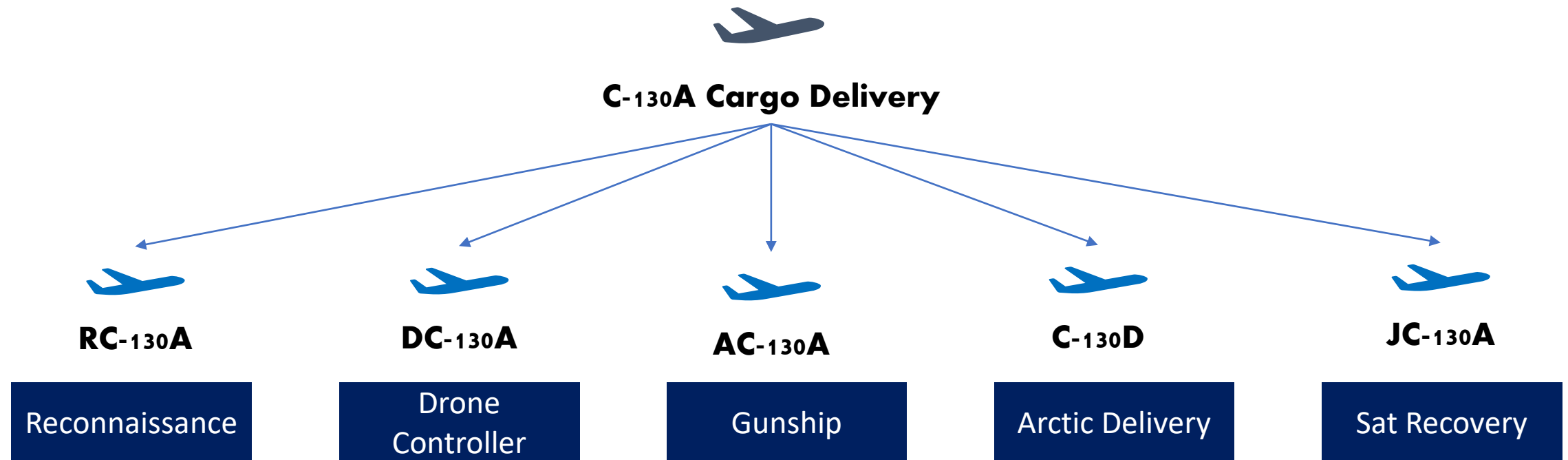


Enablers of Post-Production Change

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Research Motivation



Systems are often tasked with missions they were not designed for

Design for Changeability (DfC) [1] [2]



Flexibility

- Change in response to a change in the operating environment

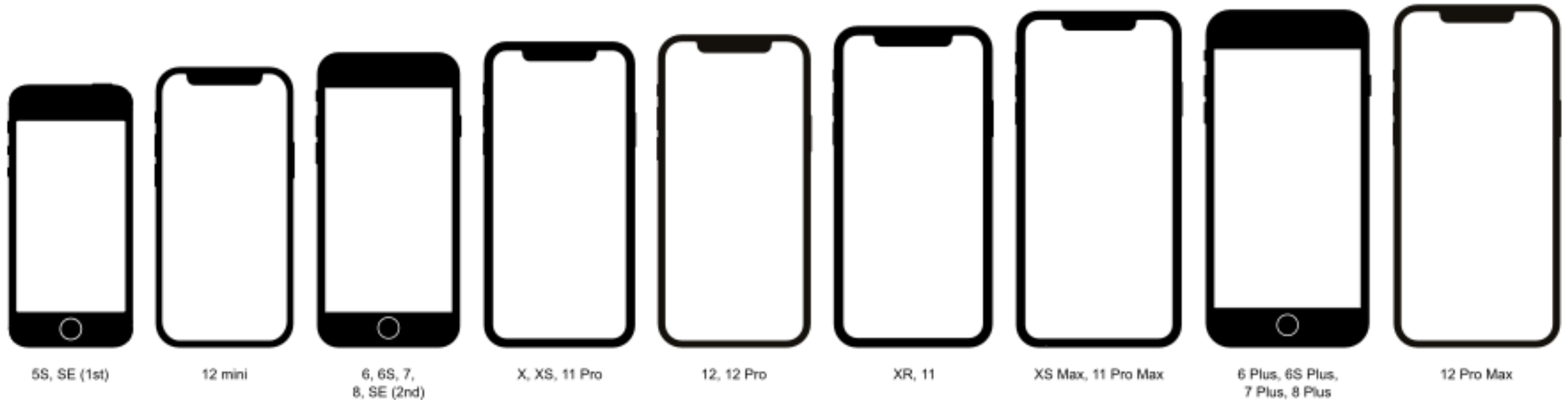


Robustness

- Remain unchanged in the face of an operating environment change

Changeability is achieved through flexibility or robustness

Generational DfC: Evolvability [3] [4] [5]



Broadly, DfC can mean changing across generations

Enablers of Changeability

Modularity

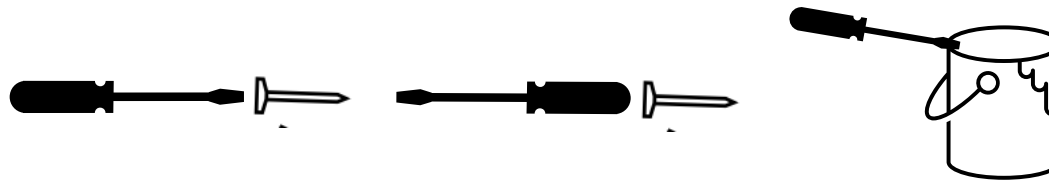
[6] [7] [8]



Component Swapping Modularity [2]

CONOPs

[10]



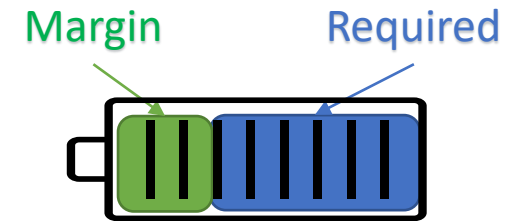
Screwdriver

Hammer

Can Opener

Margin

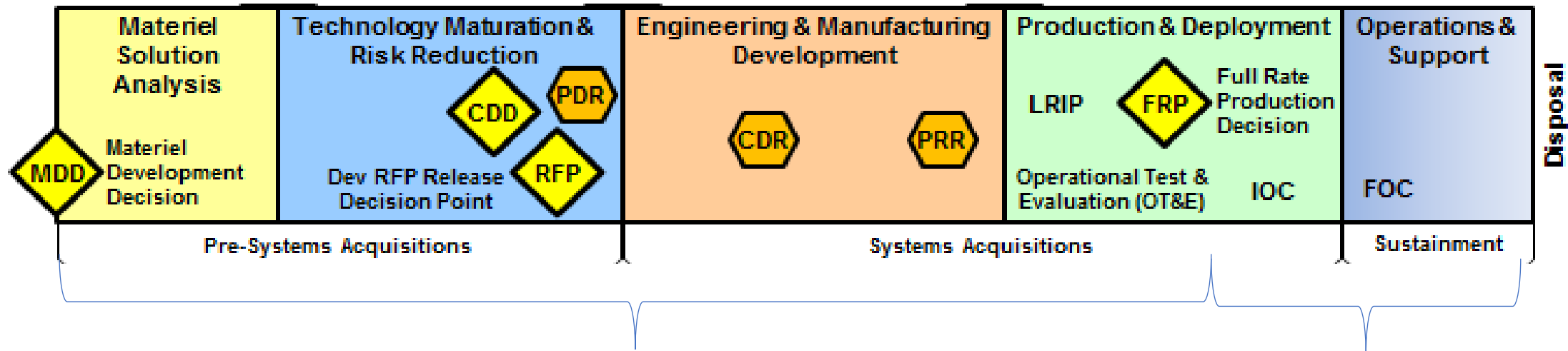
[5] [9]



Power Generated

Changes to form and function can enable capability gain

What about Post-Production Change?



Existing literature assumes changeability considerations occur during the design phase and that possible changes are known

System may need change in this phase

Changeability might be needed after system deployment

Research Question

- **How is post-production changeability enabled?**
 - Lack of work on changes outside of design phase
 - Lack of work on enablers of change for unknown changes
 - Can be empirically tested

Sources

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- [8] Chun-Che Huang and A. Kusiak, "Modularity in design of products and systems," in *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans*, vol. 28, no. 1, pp. 66-77, Jan. 1998, doi: 10.1109/3468.650323.
- [9] C. Eckert, O. Isaksson and C. Earl, "Design margins: a hidden issue in industry," *Design Science*, pp. 1-24, 2019.
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Feedback

- Better definition of systems studied, and changes considered
- Emphasize that no one else has done this

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