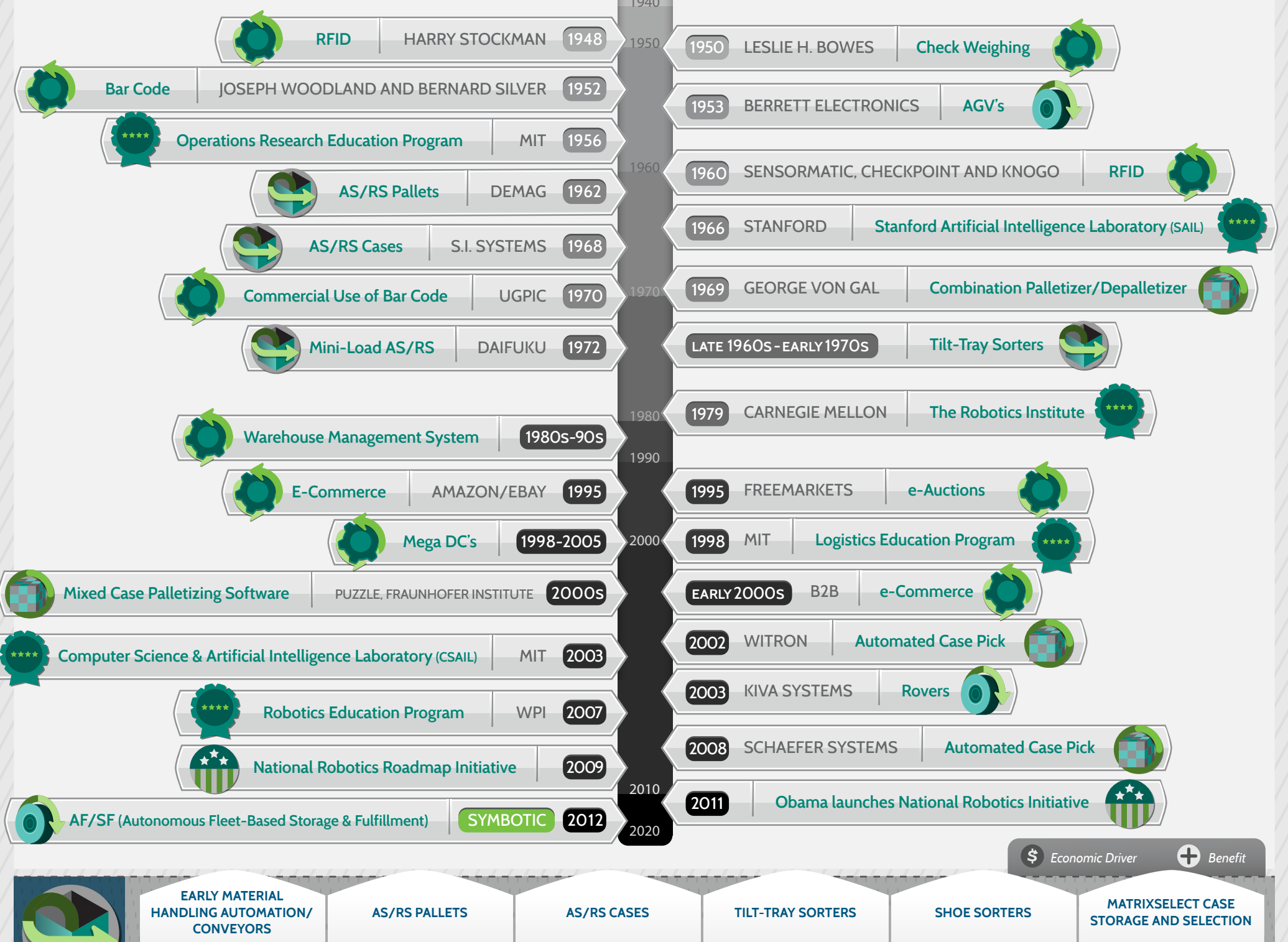


# THE EVOLUTION OF WAREHOUSE AUTOMATION



Category	Year	Company/Institution	Key Milestone
AUTOMATED MATERIAL HANDLING	1914	Henry Ford	Developed the first mass production conveyor system.
	1962	Demag	First pallet Automated Storage and Retrieval Systems (AS/RS) were developed during this time.
	1968	S.I. Systems	S.I. Systems later developed the SI Ordermatic to use in large distribution centers.
	1960s-1970s	-	Developed to simultaneously sort irregularly shaped products for items that slip off the tray by gravity.
	1970s-1980s	Sandvik AB	The shoe sorter is an apparatus for selectively sorting fragile items in warehouses.
	2012	Symbotic	Symbotic introduces the first rover-based case storage and selection system capable of direct storage of cases in dense 3D structures.
EDUCATION	1919	Syracuse University	Curriculum consisted of Railroad Transportation, Water Transportation, and Traffic Management.
	1956	MIT	Operations Research Center at MIT was launched and directed by Philip Morse who is considered to be the father of Operations Research.
	1966	Stanford	John McCarthy and Les E. Lamport form the Stanford Artificial Intelligence Laboratory (SAIL).
	1979	Carnegie Mellon	Founded by Raj Reddy, Tom Murrin and Angel Jordan with the goal of making it the best place on the planet to do robotics research.
	2003	MIT	Before CSAIL was established in 2003, it was the Laboratory for Computer Science and the Artificial Intelligence Lab.
	2006	Georgia Tech	Center for Robotics and Intelligent Machines (RIM-CIM) is an interdisciplinary research center that currently offers the first truly multi-disciplinary Ph.D. program in robotics after the one at Carnegie Mellon.
	2007	WPI	Worcester Polytechnic Institute (WPI) offers the first BA degree in Robotics.

Category	Year	Company/Institution	Key Milestone
SUPPLY CHAIN TECHNOLOGY	1948	Harry Stockman	The earliest work exploring RFID began in 1948 by Harry Stockman but his idea did not reach fruition.
	1950	Leslie H. Bowes	A weighing apparatus that checks if the package has been filled with the correct amount of the product.
	1952	Joseph Woodland and Bernard Silver	The Woodland and Silver "bull's eye" was first patent for a bar code.
	1960s	Sensormatic, Checkpoint & Knogo	Radio Frequency Identification (RFID) was leveraged for commercial use for electronic article surveillance (EAS).
	1970	UGPIC	First commercial implementation of bar coding was for grocery distribution by UGPIC.
	1980s-90s	Warehouse Management Systems (WMS)	Warehouse Management Systems (WMS) control the flow of inventory into, within, and out of a company's DC in order to track inventory at all times.
	1995	FreeMarkets	FreeMarkets launches the first e-Auction - an online negotiation platform that gives the supplier the power to gain market feedback to improve their proposal.
	1995	Amazon/eBay	Future king of e-commerce launched in 1995. Also in this year AuctionWeb launched their site that is later renamed eBay.
ROVERS	1953	Berrett Electronics	Automated Guided Vehicles (AGV's) are mobile robots that move items around a warehouse by following various types of guides.
	2003	Kiva Systems	The first autonomous fleets of mobile robots, or 'rovers' are utilized warehouses for each pick fulfillment to retrieve product and bring them to a warehouse.
HOSPITAL ROVERS	2005	Aethon	Aethon TUG is an automated robotic delivery system for transporting various hospital carts to increase efficiency, optimize staff time and empower caregivers to better coordinate delivery of care.
	2010	Dematic, Muratec	Automated storage systems for cases, totes, and trays are introduced by a number of vendors using shuttles, mobile cranes, and linear rails.
SHUTTLE SYSTEMS	2010	Dematic, Muratec	Automated storage systems for cases, totes, and trays are introduced by a number of vendors using shuttles, mobile cranes, and linear rails.
	2012	Symbotic	Symbotic introduces the 3D case storage and selection system based on autonomous mobile robots, or rovers. Rovers are capable of high speed access to storage locations, like shuttle, but can navigate autonomously providing access to all locations throughout the structure, not just individual aisles.

Category	Year	Company/Institution	Key Milestone
PALLETIZE	1969	George von Gal	An automatic palletizer, de-palletizer and conveyor system for single SKU pallets was developed by George von Gal to automatically palletize layers of 24 bottle-wooded layers of Coca-Cola cases.
	2000s	Puzzle, Fraunhofer Institute	The Fraunhofer Institute develops automatic order picking software to optimize the arrangement of mixed SKU pallets using 3D puzzle software.
	2002	Witron	A fully automated case storage and palletizing system with applications to grocery where there are a large number of SKUs.
	2008	Schaefer	Schaefer developed a fully automated case-picking system for mixed full-case-pallet order selection for dry grocery environments, storing cases in trays.
	2012	Symbotic	Symbotic developed its own proprietary palletizing software solution with better control of pallet density, aisle differentiation, and handling special SKU characteristics.
	2012	Symbotic	At the end of 2011, expectations for revenues for 2012 were expected to be greater as well as individual capital expenditures which for manufacturing organizations was expected to improve by 2%.
	2012	Symbotic	Support for a wide range of case dimensions, Unlimited SKU handling, Pallets that are built for stability to full truck loading height, Bales that are maximized for the highest density, Special consideration for fragile case handling, Multi-product family group capability for store friendly shipments.
	2012	Symbotic	As of Sept 16, 2012, \$50 Million in Research funding awarded by National Robotics Initiative to university researchers across the country.
	2012	Symbotic	FOR MORE INFORMATION VISIT www.robotics-vo.com to learn about upcoming news and events!
	ROBOTICS ROADMAP INITIATIVE	2009	U.S.A.
2009		Carnegie Mellon	Built upon the National Robotics Roadmap this initiative will be a collaborative effort between the brightest academics, business and service leaders in fields of science and technology.
2012		University of Washington	The use of robotics technology in the service industry spans professional and domestic applications. In professional services applications for service robotics include improved mining, automated harvesters, and cleaning of large-scale facilities.

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1947	UC Berkeley	George Danzig develops SIMPLEX algorithm for Linear Programming, addressing large class of logistics / supply chain problems
1951	U Manchester	1st working AI computer program
1952	MIT	Patent for 1st Computer Numerical Control (CNC) of machine tools, pre-cursor for robot control developed later
1969	SRI	"Shakey the Robot" robot demonstrates animal locomotion, perception, and problem solving
1970	U Tokyo	Use of force feedback in robots
1973	U Edinburgh	"Freddy Assembly Robot" uses visual perception to locate and assemble models
1979	U Pittsburgh	"Internist" program uses NASA the National Institutes of Health
1979	Stanford	1st computer controlled autonomous vehicle traverses chair filled room
1970s	Stanford	ARPAnet demonstrates power for scientific collaboration, pre-cursor of Internet
1980s	MIT, SRI	Robot control based on machine vision
1980	CMU	Six legged walking machine
1981	CMU	1st drive robot arm
1980s	Bundeswehr U Munic	Robot cars driving up to 55 mph on empty streets
1980s	Harvard	Neural networks
1986	CMU	Autonomous Navigation Lab
1987	Utah	Utah/MIT Dexterous Hand demonstrates high functionality, antagonistic actuation
1993	DLR	ROTEX 1st remotely controlled space robot flown on shuttle Columbia
1990s	U Tokyo	Humanoid robots walk, manipulate objects under visual guidance
2005	Stanford, CMU, U Pittsburgh	Five vehicle successfully complete DARPA Grand Challenge race (university sites cited plus Team Gray, Oshkosh Truck)

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**MILESTONES TIMELINE**

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