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Transforming the World of Work

# Scrum for Hardware

Hubert Smits | June 15, 2016

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# About Hubert

- Certified Scrum Trainer – 2005
- Teaching – 5,000 CSMs
- Coaching – Fortune 1000, globally
- Researching –
  - Scrum for Hardware
  - Scrum from Government
  - Team Motivation
  - Psychology of Organizational Change
- Reach me – hubert@smitsmc.com

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# Live Tweet During The Webinar!

@ScrumAlliance
@HubertSmits
**#SAMW16**

Listening to a great webinar with
@HubertSmits and @ScrumAlliance!
#SAMW16

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# If you can kick it, you can Scrum it!

- Why Scrum for Hardware
- Principles
- Myths, examples
- Practices
- John Deere – a case study
- How to start
- Upcoming events

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# Why Scrum for Hardware

"The rules of the game in new product development are changing. Many companies have discovered that it takes more than the accepted basics of high quality, low cost, and differentiation to excel in today's competitive market. It also takes speed and flexibility."

*Hirotaka Takeuchi and Ikujiro Nonaka*
*The New New Product Development Game*
*Harvard Business Review, 1986*

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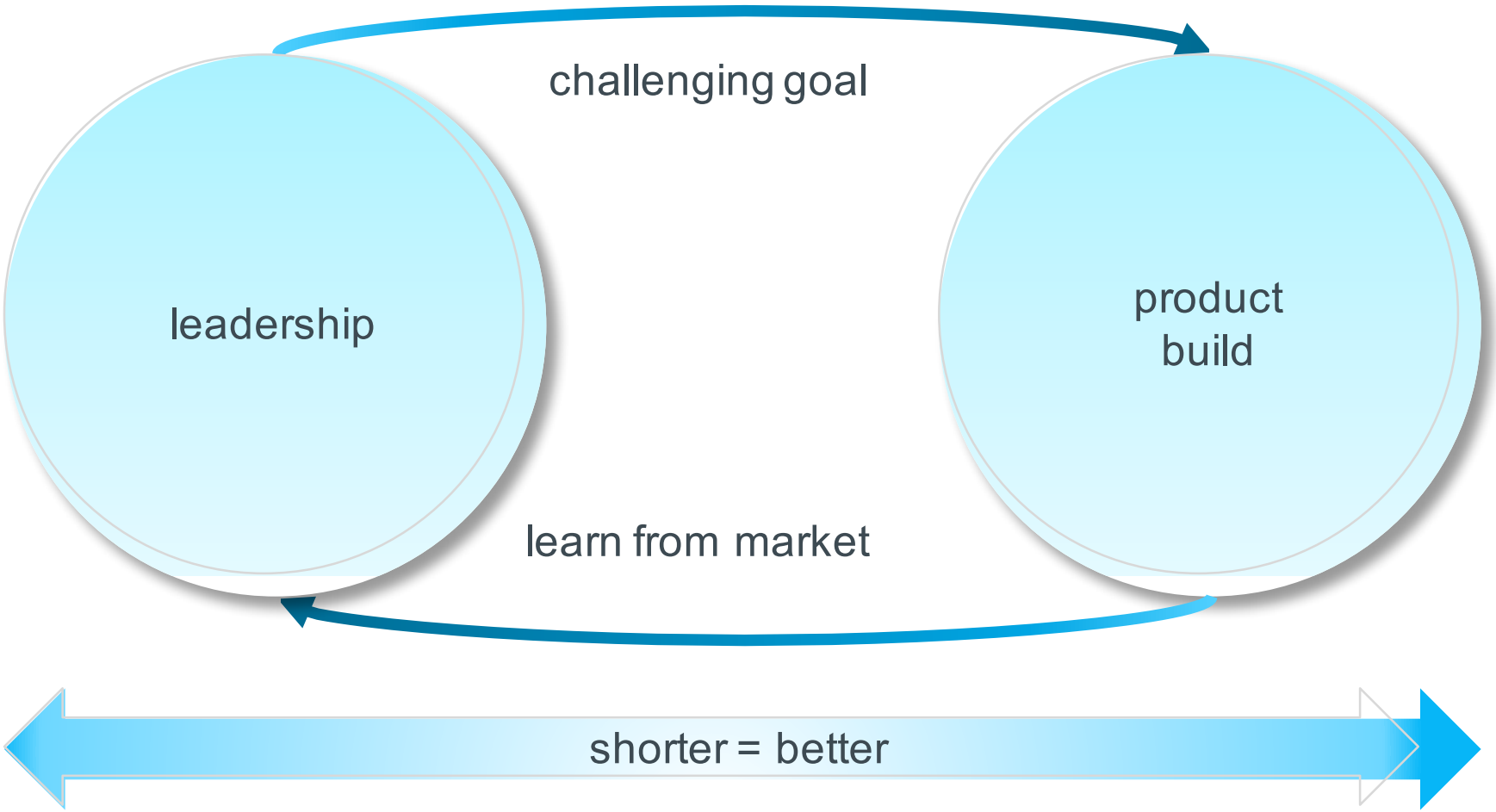
# “… it also takes speed and flexibility.”



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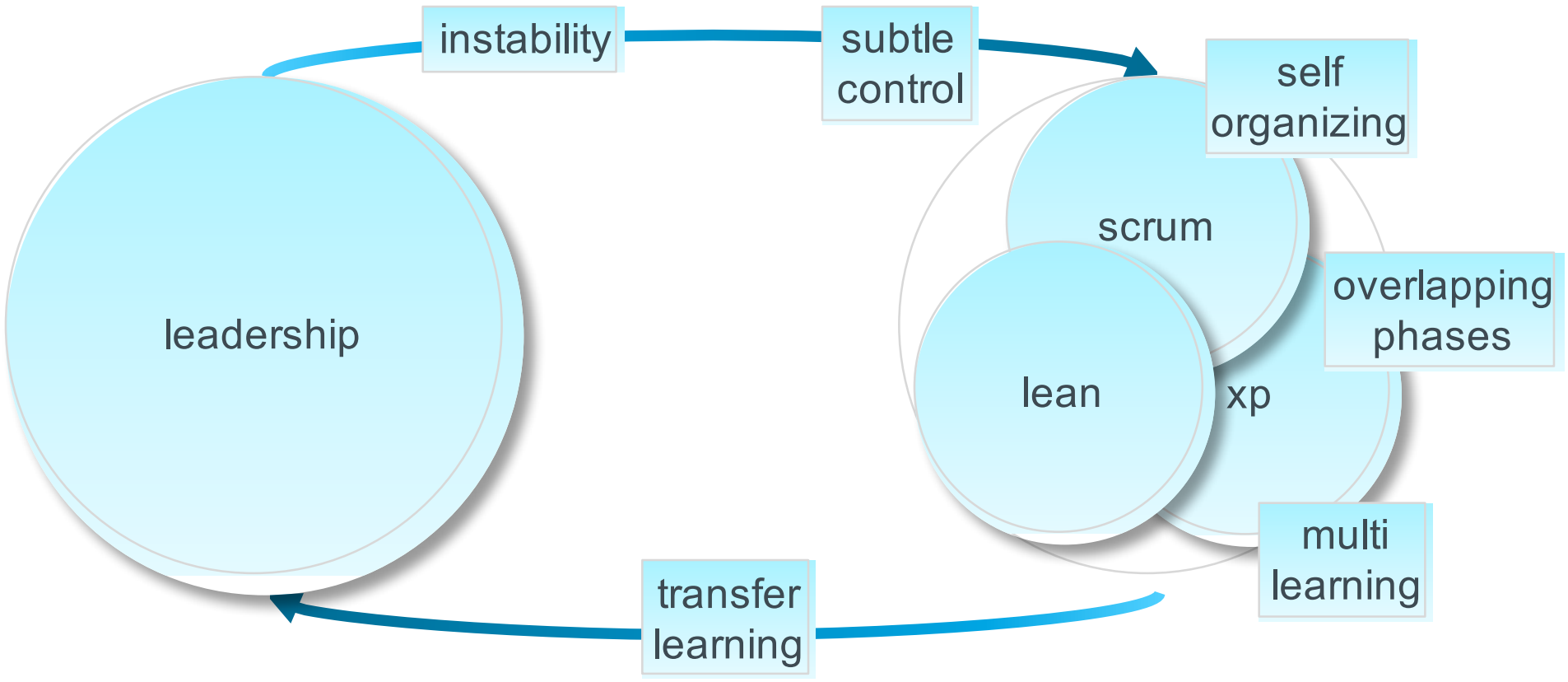
# Scrum for Hardware – Principles



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# Leadership… leads

**leadership**

- establishing direction
- aligning people
- motivating
- inspiring
- mobilizing people to achieve astonishing results
- propelling us into the future

**management**

- planning, budgeting
- organizing
- staffing
- measuring
- problem solving
- doing what we know how to do exceptionally well
- producing reliable, dependable results constantly

Source: John Kotter

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# Leading Product Development I

- Set broad, challenging goals, a strategic direction
- Development and solution: total freedom for the development team
- Create tension between the goals and the freedom
- Subtle control through selecting the right people, an open work environment, learning from product users. And by rewarding the team, establishing a rhythm, tolerating mistakes and encouraging self-organization

Source: Takeuchi & Nonaka

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# Leading Product Development II

- Accept that product development is nor a linear, nor a static process
- Management must promote the new process
- Companies must maintain a highly adaptive style

New product development is a catalyst to bring change into the organization

Source: Takeuchi & Nonaka

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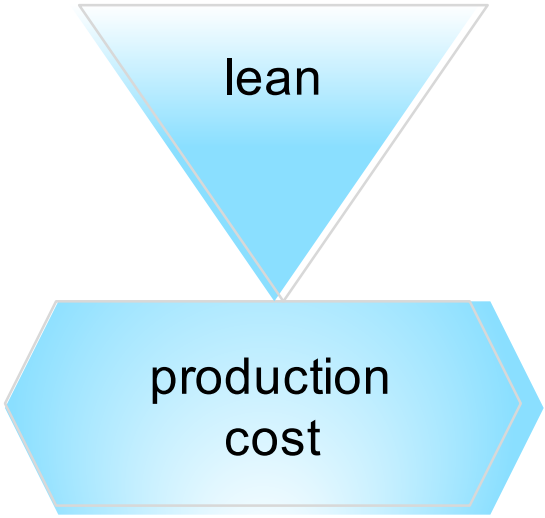
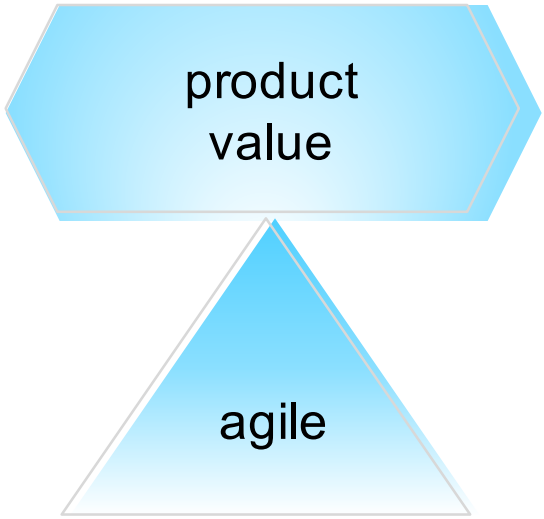
# Lean *plus* Agile…

lean… finds




less waste, more value:
value stream mapping,
A3–thinking,
mura - muda - muri…

agile… delivers




plan – do – inspect
iterative, incremental
people & collaboration
welcoming change…

Source: Joe Justice, ScrumInc

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# Lean *plus* Agile *equals* Scrum

Lean: Reduce waste, without frustrating your customer

+

Agile: Reduce the cost to make change

=

Scrum for Hardware

Lean alone makes an efficient company
with no innovation

Innovation is a variance!

Source: Joe Justice, ScrumInc

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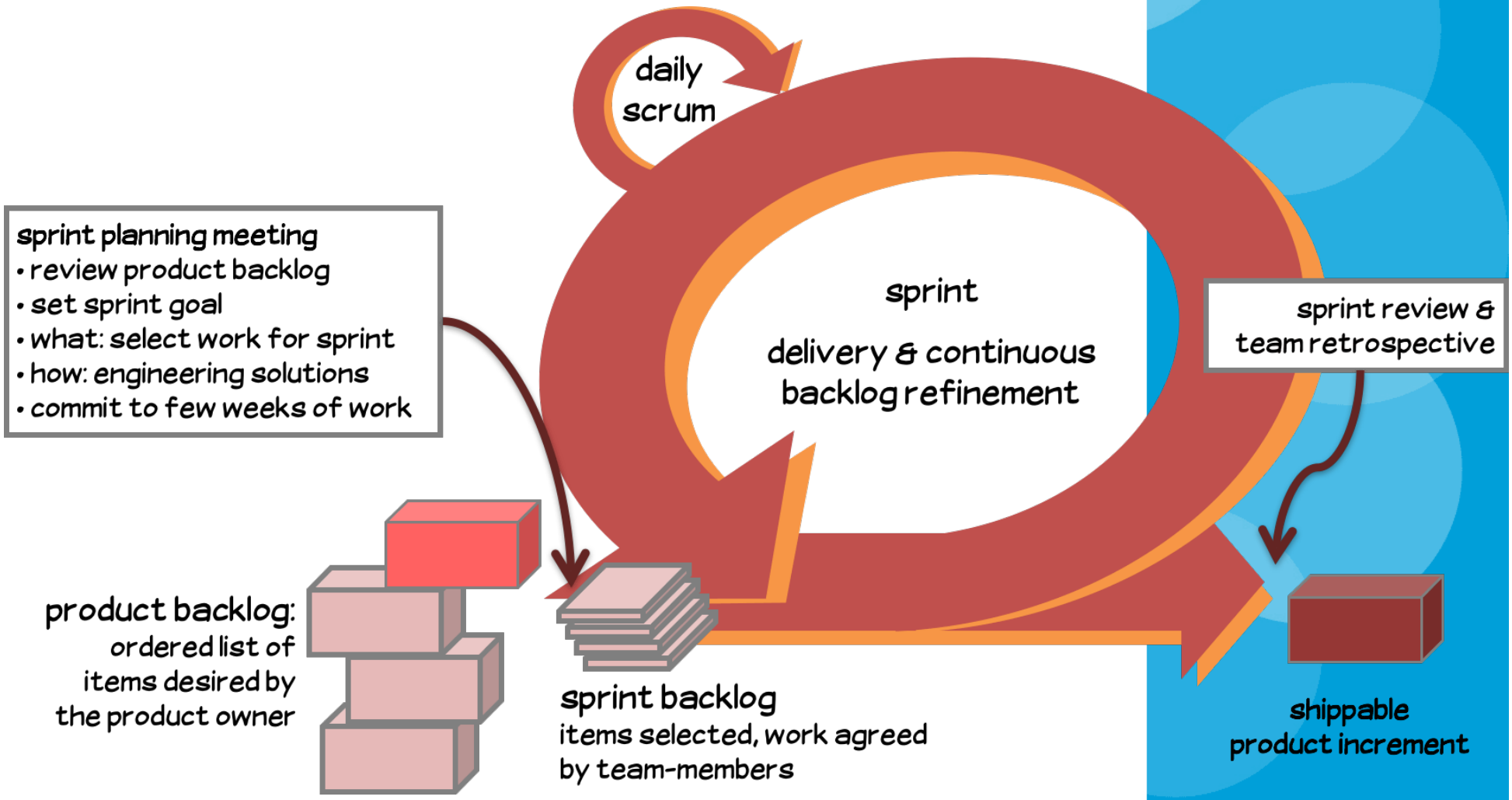
# Scrum



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# Myth: you can't iterate hardware


**Waterfall**

$143 billion over budget; delayed until 2022 (final systems integration)
cost of F-35C grew from $273 million in 2014 to $337 million by 2015


**Scrum**

Cumulative program cost of $15 billion; new iteration of all systems released every 6 months
SAAB JAS 39 Gripen cost: $43M

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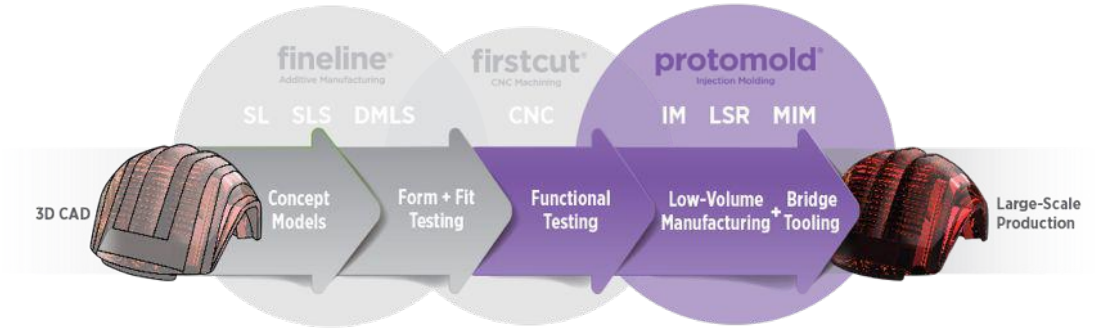
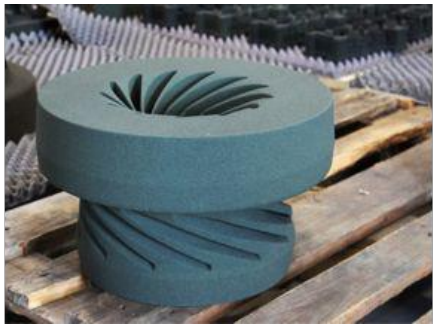
# Myth: You can't iterate hardware II

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# Shippable increments

Horizontal slice or modules

A stack of horizontal slices creates vertical slice; a component, or a product

An updated vertical slice is part of an updated version of a module

Show a vertical slice of the product: working, inspectable – every few weeks


Source: Joe Justice, WikiSpeed

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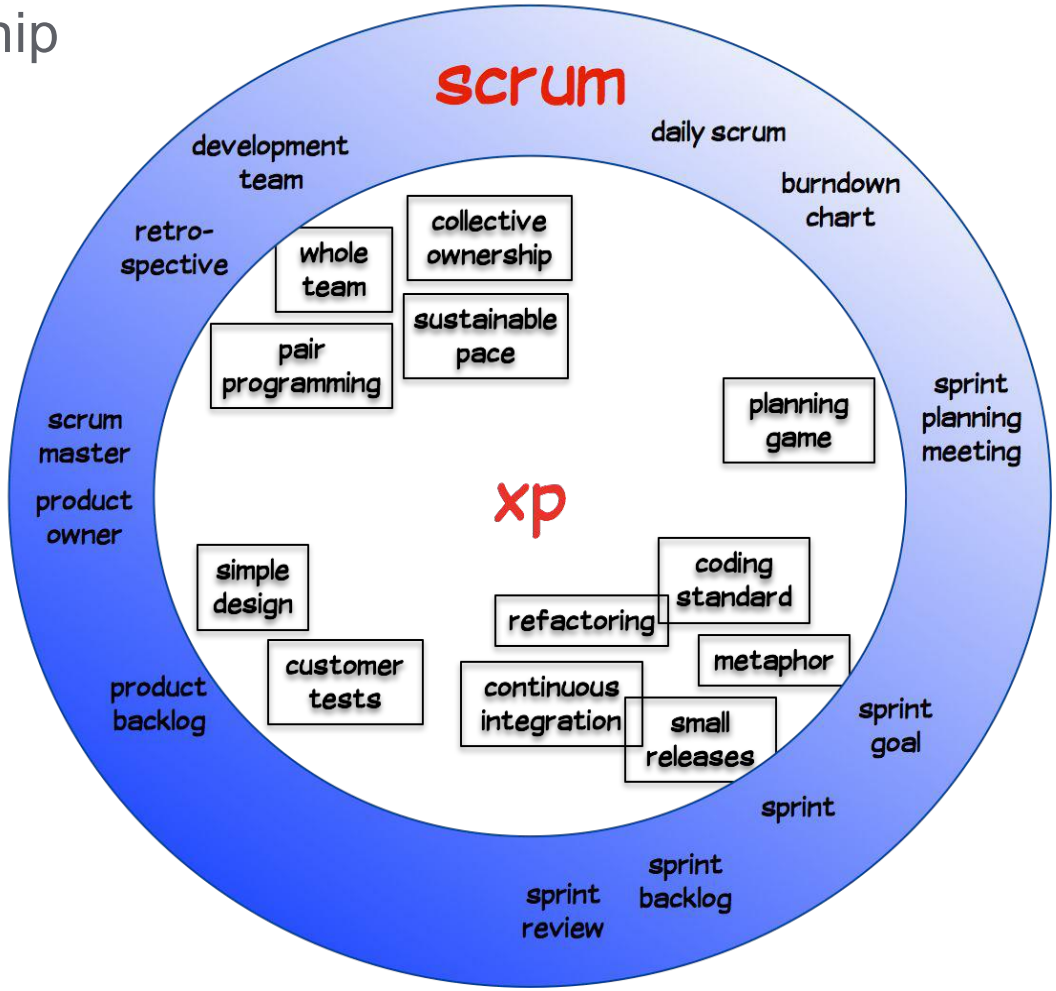
# eXtreme Programming: practices

- whole team, collective ownership
- sustainable pace
- pair programming, refactoring, coding standards
- simple design, customer tests
- continuous integration
- metaphor
- small releases, planning game



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# Whole team – feeder lines at Boeing

KEN DEJARLAIS PHOTO

Feeder lines provide subassemblies for installation on 777 twinjets in Everett, Wash. This process frees mechanics from installing many small parts on the airplane, resulting in decreased production time.

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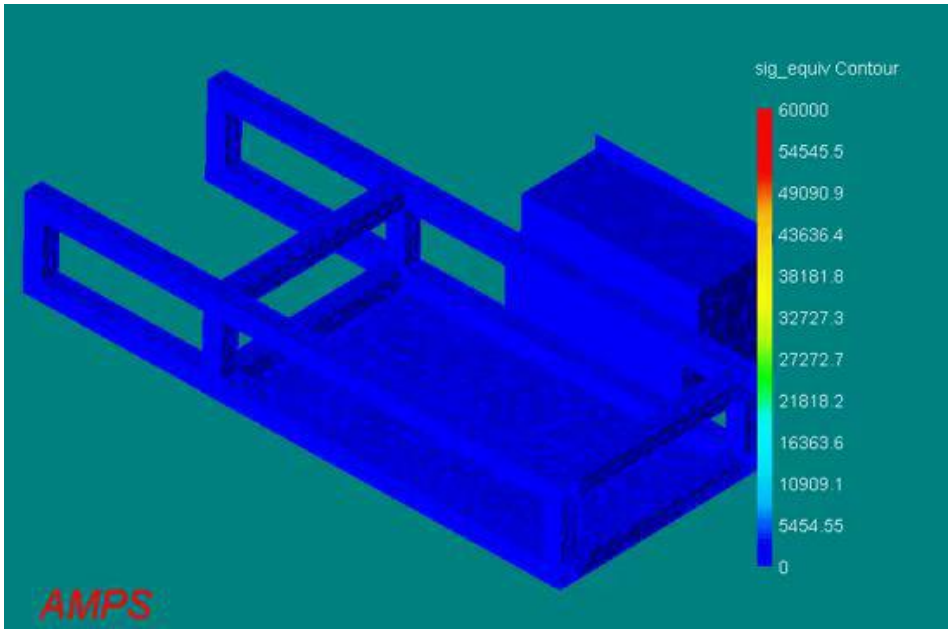
# Standards – Regulatory Driven Development

- Simulate impact tests
- Build prototype to match simulation
- Run actual test ($$$)
- Update simulation with actual data
- Accepted by government as meeting regulatory needs




Source: Joe Justice - WikiSpeed

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# Regulatory Driven Development

- Deere EPDP > 800 steps; Bosch Lifecycle Management > 800 steps
- These phase gate steps are meant to mitigate risk
- Scrum mitigates as much or more risk - TDD is typically one-to-one compatible with regulatory bodies
- Agile Project Management tools are accepted by auditors as process documentation
- Scrum teams with a Definition of Ready and a Definition of Done wins over middle management
- Scrum team with Release Burn Downs wins over middle & senior management and investors

Source: Joe Justice - ScrumInc

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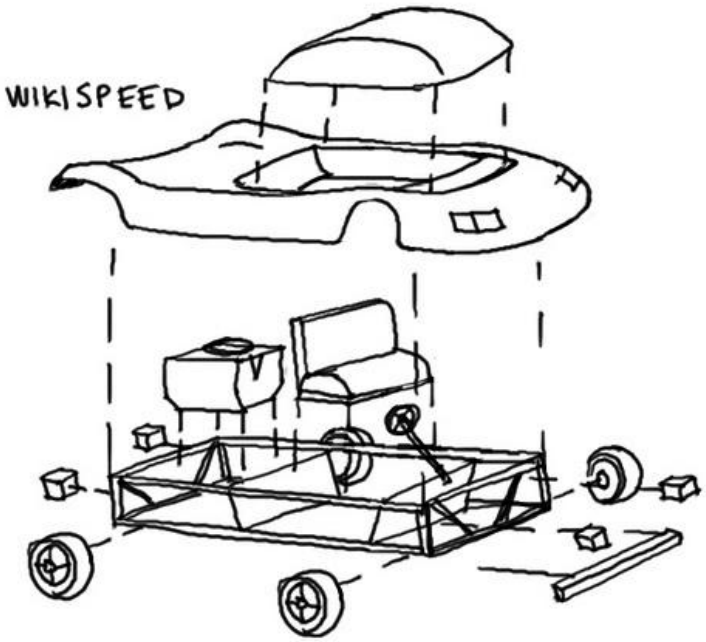
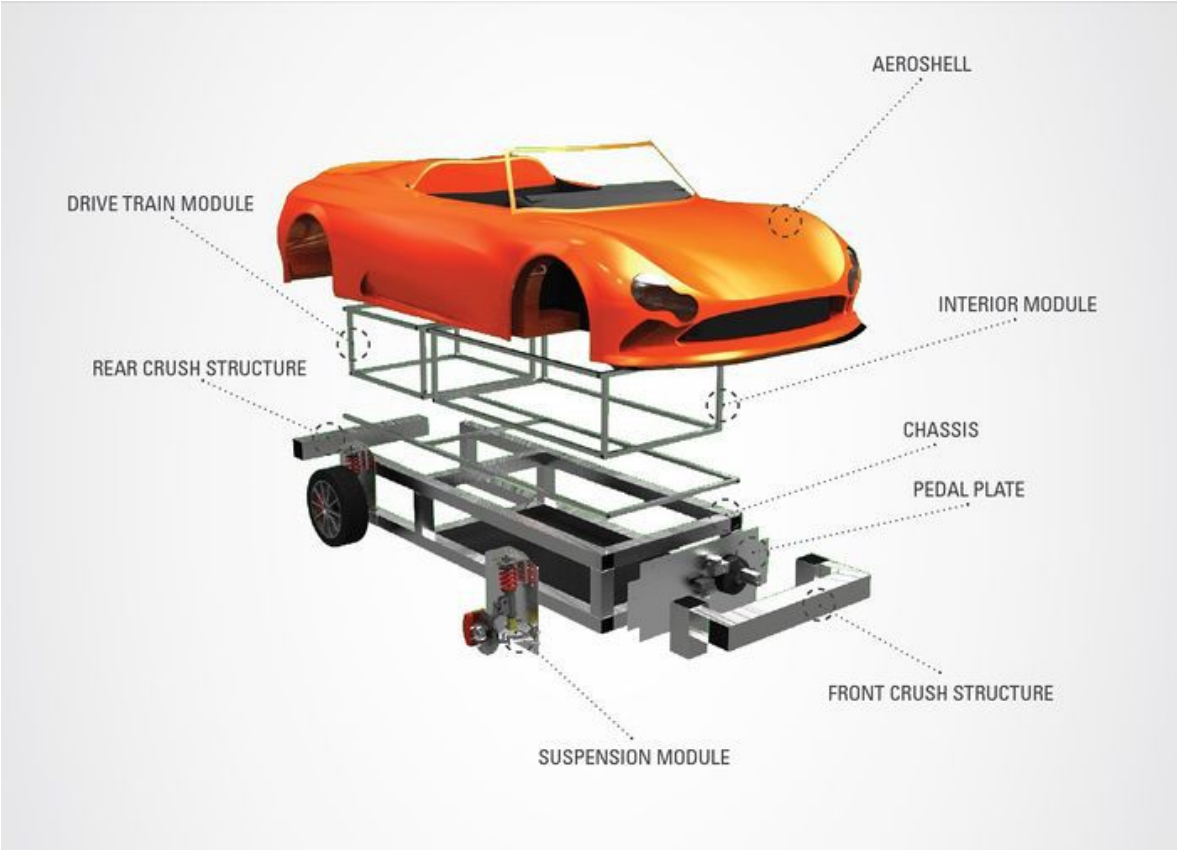
# Simple design




Source: Joe Justice - WikiSpeed

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# Simple design II

## NOTABLE FACTS

0 to 60 in less than 5.0 seconds

Weighs just 1,404 pounds

Continues to achieve 100 mpg up to and including 67 mph

Top speed of 149MPH

5-star crash test equivalency in all directions including front, rear, side, offset front, offset rear, rollover, and roof crush

Ability to adjust ground clearance from racing to sport utility

Has the cargo roo m to fit 20 bags of groceries or 6 golf bags


Source: Joe Justice - WikiSpeed

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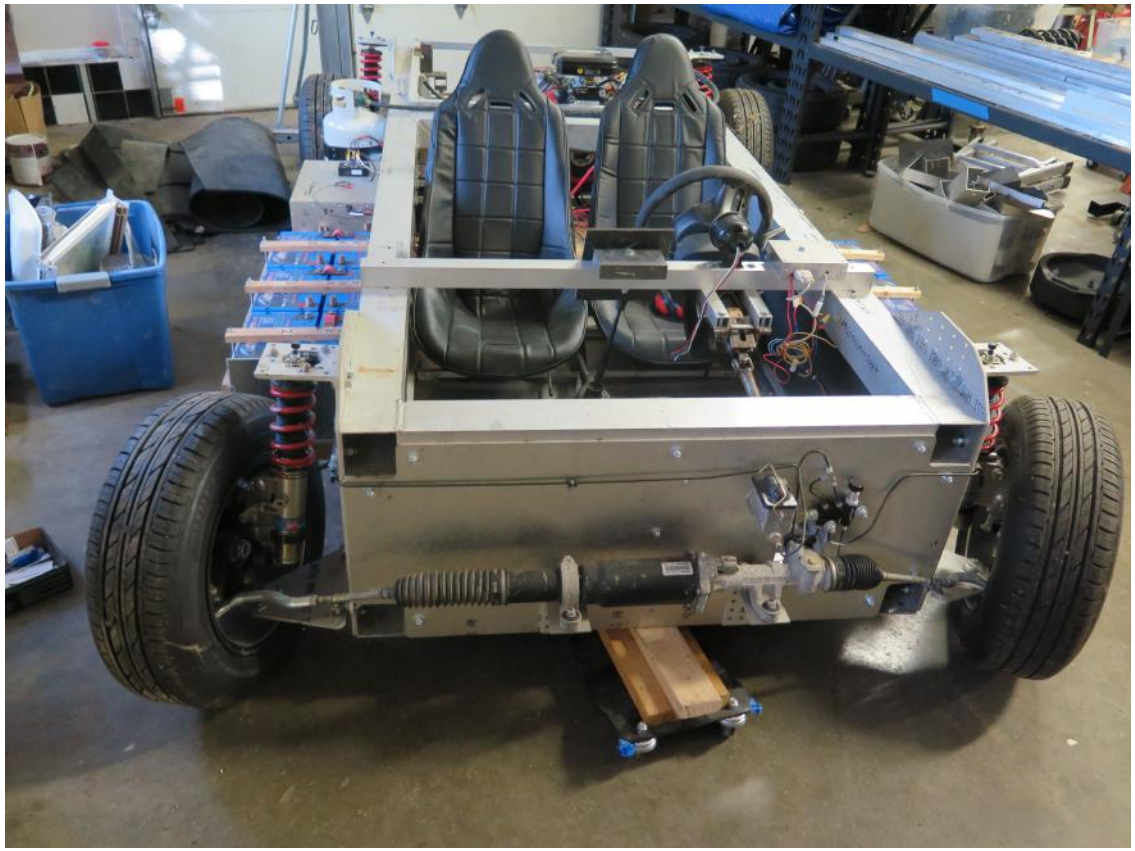
# Continuous integration

Shippable does not imply pretty

Fast learning, fast feedback



Source: Joe Justice - ScrumInc

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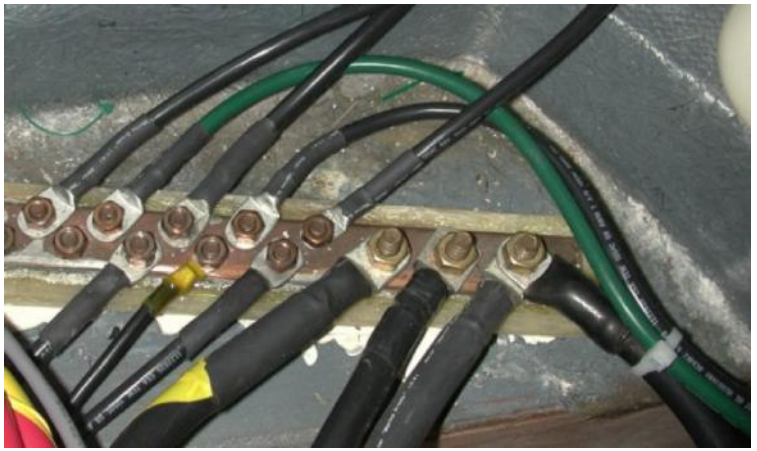
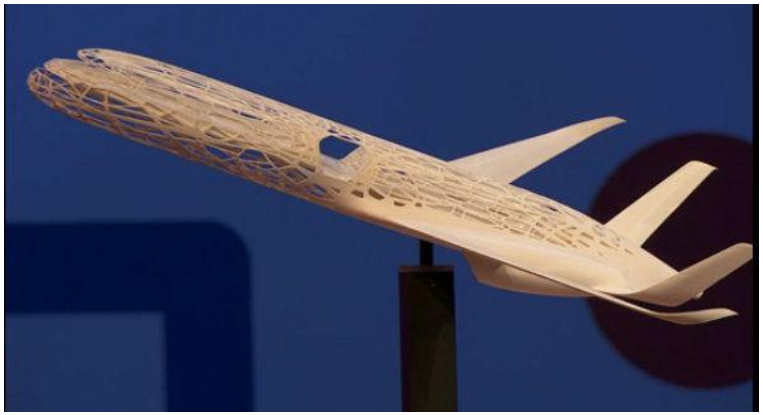
# Scrum4HW – Object Oriented Architecture

Encapsulation



Singleton



Abstract factory
Lazy instantiation

Source: Joe Justice - WikiSpeed

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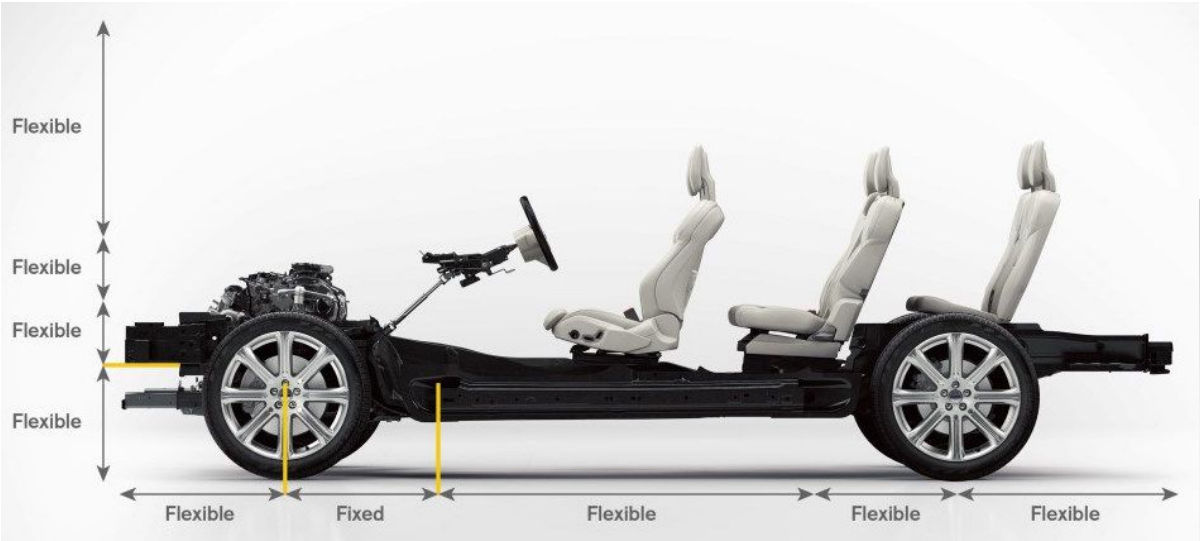
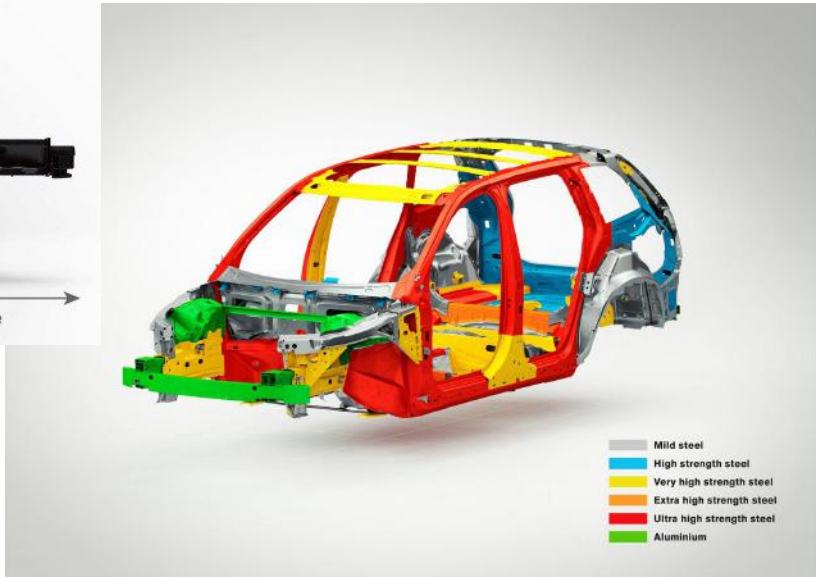
# OOA – Volvo Scalable Product Architecture

Contract-First design: reduce cost of future designs

Next: reduce cost of manufacturing process

Needed: known stable interfaces




Source: Joe Justice - ScrumInc

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# John Deere – case study

Situation in 2012:

- Process to drive innovation: > 800 process steps; aimed to mitigate risk
- Massive parallel processing: 27 projects; on average 10 projects per person
- Lacking collaboration: each project owned by a different manager

- No new products delivered for 7 years
- People productivity ~5% due to task switching (Weinberg)

Joe Justice – Scrum Inc

"Founder and CEO of WIKISPEED Inc., a non-profit automotive manufacturing company, credentialed and registered, dedicated to validating eco and autonomous technologies, with activities in 23 countries"

George Tome – John Deere

"I manage the agile global project/ program management organization and the agile development process eXtreme Innovation (XI) with teams in the five John Deere Global Technology Innovation Technical Centers"

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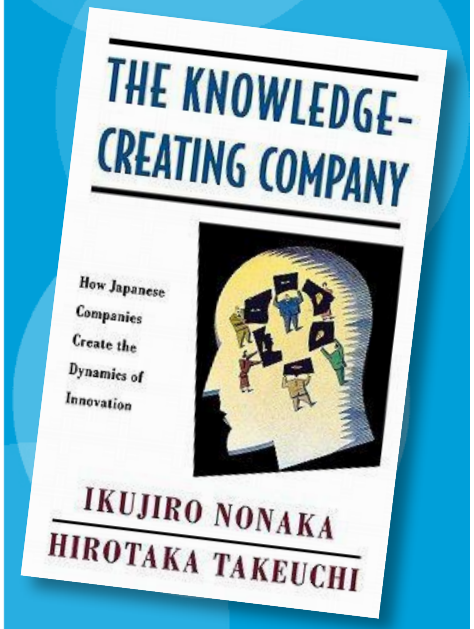
# Goal: a Learning Organization

- "The goal was to think unreasonably big, work as iteratively and as small as practical, deliver faster than what's been possible, and adjust and adapt constantly. We needed to become a learning organization with higher team engagement."

  George Tome (2012)

- "Organizational knowledge creation … the capability of a company as a whole to create new knowledge, disseminate it throughout the organization, and embody it in products, services and systems."

  The Knowledge Creating Company – Nonaka & Takeuchi (1995)



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# How the change happened

- Starting small – Team XI (eXtreme Innovation)
- Train Scrum, Coach Scrum – hire experience
- Create a cadence and collect data – velocity, value
- Improve velocity with the happiness metric
- Decide on change based on data

*Scrum as Shock Therapy*
*Scrum as a Flying Wheel*

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# John Deere – results

- XI team: doubles velocity in two months, goes up 7 times in 16 months
  (Pune team: 6 times velocity in 13 months)
  (Germany & Brazil teams: double velocity in 2 months)
- Employee satisfaction goes from bottom 30% within JD to top 1%
- Working prototype in 8 months (was 18-36 months)
  First deliveries included business cases
  Later deliveries included prototypes
  Final deliveries included the manufacturing process
- Working on 1 delivery (project) at a time, finishing 3 deliveries (projects) each year

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# Shippable – data every two weeks

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# Scrum4HW - how to start

## Lead with money, implement with respect for people

- Agree with the executive team on the urgency, build a coalition
- Look with “lean eyes” at the production process, select an improvement
- Enlist a volunteer army, enable them, remove barriers
- Generate short term wins, learn, inspect & adapt
- Sustain acceleration, institute the change

(John Kotter, 8-step process for Leading Change)

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# Events and reading

- Scrum for Hardware - Train the Trainer class:
  August 22-24 in Broomfield, CO
- Scrum for Hardware gathering:
  August 25/26 in Boulder, CO
- Wikispeed Build Party:
  August 27 in Boulder, CO

- To explore: Scrum4HW.com

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# QUESTIONS?

# Thank you for attending

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