



Creating Disruptive Products

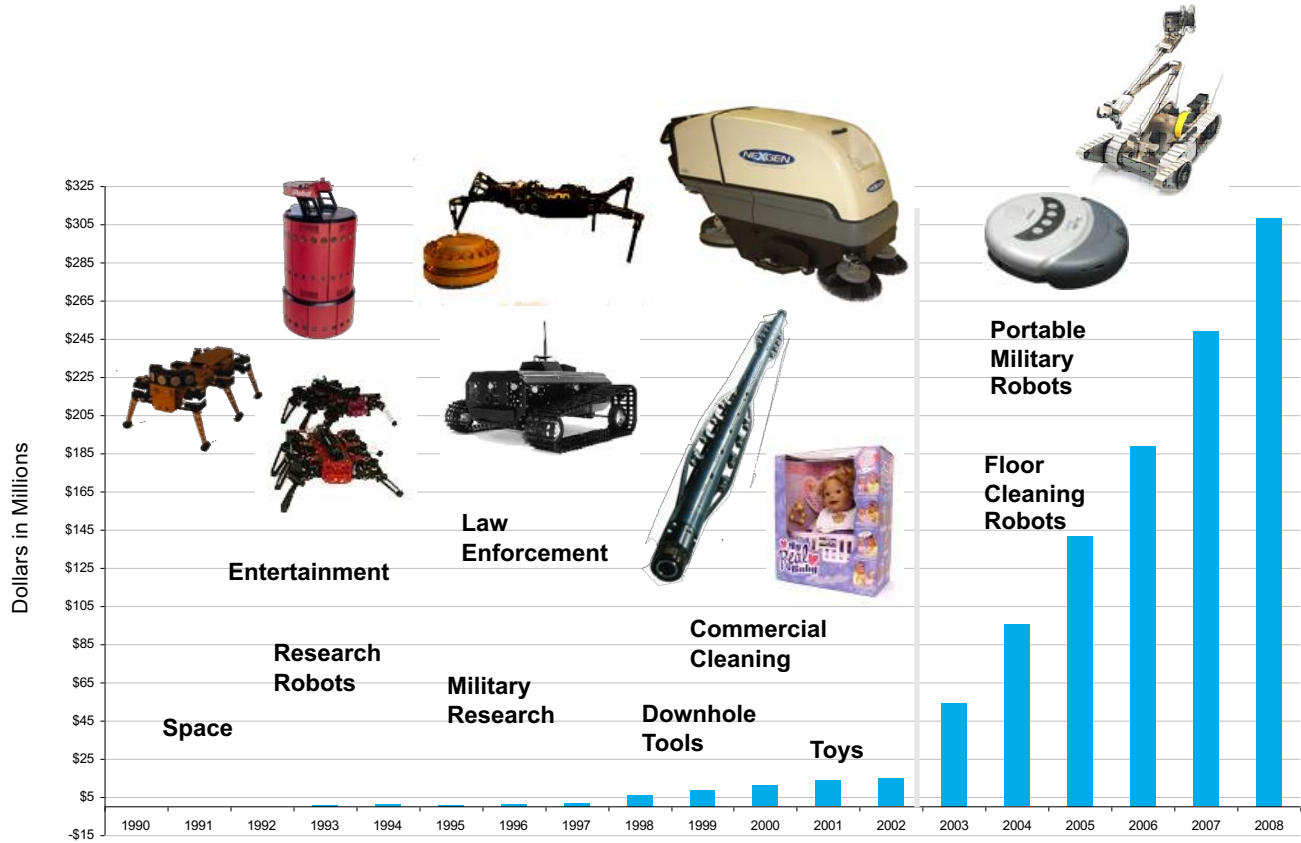


A Drones-Eye View









Just as we planned it 15 years earlier!



#SCIFEST



Disruptive Products

- **Technology**
 - Strong Axes
 - Cost
 - Modular/Reuse
 - Road Map
 - Human Interface
- **Humanity**
 - Passionate People
 - Getting Lucky
 - Pursue Your Passion
 - Consequences



Technology

Strong Axes

Strong Axes

- Time
- Frequency
- Floor coverage

Weaker Axes

- Power
- Waste storage
- Non-floor coverage



Strong Axes - Electric Lawnmowers

Strong Axes

- No gas smell
- Cordless
- No gas hassle
- Seasonal maintenance

Weaker Axes

- Power
- Run-time

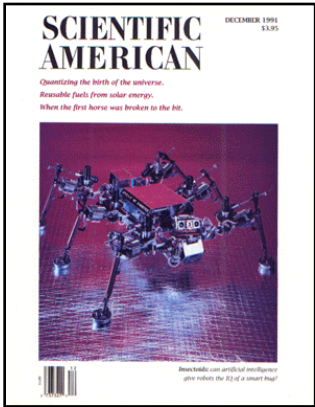


Cost



- Take cost goal seriously
- Margin requirements
- Price is market/capability/volume dependent

Cost



Cost

- Roomba
 - Launched for \$200 in 2002
 - Bill of material <\$100 including assembly
 - Spreadsheet
 - Inventions for cost- reliable IR sensing



Modularity

- Testing ease
- Debugging ease
- Ease of service



Modularity

Generation 1 Roomba

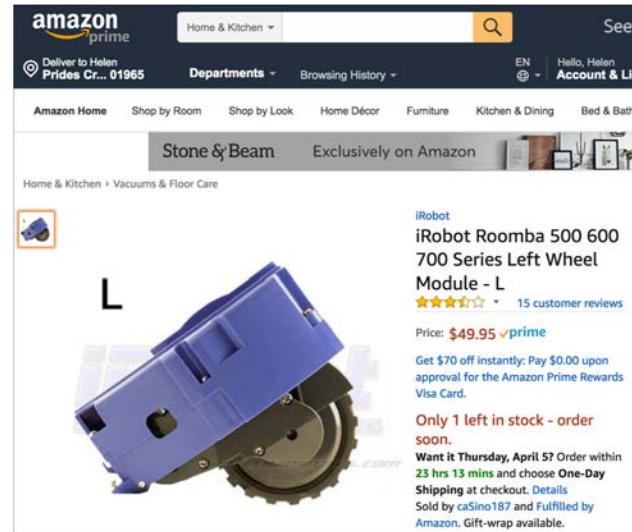
- Not modular
- Malfunction = whole robot replacement
- E.g. Treads



Modularity

Generation 3 – Modular Roomba

- Debugging
- Statistical testing
- Warranty replacement
- User self-serve



The screenshot shows the Amazon product page for the iRobot Roomba 500 600 700 Series Left Wheel Module - L. The page features the Amazon Prime logo, a search bar, and navigation links. The product is displayed with a large image of the blue wheel module and a smaller inset image. The product title is "iRobot iRobot Roomba 500 600 700 Series Left Wheel Module - L". The price is listed as \$49.95 with a Prime logo. There are 15 customer reviews shown as stars. The page also includes promotional text about a \$70 off instant discount and a warning that only one unit is left in stock.

amazon prime Home & Kitchen

Deliver to Helen Prides Cr... 01965 Departments

Amazon Home Shop by Room Shop by Look Home Décor Furniture Kitchen & Dining Bed & Bath

Stone & Beam Exclusively on Amazon

Home & Kitchen > Vacuums & Floor Care

iRobot
iRobot Roomba 500 600
700 Series Left Wheel
Module - L
★★★★☆ 15 customer reviews

Price: \$49.95 **prime**

Get \$70 off instantly: Pay \$0.00 upon approval for the Amazon Prime Rewards Visa Card.

Only 1 left in stock - order soon.

Want it Thursday, April 5? Order within **23 hrs 13 mins** and choose **One-Day Shipping** at checkout. [Details](#)

Sold by caSino187 and Fulfilled by Amazon. Gift-wrap available.

Roadmap

- Product to market is always priority
- Cost and schedule killer
- Roomba recharging station, navigation, voice control
- Future generations



Human Interface

- Buttons
- WiFi/Smart Phone
- Voice

- Autonomous



3 buttons



app



1 buttons



voice

Humanity

Passionate People

Small Groups With Passion...



Can Change The World

Passionate People

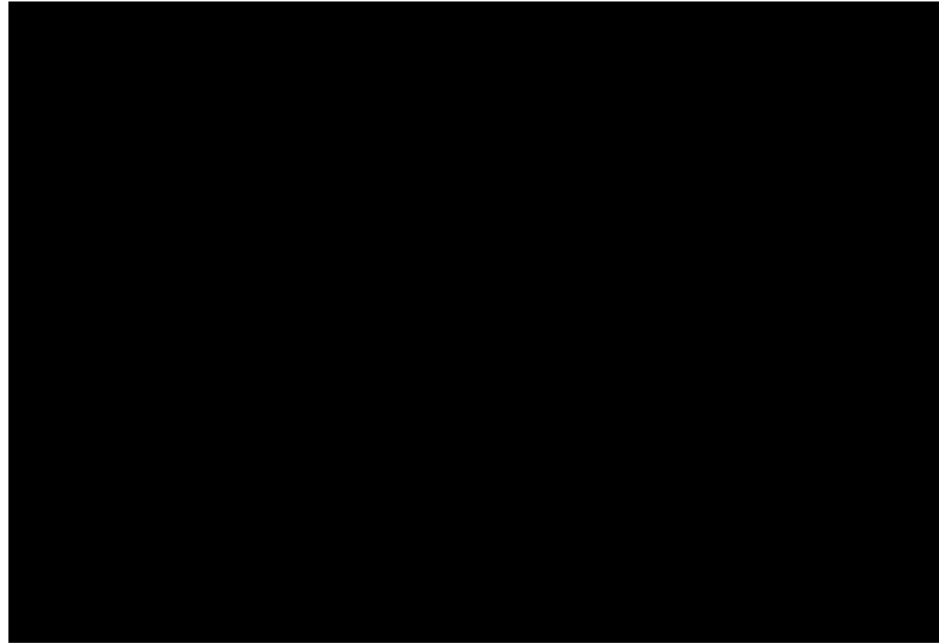
~~Resie~~

~~CyberSuck~~

~~Dirtanator~~

~~Muck Master 2000~~

Getting Lucky



Corner Cases

- Tough real world issues
 - One tall reed
 - Bullnose stairs
 - Snow and hail
 - Higher than US steps
 - GPS outages
 - Interference from other systems
 - Multiple extremes simultaneously



“All sensor suck in their own way” HG

Consequences

- Tesla on Autopilot Decapitates driver
- Uber Self Driving Vehicle Kills Cyclist
- Tesla Autopilot in Fatal Crash

Consequence must be factored into design, test, and deploy decisions



Human Robot Cooperation

- Humans make incredible primary systems
- Humans make terrible real-time backup systems
 - Over-reliance on technology
 - Boredom
 - Fatigue
- Humans make great “phone a friend” support



Pursue Your Passion

“Too science fiction”

“We don’t make investments
in this space”

“Not an Internet company,
We don’t have time for this”

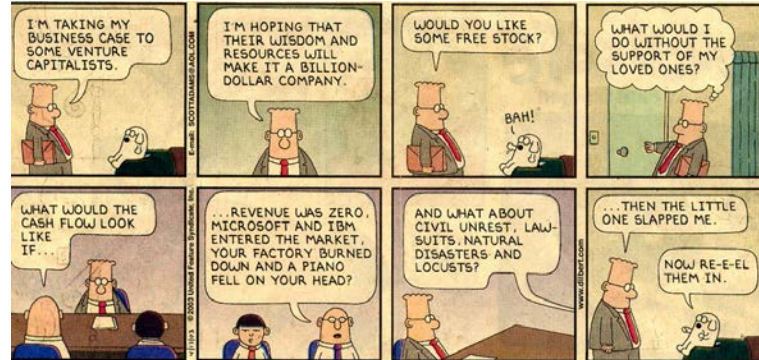
“My partners
would kill me”

“I gave
at the office”

“Pick a vertical”

“Too early stage”

“Too late stage”





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