车辆，支持实时优化和自适应路径规划。

Modular Rack Design模块化货架设计

Standardized components reduce manufacturing and installation costs, enabling rapid deployment and flexible warehouse layouts.

标准化组件降低制造和安装成本，实现快速部署和灵活的仓库布局。
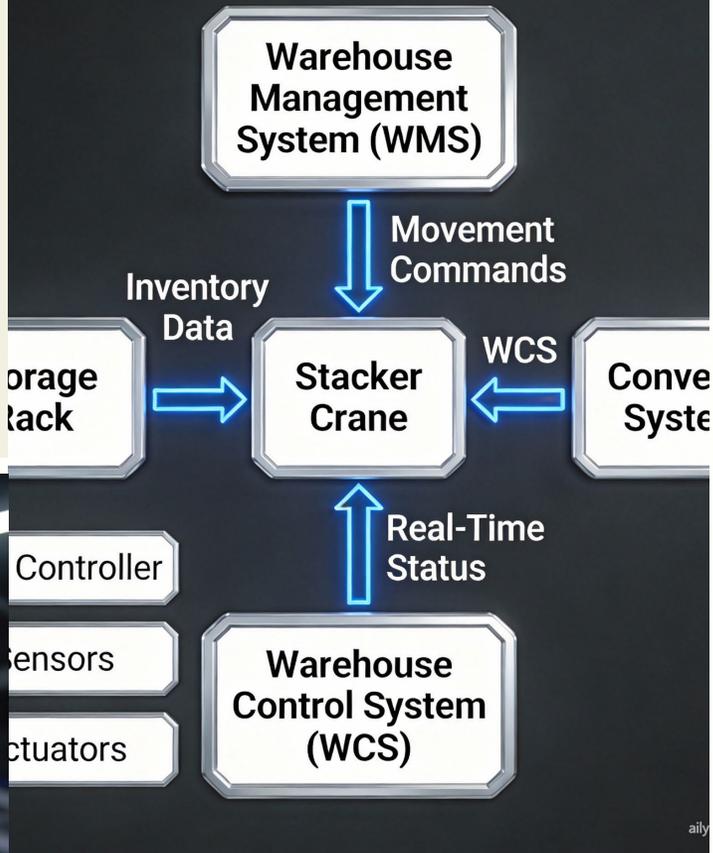
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3. System Architecture & Economic Benefits
系统架构与经济效益

Technical System Architecture技术系统架构

System Overview系统概述

Comprises 1) Modular Storage Racks; 2) Autonomous Retrieval Vehicles (ARVs); 3) Fleet Management System (FMS); 4) Warehouse Management System (WMS) integration.

由以下部分组成：1）模块化存储货架；2）自主取存车（ARV）；3）车队管理系统（FMS）；4）与仓库管理系统（WMS）集成。

Operational & Economic Advantages运营与经济效益

Cost Reduction
成本降低

Up to 40% lower initial investment compared to full AS/RS systems.
比全自动存取系统（AS/RS）投资降低高达40%。

Labor Efficiency
运营与经济优势

Reduces manual labor costs by approximately 58%, addressing workforce shortages.
自动化可降低人工成本约58%，应对劳动力短缺问题。

Accuracy & Uptime
工作效率

Achieves error rate below 0.02% and higher system availability for reliable operations.
实现误差率低于0.02%，系统可用性高，保障可靠运行。

ROI Analysis & Payback Period投资回报分析与回本期

Analysis for a mid-sized warehouse, comparing initial investment, annual operational savings, and ROI, with a typical payback period of 2-3 years.

以中型仓库为例，比较不同自动化方案的初期投资、年度运营节省和投资回报期，平均回本期为2-3年

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Investment Scenario投资方案

Mid-Sized Warehouse

Analysis for a mid-sized warehouse, evaluating automation solutions like AS/RS and AGVs. Considers upfront costs for hardware, software, and system integration.

分析中型仓库的硬件、软件及系统集成的前期成本，评估自动化方案如AS/RS和AGV的适用性。

02

Key Metrics主要指标

Cost & Savings

Compares initial investment, annual operational savings from labor reduction and error reduction, and calculates ROI. Savings driven by 24/7 operation and improved accuracy.

比较初始投资、劳动节省和误差降低带来的年度节省，并计算投资回报率，节省主要来自24/7运行和更高的准确性。

4. Implementation & Future Outlook

实施与未来展望

Target Application Scenarios

目标应用场景

E-commerce

Manufacturing

Logistics

Healthcare

aily 工作助手生成

E-commerce & Retail Fulfillment电商与零售配送

AS/RS solutions are tailored for diverse industries, addressing specific operational challenges with automated storage and retrieval.

多品种中等量商品，加快订单处理和动态库存管理，支持全渠道运营。

Manufacturing Raw Material & WIP制造业原材料与在制品

High-mix, medium-volume goods; enables rapid order processing and dynamic inventory management for omnichannel operations.

适配多品类、中货量的货品作业需求；可实现订单快速处理，并为全渠道运营提供动态化的库存管理支持。

Cold Chain Logistics冷链物流

Flexible production environments; automates storage and movement of components, supporting lean manufacturing and JIT delivery.

灵活的生产环境，自动化存储和移动，支持精益制造和准时（JIT）交付

Pharmaceutical & High-Value Goods医药与高价值商品

Temperature-controlled spaces; ensures precise handling of perishable goods with real-time monitoring and compliance.温控空间，确保易腐品的精准处理，实时监控和合规。

Technology Roadmap & Future Integration技术路线图与未来集成

○ **Near-term (1-2 years)近期（1-2年）**
Enhance vehicle AI for dynamic path planning and obstacle avoidance, improving operational flexibility and safety.
提升车辆AI，实现动态路径规划和障碍物规避，增强操作灵活性和安全性。

○ **Mid-term (3-5 years)中期（3-5年）**
Integrate with FSD (Full Self-Driving) and advanced robotics for outdoor-yard logistics, expanding automation scope.
与**FSD**（全自动驾驶）和先进机器人技术结合，扩大户外场景的自动化范围。

○ **Long-term Vision长期愿景**
AI-driven predictive analytics for inventory optimization and fully autonomous supply chain nodes, achieving end-to-end automation.
利用**AI**进行预测分析，优化库存，实现端到端的全自动供应链。

Summary & Strategic Recommendations总结与战略建议

Semi-AS/RS offers a balanced, cost-effective automation path, bridging the gap between manual operations and full-scale AS/RS investment.半自动存取系统（Semi-AS/RS）提供了一条平衡、经济的自动化路径，填补了手动操作与全自动AS/RS投资之间的空白。

Cost-Efficiency Bridge成本效益桥梁

Balanced Investment

Addresses the cost gap in warehouse automation, enabling efficient storage without prohibitive capital expenditure of full AS/RS.解决仓储自动化的成本差距，实现高效存储，避免高昂的全自动投资。

Competitive Advantage竞争优势

Operational Leadership

Early adoption delivers superior operational efficiency, reducing errors and labor costs while accelerating order fulfillment.早期采用者可获得更高的运营效率，降低错误率和人工成本，加快订单履行。

Scalable & Future-Proof平衡投资

Adaptive Design

Provides a modular solution adaptable to modern logistics challenges, allowing gradual expansion as business needs evolve.可扩展且具有未来适应性，模块化设计满足不断变化的物流需求。

Compelling Investment具有吸引力的投资

Strategic Automation

A strategic choice for businesses seeking automation benefits without the high upfront costs and integration complexities.对于希望实现自动化但又担心高前期成本和集成难题的企业，是一个战略性选择。

Thank you! 谢谢！

GreenWave Tech Trade and Consulting Limited
email: greenwave.tech.trade@gmail.com