

Rapid Learning Cycles Practitioner Training

v. 7-0

February 2025

Prepared by Katherine Radeka

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The Rapid Learning Cycles Practitioner Training

v. 7.0

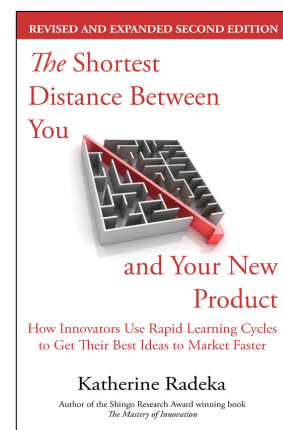
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The Rapid Learning Cycles Framework



- Framework for running Innovation & Product Development programs
- Optimized to accelerate the time from Idea to Launch
- Synthesis of Lean Product Development and Agile Project Management methods
- Integrates with phase-gate PDPs to improve their performance without sacrificing flexibility, creativity and responsiveness



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Why Does Development Take So Long?

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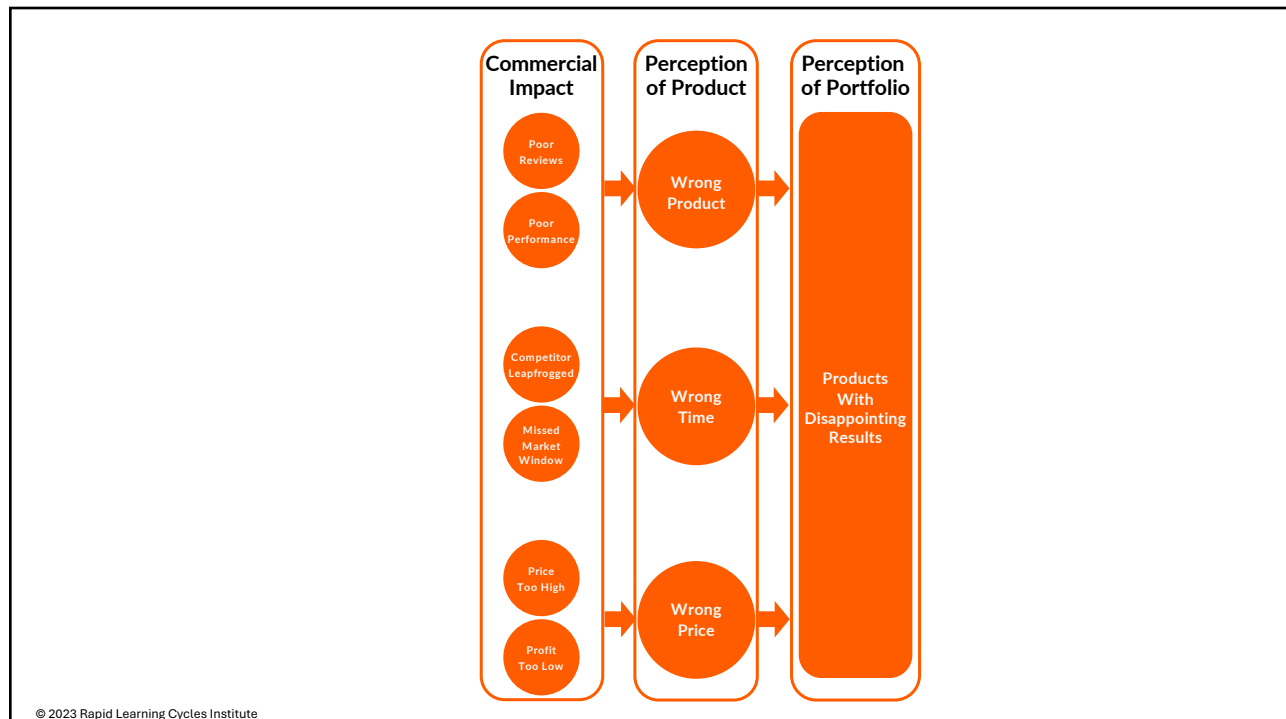
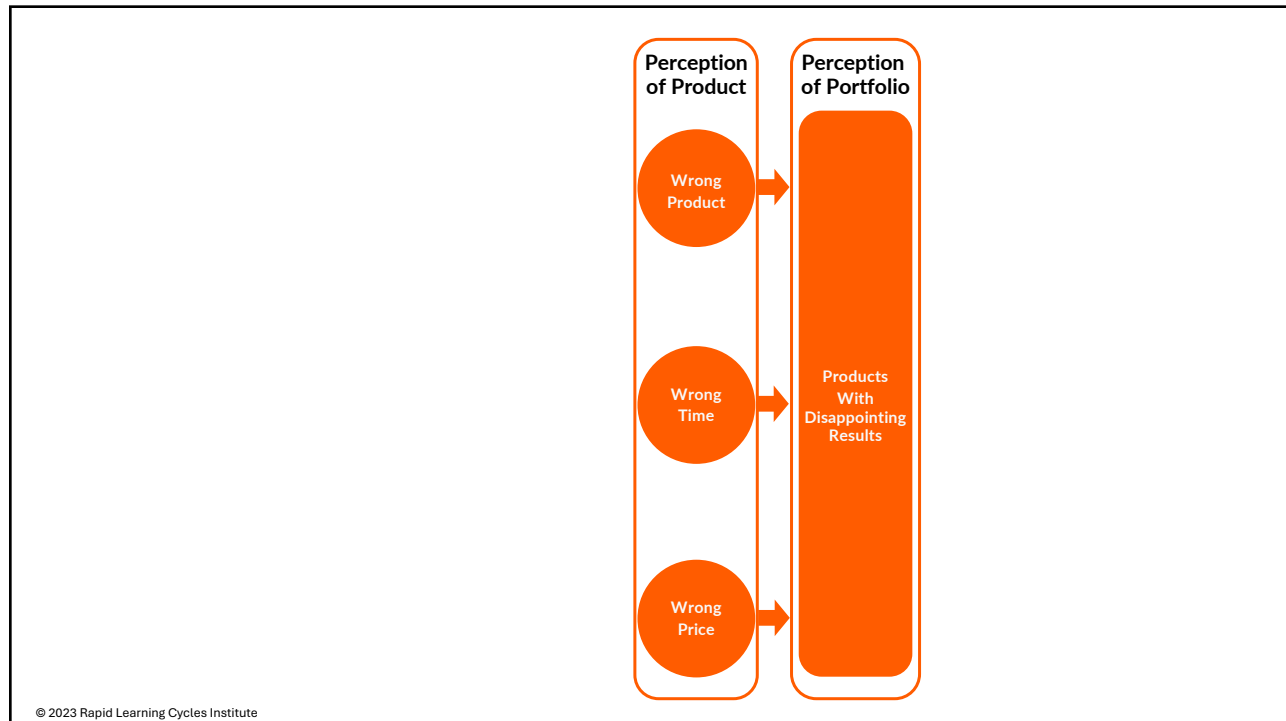


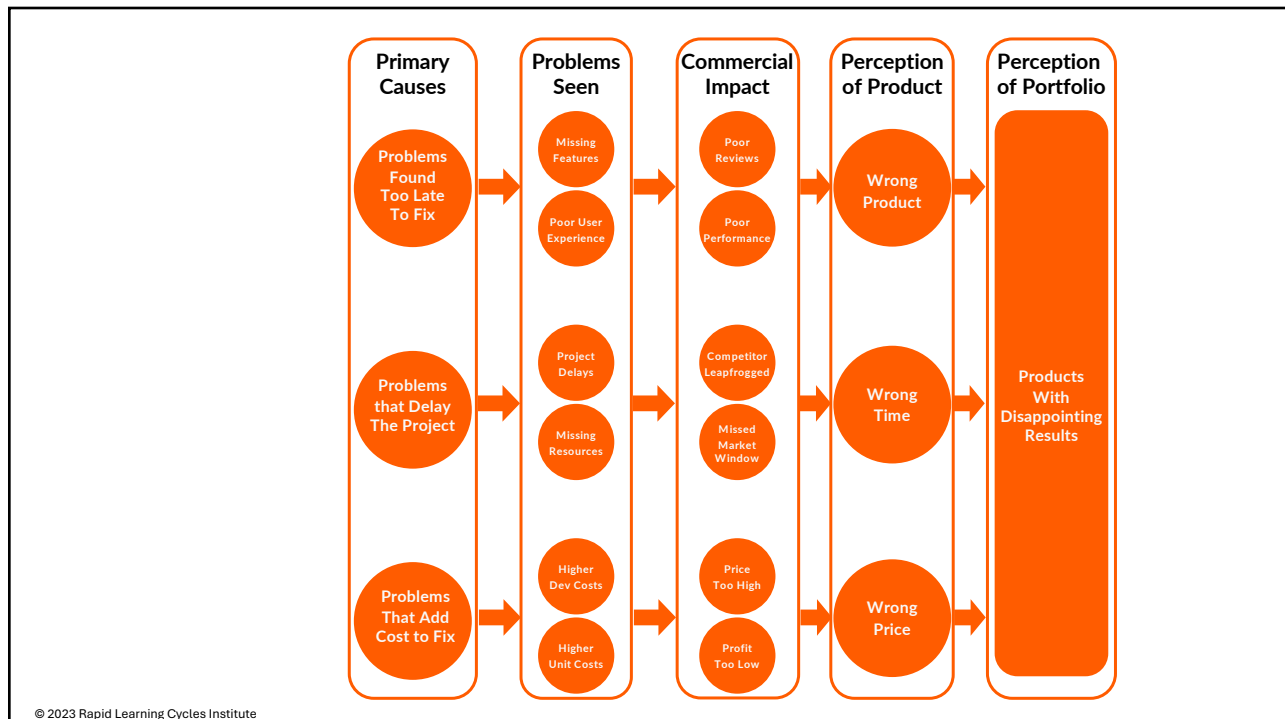
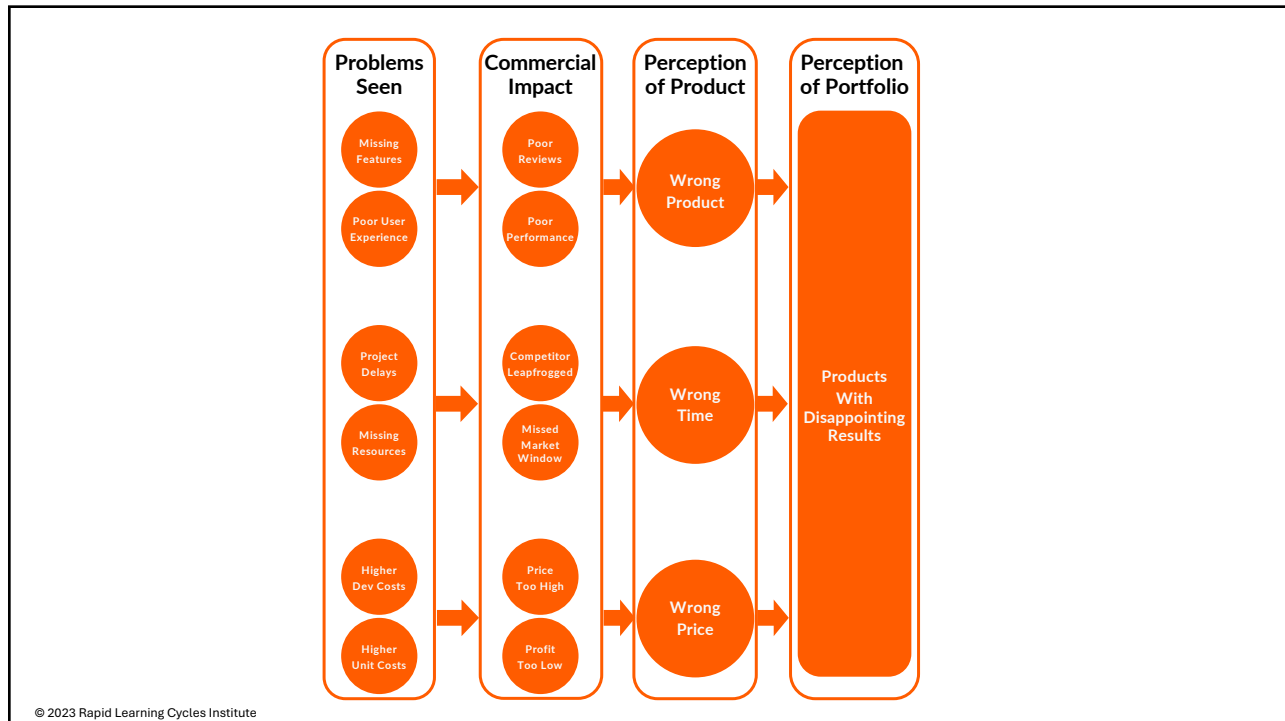
Across industries, at least 40% of new product launches lead to disappointing results.

Source: "Myths About New Product Failure Rates"
George Castellion & Stephen K. Markham, Journal of Product Innovation & Management
30 pp. 976-979 (2013) <http://qoo.gl/M88dA5>

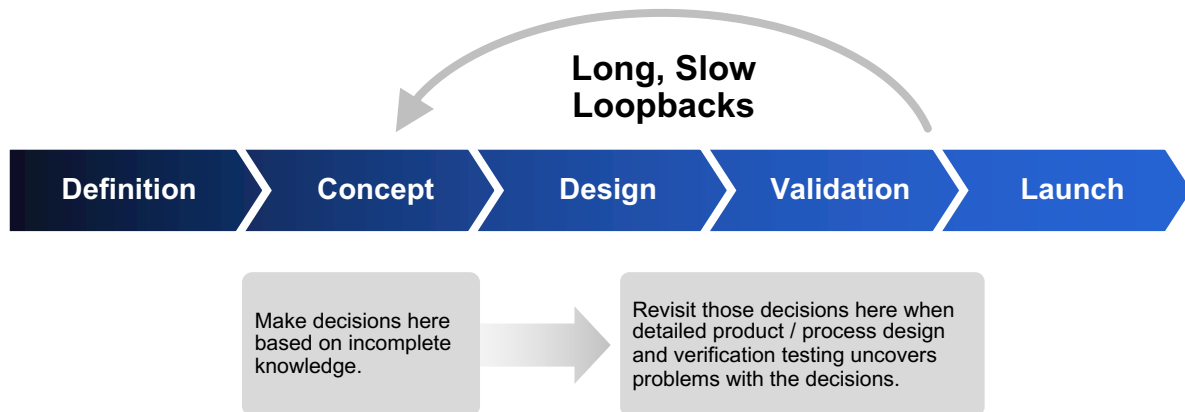
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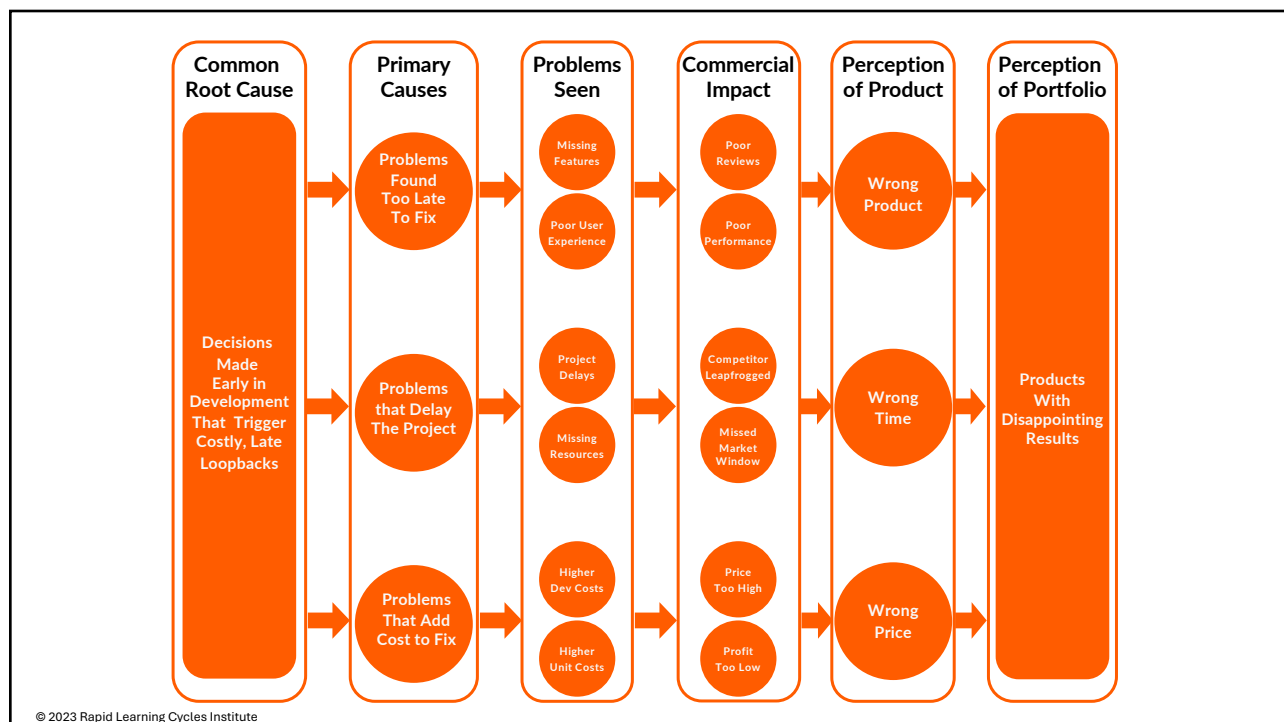


Most Product Development Programs Are One Slow Learning Cycle



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What the Rapid Learning Cycles Framework Does Differently

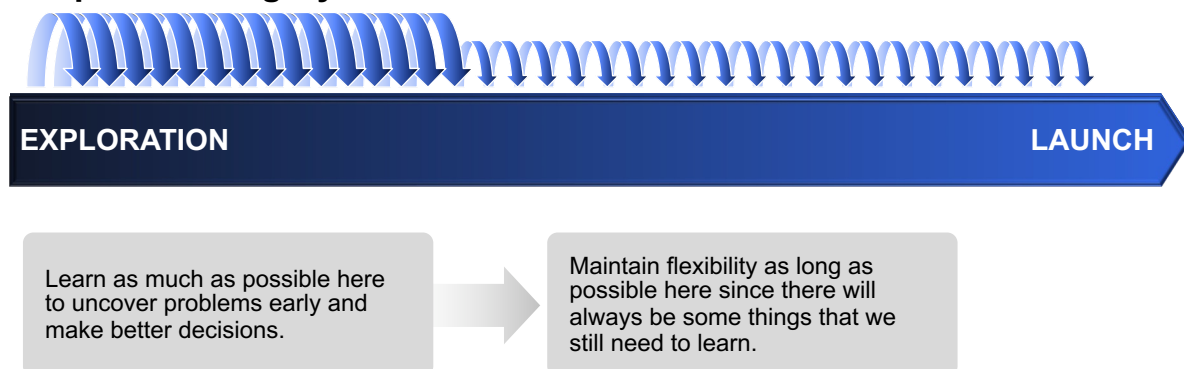
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Rapid Learning Cycles Change When and How Major Decisions Get Made



Rapid Learning Cycles



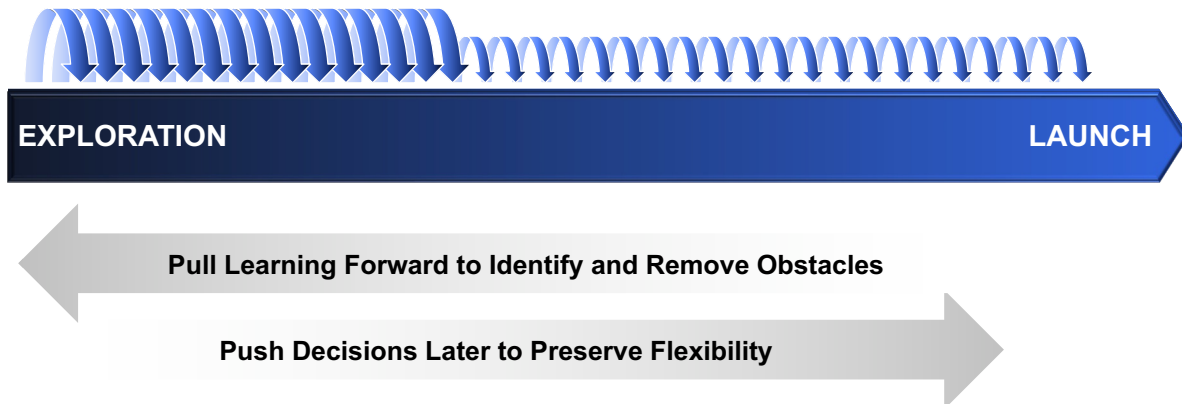
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Pull Learning Forward and Push Decisions Later



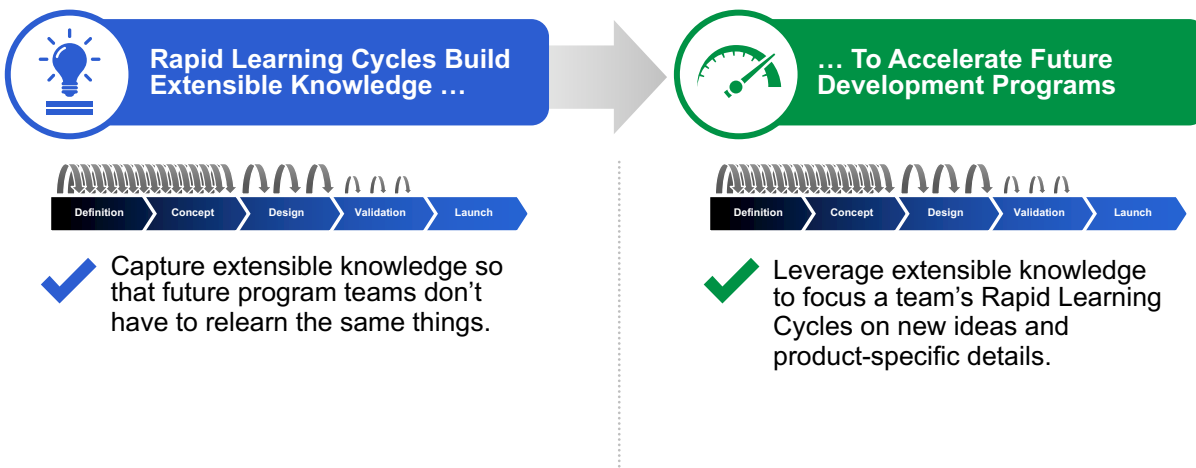
Rapid Learning Cycles



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Extensible Knowledge



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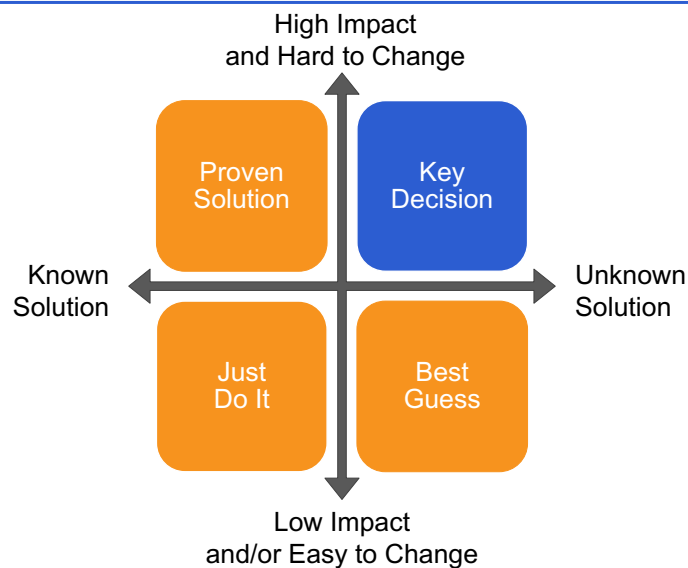


The Difference: Resilient Key Decisions

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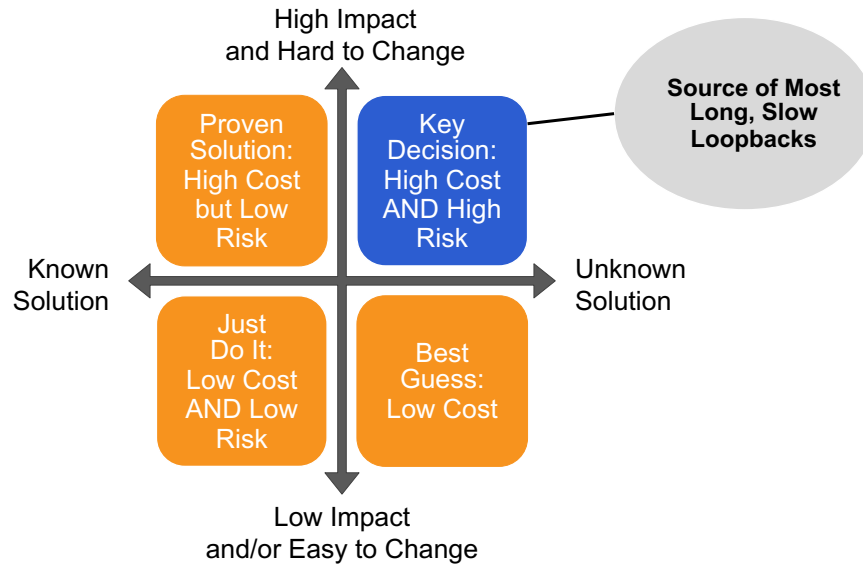
What Is a Key Decision?



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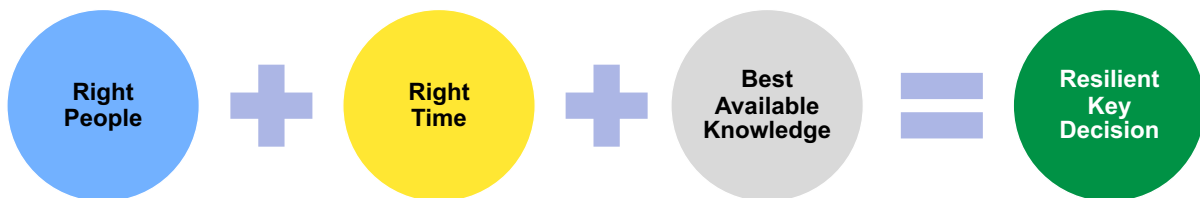
The Cost and Risk of a Revisited Decision



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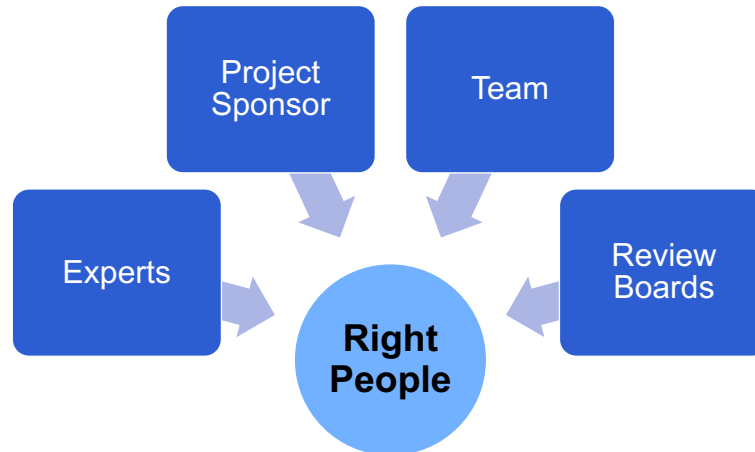
Resilient Key Decisions



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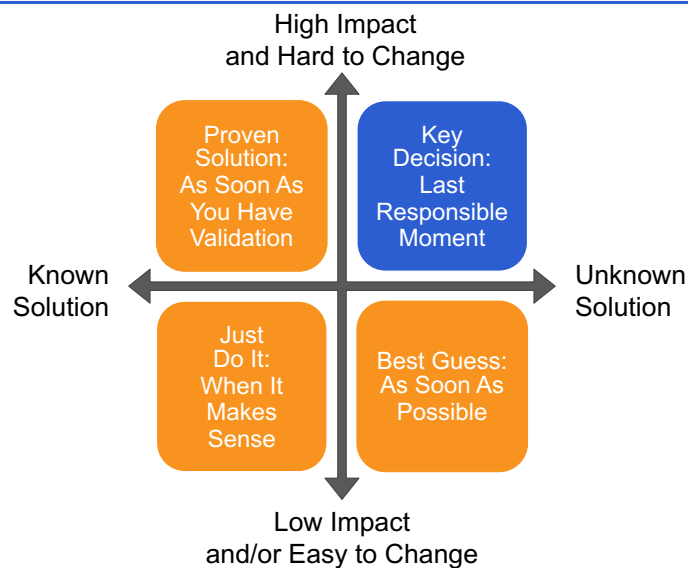
Right People: Decision Makers



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Right Time Depends on Risk and Cost of Change



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The Right Time for a Key Decision: The Last Responsible Moment

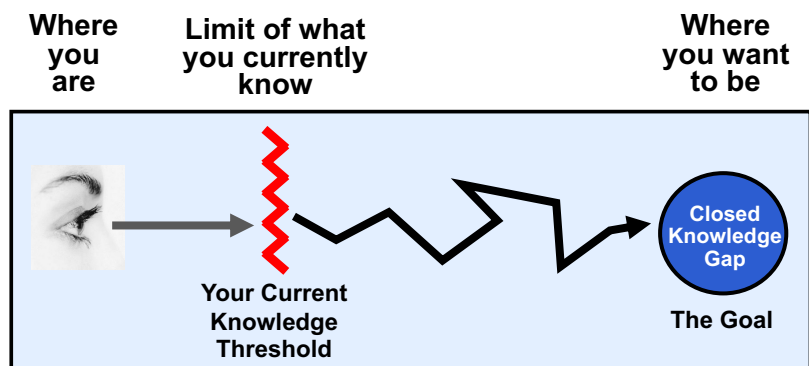


The last moment on a project's timeline
when a decision must be finalized
to avoid incurring costs of delay:
time, money and other resources

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Key Decisions Have Knowledge Gaps

Image adapted from: Mike Rother, University of Michigan. "Toyota Kata Slides and Graphics", http://www-personal.umich.edu/~mrother/Supporting_Materials.html, downloaded 4/5/2015.

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Rapid Learning Cycles to Close Knowledge Gaps



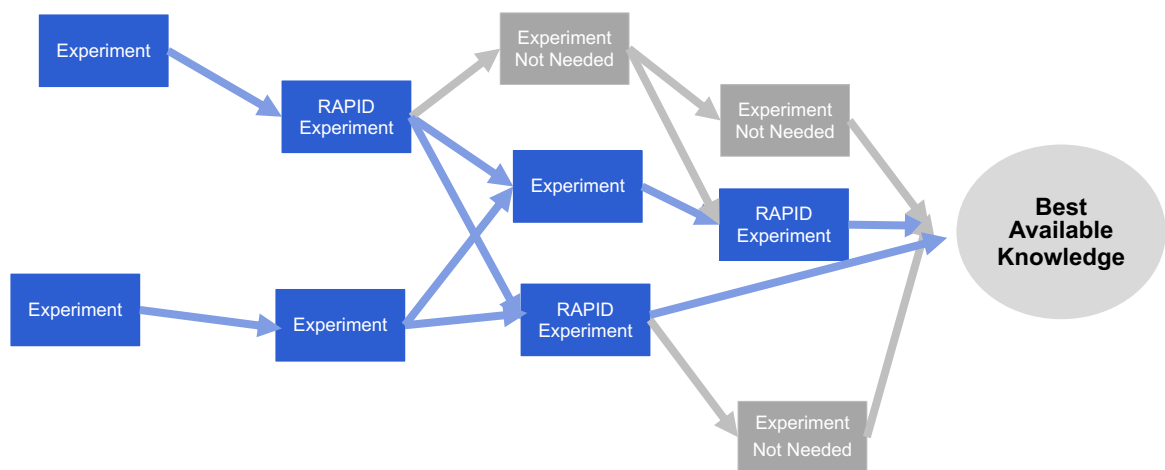
Rapid Learning Cycle:

- Timebox: 2 - 4 weeks
- Focus on closing Knowledge Gaps
 - Web and library research
 - Interviews with customers, SMEs
 - Experiments
 - Targeted prototype builds
- Real Time Knowledge Capture
 - Knowledge Gap Reports to summarize learnings
 - Key Decision Reports to synthesize learnings into recommendations

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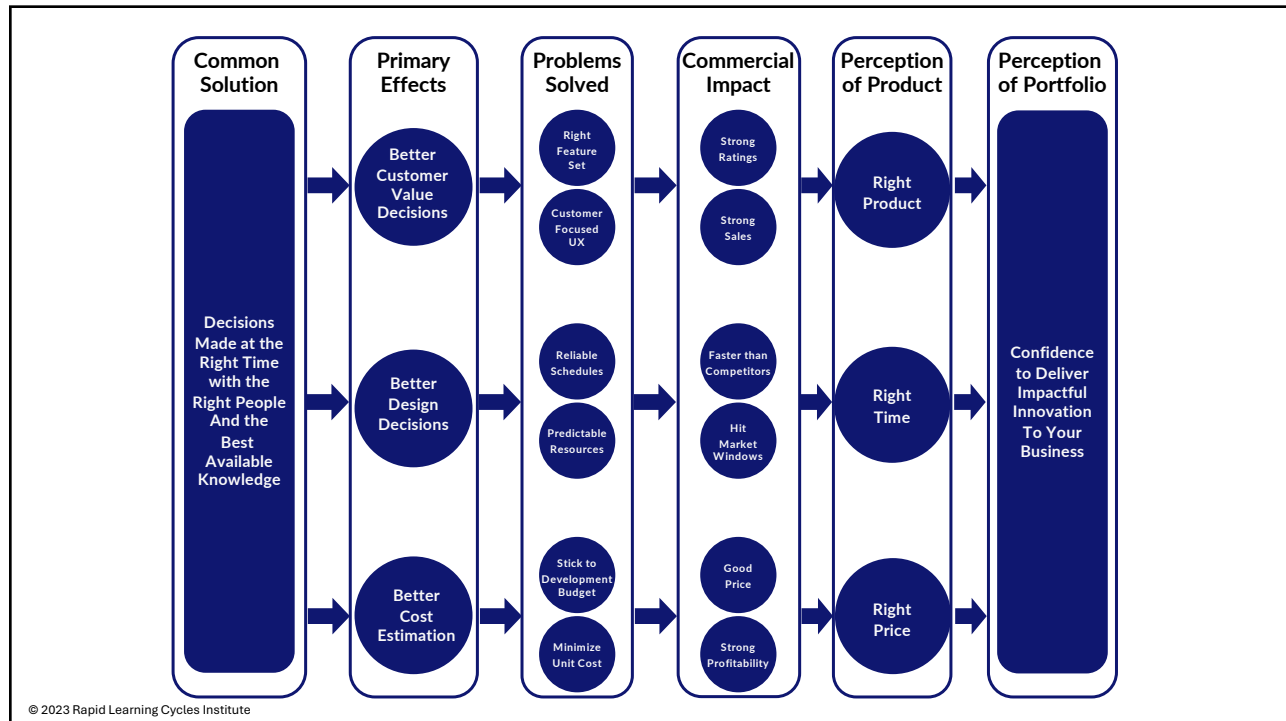
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Best Available Knowledge: Faster, Cheaper Ways to Learn



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Rapid Learning Cycles®

The Elements of the Framework

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Rapid Learning Cycles



A synchronized set of learning activities
to remove uncertainty, manage risk, and eliminate obstacles
that pulls learning activities ahead so that teams make
more confident, knowledge-driven decisions.

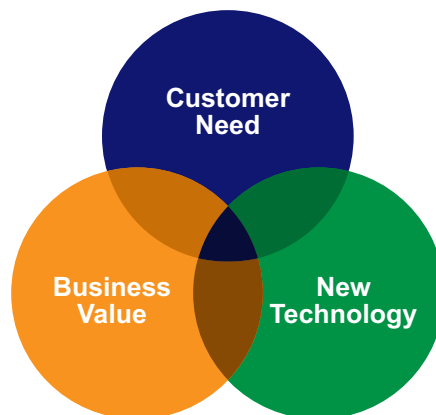
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The Core Hypothesis



Core Hypothesis: The reason why your company believes in this product.



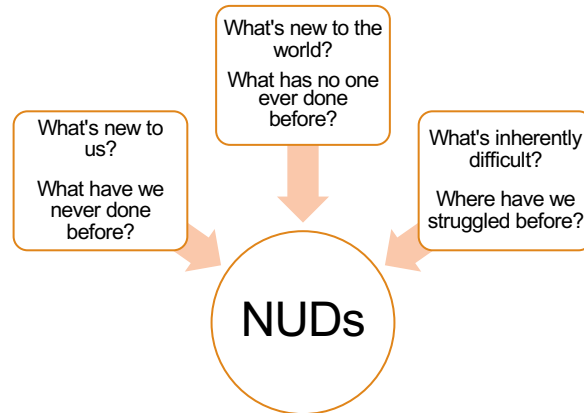
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NUDs, Uncertainties and Risks



NUDs, Uncertainties and Risks: What obstacles lie between you and a successful product that delivers the customer and business value you promise?



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Key Decisions



Core Hypothesis: The reason why your company believes in this product.

Key Decisions: Decisions that are High Impact and High Unknown – they must be made in order to complete the product or process design – but the team cannot make them with confidence yet.

Examples:

- What material will we use as a heat shield?
- Will we include an automatic shutoff function?
- Which region will we target first?
- What will be our FOB cost target?
- Who will be our production partner?

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Knowledge Gaps



Core Hypothesis: The reason why your company believes in this product.

Key Decisions: Decisions that are High Impact and High Unknown – they must be made in order to complete the product or process design – but the team cannot make them with confidence yet.

Knowledge Gaps: Something that a team needs to know in order to make a Key Decision.

Examples include:

- What could we use as a heat shield?
- What does it cost to add an automatic shutoff switch?
- Which regions would get the most value from our MVP product?

Activities



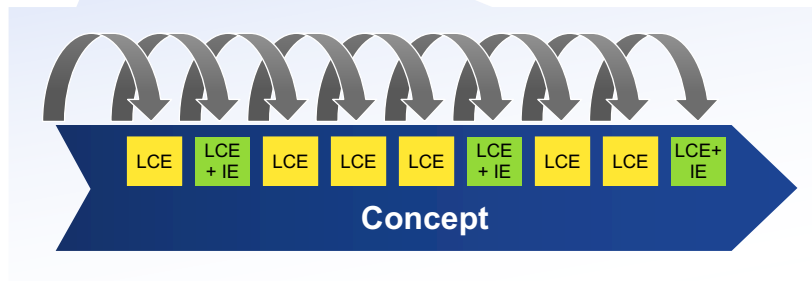
Core Hypothesis: The reason why your company believes in this product.

Key Decisions: Decisions that are High Impact and High Unknown – they must be made in order to complete the product or process design – but the team cannot make them with confidence yet.

Knowledge Gaps: Something that a team needs to know in order to make a Key Decision.

Activities: The specific activities that will be done to close a Knowledge Gap – or perform some other task within the Product Development Process.

Learning Cycle and Integration Events



Regular Events to:

- Capture and Share Knowledge (Learning Cycle Events)
- Make Key Decisions (Integration Events)
- Update the Learning Cycles Plan (Both!)

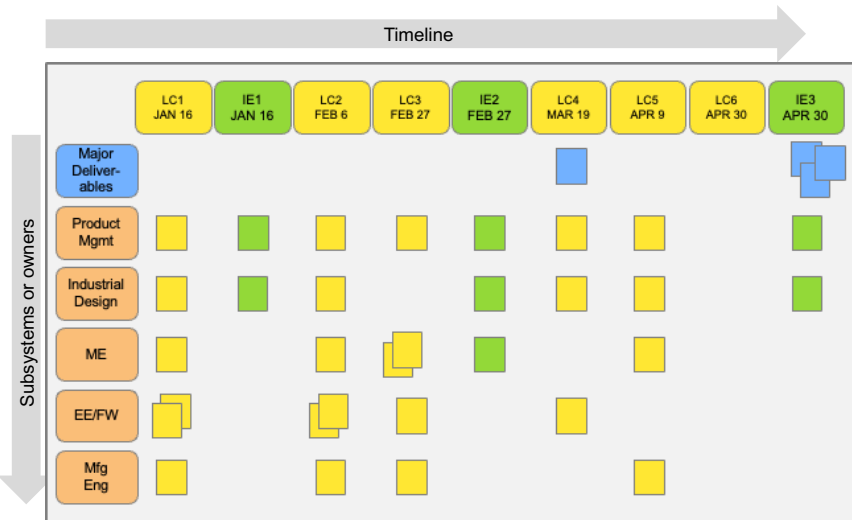
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Learning Cycles Plan



- “Swim Lanes” by owner, department, sub-team or focus area.
- Learning Cycle and Integration Event cadence across the top.
- Key Decision sticky notes in the Integration Event where they **Close** (the Last Responsible Moment)
- Knowledge Gap sticky notes in the Learning Cycle where they **Start**
- **MAJOR** Deliverables in the Learning Cycle or Integration Event where they will be **Finalized**.



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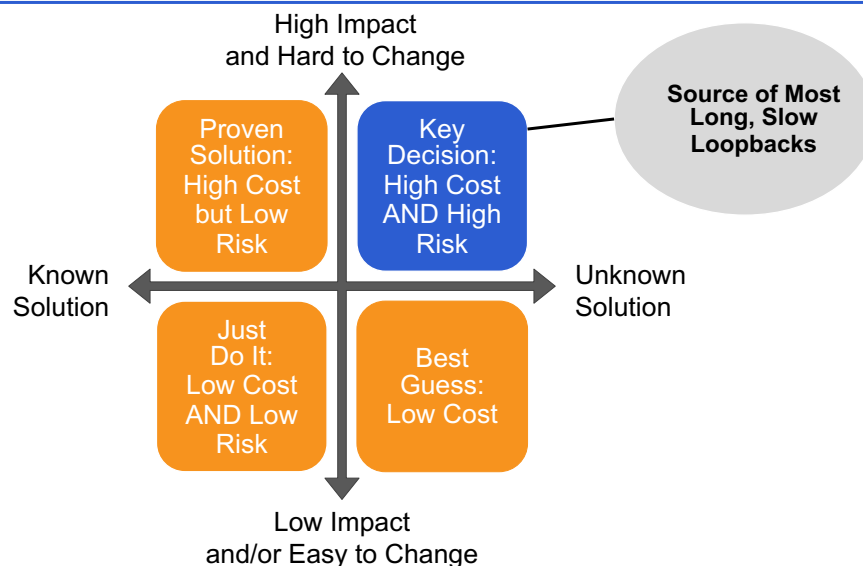


Deliverables and Execution Tasks with Rapid Learning Cycles

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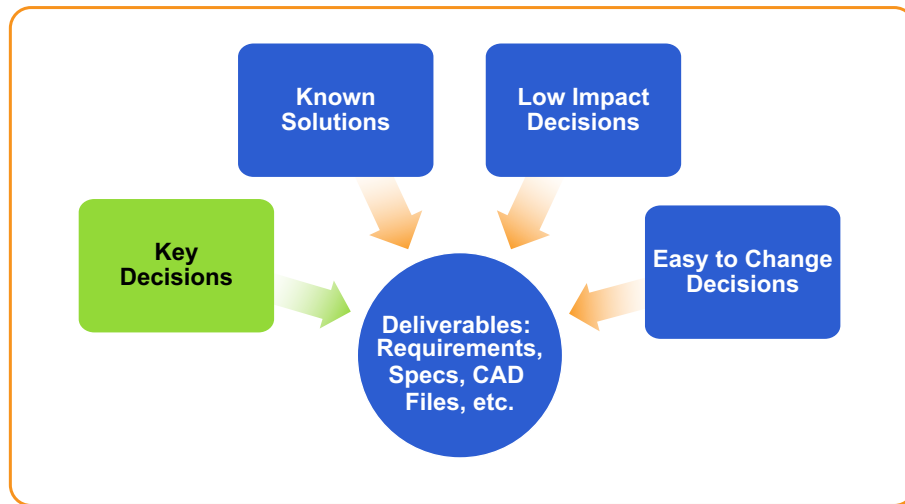
The Cost and Risk of a Revisited Decision



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A Deliverable is a PACKAGE of Decisions



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Deliverable Example: Fitness Tracker



Key Decisions

- How will we improve the accuracy of the HR monitor?
- How will we extend battery life?
- Which adhesive will we use for the band to make the tracker more water resistant?

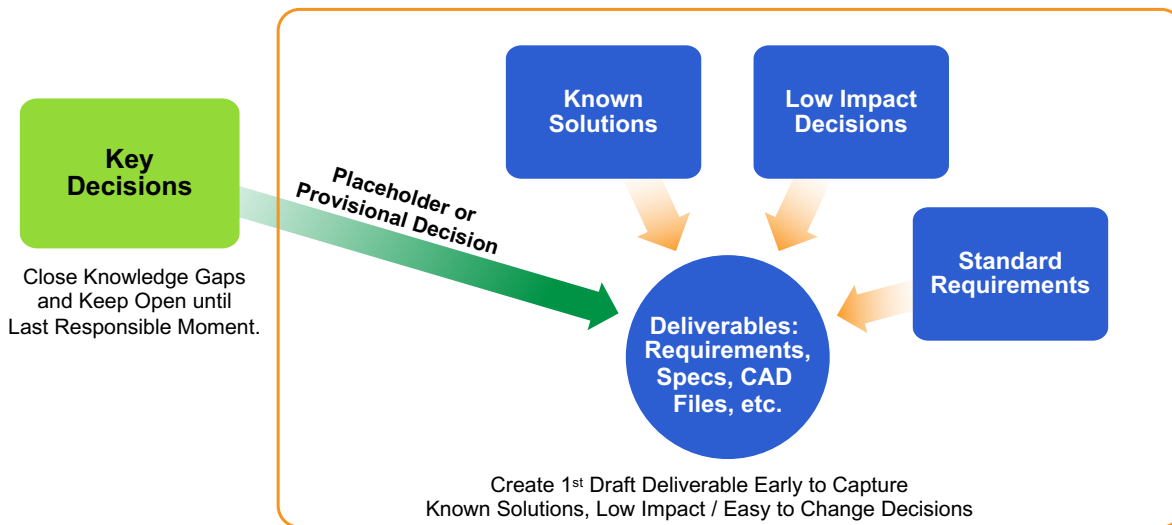
Known Solutions

- Tracker shall connect with Android and iOS devices via Bluetooth.
- Tracker shall maintain records of steps taken, stairs climbed, and distance traveled — as calculated from pedometer, heart rate and stride length.
- Tracker shall have a small display.

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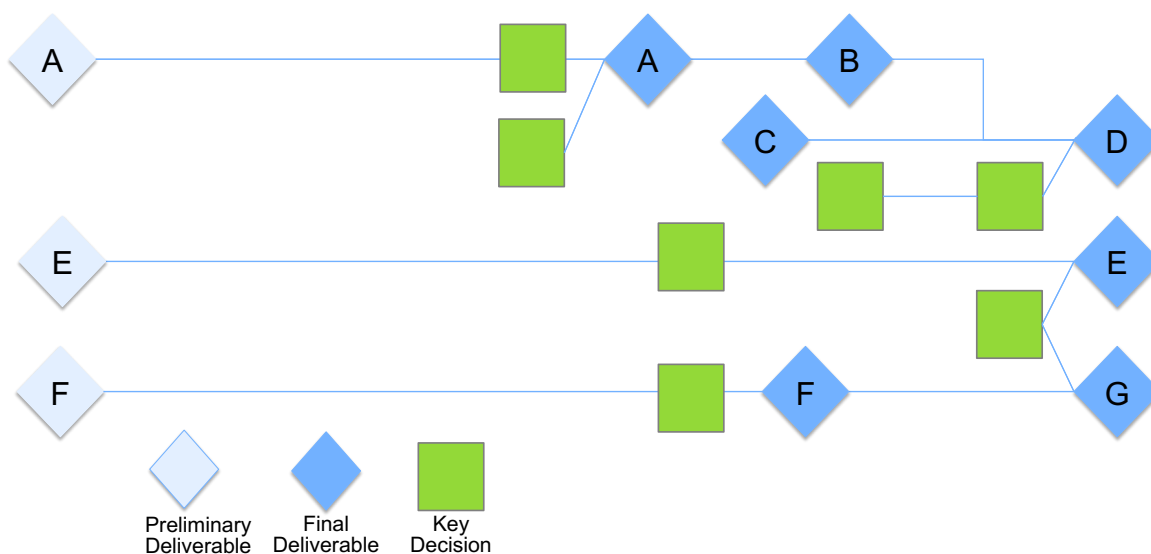
Deliverables in a Rapid Learning Cycles Program



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Key Decision and Deliverables Flow



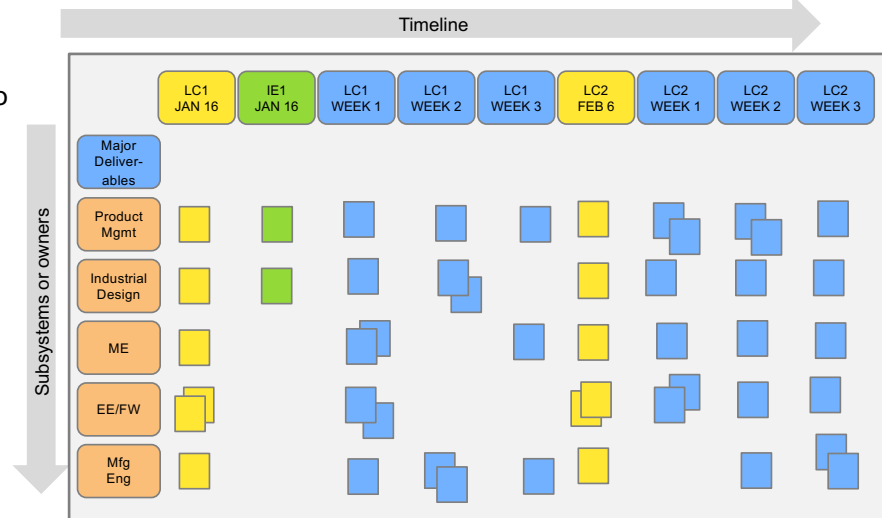
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Execution Tasks for the Next 3 Months (maximum)



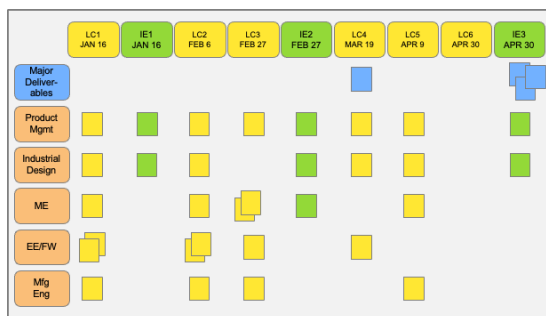
- Scope:
 - Learning Activities to Close Knowledge Gaps (Learning Tasks)
 - Producing Deliverables (Doing Tasks)
- Size:
 - At least ¼ Learning Cycle (2 days for 2-week cycle)



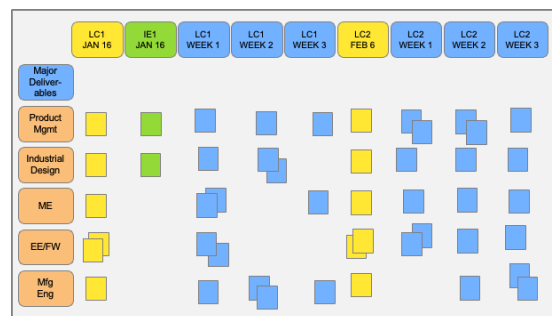
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Keep the Plans Separate but Visible



Learning Plan



Execution Plan

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The Core Hypothesis

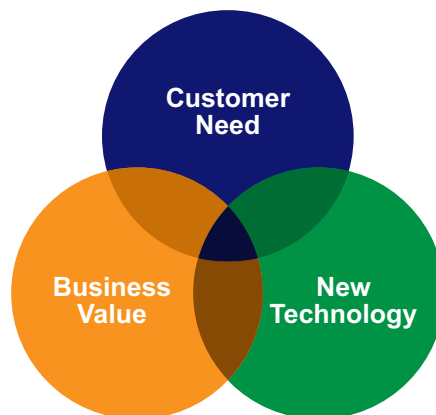
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Core Hypothesis: Examples



A GPS collar for cattle will help ranchers improve their herd management and reduce costs for fencing as we earn revenue from collar sales and from subscription fees for services that interpret, consolidate and visualize the data from the collars.

An in-ear heart rate monitor will provide heart rate monitoring during fitness activities without the need for a separate device, allowing us to grow our presence in the consumer audio market with a unique solution.

The XR700 will be much less expensive for us to produce, and a little less expensive for our customers to buy, because we will use new manufacturing methods, new suppliers and new materials that are less costly and require less WIP inventory.

How to Build a Core Hypothesis



The (product / project codename) uses

(technology) that delivers

(customer value) so that we get

(business value)

The Core Hypothesis



Why is our company investing in THIS product development program?

**What new technologies
does it embody?**

Ex: new architecture,
different materials

**What is the
customer pull?**

Ex: better performance,
lower cost

**What is the business
value for us?**

Ex: higher profit,
increased market share

Use this to build the Core Hypothesis in a single sentence.

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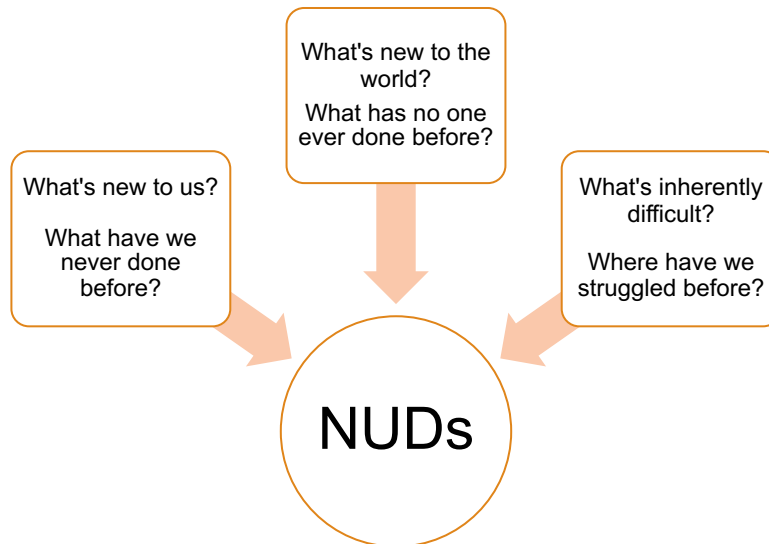
**Rapid
Learning
Cycles®**

**NUDS, Uncertainties
and Risks**

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Find the NUDs



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A Highly Likely Event with Major Impact Is Not Just a Risk



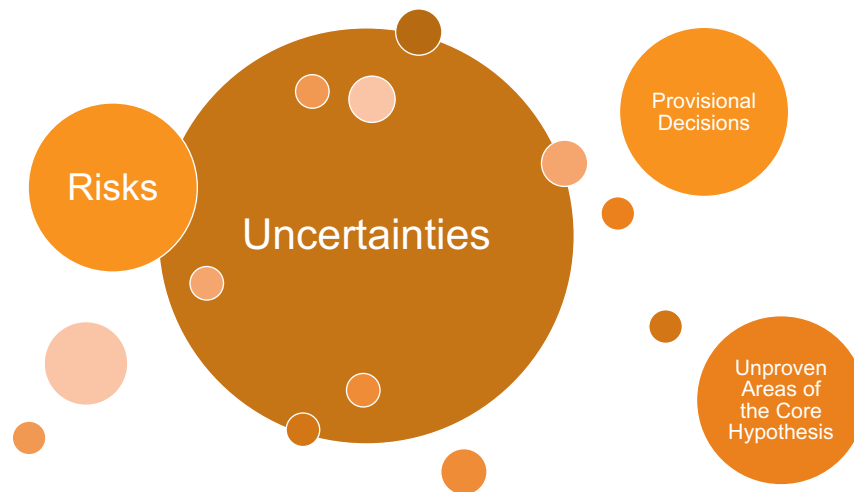
LIKELIHOOD	almost certain	Moderate	Major	Critical	Critical
	likely	Moderate	Major	Major	Critical
	possible	Moderate	Moderate	Major	Critical
	unlikely	Minor	Moderate	Moderate	Major
	rare	Minor	Minor	Moderate	Major
		insignificant	minor	moderate	major
		CONSEQUENCE			

Key
Decisions
with
Knowledge
Gaps

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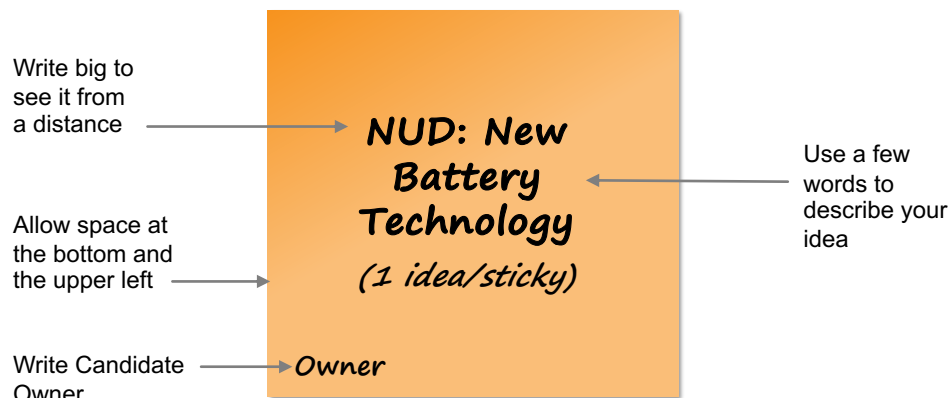
Other Sources of Uncertainties



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Sticky Note – NUDs and Other Uncertainties



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NUDs and Other Uncertainties



What are the NUDs?

Ex: new architecture,
different materials

What are the risks?

Ex: unable to meet cost
requirements

What other uncertainties are out there?

Ex: new customers may not
perceive performance the
way existing customers do

Assign Each Area an Owner: Give the area of uncertainty to the person best suited to own it during the Kickoff Event.

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The Lifecycle of a Key Decision

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Key Decisions



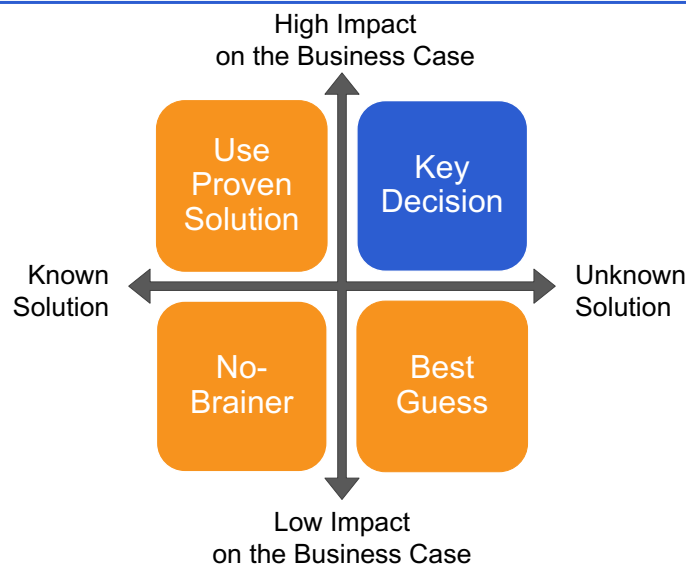
Core Hypothesis: The reason why your company believes in this product.

Key Decisions: Decisions that are High Impact and High Unknown – they must be made in order to complete the product or process design – but the team cannot make them with confidence yet.

Examples:

- Which motor will we use?
- What will be the primary market segment for this product?
- Will the Midway feature be available on all versions of the product?

Is This a Key Decision?



Low Impact Decisions – Do What We've Always Done



No-
Brainer

Best
Guess

- Decide who should decide based on who has the most relevant knowledge.
- Then get these done early to free up capacity – document in the program's deliverables.
- For major decisions, track the risk that the impact could be higher than expected.

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Known Solutions Need Early Validation



Use
Proven
Solution

The idea that a proven solution can be reused (or purchased from an external source) is a hypothesis.

- What can the team do to validate their hypothesis early?
- What is the impact to the program if the solution doesn't work out as expected? What is the risk?
- How much does the squad really know about this solution?

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Key Decisions: Focus Team's Attention Here



Key Decision

- ☐ Ownership for Developing Recommendation
- ☐ Last Responsible Moment
- ☐ Decision Maker and Other Stakeholders
- ☐ Prioritized Knowledge Gaps
- ☐ Pre-Integration Event Recommendations Review
- ☐ Decision Finalized at Integration Event at Last Responsible Moment

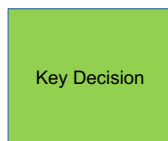
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The Lifecycle of a Key Decision



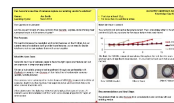
**Created in the
Kickoff Event**



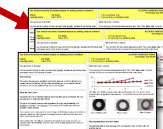
**Prioritized and Stored
in the
Learning Cycle Plan**



**Informed
by the closed
Knowledge
Gaps**



**Recommendation
formed by integrating
findings from
Knowledge Gaps**



**Decided at an
Integration
Event**



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Key Decisions Have Owners



- Develop the first-pass list of Knowledge Gaps.
- Validate the Last Responsible Moment.
- Meet with the decision maker to find others.
- Assign ownership for Knowledge Gaps.
- Develop the Recommendation.
- Write the Key Decision Report.

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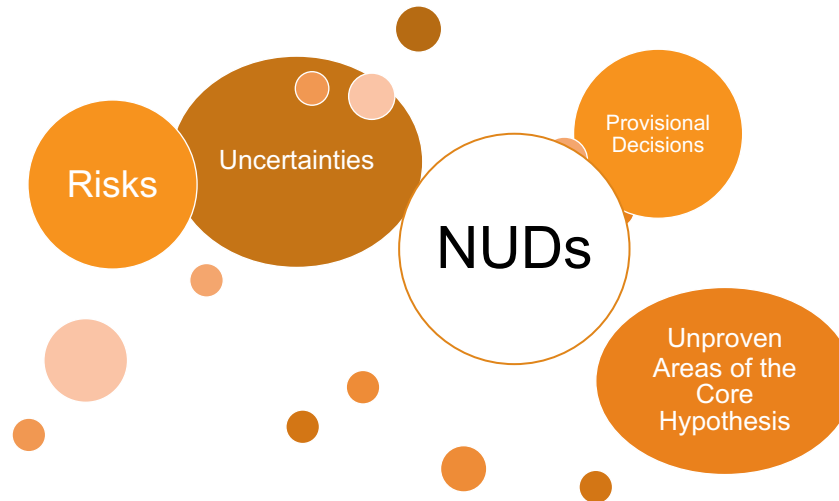


How to Find Key Decisions

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Start with NUDs, Risks and Uncertainties



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Questions to Find Other Key Decisions



- When I look at my current list of potential Key Decisions, what's missing?
- What has to be right for the program to succeed, because we can't afford a loopback at the end?
- What decisions typically get revisited on a program like this?
- Which decisions keep me up at night?

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These Are Never Key Decisions — They Are Collections of Decisions

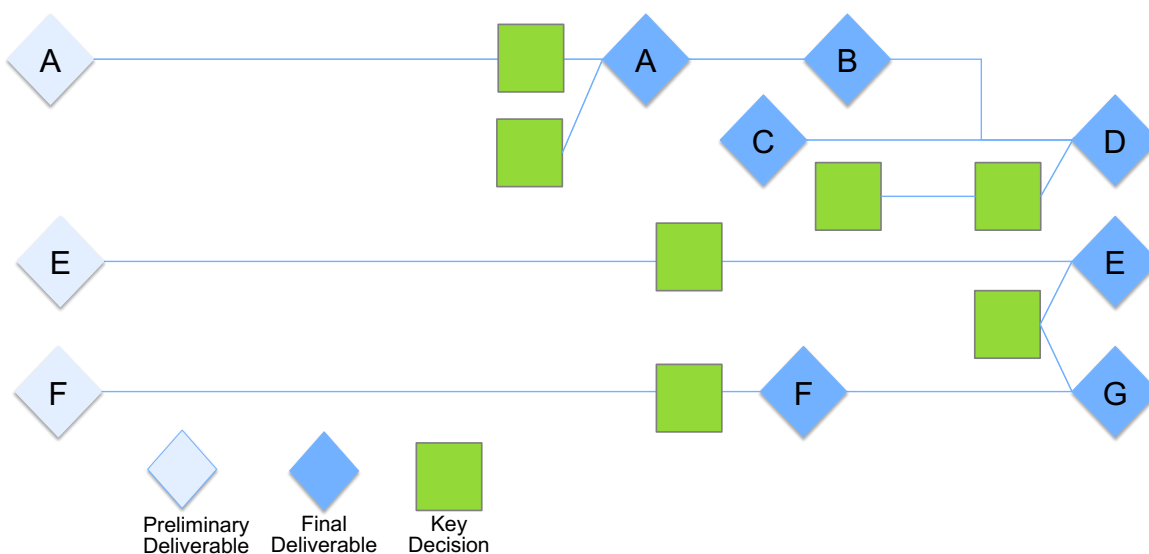


- **What will be the project plan?** — we assume that we're operating in a dynamic environment. Consider smaller, more incremental decisions:
 - What will be the target date for X?
 - How many hours will we allocate for closing Knowledge Gaps vs. execution tasks?
- **What will be the requirements / specs for X?** — Requirements are groups of decisions. Consider which of those decisions are high impact / high unknown:
 - Will we include an auto-off feature?
 - What temperature range will our product support?
- **What will be the system / subsystem architecture?** — Architectures are groups of technical and design decisions. Consider which elements are NUDs vs Known Solutions:
 - How extensible will the next gen architecture be?
 - What will be the standard interface for connecting attachments?

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Key Decisions Flow Into Other Key Decisions and Deliverables



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Is It a Key Decision – or a Knowledge Gap?



Will the team and/or stakeholders decide?

→ Key Decision (if High Impact / High Unknown)

Will the team and/or stakeholders make a recommendation?

→ Key Decision (if High Impact / High Unknown)

Will the team and/or stakeholders get an answer by doing a learning activity?

→ Knowledge Gap

Will the answer to this question be captured as a requirement or specification?

→ Defining requirements is a SHARED responsibility to make Key Decisions (if High Impact / High Unknown)

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How to Handle Decisions About Features



- Each feature is a decision on its own:
 - If we can deliver a feature easily then it has low impact on the product – “No Brainer” or “Best Guess”
 - If we can leverage knowledge from another product to deliver the feature, then it’s a “Known Solution” – or even a “No Brainer” if it’s also easy to do
 - Features that will require substantial development time have high impact / high unknowns – “Key Decision”
- To maximize overall value for a product, Marketing + Engineering decide together which Key Decision features the team will invest in developing.

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How to Write a Key Decision Question

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How to Formulate a Key Decision



Key Decisions are Well-Defined Questions with Choices:

What WILL we do?

- Which supplier **WILL** we select for our robotic arm?
- What region **WILL** we sell the product into first?
- Which manufacturing partner **WILL** produce the product?

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Why Is "Will" So Important?



What about dinner?

- Where CAN you go for dinner? . . . Any of a dozen restaurants within walking distance.
- Where SHOULD you go for dinner? . . . Well, I probably should eat dinner at home.
- Where DO you go to dinner? . . . I do eat dinner at lots of places.
- Where WILL you go for dinner? . . . I think I will go to that new Thai place in town.

WILL implies a clear decision with the intention to follow through.

The very fact that I've said that "This is what I will do" makes me much more likely to follow through and do it.

Sticky Note – Key Decision Format



**KD 01: What is
the
Key Decision
to be made?
(1 decision/sticky)**

Don't number them yet! We'll do that as a team to avoid duplicates.

Name the Owner - probably you for now.

Owner

Find the Key Decisions



- 1 Use the NUDs, Uncertainties and Risks to identify potential Key Decisions you need to make **BETWEEN NOW AND THE NEXT MAJOR MILESTONE**, using the Key Decision template and writing your own name as the temporary owner.
 - Phrase them all as complete **QUESTIONS** with **WILL**.
 - Add yourself as the Owner for now on every Key Decision candidate you write.
- 2 Organize them into the Key Decisions Matrix.
- 3 For decisions that are very close to each other in the Key Decisions quadrant, write a summary question or choose the best one to carry forward.
- 4 **COPY** your Key Decisions to the Key Decision Flow and arrange them in a logical sequence. (Do not copy the other decisions).

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How to Re-Assign Ownership



- Review the owners for each Key Decision. If the Key Decision Owner is not present, assign someone to act as his or her proxy during the rest of the Kickoff Event.
- If your sub-team has a Key Decision that belongs to a different team, you may give it to them at this step.
- When you receive a Key Decision from another team, you can decide what to do with it.
 - Accept it as a Key Decision.
 - Reclassify as “Known Solution” or other category — consider sharing your rationale with the team that gave it to you — you can delete it from this Board as it is already present on the other Board.
 - Combine it with one you already have.

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The Lifecycle of a Knowledge Gap

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Knowledge Gaps



Core Hypothesis: The reason why your company believes in this product.

Key Decisions: Decisions that are High Impact and High Unknown – they must be made in order to complete the product or process design – but the team cannot make them with confidence yet.

Knowledge Gaps: Something that a team needs to know in order to make a Key Decision.

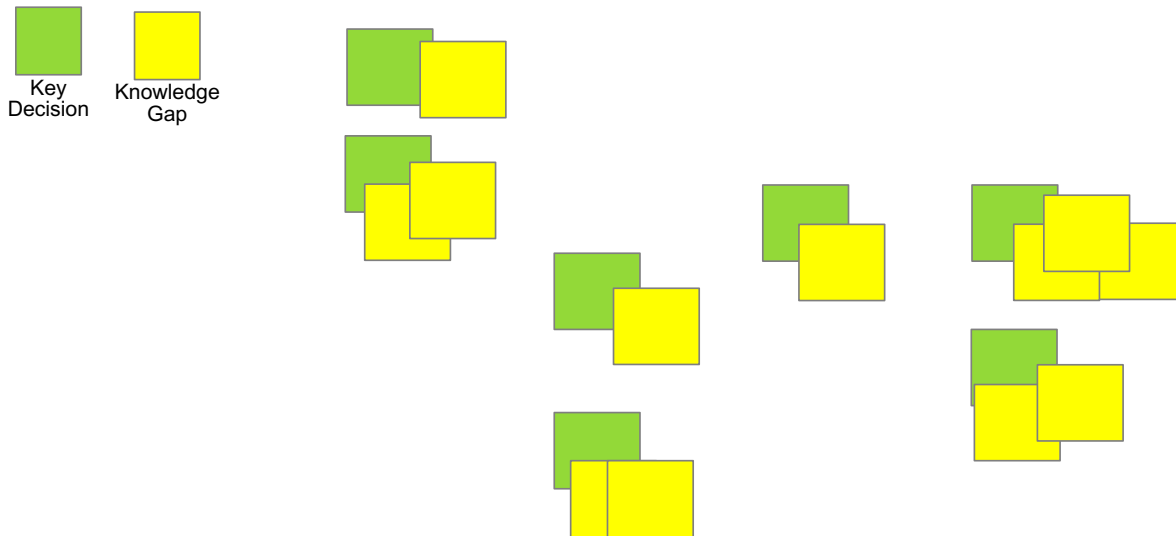
Examples include:

- What are the available motors and how closely do they meet our needs?
- What potential market segments could we target?
- What is the cost of adding the Midway feature?

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The Key Decision Flow with Knowledge Gaps



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Knowledge Gaps Have Owners



- Design the Learning Activities to close this Knowledge Gap.
- Enlist any help or resources needed.
- Do the Learning Activities.
- Develop the Recommendation.
- Write the Knowledge Gap Report.

*Often the Key Decision and Knowledge Gap owners are the same
but it's better to delegate the KG if possible.*

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How to Find Knowledge Gaps and Write Knowledge Gap Questions

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Questions to Find Knowledge Gaps



Knowledge Gaps from Key Decisions

- What's keeping us from making this Key Decision today?
- Why is it High Impact / High Unknown?
- What's new about it? What's changed? Where are we pushing the boundaries?

Other Knowledge Gaps

- What do we have to do that we don't know how to do?
- What questions do we have about the regulatory landscape, compliance issues, or mandatory standards?

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These Are Not Knowledge Gaps As Written — They Point Towards Knowledge Gaps



- The only way to close the Knowledge Gap is to make a decision / recommendation.
 - What region should we target? → What region will we target?
 - What is the supplier strategy? → What will be the supplier strategy?
- It's really an action item or even a deliverable.
 - What is the design for the component? → Design the component (task, and not on this plan). Consider instead what you need to learn: How have we designed this component before?
 - What are the results of the experiment? → Run the experiment. (task, and not in the plan). Consider why you're running the experiment: "How do the different formulations behave under high temperature?"

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Formulate a Knowledge Gap



Knowledge Gaps are Well-Defined Questions with Answers:

What Could We Do?

- Which suppliers can deliver the robotic arm?
- What materials meet our requirements for durability, strength and cost for the tubing?
- Which of our factories have the process capability we need?

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Sticky Note – Knowledge Gap Format



***KG 01-01: What
is the knowledge
gap that needs
to be solved?
(1 decision/sticky)***

Set yourself as
the Owner for
now

Owner C-1 D-3 U-5

We'll add these in
a moment..

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Find the Knowledge Gaps



For the Key Decisions assigned to you and anyone you represent:

- 1 Copy the Key Decisions into the Knowledge Gaps area.
- 2 Find the Knowledge Gaps for one of your individual Key Decisions and write them on the Knowledge Gap note, using the template in your system. Write your own name as the owner but don't fill out the rating yet.
- 3 Repeat Steps 1 & 2 with your other Key Decisions.
- 4 Ask questions to find other Knowledge Gaps and write them on additional Knowledge Gap notes.

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Assign Ownership to Knowledge Gaps



- If your sub-team has a Knowledge Gap that belongs to a different team, you may give it to them at this step.
- When you receive a Knowledge Gap from another team, you can decide what to do with it.
 - Accept it and prioritize it against others.
 - Decide that it is already closed and share that with the related Key Decision owner – they will need the information for the Key Decision recommendation and report.

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Number Your Key Decisions and Knowledge Gaps!



- Key Decisions: The facilitator will number these.
 - KD 01: . . . , KD 02: . . .
- Knowledge Gaps:
 - KG 01-01: . . . KG 01-02: . . . Knowledge Gaps for Key Decision #01
 - KG 02-01: . . . KG 02-02: . . . Knowledge Gaps for Key Decision #02
 - KG N-01: . . . KG N-02: . . . Knowledge Gaps with no Key Decision

Before you go on, make sure every Key Decision and Knowledge Gap has a number and that the format includes KG or KD and the COLON.

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How to Prioritize Knowledge Gaps

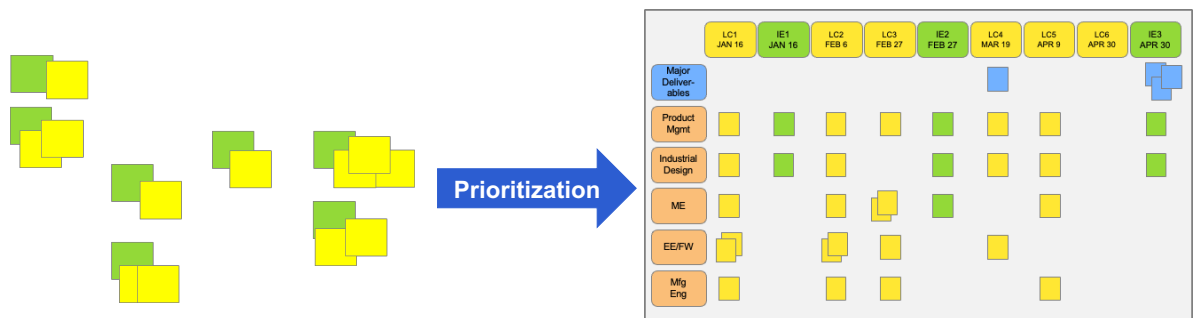
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Why Prioritize?



Prioritization is the bridge from the flow of Key Decisions and stacks of Knowledge Gaps to the Learning Cycle Plan.



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Priority of a Knowledge Gap



We determine priority with three criteria:

Criticality

How critical is this to the success of the project or business case?
What is the impact if we can't close this gap?

Duration

How long will it take to close this gap?

Uncertainty of Duration

How accurately can we predict how long it will take to get an acceptable answer?

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Criticality



How critical is this to the success of the project or business case?
What is the impact if we can't close the gap?

- 5 **Critical impact** – entire product program may fail
- 4 **Severe impact** – risk to timeline, schedule, budget and/or objectives that will cause missed launch dates or ROI targets
- 3 **Moderate impact** – delay project, cost more, require us to drop features
- 2 **Little impact** – no major customer or business impacts
- 1 **No impact** – no one would even notice

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Duration



How long will it probably take to close this knowledge gap, based on what we know today?

- 5 **Very Long** – more than 6 weeks
- 4 **Long** – 3 to 6 weeks
- 3 **Medium** – 1 to 2 weeks
- 2 **Short** – less than 1 week
- 1 **Very Short** – 1 day

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Uncertainty



How accurately can we predict the duration?

- 5 **Very unpredictable** – we have no idea how long this will take.
- 4 **Unpredictable** – we have some idea what needs to be done but not sure how long it will take.
- 3 **Neutral** – we have a pretty good idea of what needs to be done, but we may need to try more than one thing to get a clear answer.
- 2 **Predictable** – we will follow a familiar procedure which is likely to result in a reliable answer the first time.
- 1 **Highly Predictable** – we will follow a familiar procedure and the answer will definitely be reliable.

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This is NOT a Scoring Method



These two gaps would have the same score in many scoring methods but have different priority:

C=5, D=1, U=1

Critical to the project
Can be closed quickly and easily

C=1, D=5, U=1

Unimportant to the project
Will take a long time and a lot of work to close.

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Principles for Prioritizing Knowledge Gaps



- 1 High criticality before low criticality
- 2 Small duration before large duration
 - Pull learning forward
 - Drive uncertainty down
 - Reduce project management overhead
- 3 High uncertainty before low uncertainty
 - You don't know how long it will take, so start early!
- 4 Early enough to finish in time for the Key Decision
- 5 Not all Knowledge Gaps will be closed. Low criticality Knowledge Gaps shouldn't be closed.

These principles may conflict with each other, which is why we need to discuss our prioritization decisions!

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Rate the Knowledge Gaps



- 1** Do one final check of Ownership before going on.
- 2** (Individually) Rate the Knowledge Gaps: Criticality, Duration, Uncertainty of Duration. Write your rating in the lower right-hand corner of the sticky note like this:

C-4 D-3 U-4
- 3** Review ratings with team members if there's time – but calibration has not proven to make a big difference in the final outcome.

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Sort into Categories by Ratings



DO NOW C-4/5, D-1/2, U-1/2/3 High value, easy. Get them done fast.	DO NEXT C-4/5, D-3/4/5, U-4/5 Will take a long time and time is uncertain.	DO NOT CLOSE C-1/2, D-1/2, U-4/5 C-1/2, D-3/4/5, U-Any Don't close the low- value Knowledge Gaps.
PRIORITIZE NEXT C-4/5, D-3/4/5, U-1/2/3 C-4/5, D-1/2, U- 4/5 Schedule shortly before their Key Decisions.	ONLY IF TIME C-3, D-Any, U-Any C-1/2, D-1/2, U-1/2/3 Fill in extra capacity with next most critical.	

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Decision Rules for Allocating Knowledge Gaps to Categories



		Duration →				
Uncertainty ↓		1	2	3	4	5
	1					
	2		DO NOW		PRIORITIZE NEXT	
	3					
	4		PRIORITIZE NEXT			
	5			DO NEXT		

Criticality = 4 or 5

		Duration →				
Uncertainty ↓		1	2	3	4	5
	1					
	2					
	3					
	4					
	5					

Criticality = 3

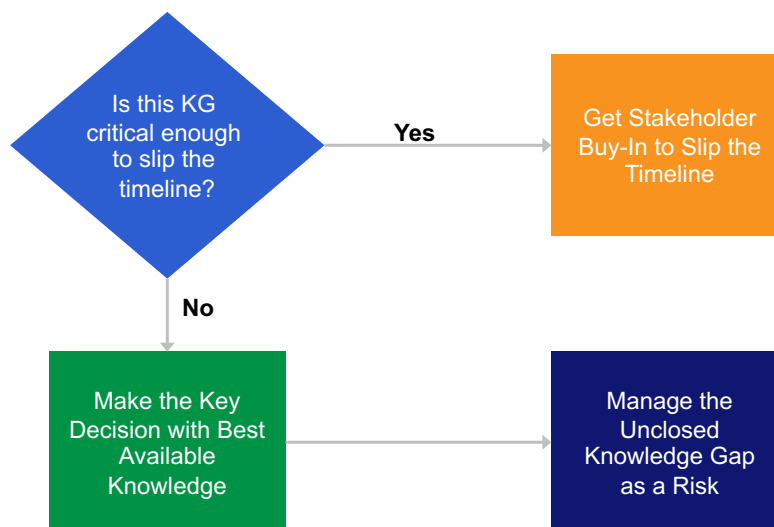
		Duration →				
Uncertainty ↓		1	2	3	4	5
	1					
	2		DO IF TIME			
	3					
	4					
	5					

Criticality = 1 or 2

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What Do You Do With Knowledge Gaps You Can't Close?



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Prioritize the Knowledge Gaps



- 1 Sort your team's Knowledge Gaps into the five categories.
- 2 Sanity check the results – are there any that seem like they are in the wrong place?

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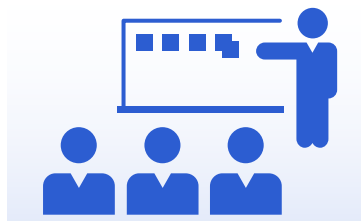


The Rapid Learning Cycles Event Structure

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The Kickoff Event



A Team Event to bring the team together to establish the Rapid Learning Cycles framework for the next phase of work.



Kickoff Event

LCE

LCE + IE

LCE

LCE

LCE

LCE + IE

LCE

LCE

LCE + IE

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Learning Cycle Event: Knowledge Gaps



	LC1 4/7/16	LC2 4/28/16	LC3 5/19/16	IE1 5/19/16	LC4 6/9/16	LC5 6/30/16	LC6 7/21/16	IE2 7/21/16	IE3 9/1/16
Sensors									
Shell									
Control Panel									
Display									
Controls									

Learning Cycle Event – The Team

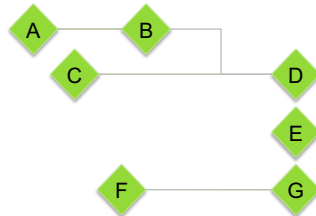
- Share results of Knowledge Gaps completed in last cycle – **with Knowledge Gap Reports**
- Decide which Knowledge Gaps to address in the next Learning Cycle
- Update the Learning Cycle Plan – a minor update



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Integration Event: Key Decisions



Integration Event – The Team + Stakeholders

- Share recommendations for Key Decisions to be taken at this Event – **with Key Decision Reports**
- Take the Key Decisions
- Update the Learning Cycle Plan to reflect the Key Decisions and any other new information – a major update



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Status Event: Activities



Status Event – The Team or a Department

- Ask Each Person Three Questions:
 - What got done?
 - What's going to get done?
 - What help do you need?
- Give Only One of Two Responses:
 - Thank you!
 - I can help with that!
- Take any other discussion offline.



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Cadence and Flow in the Rapid Learning Cycles Framework

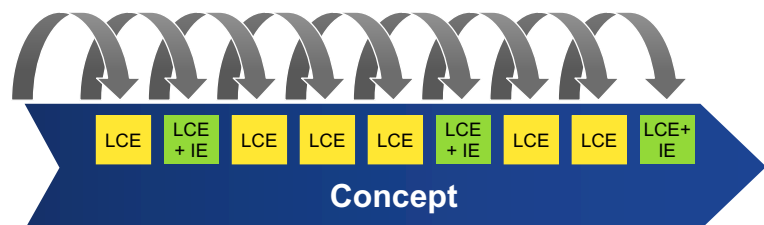
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The Power of Regular Cadence



**A regular cadence
reduces overhead
and pulls work
through with gentle
accountability.**



- Less time spent scheduling meetings.
- Less time spent on interruptions and the associated task-switching.
- More urgency for learning-related activities that otherwise may be shuffled aside in favor of work with earlier deadlines.
- Gentle accountability via reinforcing the desire to show up to support the team.

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Ideal Cadence is a Trade-off

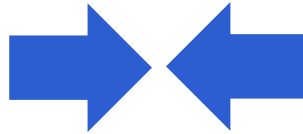


How long should a Learning Cycle be?

Transaction Cost

Cost of **more** frequent events:

- Overhead of having the meetings
- Overhead of preparing for the meetings



Holding Cost

Cost of **less** frequent events:

- Don't start newly discovered KGs as soon
- More time going down dead ends
- More interruptions
- More issues accumulating

Transaction cost is obvious and immediately felt.

Holding cost is less obvious but often larger and more impactful to the project.

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Three Cadences to Establish



- **Learning Cycle:** Heartbeat of the program with regular cadence to generate pull.
- **Integration Events:** As needed to make Key Decisions at the Last Responsible Moment, but always at the end of a Learning Cycle.
→ This is the ONLY event that does not occur on a regular cadence.
- **Status Event:** Often enough to help team stay in sync, but not so often as to be annoying.

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The Learning Cycle is the Key Cadence



Learning Cycles: Always the Same Length*

**Learning Cycle Events: Always the Same
Day / Time / Location**



*If you are a pilot project for RLC, you may choose your own cadence and you may update it after at least 3 months / 4 Learning Cycles.

Most organizations with full adoption of RLC have standardized on a single cadence across teams to reduce transaction costs and align schedules for everyone.

High Cost of Delay When We Move a Learning Cycles Event



When we **don't** have a Learning Cycle Event,
the Knowledge Gap results are "held" until the Learning Cycle Event.

- Team members don't wrap up their Knowledge Gap Reports with final analysis
 - **May not realize they've learned enough and it's time to stop working on this Knowledge Gap.**
 - **May not recognize & start new Knowledge Gaps.**
- Team members don't share their learnings
 - **Can't recognize when someone else's answers or assistance can shorten their own work.**
 - Key Decision Owner can't start using the new knowledge.
- Team doesn't revisit their Learning Cycle Plan to:
 - De-prioritize Knowledge Gaps which no longer really need to be closed.
 - Add newly discovered Knowledge Gaps which critically need to be closed.
 - **Address the issues that led to Knowledge Gaps that were not closed on time.**

This Is Why The Learning Cycle Events Don't Move!



- **We hold the event** even when we may not have made much progress.
 - *The event shares the knowledge that has been built so far, and surfaces problems so that the team can address them.*
- **We hold the event** even when many of the team members may be away due to illness, holidays, or a major service/support issue that's pulled everyone away.
 - *The event will help the team understand the impact of the disruption and reprioritize based on their new reality.*
- **We hold the event** even when other work-related commitments may pull key team members away.
 - *These events work fine as hybrid events — team members who are traveling should plan their time so that they can join a virtual meeting, or designate someone who can attend*

Predictable events prevent interruptions and enable rapid response to issues that arise.

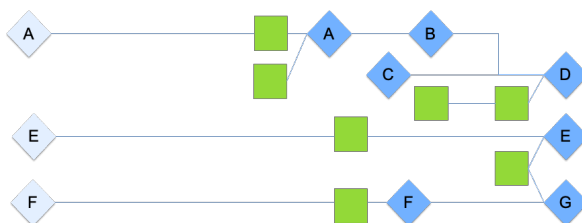
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We Have Integration Events When We Need Them



Group Key Decisions into Integration Events



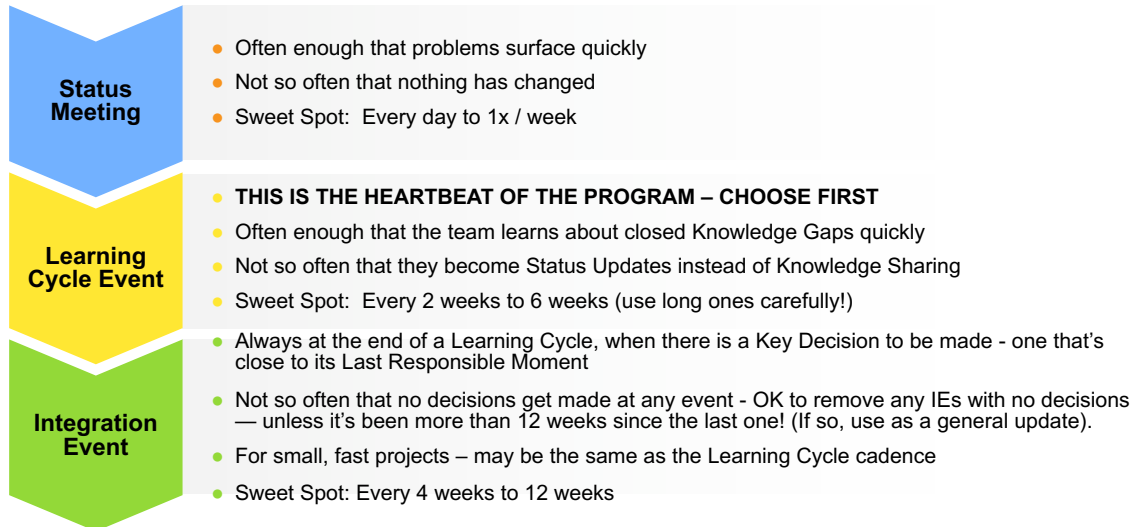
	LC1 JAN 16	IE1 JAN 16	LC2 FEB 6	LC3 FEB 27	IE2 FEB 27	LC4 MAR 19	LC5 APR 9	LC6 APR 30	IE3 APR 30
Major Deliverables									
Product Mgmt									
Industrial Design									
ME									
EE/FW									
Mfg Eng									

- Key Decisions are placed into Integration Events, which happen at the end of a Learning Cycle just prior to the Last Responsible Moment.
- This means some Key Decisions may be a week or two earlier than their Last Responsible Moment, but never more than one Learning Cycle early.

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Timings for Rapid Learning Cycles



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Plan the Team Cadences



- 1 Establish a cadence for your Rapid Learning Cycles first. This is the Heartbeat of the Program.
- 2 Decide when your Integration Events will be by looking at the Last Responsible Moment for Key Decisions. Integration Events are always at the end of a Learning Cycle.
- 3 Decide how often you will have Status Events, where and when.
- 4 Record these decisions where everyone can see them.

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The Learning Cycles Plan

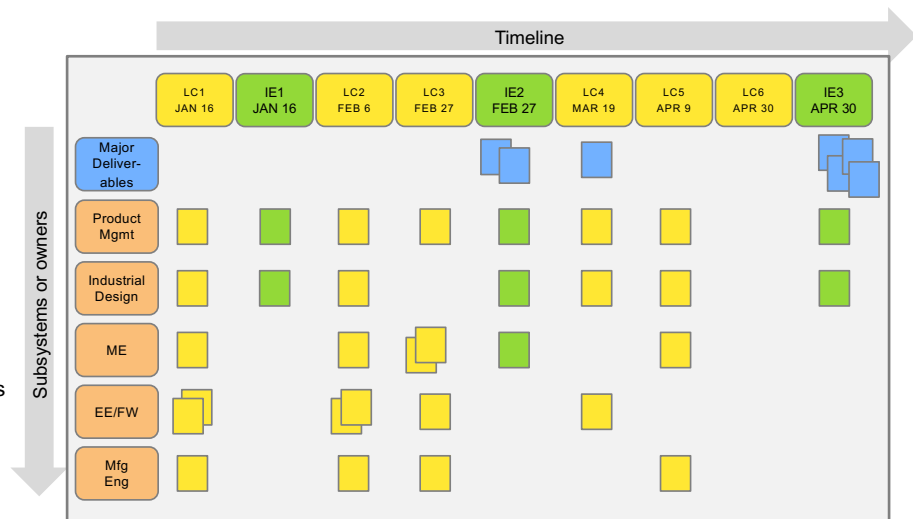
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Learning Cycle Plan



- “Swim Lanes” by owner, department, sub team or focus area.
- Learning Cycle and Integration Event cadence across the top.
- Key Decision sticky notes in the Integration Event where they **Close** (the Last Responsible Moment)
- Knowledge Gap sticky notes in the Learning Cycle where they **Start**

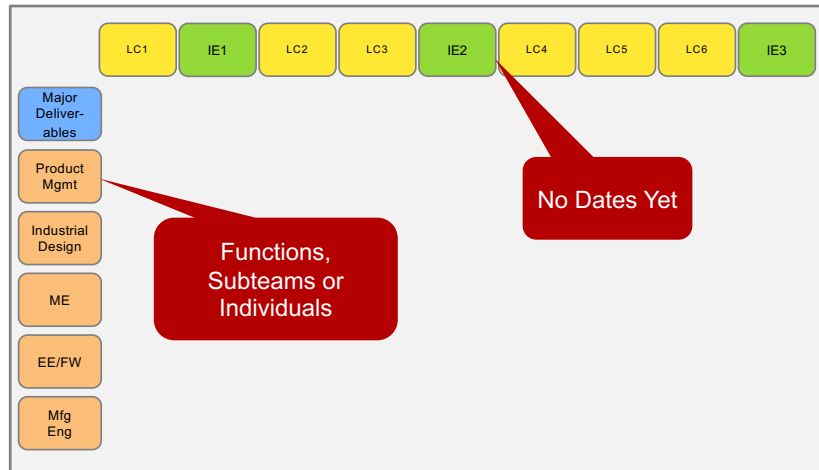


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Step 1: Make Labels for Your LCs, IEs and Swim Lane Owners

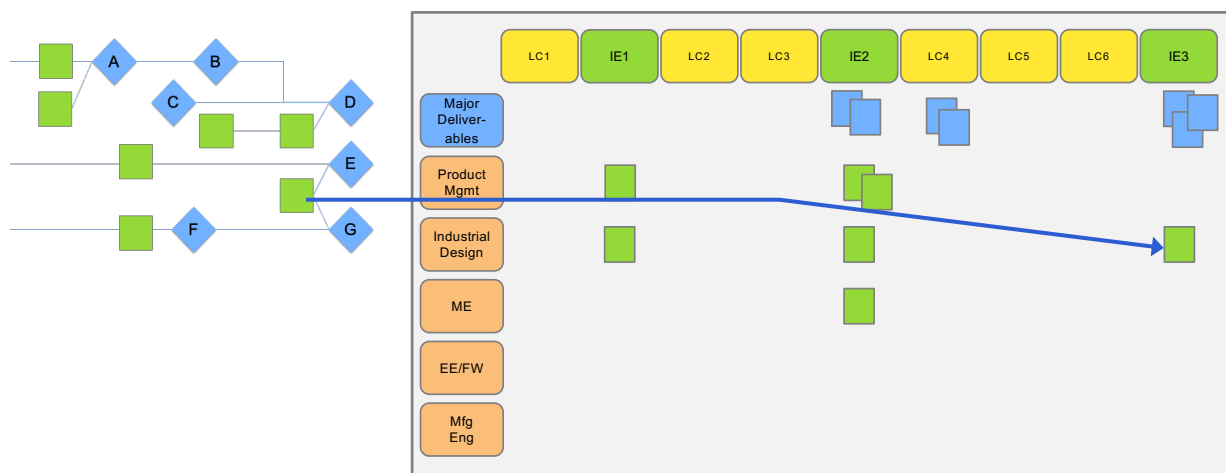
F2F and Virtual



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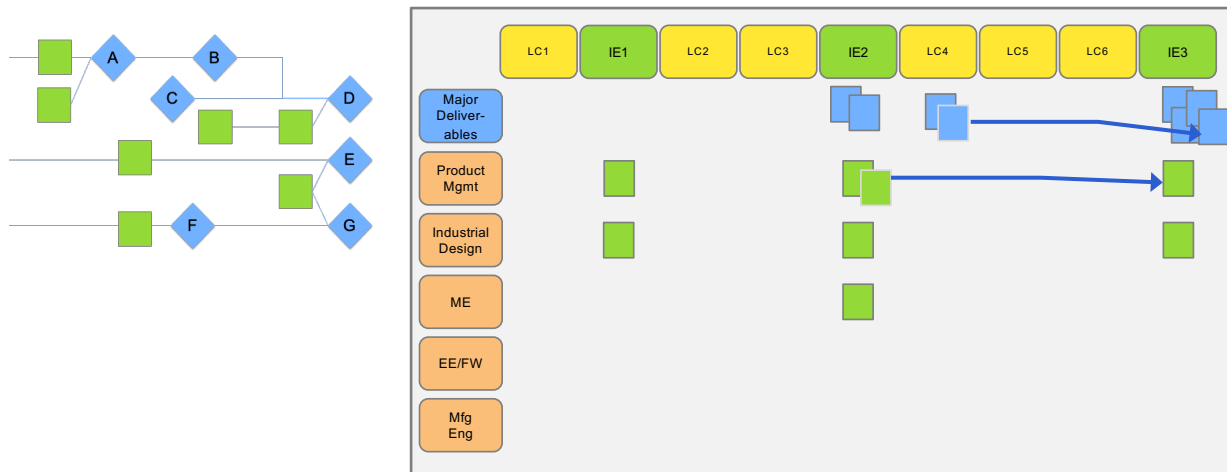
Step 2a: Put Key Decisions into Integration Events at their Last Responsible Moment



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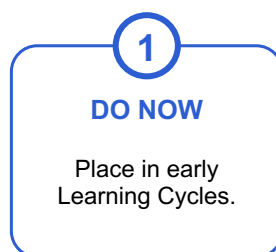
Step 2b: Validate the Key Decisions with the Entire Program Team



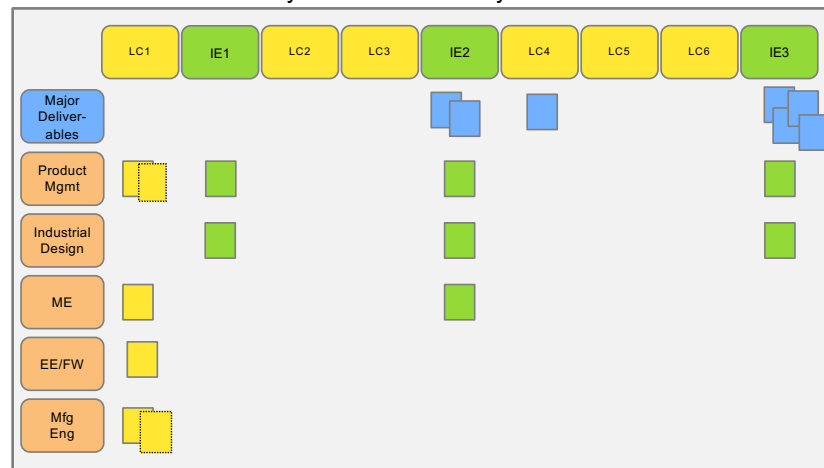
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Step 3a: Move the “Do Now” Knowledge Gaps into Early Learning Cycles



Place Knowledge Gaps in the Learning Cycle Plan where they will START



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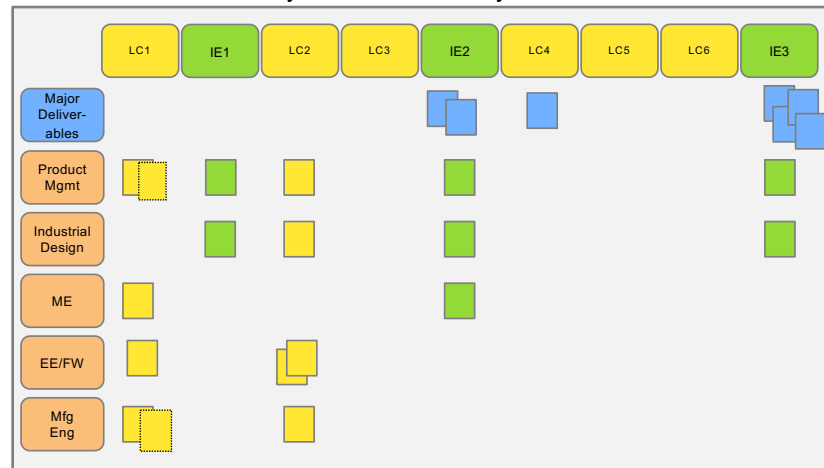
Step 3b: Move the “Do Next” Knowledge Gaps into Early Learning Cycles


2

DO NEXT

Start early – these might take longer than you think.

Place Knowledge Gaps in the Learning Cycle Plan where they will START



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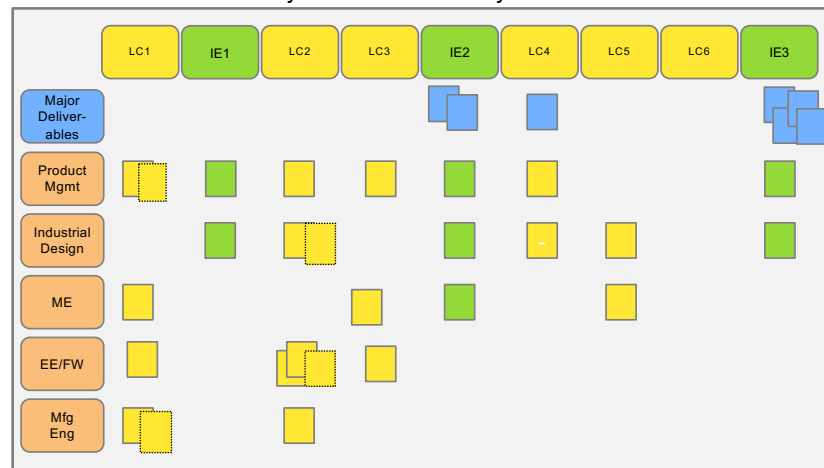
Step 3c: Move the “Prioritize” Knowledge Gaps into the Learning Cycle Plan – Without Overloading Anyone


3

PRIORITIZE

Start in time to finish by its Key Decision

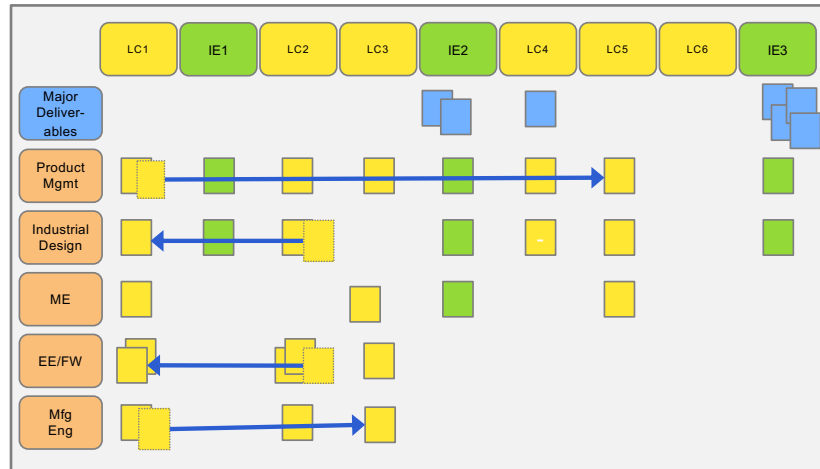
Place Knowledge Gaps in the Learning Cycle Plan where they will START



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Step 3d: Rationalize the Plan Before Adding Low Priority Knowledge Gaps



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Step 3e: Add Only as Many “Do if Time” Knowledge Gaps as You Can Without Overload.

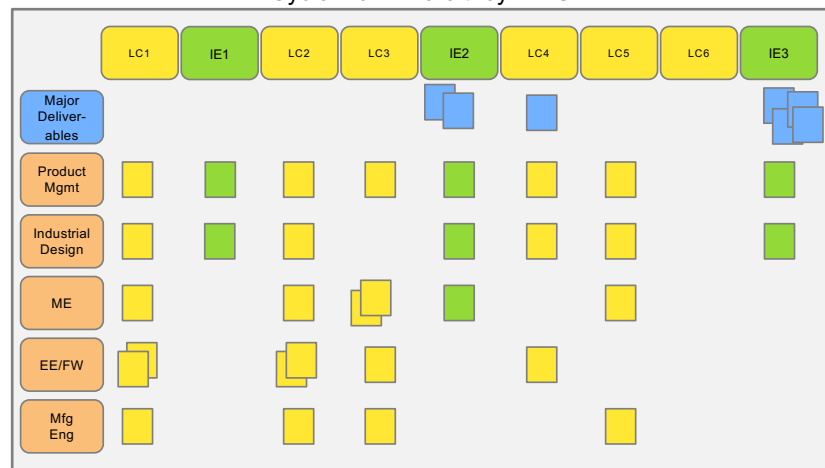


4

IF WE HAVE TIME

Fill in with the most useful

Place Knowledge Gaps in the Learning Cycle Plan where they will START



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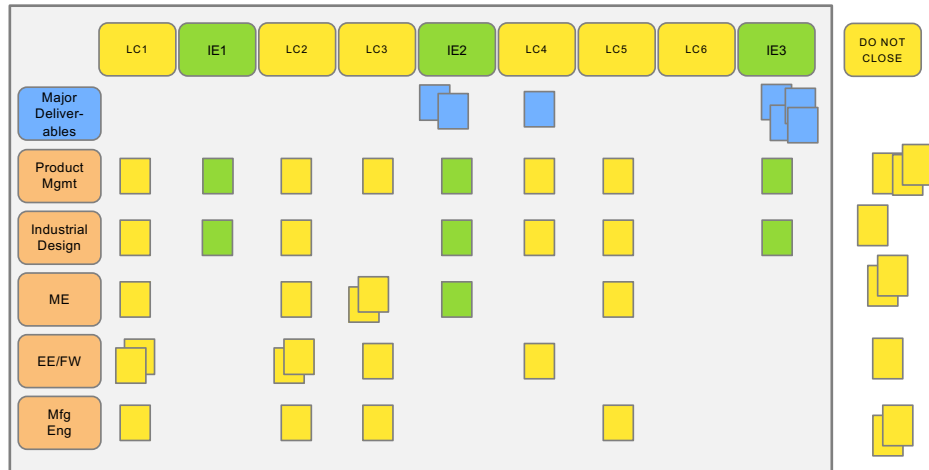
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STOP: Set Aside Anything from the “Do Not Close” Category Without Adding It to the Plan – Even If You Think You Have Time.



DO NOT CLOSE

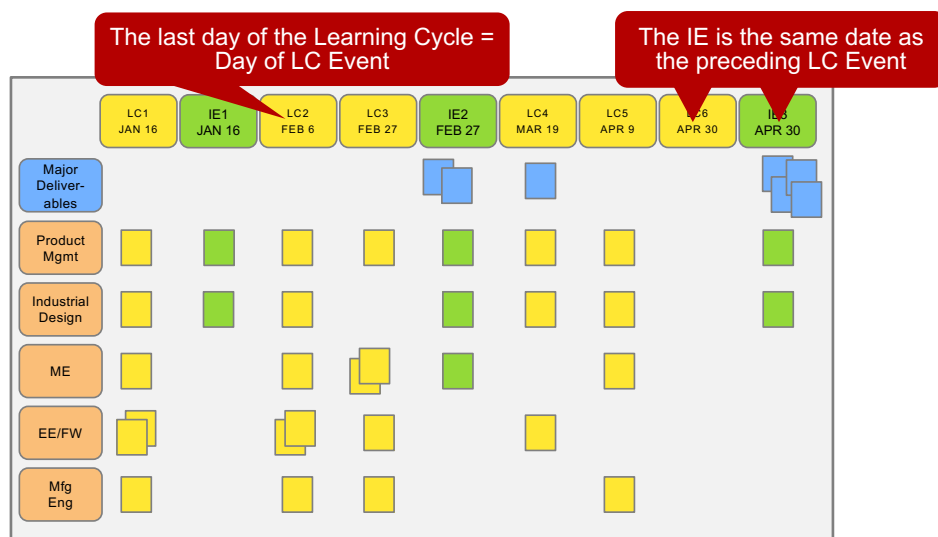
Don't put these on the plan at all.



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Step 4: Add Event Dates



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Inside the Learning Cycle

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Key Decision (title should include keywords but doesn't have to be question)
Owner:
Decision Maker:
Integration Event:

The Key Decision

The Purpose (link back to the project's Objectives)

What We Have Done – summary of work to close Knowledge Gaps and build stakeholder alignment around decision

PROJECT NAME
Key Decision #__

Ready for Decision

- Font size at least 12 pt.
- No more than two additional slides

What We Have Learned – summary of all Knowledge Gaps

What We Recommend / What We Have Decided

<div style="background-color: #ffff00; padding: 5px; border: 1px solid black;"> Knowledge Gap: (title should include keywords but doesn't have to be question) Owner: Contributors: Learning Cycle: </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> The Question to Answer: </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> The Purpose (link back to the Knowledge Gap's Key Decision): </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> What We Will Do / What We Have Done (summary of your plan to close the KG) <div style="margin-top: 10px;">Done:</div> <div style="margin-top: 10px;">Planned:</div> </div>	<div style="background-color: #ffff00; padding: 5px; border: 1px solid black; text-align: right;"> PROJECT NAME Knowledge Gap # _____ In Progress </div> <div style="background-color: #ffff00; padding: 5px; border: 1px solid black;"> <ul style="list-style-type: none"> Font size at least 12 pt. No more than two additional slides </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px; min-height: 150px;"> What We Have Learned </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px; min-height: 50px;"> Recommendations and Next Steps </div>
---	--

<div style="background-color: #90EE90; padding: 5px; border: 1px solid black;"> Klickitat's Video Solution Owner: Jim Smith Decision Maker: Suzanne Brown Integration Event: March 31, 2024 </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> The Key Decision Who will provide the Klickitat's video solution? </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> The Purpose (link back to the project's Objectives) We want improved remote control and video recording in our undersea robot, compared to our current vendor's video capabilities. We must choose a video solution tool by start of 3rd quarter to meet target launch date. If we don't have better video, our competitors will take over. There's lots of video cameras available but we don't know if they can survive submersion. </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> What We Have Done – summary of work to close knowledge gaps and build stakeholder alignment around decision <ul style="list-style-type: none"> ✓ KG 03-01: Which cameras from which vendors might meet our needs? We found five candidates from three vendors. ✓ KG 03-02: Can the candidate cameras be controlled by our control system on dry land? This eliminated two vendors. ✓ KG 03-06: Which candidate cameras can survive a hydrostatic pressure test? We tested three cameras in via hydrostatic pressure test. Two failed completely. The third failed the test but seemed close, if we were willing to let them leverage our expertise to improve the seals. <ul style="list-style-type: none"> Approached our current vendor about the possibility of joint development on a camera that has the functionality we need. </div>	<div style="background-color: #90EE90; padding: 5px; border: 1px solid black; text-align: right;"> KLICKITAT UNDERSEA ROBOT Key Decision #03 Ready for Decision </div> <div style="background-color: #90EE90; padding: 5px; border: 1px solid black;"> <ul style="list-style-type: none"> Font size at least 12 pt. No more than two additional slides </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> What We Have Learned – summary of all Knowledge Gaps As of today, none of the alternative vendors provide solutions that are better than our current vendor. <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th>Criteria</th> <th>Current Vendor</th> <th>A</th> <th>D</th> <th>B</th> <th>C</th> <th>E</th> </tr> </thead> <tbody> <tr> <td>Video Resolution</td> <td>Not good enough</td> <td>+</td> <td>++</td> <td>+</td> <td>+</td> <td>++</td> </tr> <tr> <td>Cost compared to current camera</td> <td>Same</td> <td>+</td> <td>++</td> <td>-</td> <td>--</td> <td>+</td> </tr> <tr> <td>Works with our control system</td> <td>Y</td> <td>N</td> <td>N</td> <td>Y</td> <td>Y</td> <td>Y</td> </tr> <tr> <td>Can withstand water pressure</td> <td>Y</td> <td>Didn't test</td> <td>Didn't test</td> <td>N</td> <td>N</td> <td>close</td> </tr> </tbody> </table> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Analysis: These results show two possibilities which would require further work: 1) Work with current vendor to improve their video resolution. They are highly motivated to work with us so that they can secure the Klickitat series contracts. 2) Approach Sonoria (option E) to see if they are willing to work with us to improve their seals to withstand the water pressure. Although the technical challenges are smaller, we have no prior relationship with them and so any co-development partnership would be a lot riskier. </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Conclusion: Our best option is to work with our current vendor to develop the improved video resolution. </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> What We Recommend / What We Have Decided Execute a co-development agreement with our current vendor to improve the video resolution of their camera. </div>	Criteria	Current Vendor	A	D	B	C	E	Video Resolution	Not good enough	+	++	+	+	++	Cost compared to current camera	Same	+	++	-	--	+	Works with our control system	Y	N	N	Y	Y	Y	Can withstand water pressure	Y	Didn't test	Didn't test	N	N	close
Criteria	Current Vendor	A	D	B	C	E																														
Video Resolution	Not good enough	+	++	+	+	++																														
Cost compared to current camera	Same	+	++	-	--	+																														
Works with our control system	Y	N	N	Y	Y	Y																														
Can withstand water pressure	Y	Didn't test	Didn't test	N	N	close																														

Can Sonoria's new line of cameras replace our existing vendor's solution?
Owner: Jim Smith
Other Contributors: Eileen Black, Joe Malloy
Learning Cycle: LC3 - March 31, 2024

The Question to Answer:
 Are the newest models of video cameras from Sonoria capable of maintaining their waterproof seals in 100 meters of water?

The Purpose (link back to the Knowledge Gap's Key Decision):
 We want to increase the resolution and control features on the Klickitat, but our current vendor's solutions don't provide those features, so we need to decide whether we can replace them with a new supplier.

What We Will Do / What We Have Done

Done:

Sonoria's new line of cameras seem to have the right specs and feature set but are unproven in deep sea applications.

We ran a hydrostatic pressure test experiment through our partnership with Seatools on samples from Sonoria of their latest line of underwater cameras (LX586, GX968, KX938)

The cameras were submerged for twelve hours at 5600 kPa (equivalent to 550m of seawater depth) on a test harness that supplied power and recorded video and other camera diagnostic data.

After submersion, the data was retrieved and analyzed for signs of failure. All cameras were disassembled, and their seals were visually inspected for signs of deterioration.

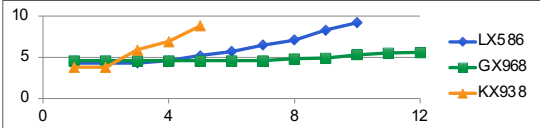
**KLICKITAT UNDERSEA ROBOT
Knowledge Gap #03-06**

Closed




- Font size at least 12 pt.
- No more than two additional slides

What We Have Learned

Two cameras did not survive the pressure test. The LX586 failed after 10 hours and the KX938 only survived for five hours before their seals failed.



The third, the GX968, remained operational throughout the test, but the seals showed signs of significant deterioration. It's not likely to have survived a second mission.

New GX968 Gasket After 8 Hours After 12 Hours

Recommendations and Next Steps

Recommend that we drop Sonoria from consideration and continue with our existing vendor.

Where to Put Your Key Decisions and Knowledge Gap Reports

- Key Decision and Knowledge Gap Templates:
- Key Decision Reports:
- Knowledge Gap Reports:
- Project Keywords and any other conventions team members should follow for their reports.

When you present this to your team, be sure to present them with the information specific to their team – and reinforce with a follow-up email.

Final Review and Check



- Are you comfortable with the plan for your first Learning Cycle?
Do you personally know what to do?
- What will get in the way?
- What help do you need?
- What will you do tomorrow?



Agile Hardware Development for the Middle Phase of Development

Katherine Radeka

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Welcome and Introduction

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2

Talking Points



- Looking forward to working with you next week
- Content is not as systematized - so recording video this way to allow rapid iteration as we learn
- Doesn't mean we don't have proof points - gathering evidence since 2018
- Mindful of the time you have to prepare

In This Course



Before Wednesday

- Why Does Development Take So Long?
- What the RLC Framework Does Differently
- The Difference: Resilient Key Decisions
- Execution Cycles with Targeted RLCs
- Agile Release Trains
- Milestones - Deliverables - Work Packages
- Execution Cycle Event Structure

Post Kickoff Event As Needed

- Core Hypothesis
- NUDs, Uncertainties and Risks
- Key Decisions
- Knowledge Gaps
- Cadence and Flow
- Learning Cycles Plan
- Inside the Learning Cycle

Pework



- Watch the videos.
- Think about these areas of your work on this project:
 - Where do you still have areas of outstanding technical risk?
 - Where do you have NUDs - New, Unique, Difficult areas of work?
 - What are the major deliverables you need to produce?
 - At a level of no less than two weeks, what do you need to get done to produce those deliverables?



Execution Cycles with Targeted RLCs

Pework

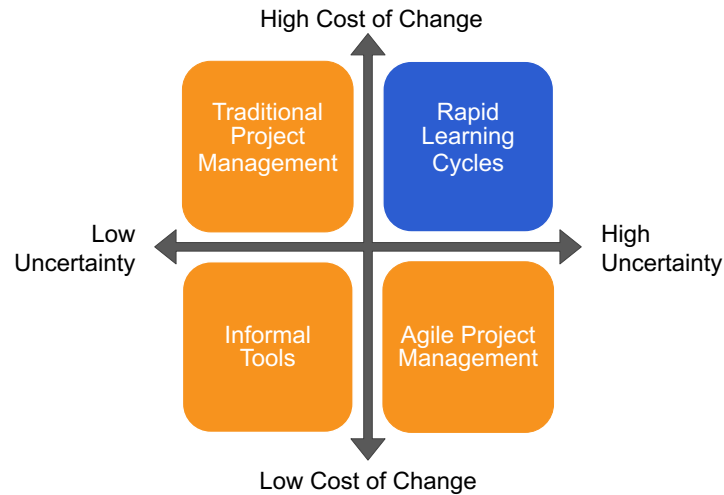


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Execution Cycles with Targeted RLCs

RLCs Drive Down Uncertainty and/or Cost of Change

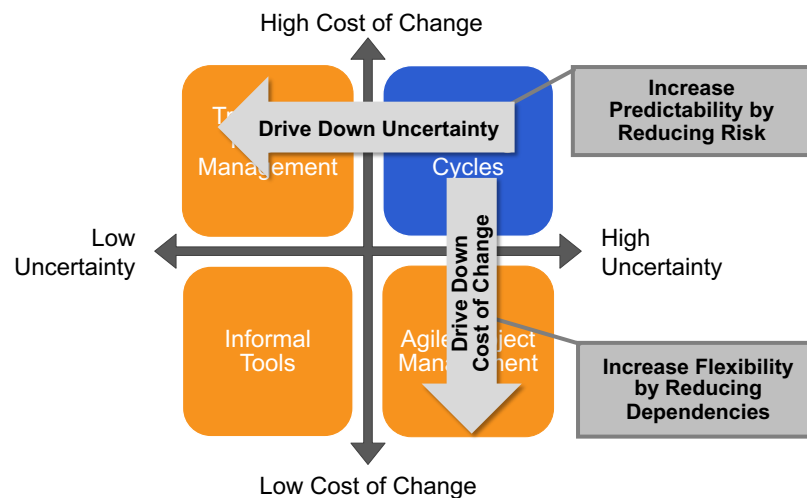


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RLCs Drive Down Uncertainty and/or Cost of Change

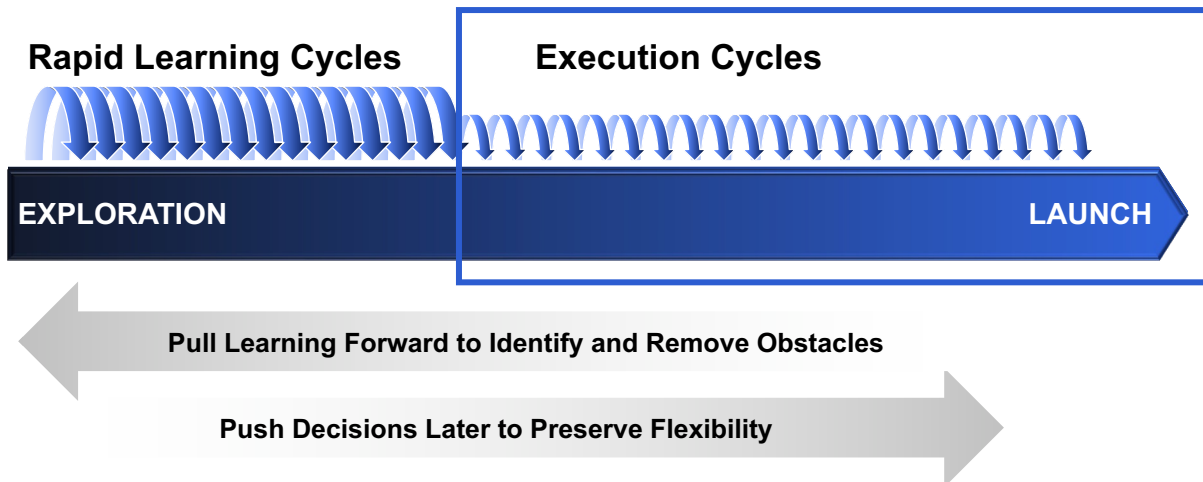


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Execution Cycles for Mid to Late Development

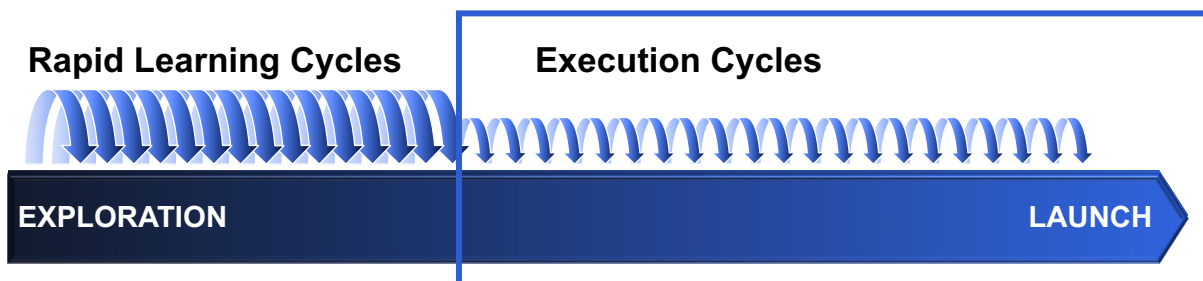


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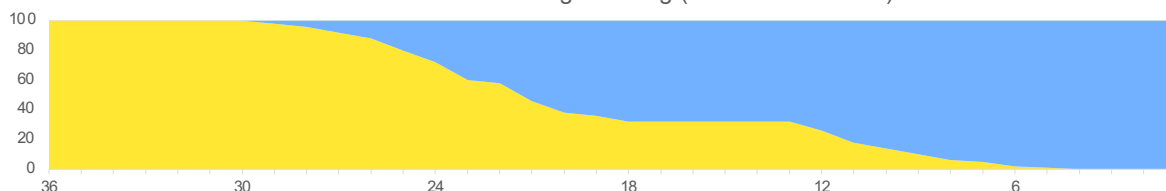
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Learning Continues Until Product Is Ready for Production



Transition from Learning to Doing (Months to Launch)



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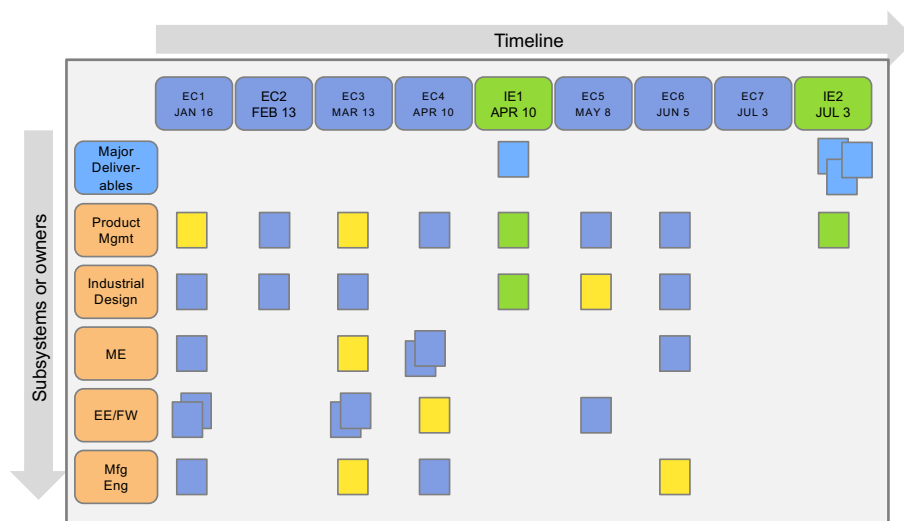
Execution Cycles to Preserve Flexibility and Support Integration



Execution Cycle:

- Timebox: 4 - 8 weeks
- Produce deliverables
 - Final requirements, specifications, CAD models, quality management plans.
 - Prototype Builds / Technology Demonstrators / Test Units
 - Production process design / build
 - Supplier Selection and Initial Purchasing
- Make outstanding Key Decisions and capture knowledge in real time
 - Knowledge Gap Reports to summarize learnings
 - Key Decision Reports to synthesize learnings into recommendations

The Execution Cycles Plan





Agile Release Trains

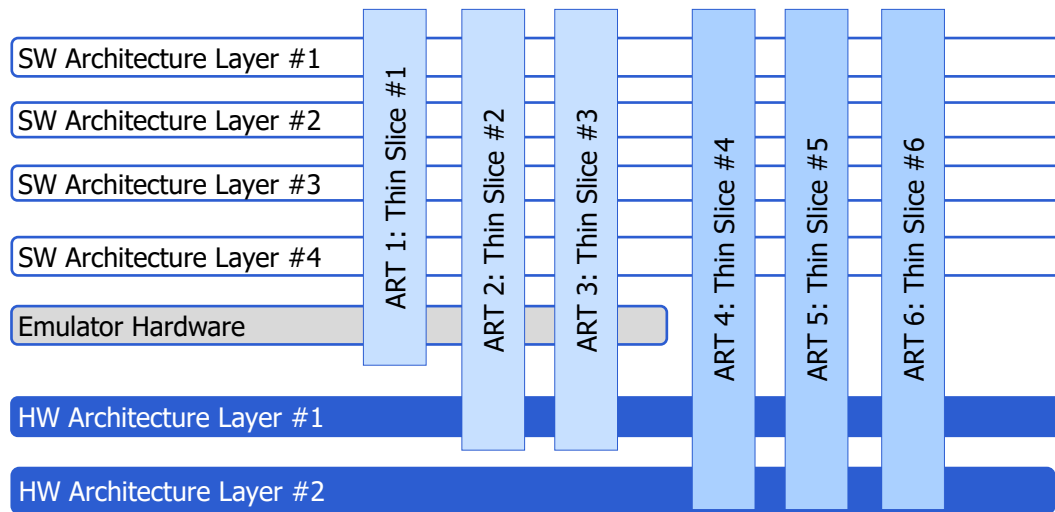
Agile Release Trains



- Run on a schedule aligned with Execution Cycles.
- One ART Slice per Train
- Train stops at station and all the system pieces needed for those slices board the train
 - Hardware prototypes
 - Software builds
 - Test harnesses
- Train stays on the tracks
 - Cannot add more slices or features once train has left!
 - If you miss the train, wait for the next one.
 - A train in motion can accept updated SW to fix problems.
- Goal: test all slices for this train and declare them done-done.



Release Trains Deliver Thin Slices through the System



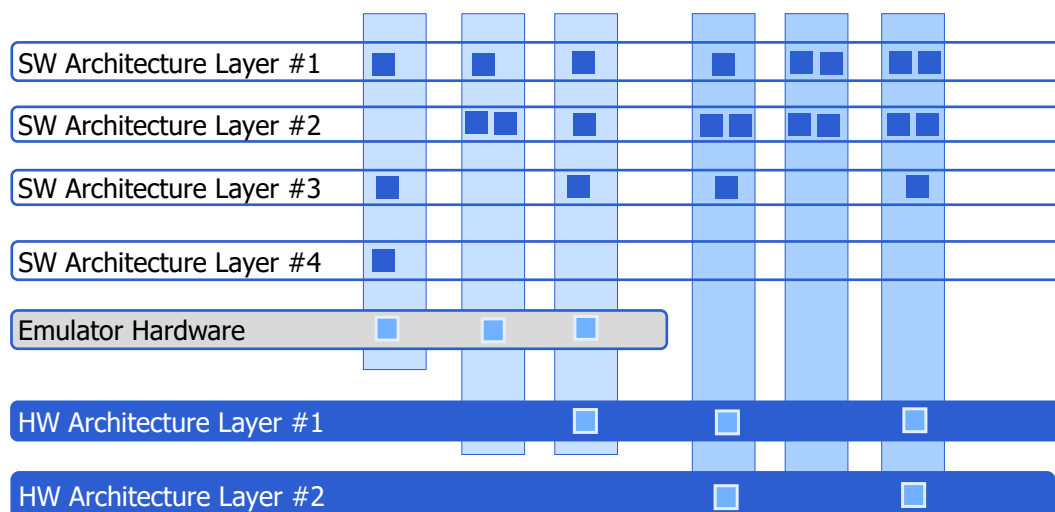
A Practical Approach to Large-Scale Agile Development by Gary Gruver, Mike Young, and Pat Fulghum

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15

Work Packages Map to an ART



A Practical Approach to Large-Scale Agile Development by Gary Gruver, Mike Young, and Pat Fulghum

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A Good Integration Slice ...



- Is a chunk of real functionality with business value
 - Takes the customer point of view
 - Tests the entire solution through all (available) layers
 - Has specific, measurable “pass” criteria
- } Agile
- Answers useful questions about the product for one or more teams
 - “Does it work?” is a useful question
 - Answers high-risk questions before low-risk questions
- } Rapid Learning Cycles

Agile Release Train Plan

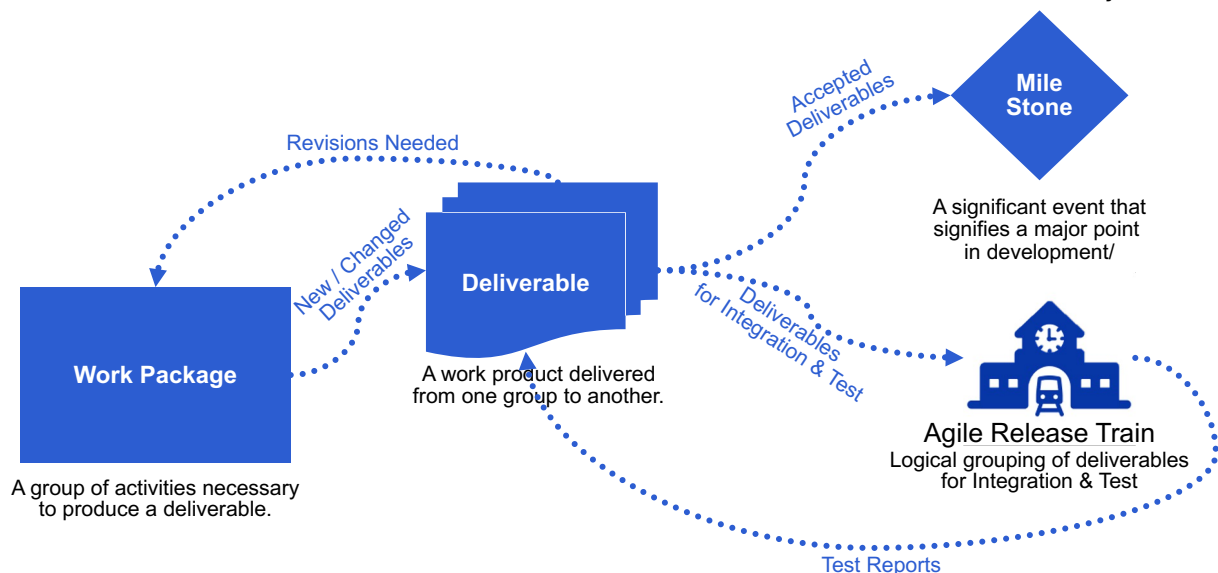


EXECUTION CYCLES	EC ending Feb 13	EC ending Mar 13	EC Ending Apr 10	EC Ending May 8
Proto Build:	Prototype 1		Prototype 2	
Hardware Deltas:	<none>	GRS board 4.2	Initial packaging	TBD – board 4.3 release?
Firmware:	Drop 0.2 4/02	Drop 0.3 4/22	Drop 0.4 - TBD	TBD
Mobile SW:	<none>	<none>	Release 1.13 4/20	Release 1.14
Slice Definitions:	- Print test page	- Print from PC - Rev 4.2 boards integrated	- Print from mobile app - Edge-to-edge photo printing	- Mfg alignment test works - Purchase more ink reminder
Tests Planned:	- Basic functionality - UX button response - Life test	- Print, all OS - Board regression - Life test, cont.	- End-to-end mobile printing - In-box durability	- Mfg verification of cartridge alignment - Low on ink - Deplete ink



Milestones - Deliverables - Work Packages

Work Packages → Deliverables → Milestones



Major Milestones



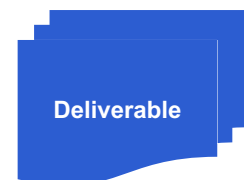
- Visible on the plan one level up
- Requires deliverables to be produced and/or decisions to be made to pass
- Usually driven by external stakeholders
 - Phase gate PDP
 - Customer commitments
 - Significant full-system prototype builds



Deliverables



- Feed into Major Milestones and ARTs
- Acceptance Criteria Set by Recipients
- Document Bundles of Decisions
 - Key Decisions
 - Standards and Regulatory-Driven Decisions
 - Known Solutions
 - Easy-to-Change Decisions
- May be physical (prototype units), digital (documents, software pkgs) or something else (new hires, partner selection).



Work Packages

- Logical chunks of work to produce a deliverable
- Ideally fit within one Execution Cycle — but only if it makes sense
- May consist of a list of smaller activities

Work Package

How to Define Work Packages

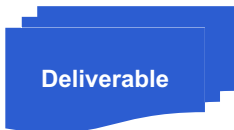
For a deliverable / set of related deliverables:

- Define the major pieces of work to be done and group into logical chunks, ideally that take up four weeks or less of time to complete.
 - A detailed activity breakdown is only necessary if you can't estimate time any other way.
- Give each Work Package a descriptive title and a Definition of Done that does not require anything outside your control.
 - If the deliverable requires review / approval / signoff / testing, the work package is done when the approver receives the work package (this is not an excuse to abdicate responsibility for chasing the next steps if needed).
- Give the Work Package a deadline that corresponds with the end of an Execution Cycle.
 - You can note major dependencies with other Work Packages if that's helpful, but not all dependencies need to be tracked or should be tracked.

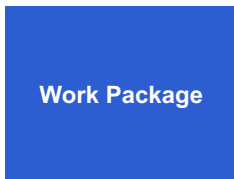
Example for a Components Supplier



First Customer Shipment: 100 Units



100 Fully Qualified Units
All Non-Commodity Parts Sourced
Automated Tooling for Full Production Released

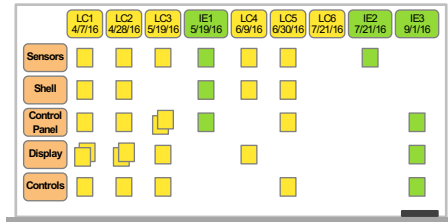


Enter and validate Final BOM in ERP System
Qualify 2nd source for strategic component
Complete Engineering Change Requests to address vibration concerns
Explore ways to reduce cost of Subsystem A by 20% at full production



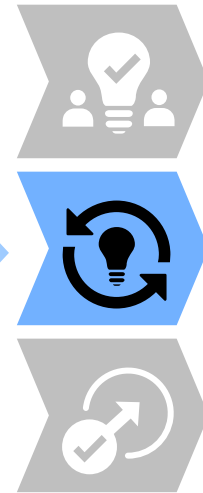
The Execution Cycle Event Structure

Execution Cycle Event: Deliverables

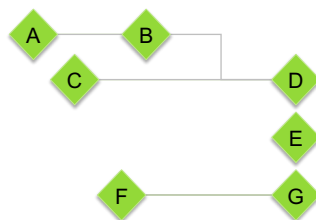


Execution Cycles – The Core Team

- Confirm delivery of work packages for each “station” of the train during this Execution Cycle.
- Review Knowledge Gaps closed during this cycle.
- Update the Execution Cycle Plan and the Agile Release Train plan if needed.



Integration Event: Key Decisions



Integration Event – The Team + Stakeholders

- Share recommendations for Key Decisions to be taken at this Event – **with Key Decision Reports**
- Take the Key Decisions
- Update the Release Train plan to reflect the decisions made.



Status Event: Activities

Status Event – The Team or a Department

- Ask Each Person Three Questions:
 - What got done?
 - What's going to get done?
 - What help do you need?
- Give Only One of Two Responses:
 - Thank you!
 - I can help with that!
- Take any other discussion offline.



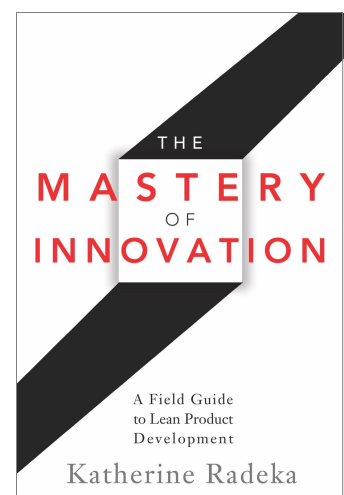
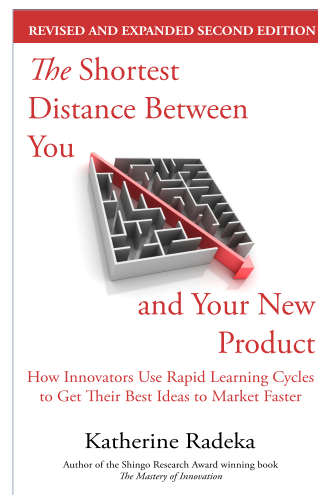
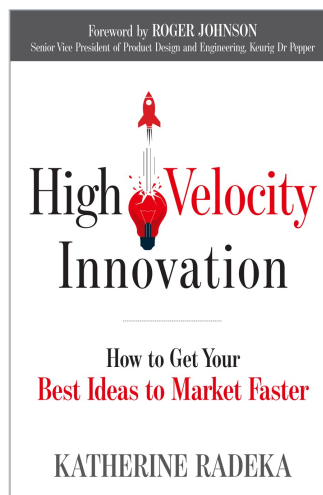
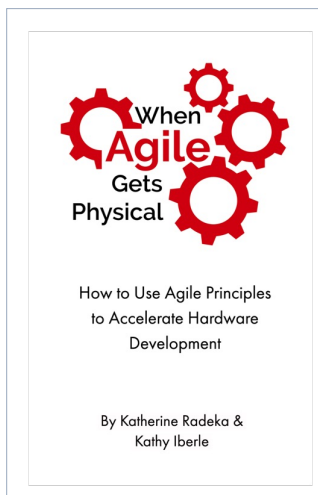


Author: Katherine Radeka

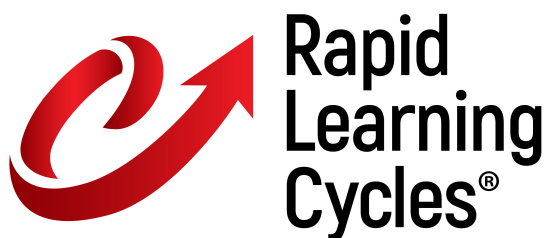
Katherine Radeka developed Rapid Learning Cycles to eliminate the root causes behind delays and disappointing results for innovation teams with physical products, so that they could accelerate the time from idea to launch.

She has shared the Rapid Learning Cycles framework with teams on every continent except Antarctica, working on products like medical devices, next-generation renewable energy, biotech, transportation, food production and consumer electronics.

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