

SUITX

Enhancing capabilities

Ohio Safety Supply:

Presentation (17 November 2017)

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- Founded in 2011 out of University of California Berkeley Human Engineering and Robotics Laboratory
- Financed with funds from:
 - National Science Foundation
 - National Robotics Initiative
 - Three innovations awards (\$1,035,000)
 - Series A
- Headquartered in Emeryville, CA
 - 18,000 sq ft facility
- Manufacturing facility in Ningbo, China
 - 10,000 sq ft facility
- Currently 35 employees
- More than 30 patents for exoskeleton bionics
- Four industrial products launched November 2016.





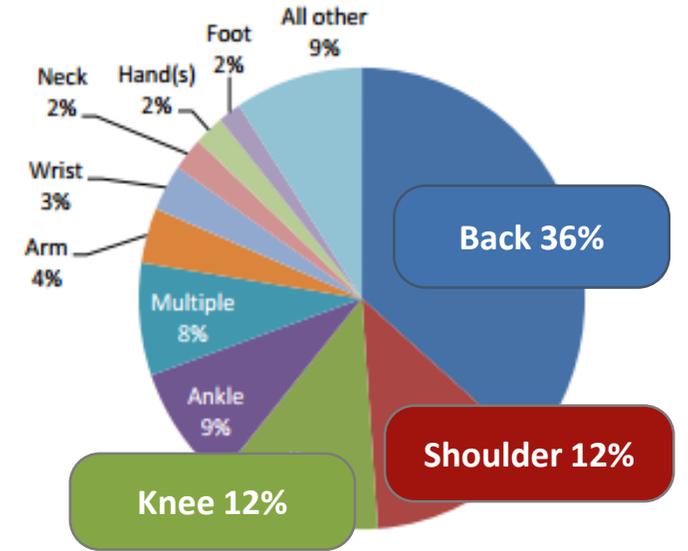
PhoeniX

Medical Exoskeleton

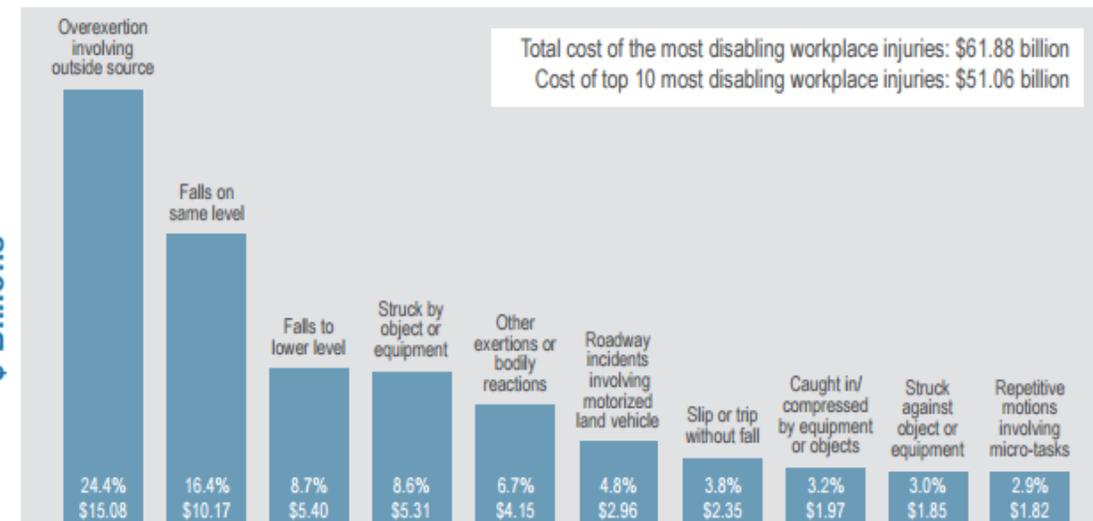
- For Rehabilitation & Individual use
- Clinical Trials Underway
- **Expected FDA Clearance: Summer 2018**
- Price will be less than 1/2 other cleared devices

Why Industrial Exoskeletons?

- Workplace injuries and accidents cost U.S. employers nearly \$62 billion in 2013
 - Indirect costs such as loss of productivity, hiring substitute laborers, and reintroducing employee back in the workplace is not accounted for in this figure.
- Overexertion involving lifting, pushing, pulling, holding, carrying or throwing objects ranked first.
 - Cost to businesses: \$15.1 billion
 - Accounted for nearly a quarter of all the costs of injuries nationally
- Top 3 areas of injury : lower back, knee, and shoulder



Top 10 Causes and Direct Costs of the Most Disabling U.S. Workplace Injuries^{1,2}



2016 Liberty Mutual Workplace Safety Index (based on 2013 injury data)

suitX Solution

Design Philosophy

Modular

- 4 industrial exoskeleton systems that can be worn together or individually

Smart

- The devices recognize when a user is in a stooping, squatting, or overhead position
- Does not impede from everyday tasks such as walking, driving, or climbing a ladder

Passive

- backX/shoulderX have no computers or batteries
- legX support is also mechanical, with electronic communication between legs.

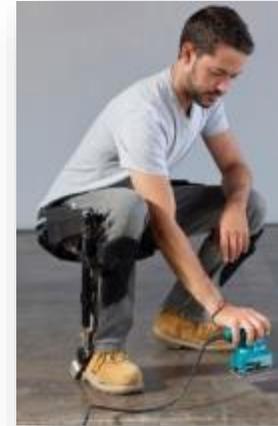
User Focus

- Comfortable enough to wear for full work day
- Easy self adjustment of support levels



backX

- 3.4kg – S, 4.7kg – AC
- Provides 13.6kg of support to the lower back (L5/S1)
- Front(S) and back(AC) (shown) acting models



legX

- 2.2kg each leg
- Provides up to 27kg of support to the lower limbs



shoulderX

- 5.4kg
- Provides up to 6.8kg of support to each arm

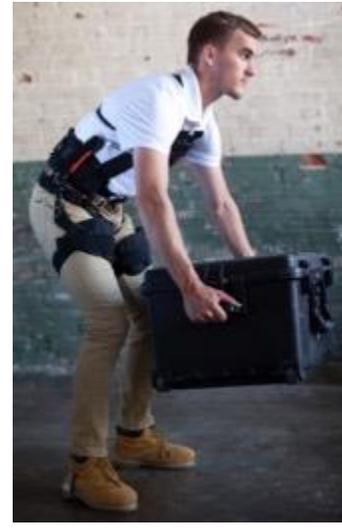
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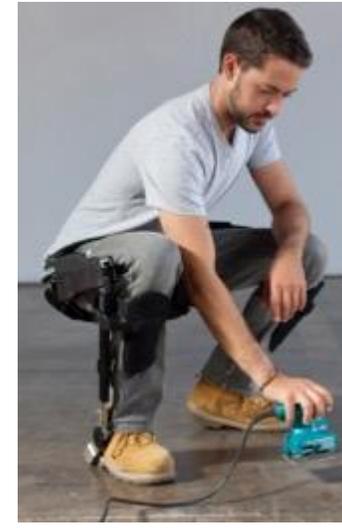
All products are one size fits all*



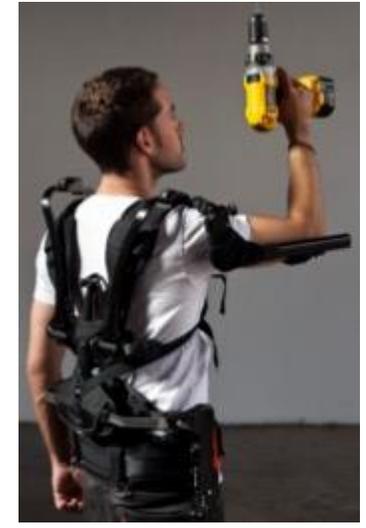
BACKX
model AC



BACKX
model S



LEGX

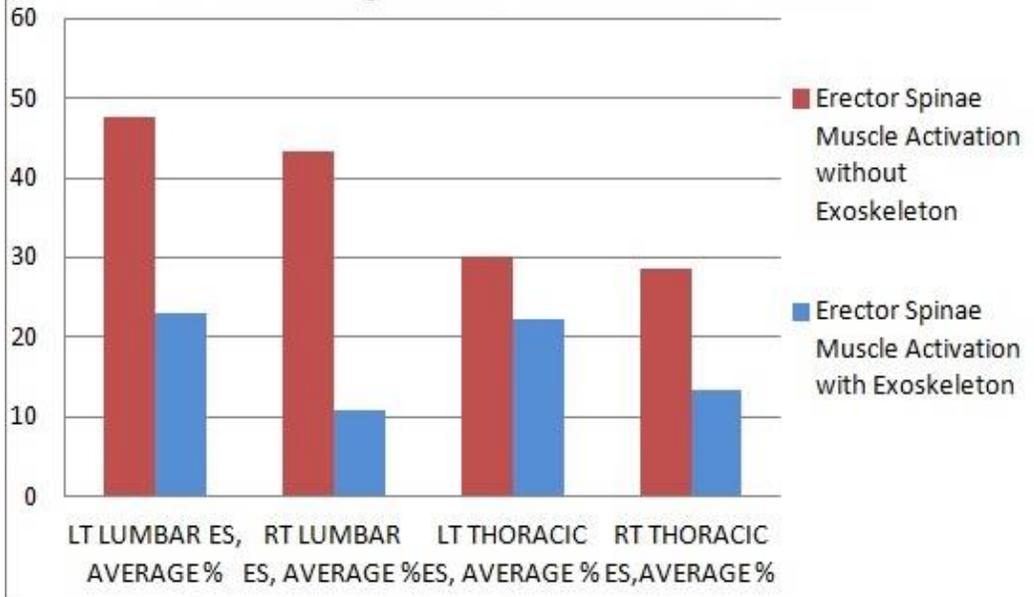


SHOULDERX

Device Weight	10.5 lb (4.7 kg)	7.7 lb (3.4 kg)	10 lb (2.2 kg) each leg	12 lb (5.4 kg)
Support to user	30 lb (13.6 kg)	30 lb (13.6 kg)	60 lb (27.2 kg)	-5-15 lb (6.8 kg)
Adjustable Support?	Yes	Yes	Yes	Yes
Put on/take off time	48/15 sec	35/20 sec	90/30 sec	80/40 sec
Compatibility	shoulderX, legX	legX	backX AC, shoulderX	backX AC, legX
Price (USD)	\$4,000	\$4,000	\$6,000	\$4,000

Exoskeleton Case Studies

Erector Spinae Muscle Activation

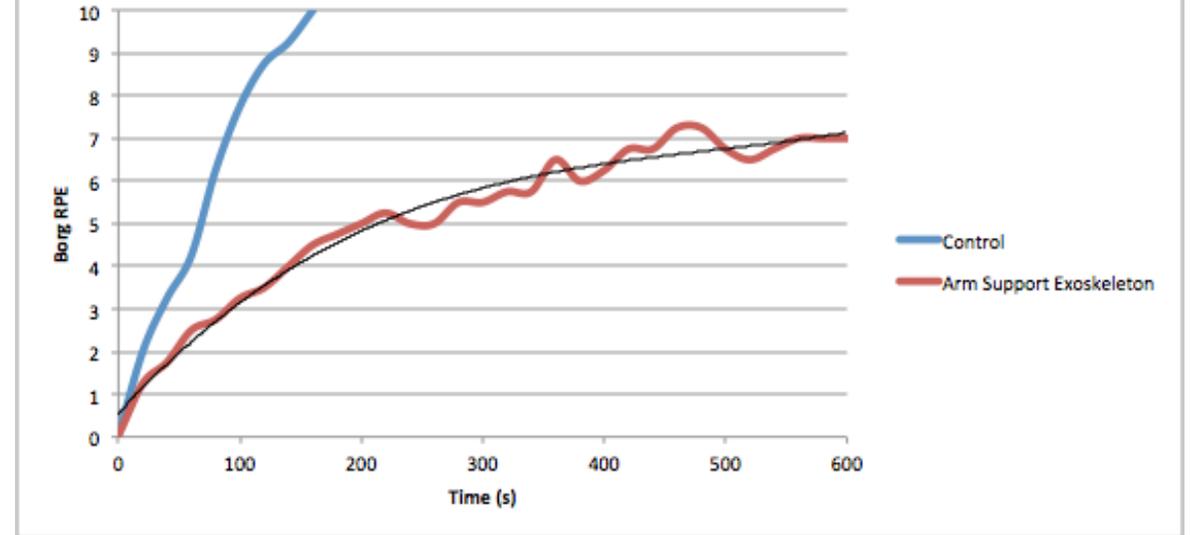


backX Study

- Study conducted through the University of California at Berkeley
- EMG probes were placed on subjects while conducting bending tasks
- Average reduction of lower back (L5/S1) muscle activation: 66%

*Currently testing partners in Construction Industry, Universities, and the State of Washington

Dynamic Welding Simulation Perceived Exertion Test



shoulderX Study

- Subjects were instructed to simulate a weld, holding a 1kg tool
- A rating of perceived exertion (BORG RPE10) was recorded at 20s intervals
- Avg. fatigue time without shoulderX: 2m15s
- Avg. fatigue time with shoulderX: 15m30s

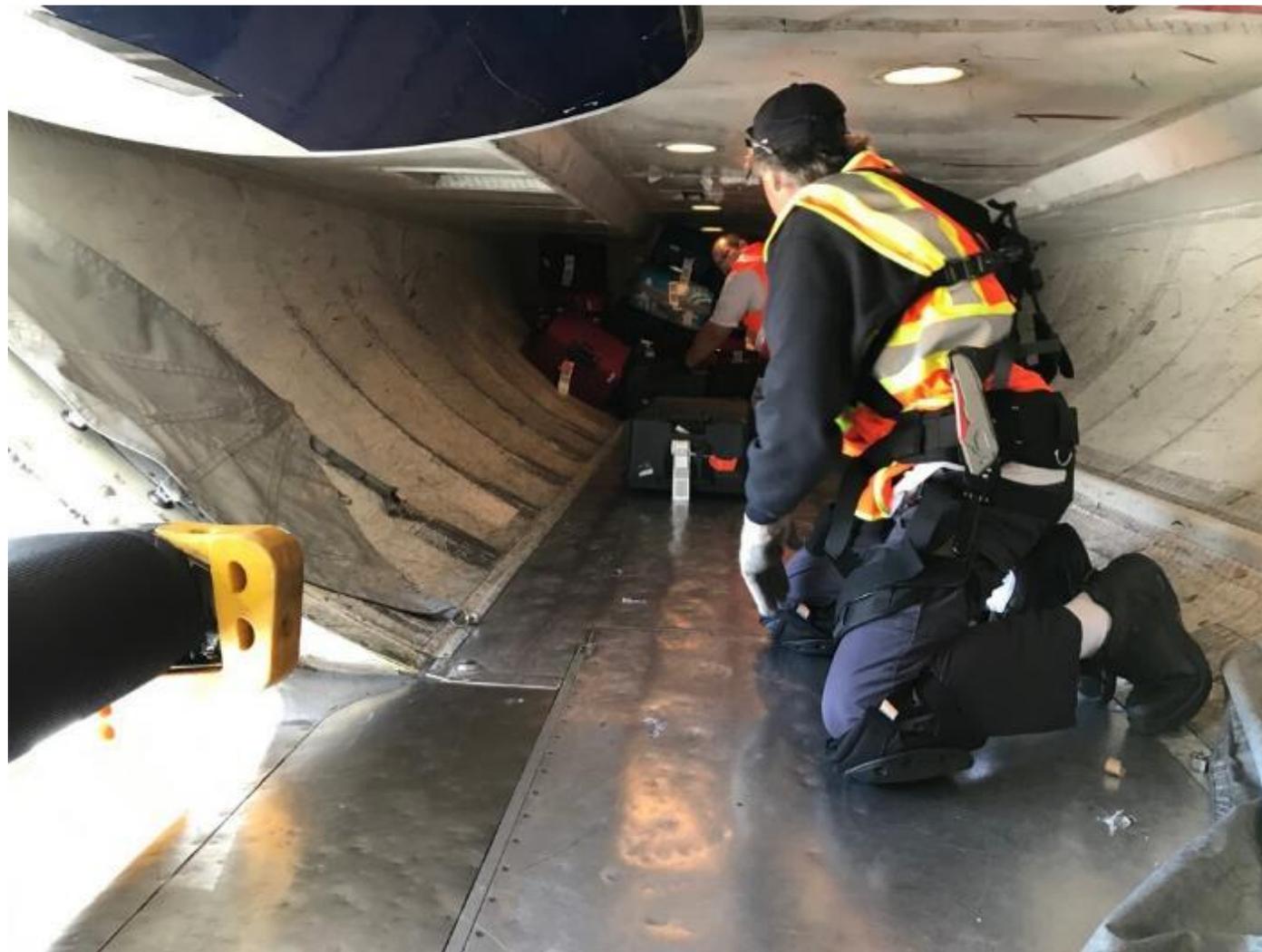
Productivity Benefit Calculator

Cost/Benefit	Variables	Unit of Measurement
V2: X - Unit Cost	\$4,000	Dollars per each
Payback Period (Device Time in Use)	4000	Hours (1 year=2000hrs)
Productivity Boost (variable)	2.5%	(i.e. 2.5% = 12 mins per 8 hr shift)
Manhour Cost (variable)	\$40	Dollars per hour
Safety Value (variable, but cost not included in this example)	Priceless!!!	Dollars/Workplace Quality/Peace of Mind/Goodwill/etc.

ROI during Payback Period	\$4,000
Total Investment (ROI minus cost of X-Unit)	\$0

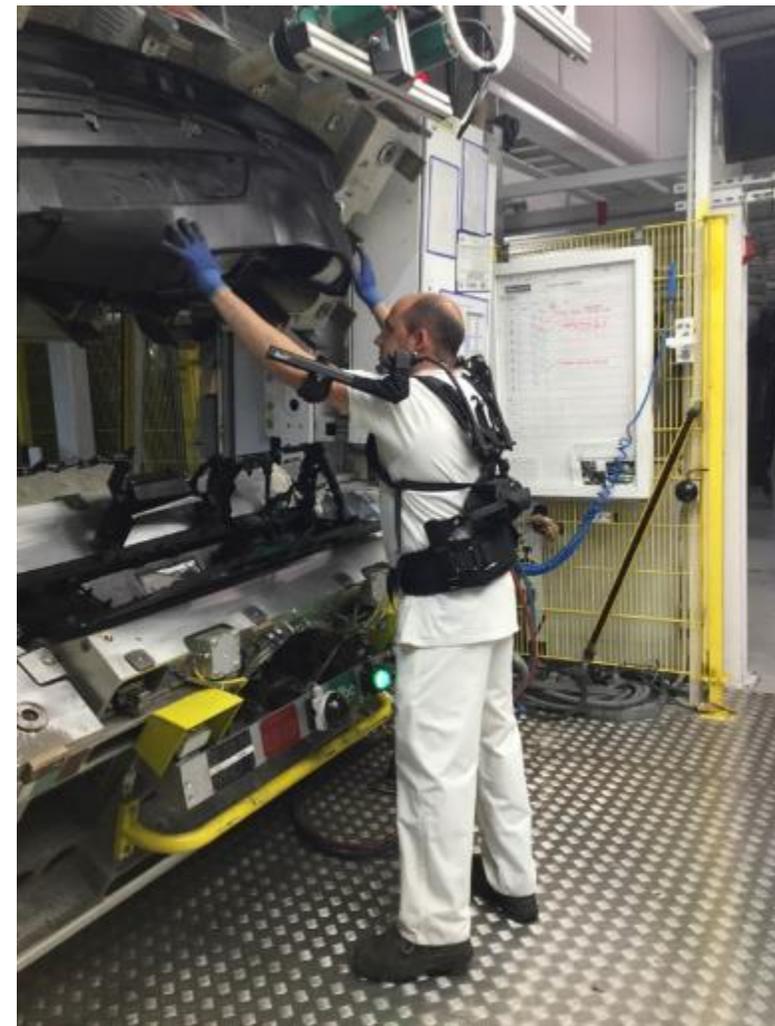
5%=24mins=\$5K net savings

8%=38mins=\$10K net savings

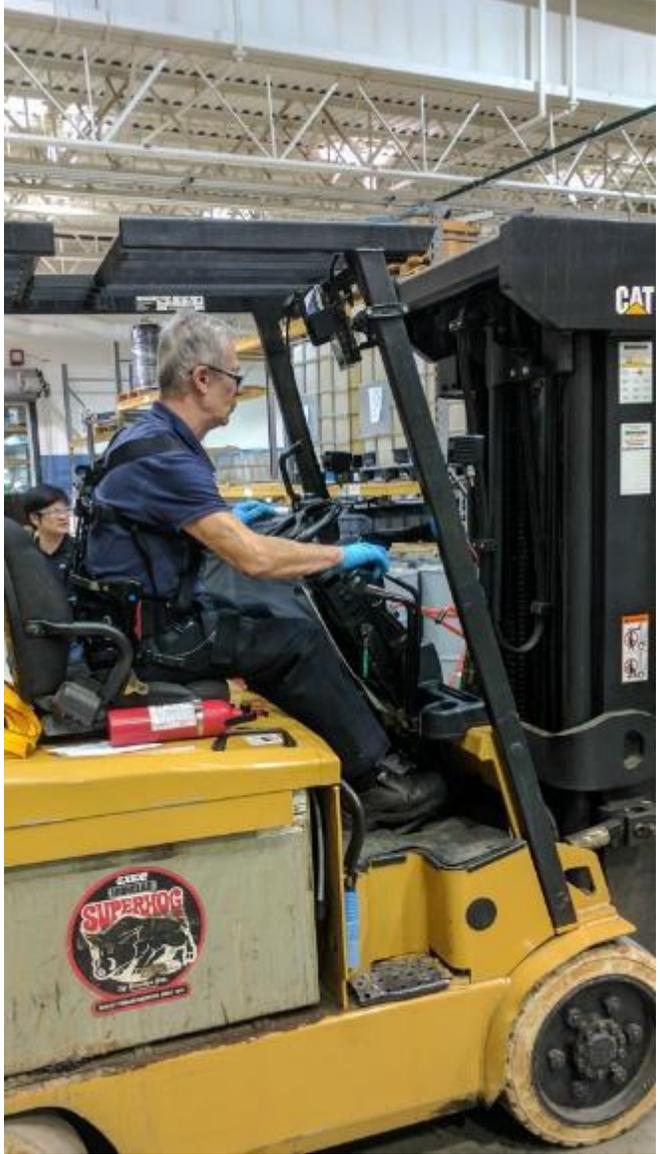


legX (left) and backX AC (right) being used for baggage handling

SUITX



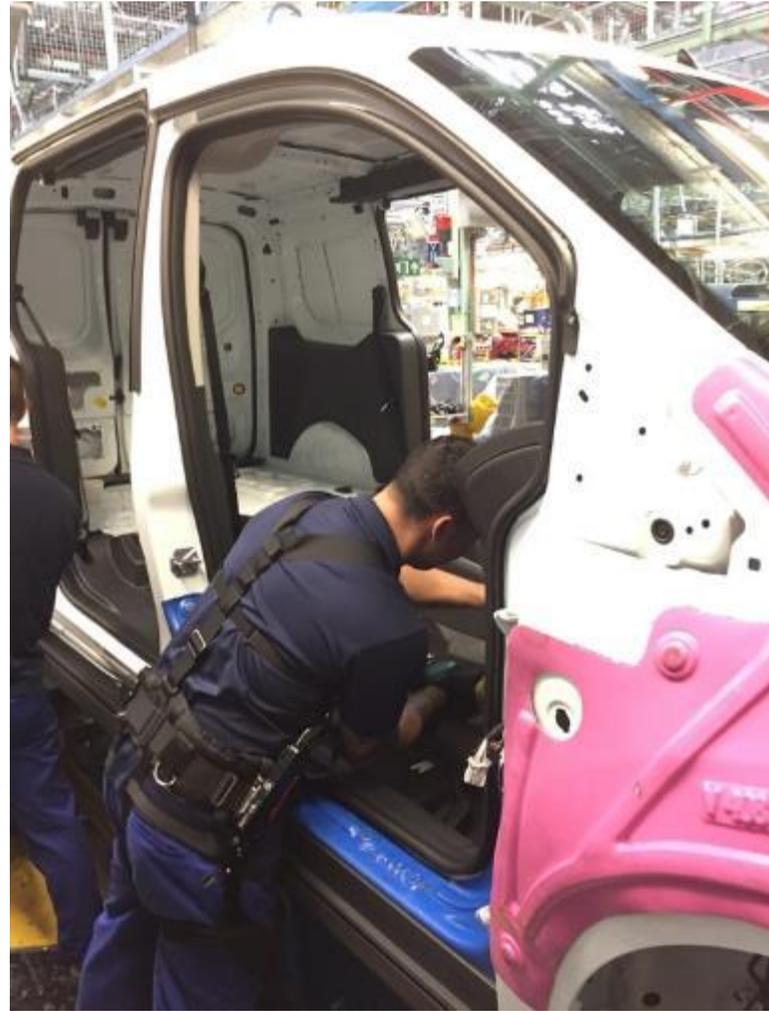
shoulderX being used in the Automotive Industry



All devices can be worn while operating vehicles (backX AC shown above)



backX AC being used for warehousing



backX S being used for warehousing and automotive assembly



Videos

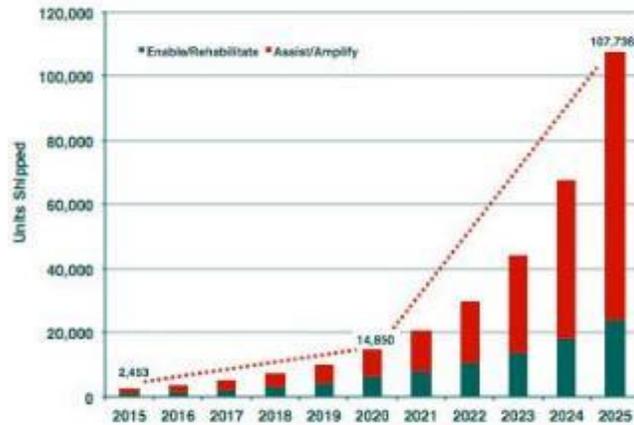
[suitX Application Video Link](#)

[backX AC/S Order Picking](#)

[shoulderX Application Link](#)

■ Exoskeletons: Total Units, Enable/Rehabilitate and Assist/Amplify

World Market, Forecast: 2015 to 2025



Assist/Amplify Eventually Dominates

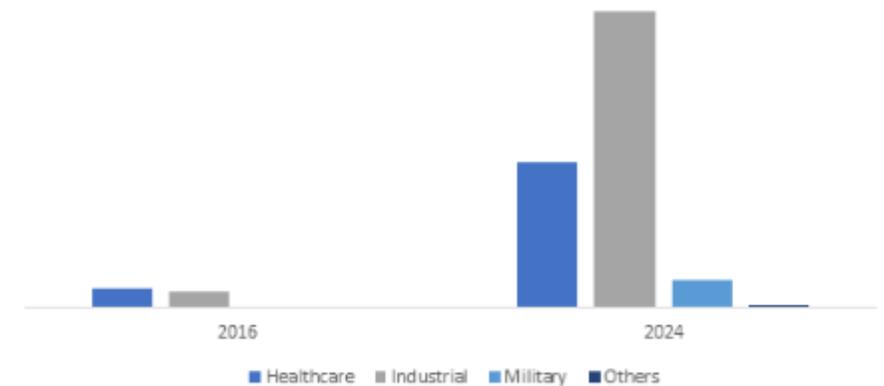
- Compared to enable/rehabilitate systems:
 - Larger overall market
 - Fewer regulatory hurdles
 - Technically less complex
 - Lower cost

→ Units that assist/amplify are largely tied to the commercial/industrial sector, including construction

Industry Trends

Exoskeleton Market size was worth over USD 110 million in 2016 and its shipment volume will surpass 86,000 units in 2024.

U.S. Exoskeleton Market, By Application, 2014-2024, (USD Thousand)



[Exoskeleton Market worth \\$3.4bn by 2024: Global Market Insights, Inc.](#)





- Austria
- Australia
- Brazil
- Bulgaria
- Canada
- France
- Germany
- Hong Kong
- Italy
- Japan
- Malaysia
- Mexico
- Spain
- Turkey
- United States

Devices sold in over 15 countries!