# Cycles, flow, and value-stream mapping in product development

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Why would you believe that just trying to go faster, without increased understanding, would result in greater speed without losses elsewhere?

Autos

- NASA
- Boeing
- Software

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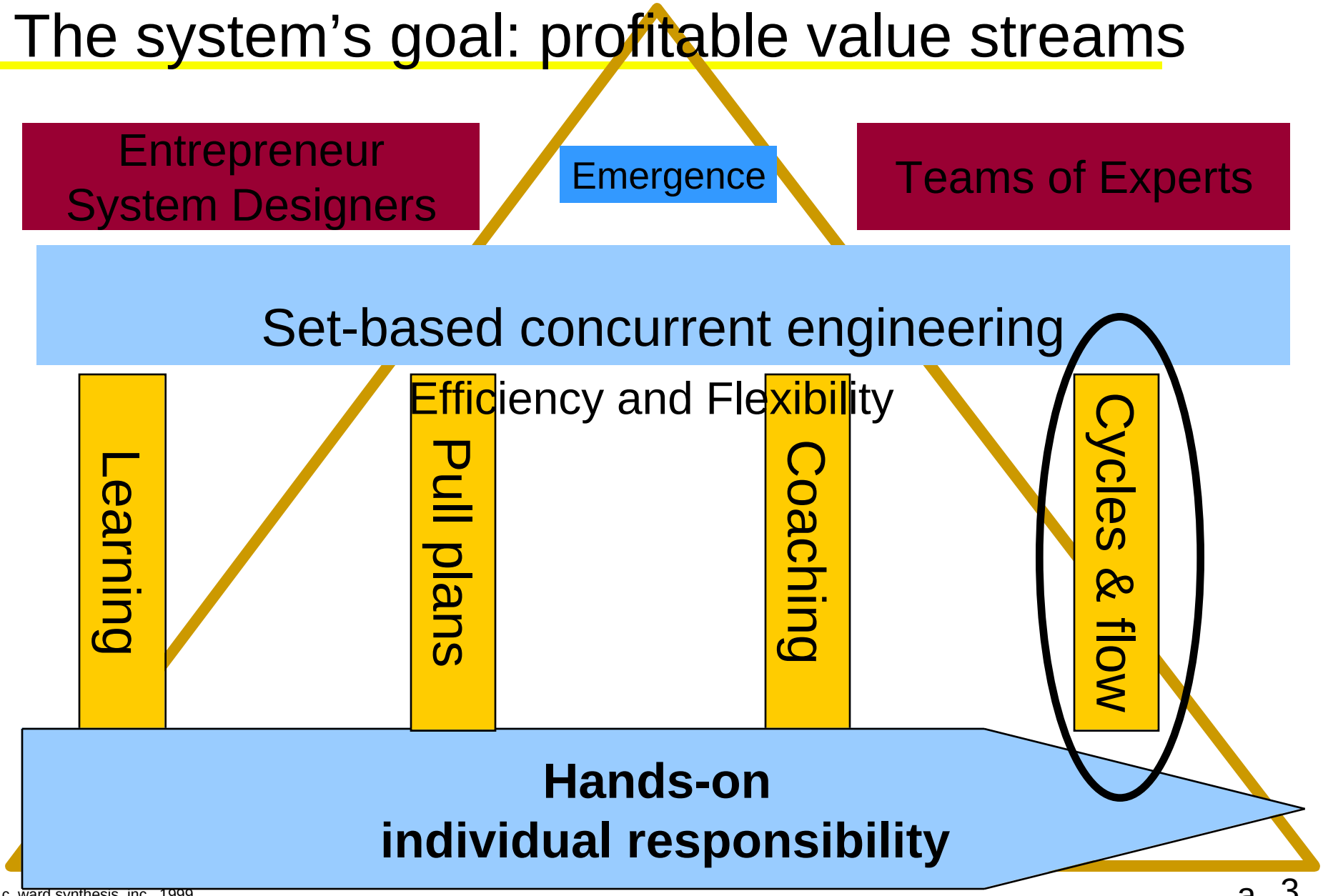
# The system's goal: profitable value streams

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# Activity timelines/cycles

- Establish a customer/owner for pull
- Establish the takt or lead time for cadence
- Create the timeline
- Eliminate production and knowledge wastes
- Nest or alternate cycles to level production

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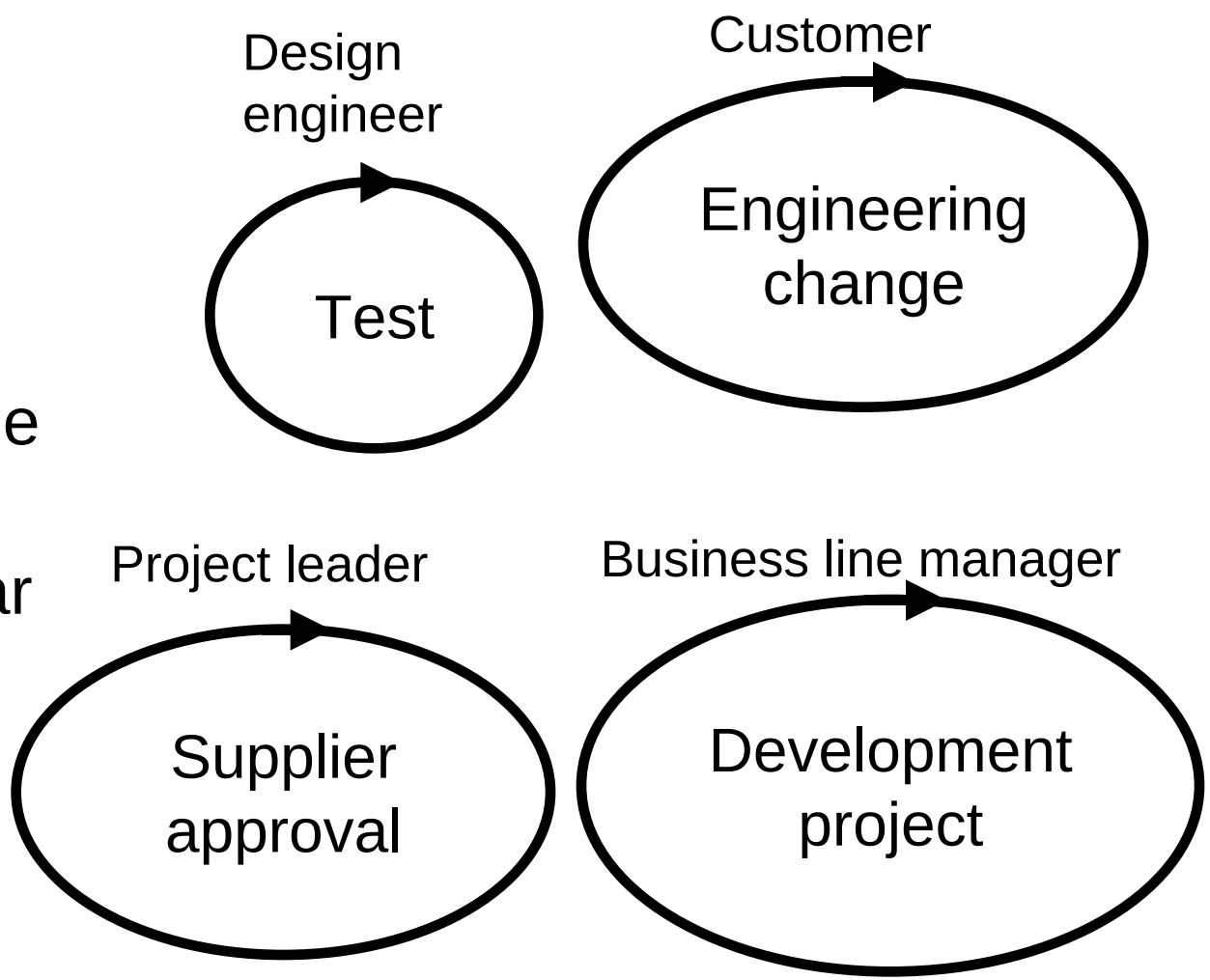
# Begin and end with cycle customer/owner

- Imposes cycles (like a clock) on linear time
- Establishes a motive for maintaining cycle time
- Establishes clear responsibility
- Allows pull

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# Cadence: takt, lead, and cycle times

- Takt time: how often (on average) do we need the process product?
  - Factory: available work time divided by customer demand
  - Generic auto parts supplier: new car project, and new product design, every month
  - Denso: new generation product design every two years (some products).
  - Defense contractor: new solid rocket motor design every four years.
  - Air force engineering change order: one per month.
- Lead time: time from decision to produce to production (including set-up, inventory delays, and processes)
- Cycle time: time from process start to process end

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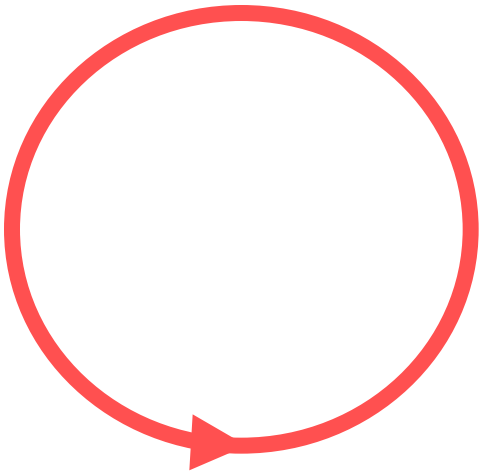
# Why stabilize cyclic cadence at takt?

- Standardization: (without stability, “standard processes” are just one-off experiments)
- Planning simplicity and pull: (people know what to do from past experience; cycles are building blocks for plans)
- Learning (basis for adjustment and improvement)
- Workload leveling



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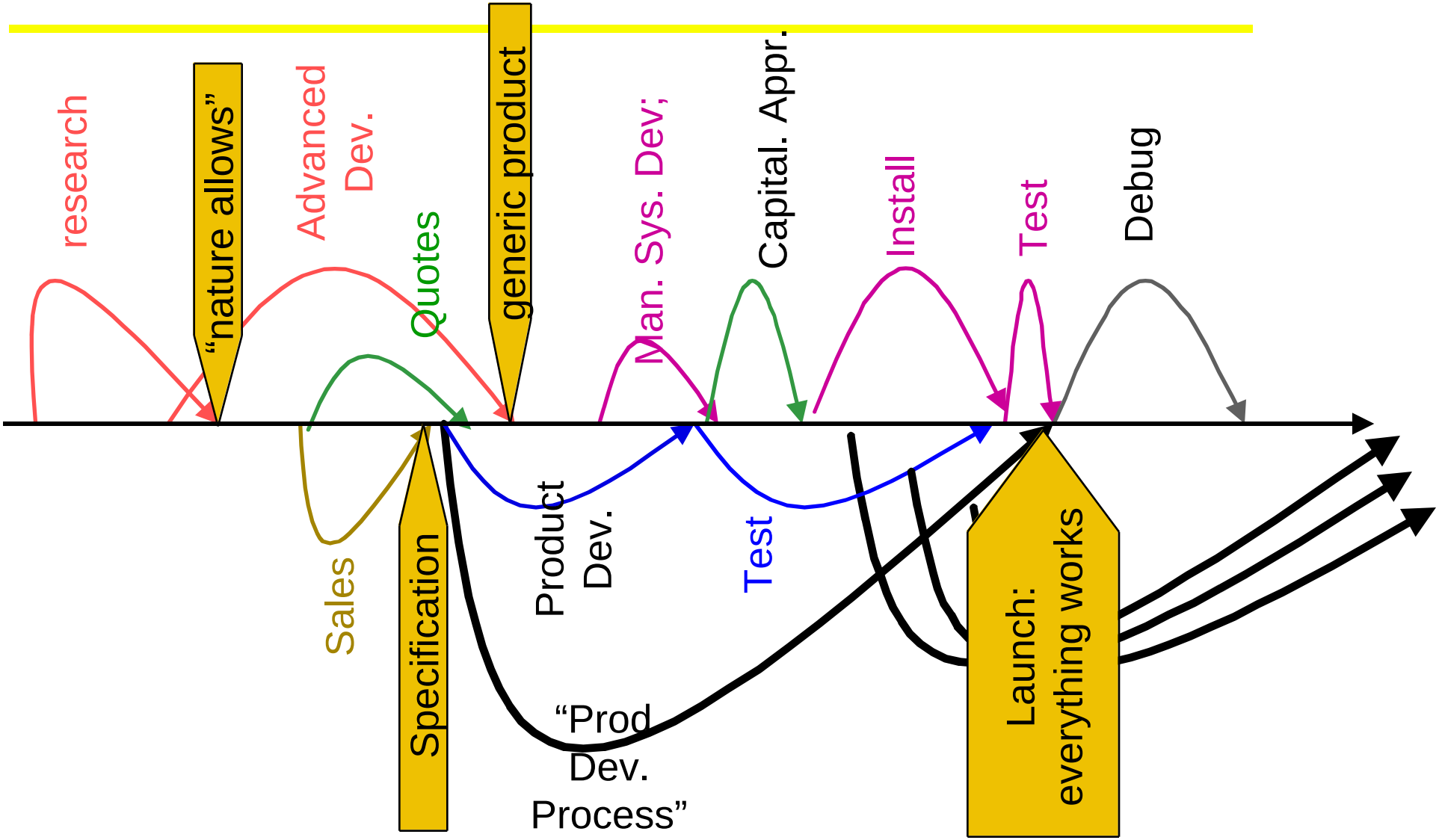
# Development at auto parts supplier

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# Value-added = useful knowledge

Efficient creation of new knowledge controls customer satisfaction and the probability of profits: better fit, reduced risk

- Need definition (increased knowledge about the customer's desire)
- Design definition (design creation or element combination reduces ambiguity)
- Evaluation (effort to break designs reduces uncertainty about risk)
- Knowledge base improvement

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# Wastes in knowledge production

- Useless knowledge (no effect on customers or probability of profit) = waste of over-production
  - Internal orientation (presentations)
  - Over-elaboration
  - Excessive precision
  - Excessive standardization
  - Too late (most tests)
  - Too early (most specs)
- Persistently misleading knowledge
- Waiting
- Missing or ignored expertise
- Discarded knowledge
- Pass-fail evaluations
- Hand-off

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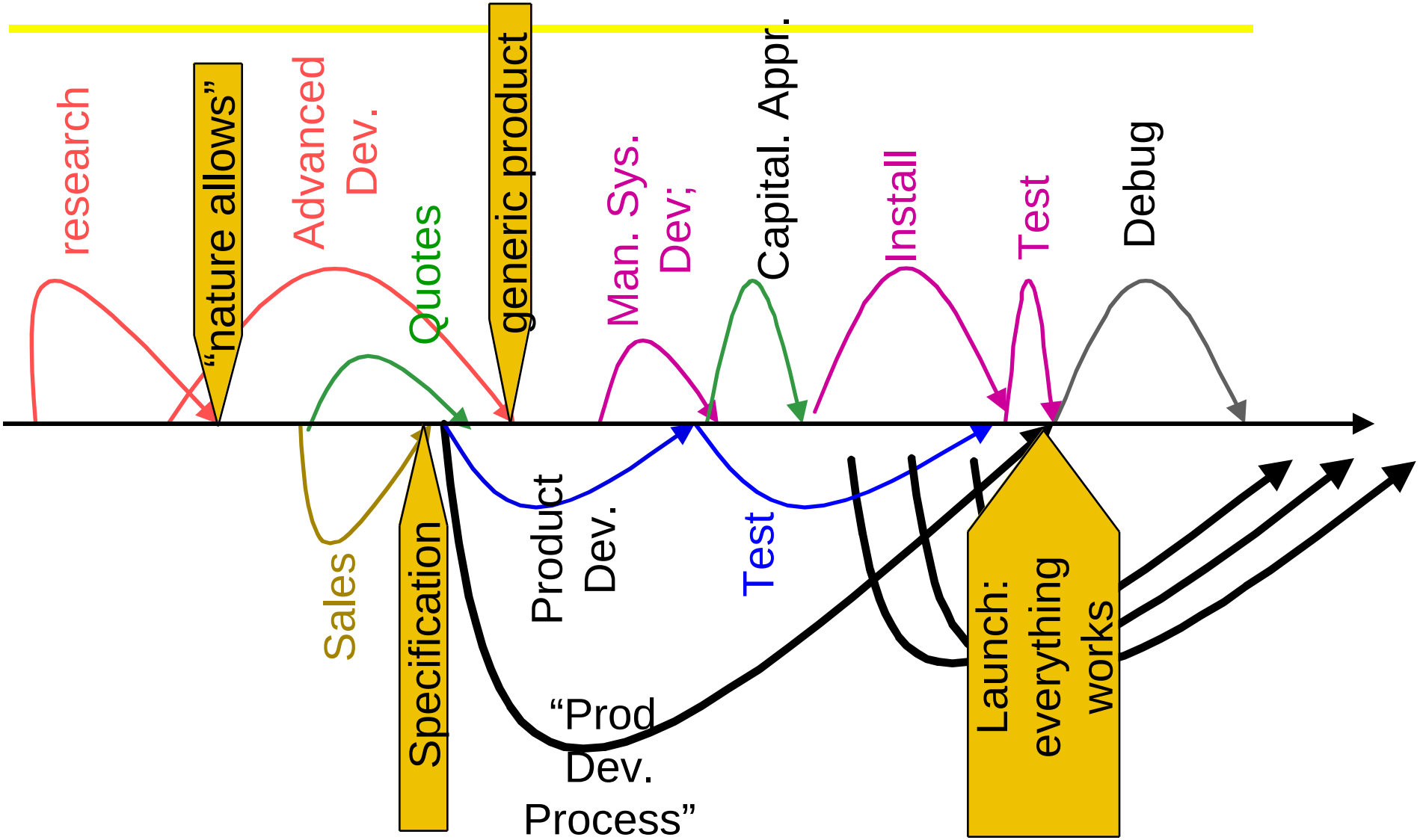
# Development at auto parts supplier

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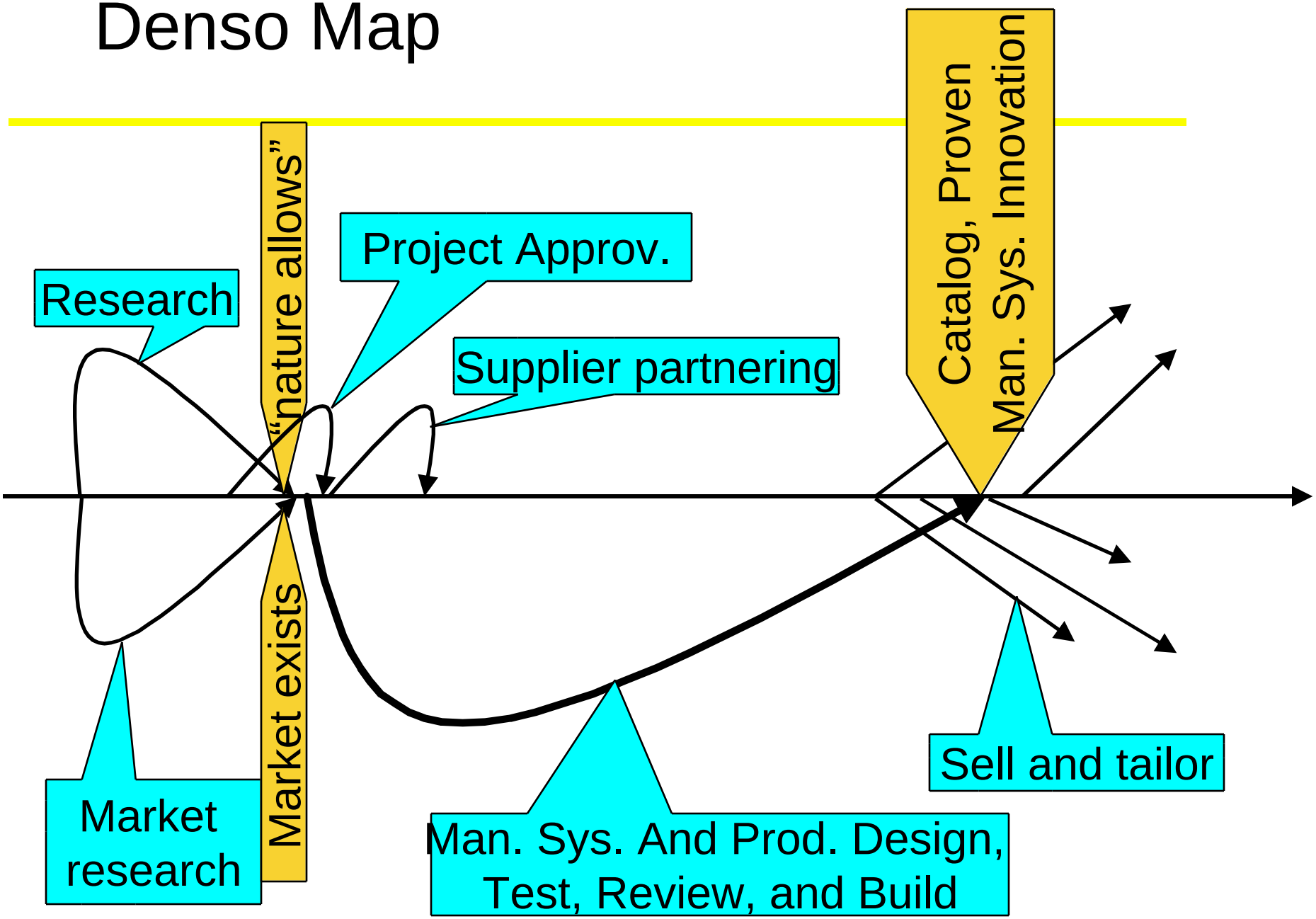
# Denso Map

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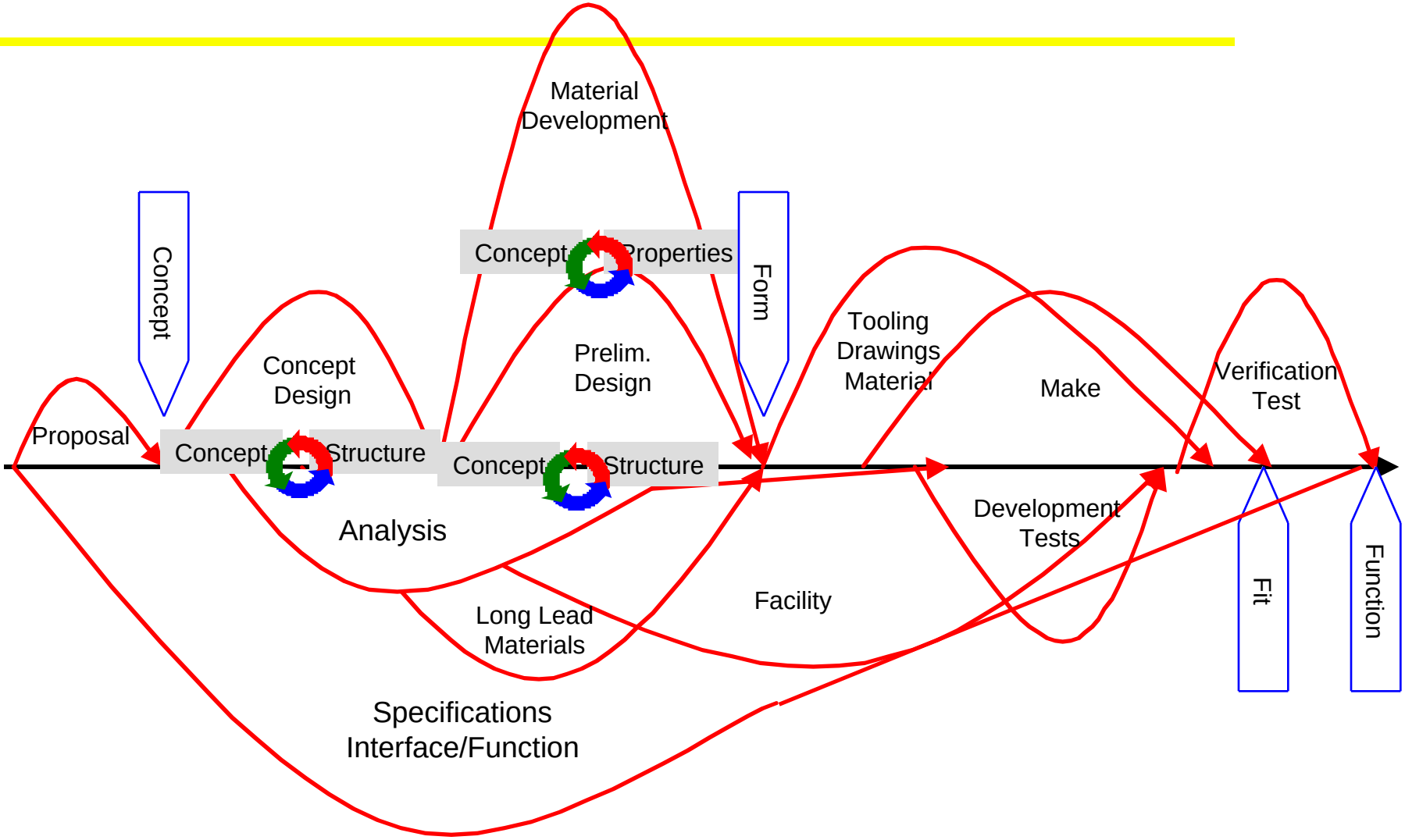
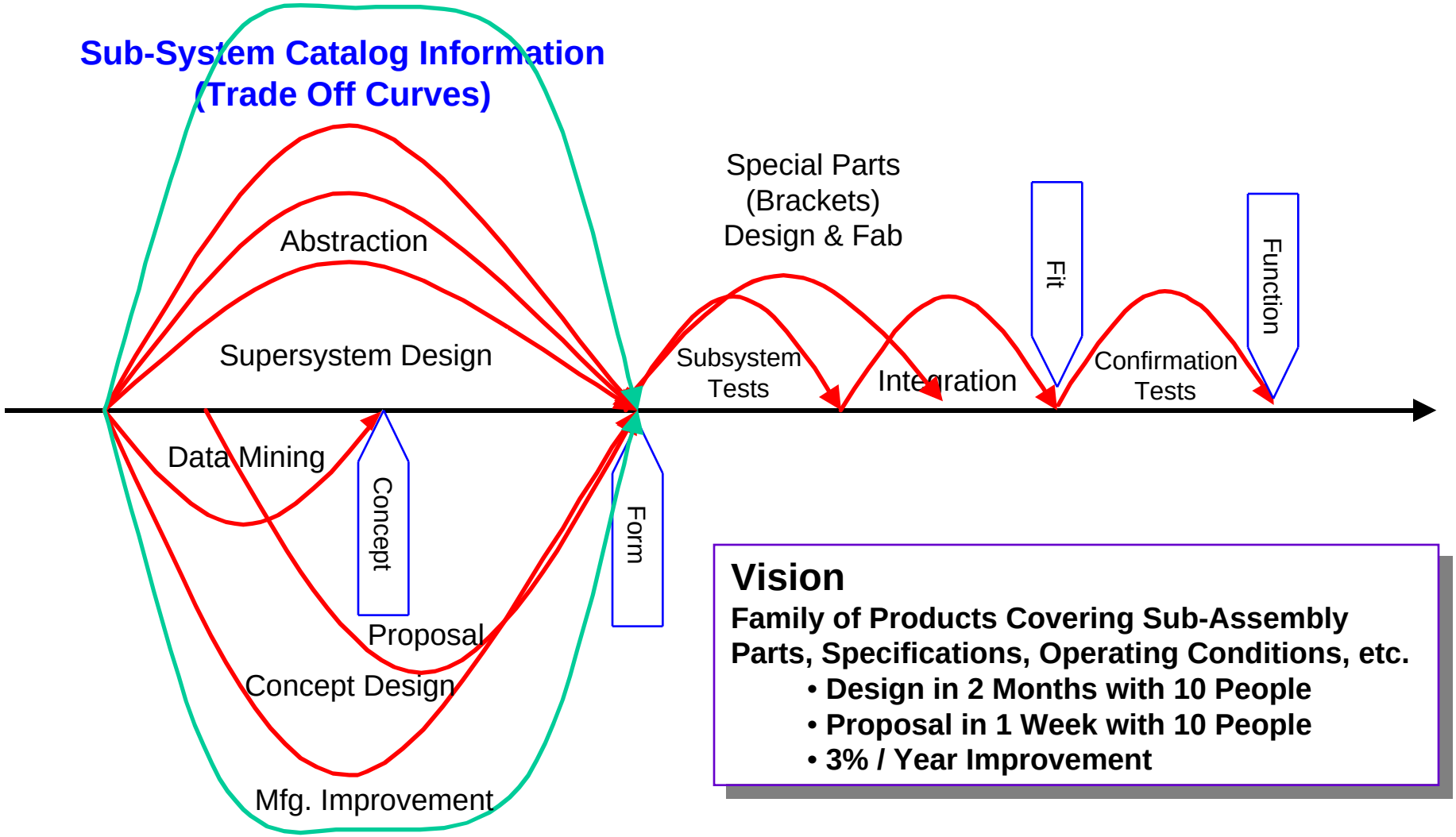
# An aerospace current situation



# An aerospace future state




**Vision**

**Family of Products Covering Sub-Assembly Parts, Specifications, Operating Conditions, etc.**

- **Design in 2 Months with 10 People**
- **Proposal in 1 Week with 10 People**
- **3% / Year Improvement**

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