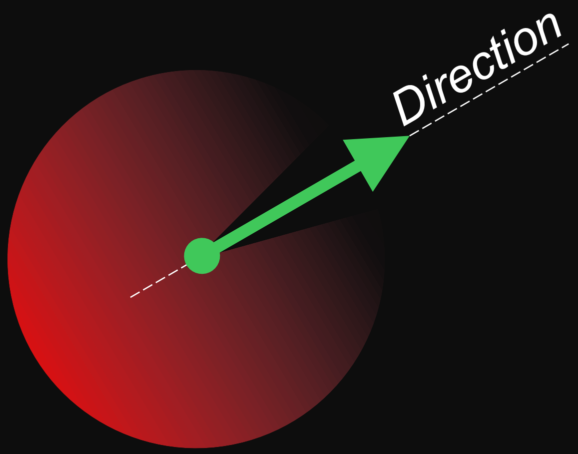
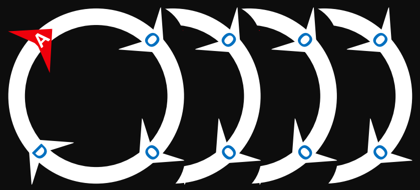
Learning Faster with Knowledge Based Design (KBD)

Keep it Simple – No Premium for Complication



Full Feedback Cycles



The Team's Work Flow

THE SCIENCE OF
IMPROVING INNOVATION

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If Customers Matter, Speed Matters

"If everything is under control, you're going too slow!"

Mario Andretti

5th generation fighter jets intentionally trade off stability for superior maneuverability at speed.

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The Feedback Cycle is the Heart of Learning & Development. Where the No. of Cycles Makes a Huge Difference.

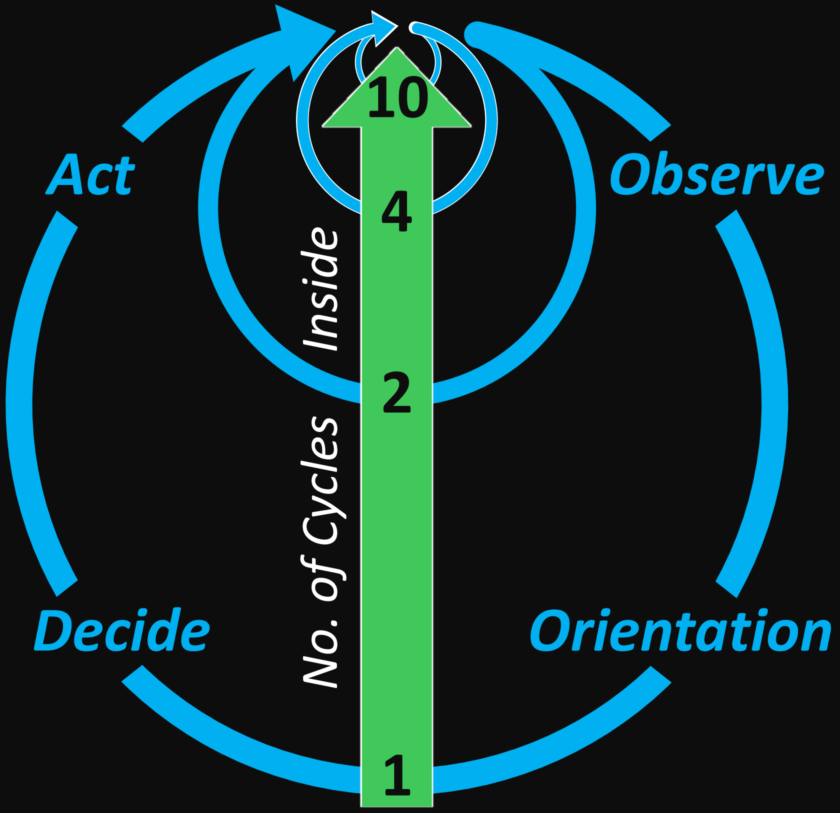

Image. John Boyd's OODA–loop, as example of efficient feedback loop.

Continuously shorten the cycle time of your feedback loops.

Today or in ten days?

Radically short feed-back loops becomes self-reinforcing.

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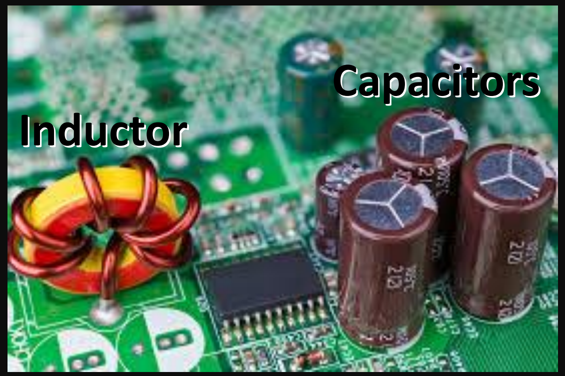
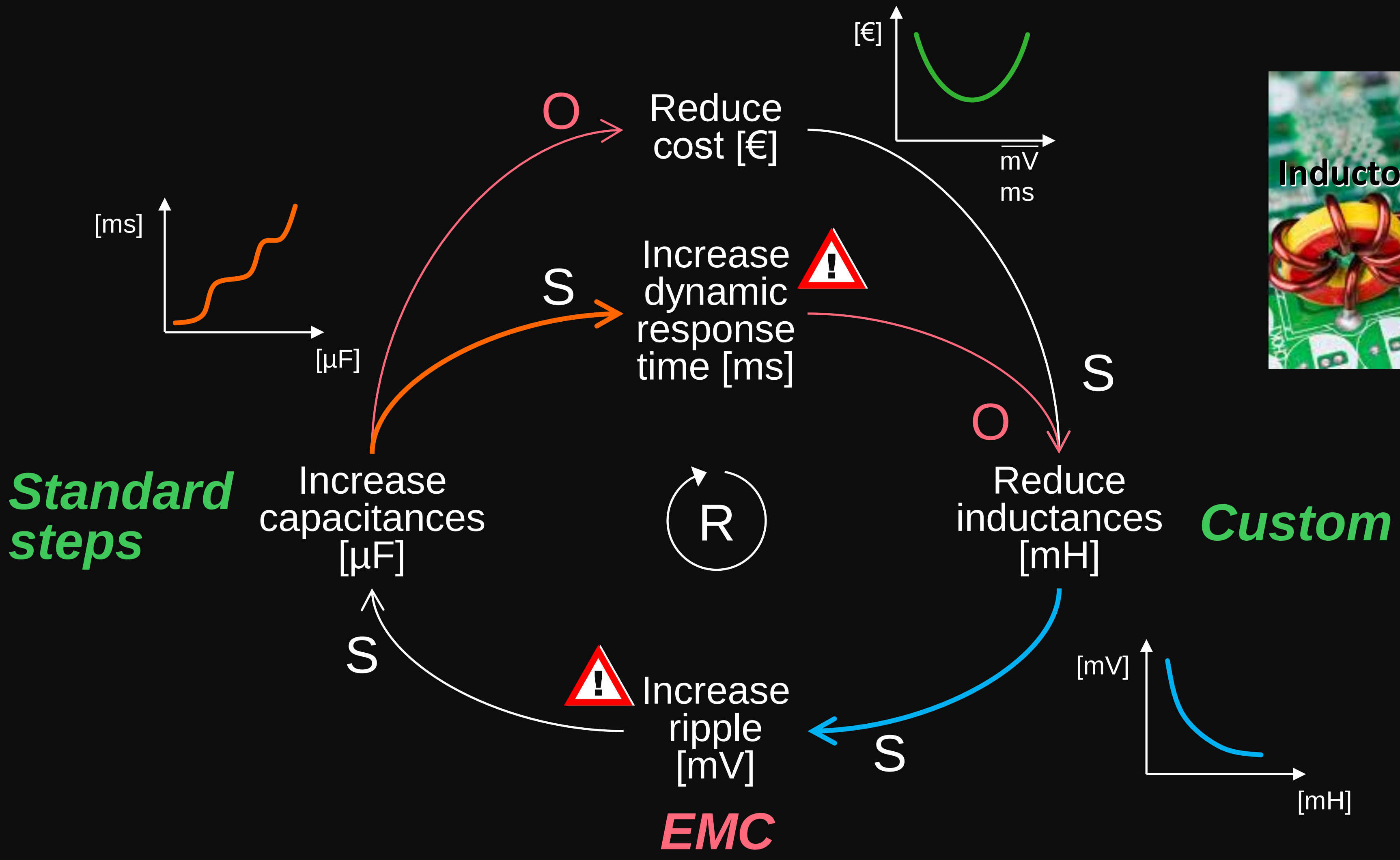
With Complex Systems Learning is Everything *(Causal Opacity)*

Same direction
Opposite direction
Reinforce

3x





Animation

Targeting, Defining **Gaps** Leads to Different Solutions (vs. Control)

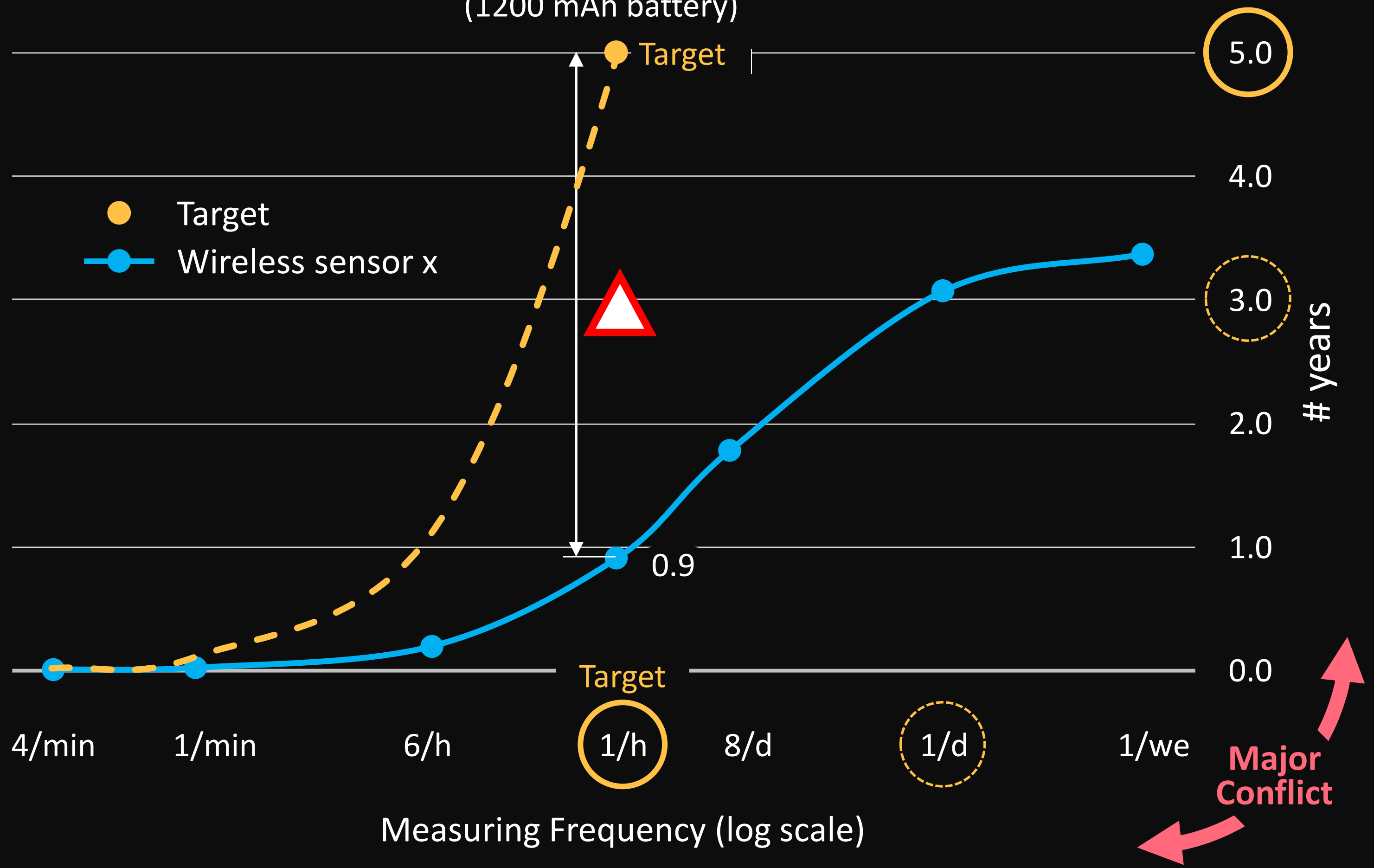
Current Condition

- Blue curve
- Sensor x
- “Wireless”

Target Condition

- Orange balloons
- **5 year** operation time
- Measuring **1x per hour**

First Testable Prototype – Theoretical Operation vs. Measuring Frequency @ 25 °C (1200 mAh battery)



Gap

- 4.1 years

Countermeasures

- Larger battery (>5x)
- Lower energy consumption
- Lower measuring frequency
- Reduce service life expectation

Close GAPS Set-based by applying multiple measures

… AND … AND …

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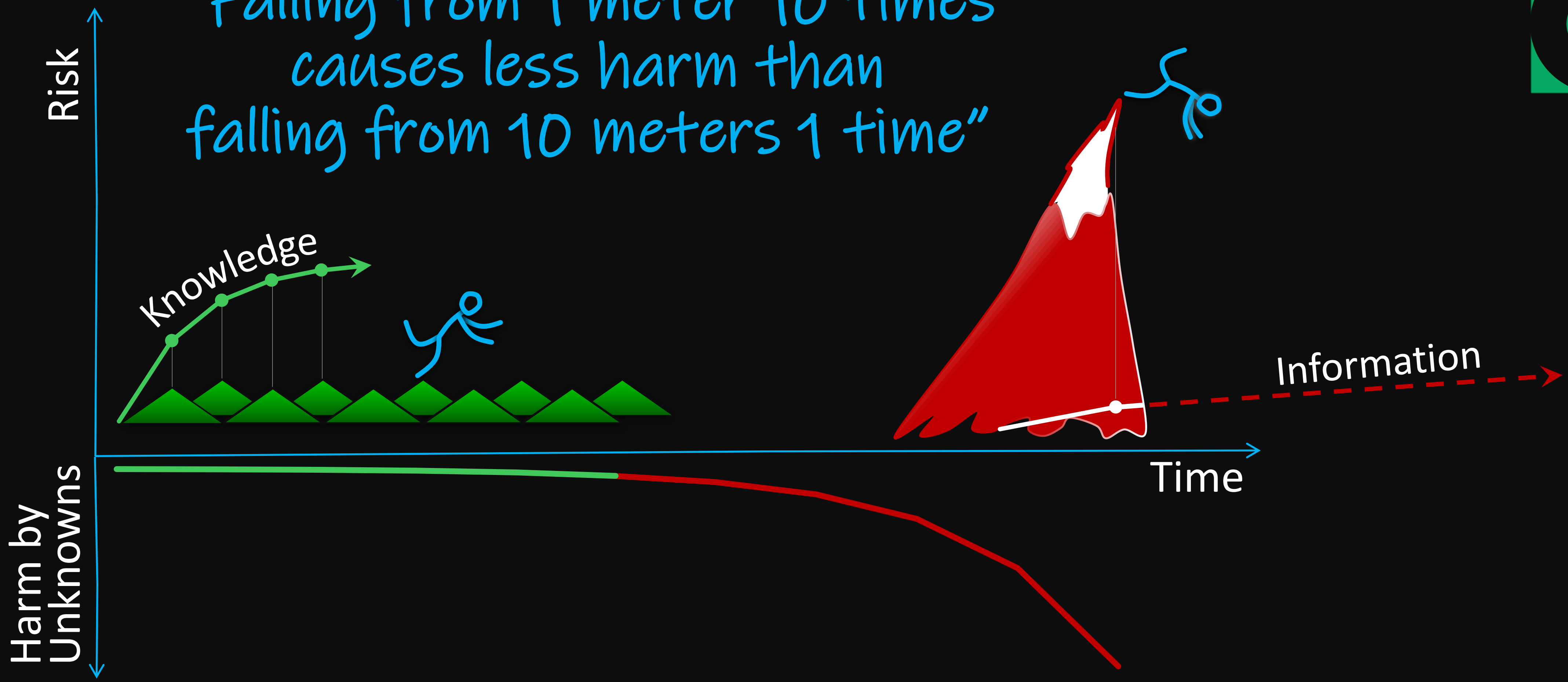
"Falling from 1 meter 10 times causes less harm than falling from 10 meters 1 time"



Multiple Trials with Small Errors

10 to 1

Unknown Errors Surface Late

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Fast feedback:
Mitigates risk and sees value creation (upsides)

Delayed feedback:
Adds risk and misses out on value creation

Short Feedback Cycle:
Learn and take the better path

<u>**Small known errors!**</u> Large positive gains!

What "kills" the sub-modules, benefits/ makes the super-system better/ stronger.

WIP = TH x CT
1 = 10 x Short

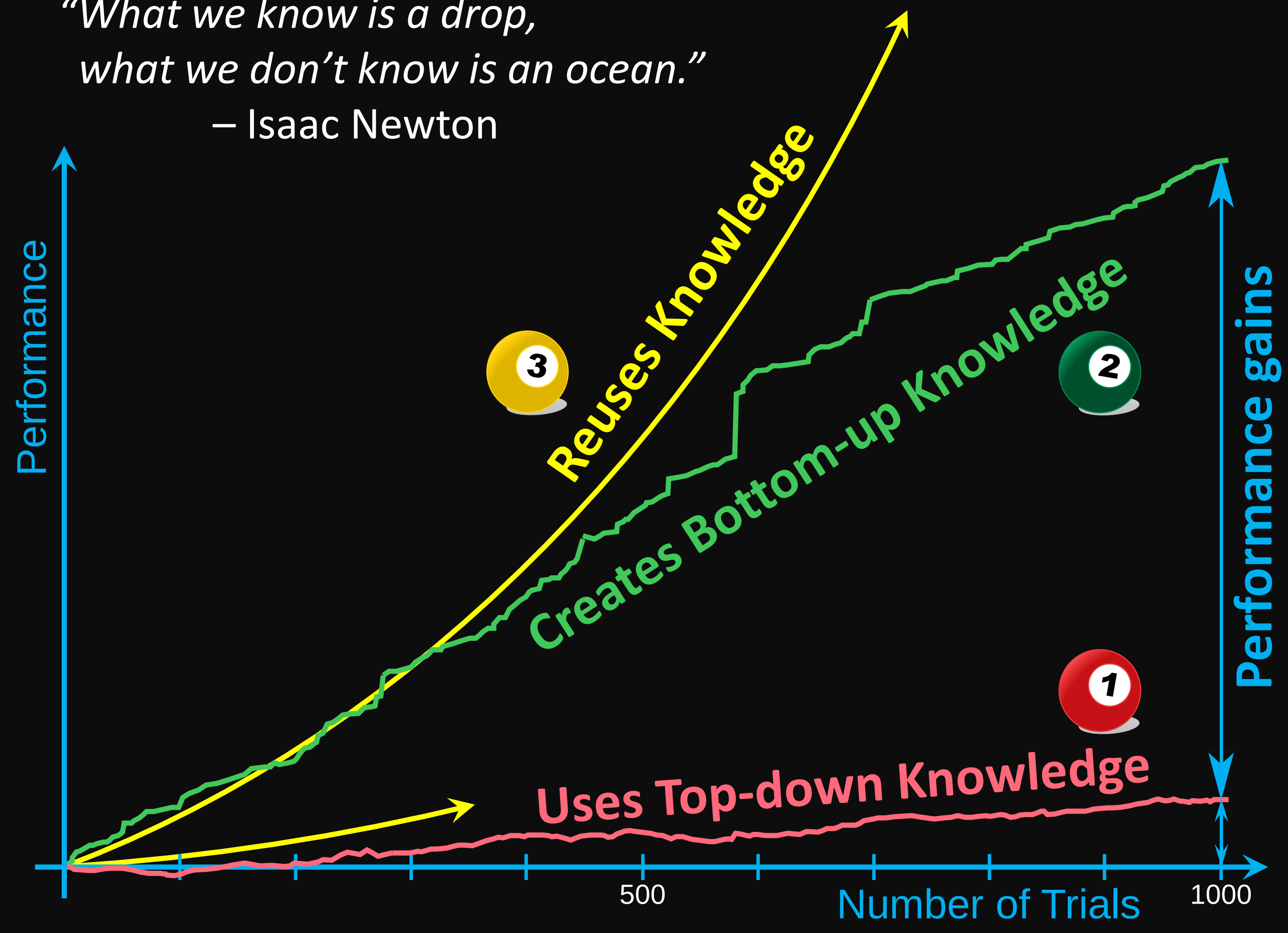
Visible known gain. <u>**Unknown errors!**</u>

"Silent" risks accumulate under the surface. The later feedback, the larger damage.

WIP = TH x CT
All = 1 x Long

‘Trials with Small Errors’ Outperforms ‘Theoretical Knowledge’

“What we know is a drop,
what we don’t know is an ocean.”
– Isaac Newton



Trials with small errors:

- + Shortest feedback cycles
- + “Stressors” = Knowledge

Scatter of data sets:

- + What doesn’t work
- + Impact f(x) curves
- + Don’t look twice at same place

Theoretical knowledge:

- Logics thinking and reasoning
- Compute and calculate

https://www.edge.org/conversation/nassim_nicholas_taleb-understanding-is-a-poor-substitute-for-convexity-antifragility

SpaceX Made More Than 1,000 Changes in 10 Weeks

Between April 20 – June 27, 2023 (68 Days)

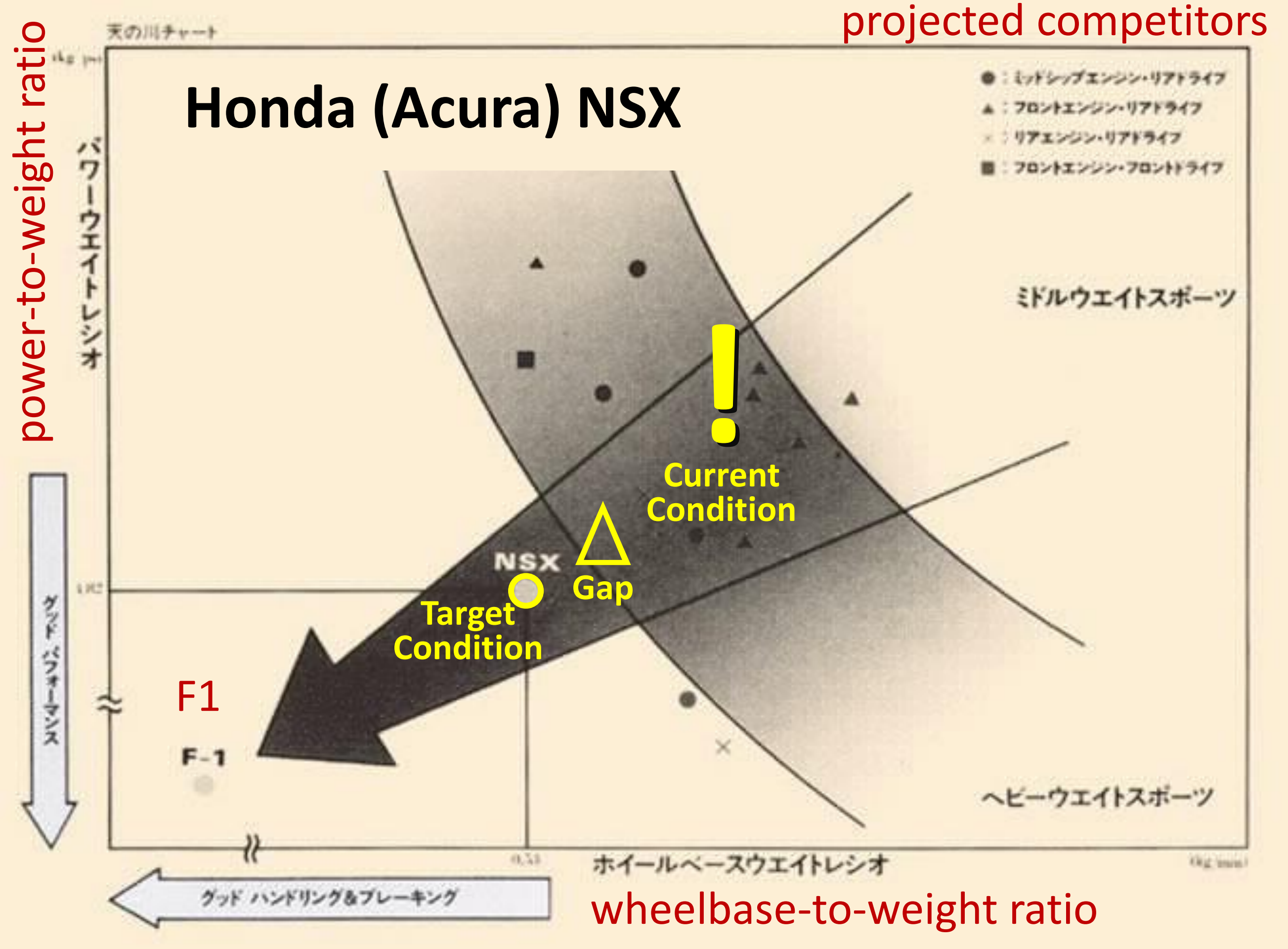
Photo. Test to failure on April 20 three minutes into its first flight.

Photo. The upper stage for SpaceX's next Starship test fight, named Ship 25, undergoes testing earlier this month (June 2023) in Texas.

https://arstechnica.com/space/2023/06/spacex-making-more-than-1000-changes-to-next-starship-rocket/

Customer Interest/ Customer Feedback → Gap vs. Target Visible → Homing

The Entrepreneurial System-Designer defines “Direction of Travel”



Source. https://windingroad.com/articles/features/classic-acura-honda-nsx/

The Cross-functional Team, test together with and collect feedback from customers.

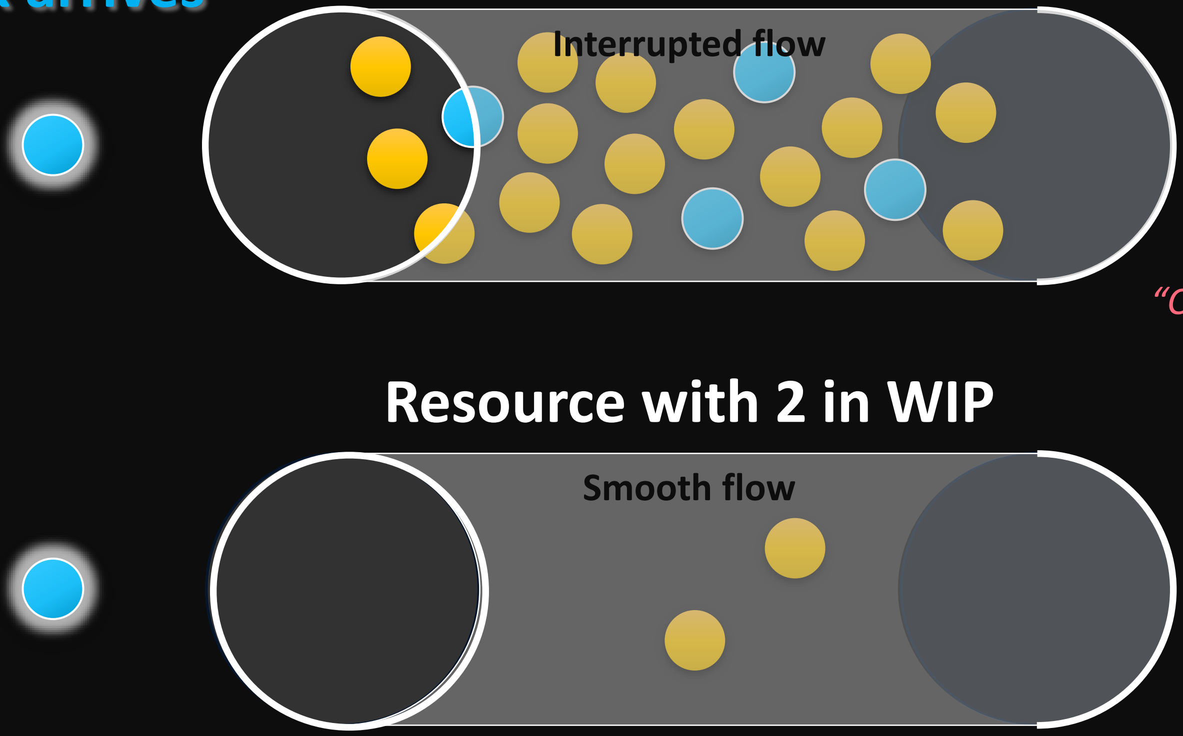
Importance of Flow – In-real Time Priority Based on Value

One priority unplanned task arrives

"Giving priority, all tasks started have to be considered. All are impacted."

"In Pipeline"
Resource with 20 in WIP

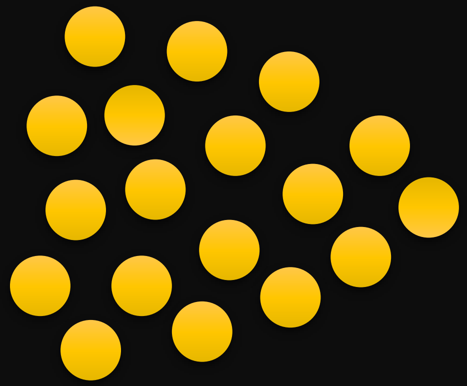
"When everything is started and nothing is finished. Cycle Time becomes very long"



Throughput 1/day
WIP 20
Cycle Time 20 days

"Can try to squeeze in this month"

Queue (18)



Resource with 2 in WIP

Throughput 1/day
WIP 2
Cycle Time 2 days

"Will be done this week"

"Priority based on value. Making in-real time priority is a no-brainer, since Cycle Time is short"

$$CT_{(time)} = \frac{WIP_{(\#)}}{TH_{(\#/time)}}$$

Little's Law

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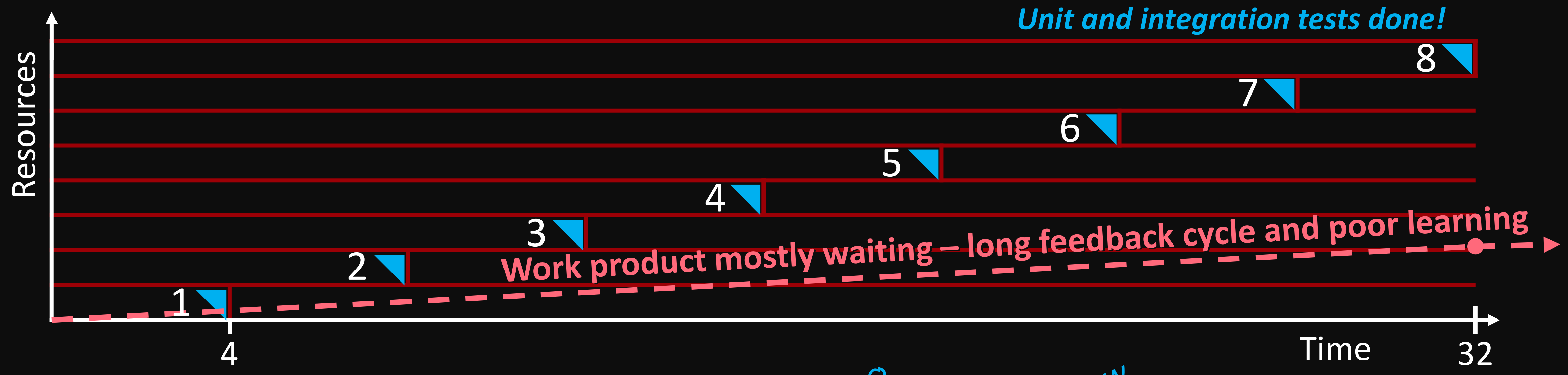
Less Responsive, Innovative, Creative, Adaptive & Productive



Effect

RISK MITIGATION:
Uncertainty is in the present. Emergency is in the future.

Total Manning	128 we's
Throughput	8 *(1 every 4 we's)*
Work In Process	8
Cycle Time	32we
Flow Efficiency	"10%"
Design In Process	4.5
Working Capital	"72"
Capital Efficiency	"22%"

How

Big batch and queue.
Push individuals.
Work products sit idle most of its cycle time.
Focus on keeping resources busy!

Values marked with "quote" are set example values, and the non quote marked are value in relation to the set value respectively.

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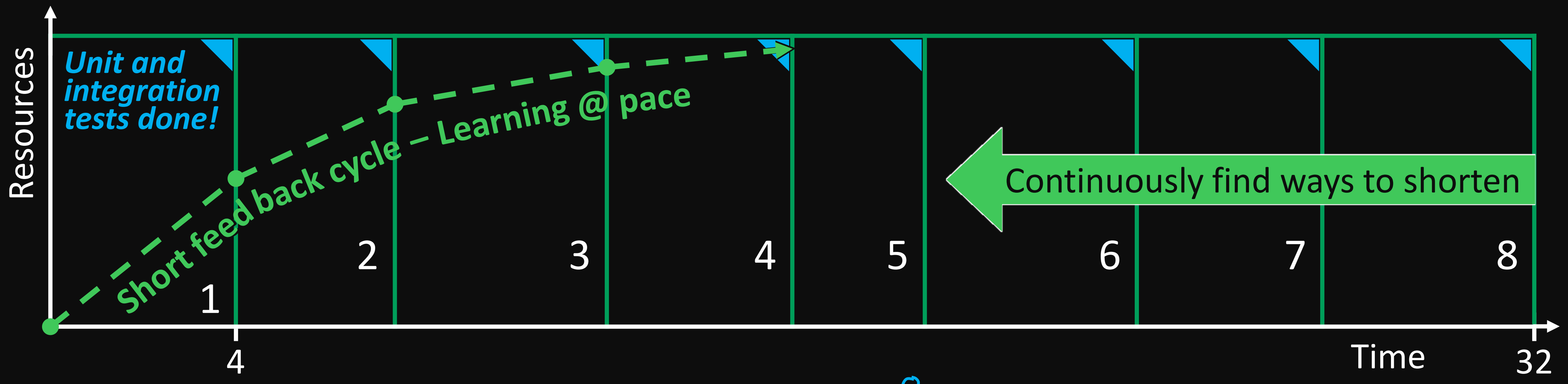
More Responsive, Innovative, Creative, Adaptive & Productive



Why

Agility with flow. Pull teams, so that they continuously create value for end customers!

Total Manning	128 we's
Throughput	8 *(1 every 4 we's)*
Work In Process	1
Cycle Time	4we
Flow Efficiency	"80%"
Design In Process	1
Working Capital	"16"
Capital Efficiency	"100%"

Effect

RISK MITIGATION:
The future is less uncertain, when emergency is closer to the present.

Values marked with "quote" are set example values, and the non quote marked are value in relation to the set value respectively.

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Knowledge Based Development

Customer Value Focus

Builds knowledge about our customers' needs, and users' experiences of our products.

Great products will emerge from that knowledge.

Entrepreneurial System-Designer Leadership

Flow (cont.), Pull and (Cadence)

Set-Based Concurrent Engineering

Team of Responsible Experts

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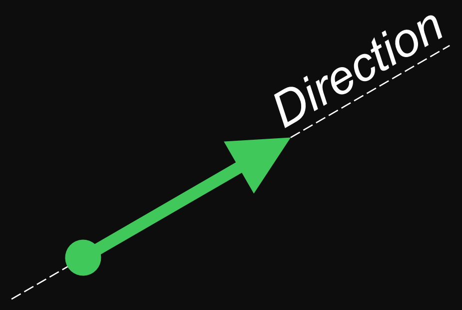
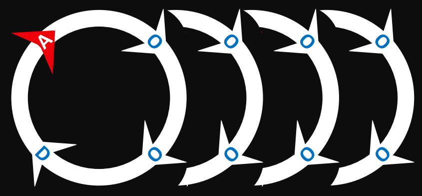
Keep it Simple
No Premium for Complication





Entrepreneurial Leadership:

- Direction of Travel
- In-real time priorities based on value (gaps)
- Ask to make sure/test first

Small Teams:

- Small experiments close gaps
- "Stressors" = Knowledge
- Learn, build knowledge and make it visible

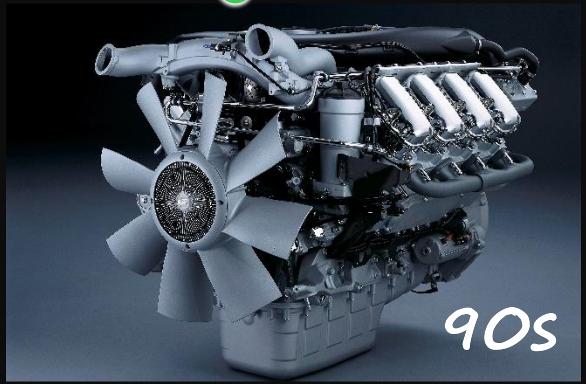
- Continuously shortening the feedback cycles
- Limit WIP – pull one gap at the time
- Integration testing together

Christer Lundh

Funder & Owner of AUFERO AB

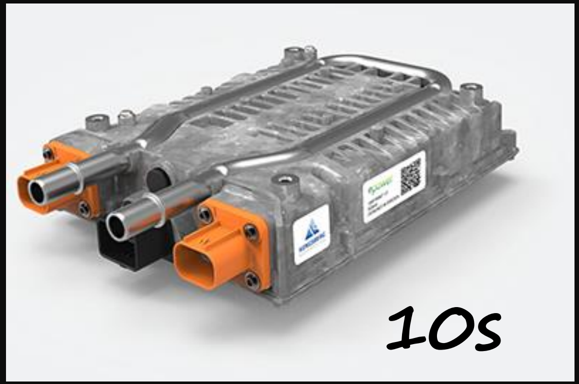
Consultant senior leader.
Led large business transformations, and product, process and team development for more than 25 years.
Led a Lean startup from start to its growth take-off.
Works embedded, provides transformational and servant leadership to business managers and teams.

Lean and Agile Development

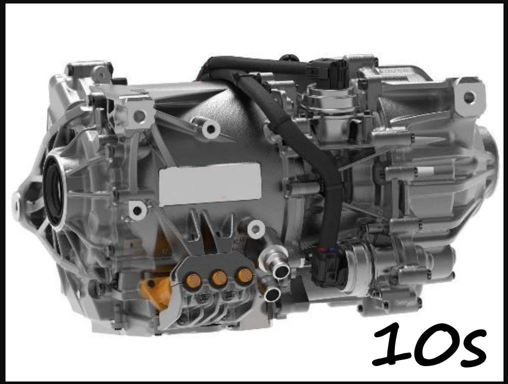


Internal Combustion Engines

Gear shifters



Power Electronics



Electric Motors

IoT Sensor

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