

System of Systems Architecting and Integration; Visualizing Dynamic Behavior and Qualities

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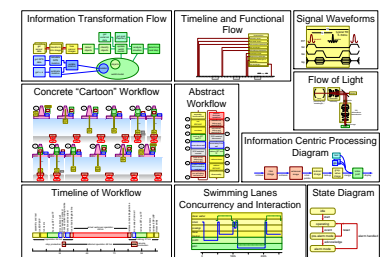
Abstract

A major responsibility of architecting and integration is ensuring that desired dynamic behavior and desired qualities emerge from the interaction of components within the systems, between systems, and between the users and environment of the systems. A challenge is that organizational attention tends to be on the parts structure, which is determining organization, logistics, manufacturing, and servicing. At the same time, many developers lack the competence to capture dynamic behavior and the way qualities emerge.

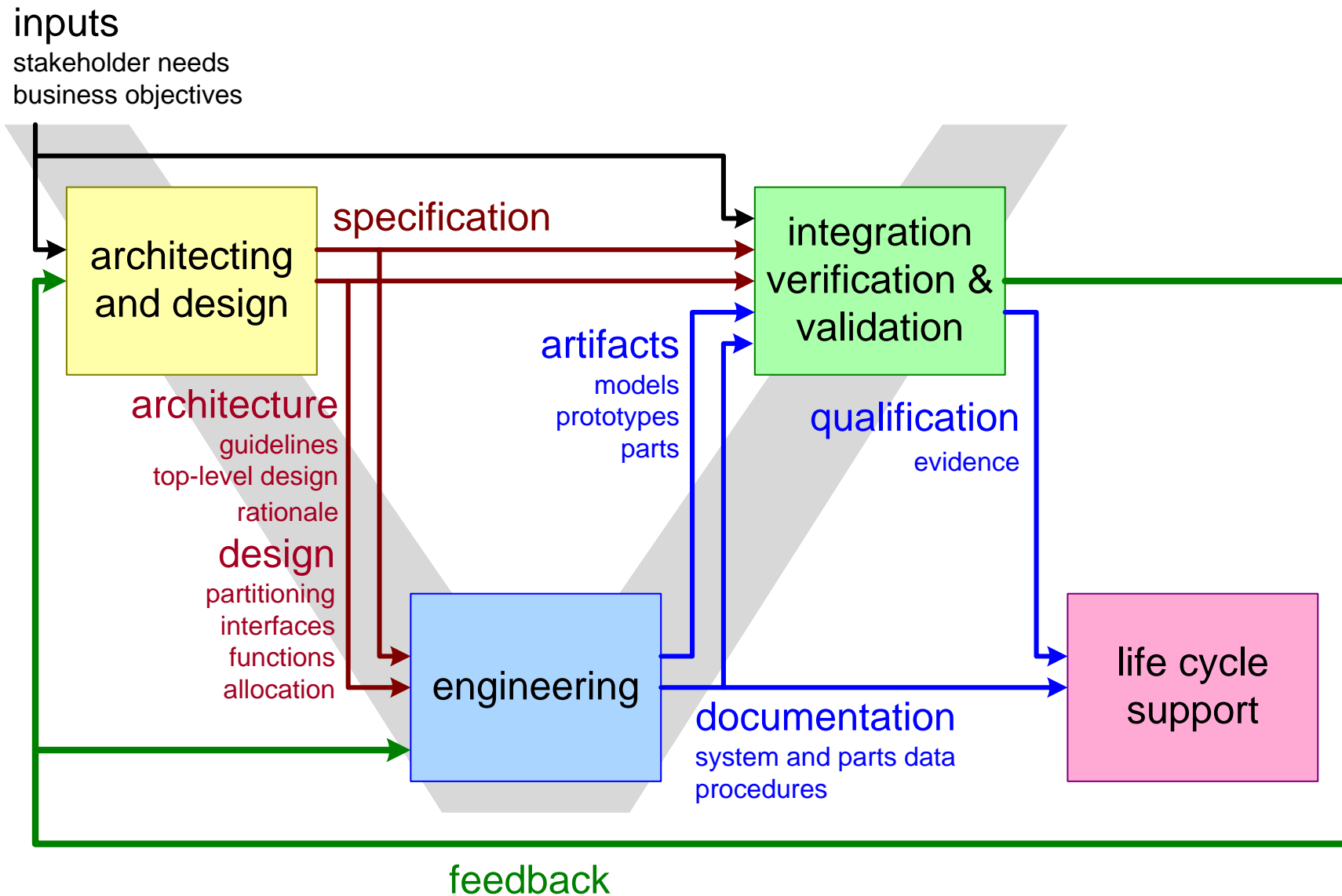
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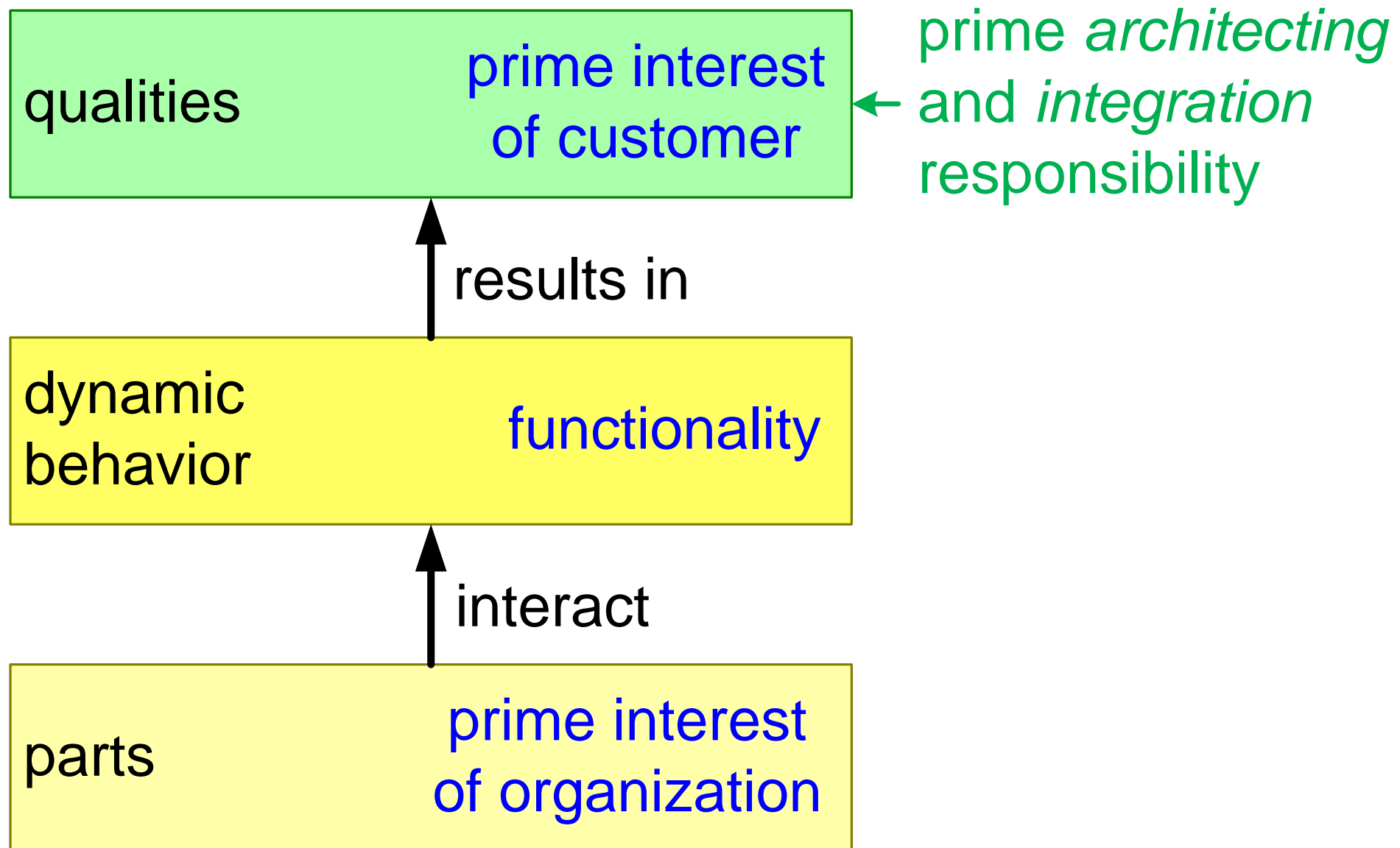
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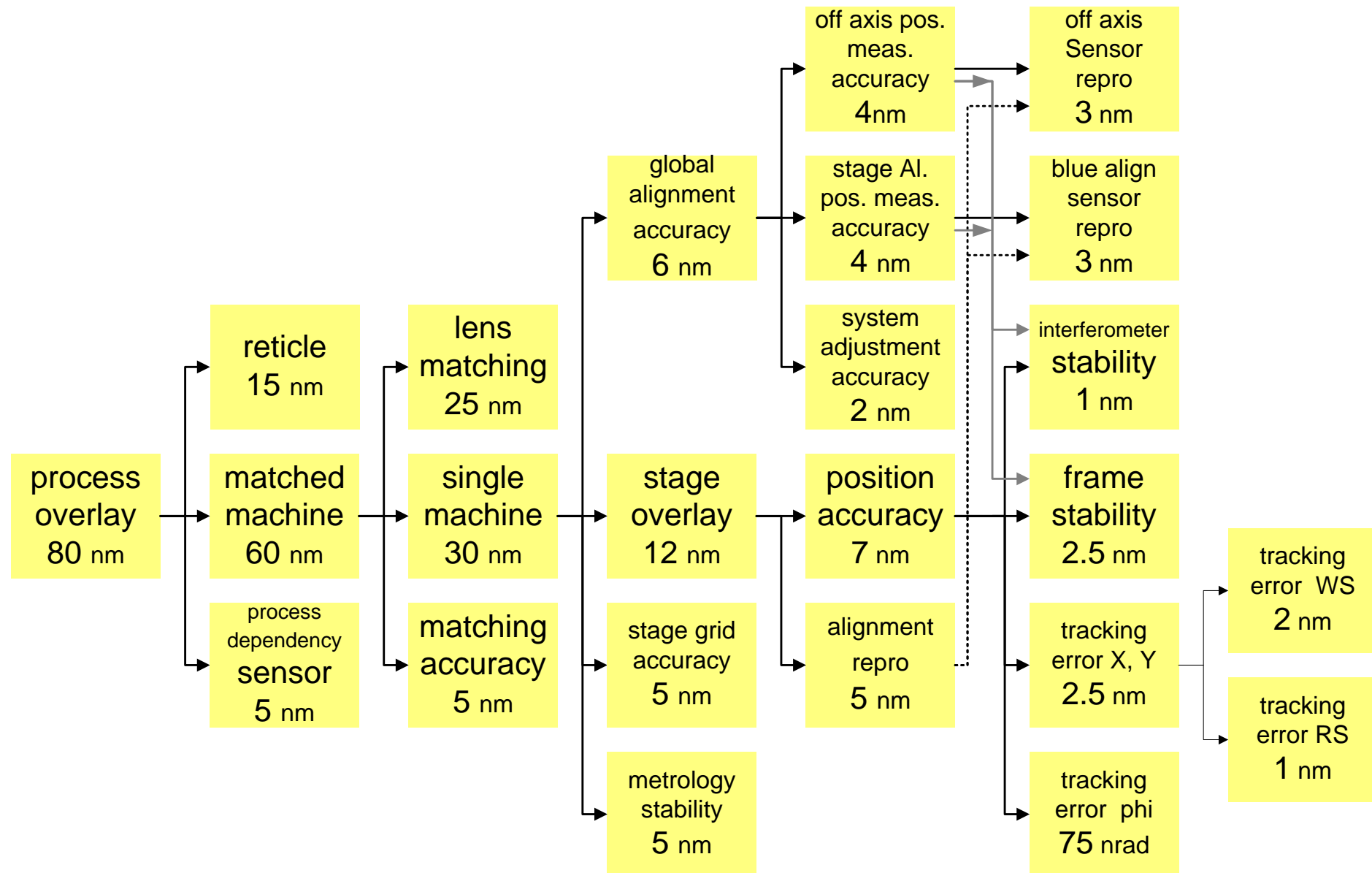
Simplified Systems Engineering V-model



From parts to qualities

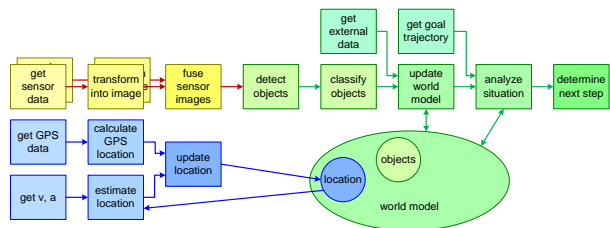


Example of a technical budget, overlay (positioning accuracy)



Overview of Visualizations of Dynamic Behavior

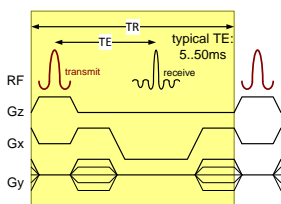
Information Transformation Flow



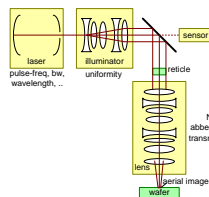
Timeline and Functional Flow



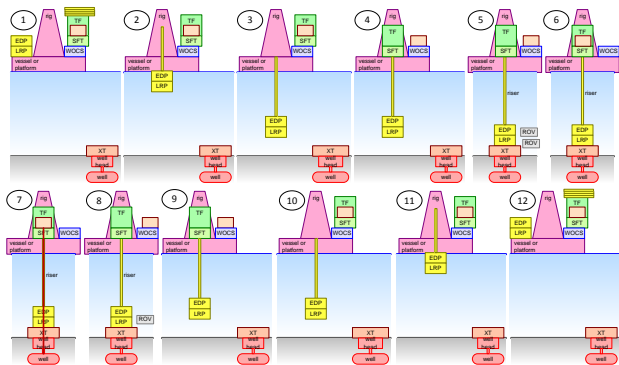
Signal Waveforms



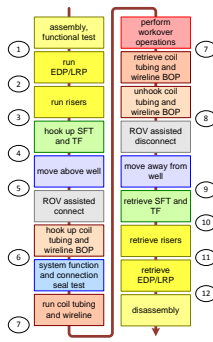
Flow of Light



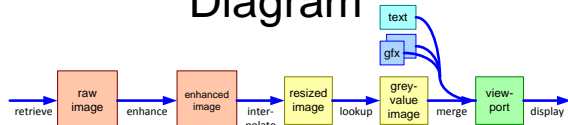
Concrete “Cartoon” Workflow



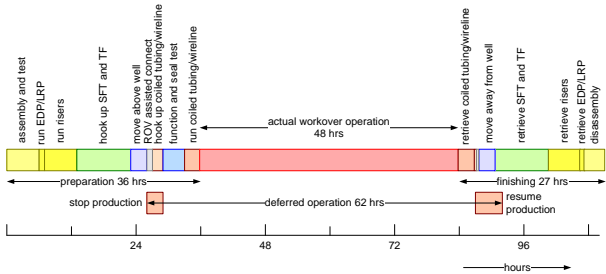
Abstract Workflow



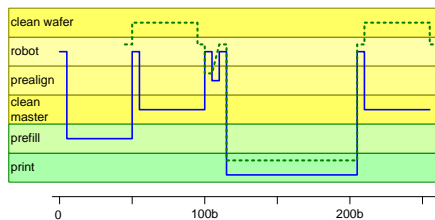
Information Centric Processing Diagram



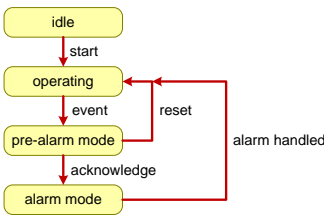
Timeline of Workflow



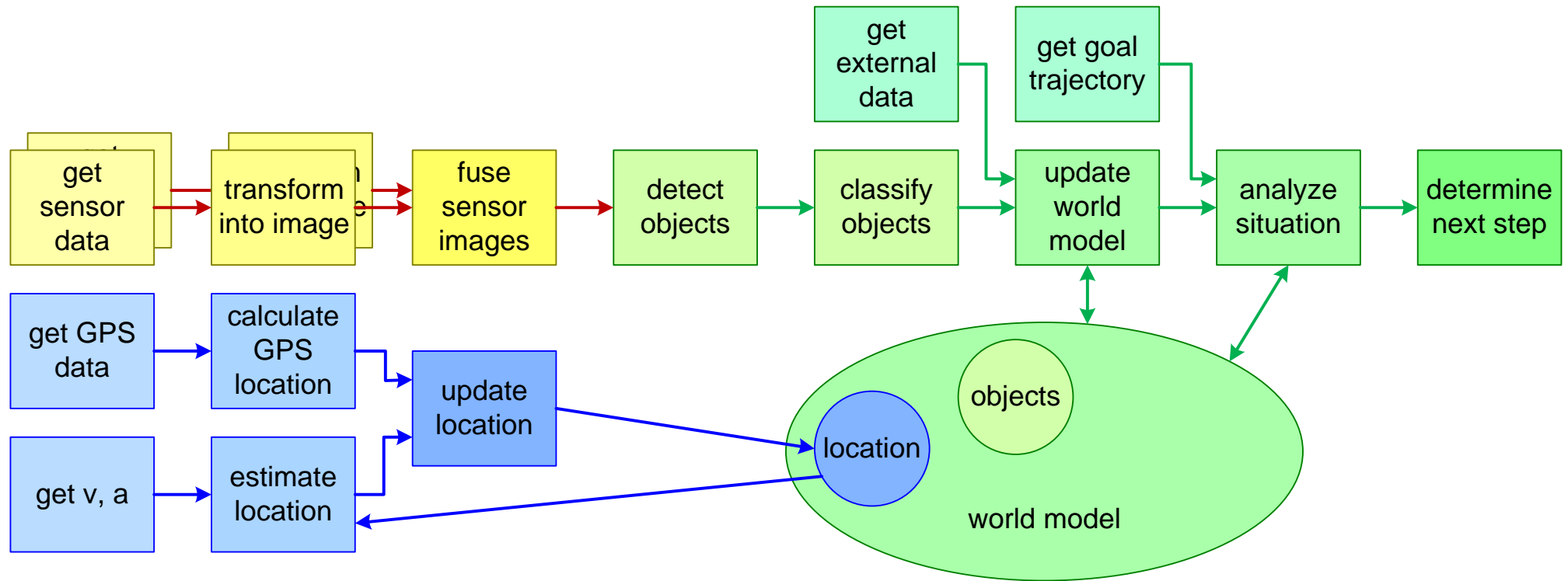
Swimming Lanes Concurrency and Interaction



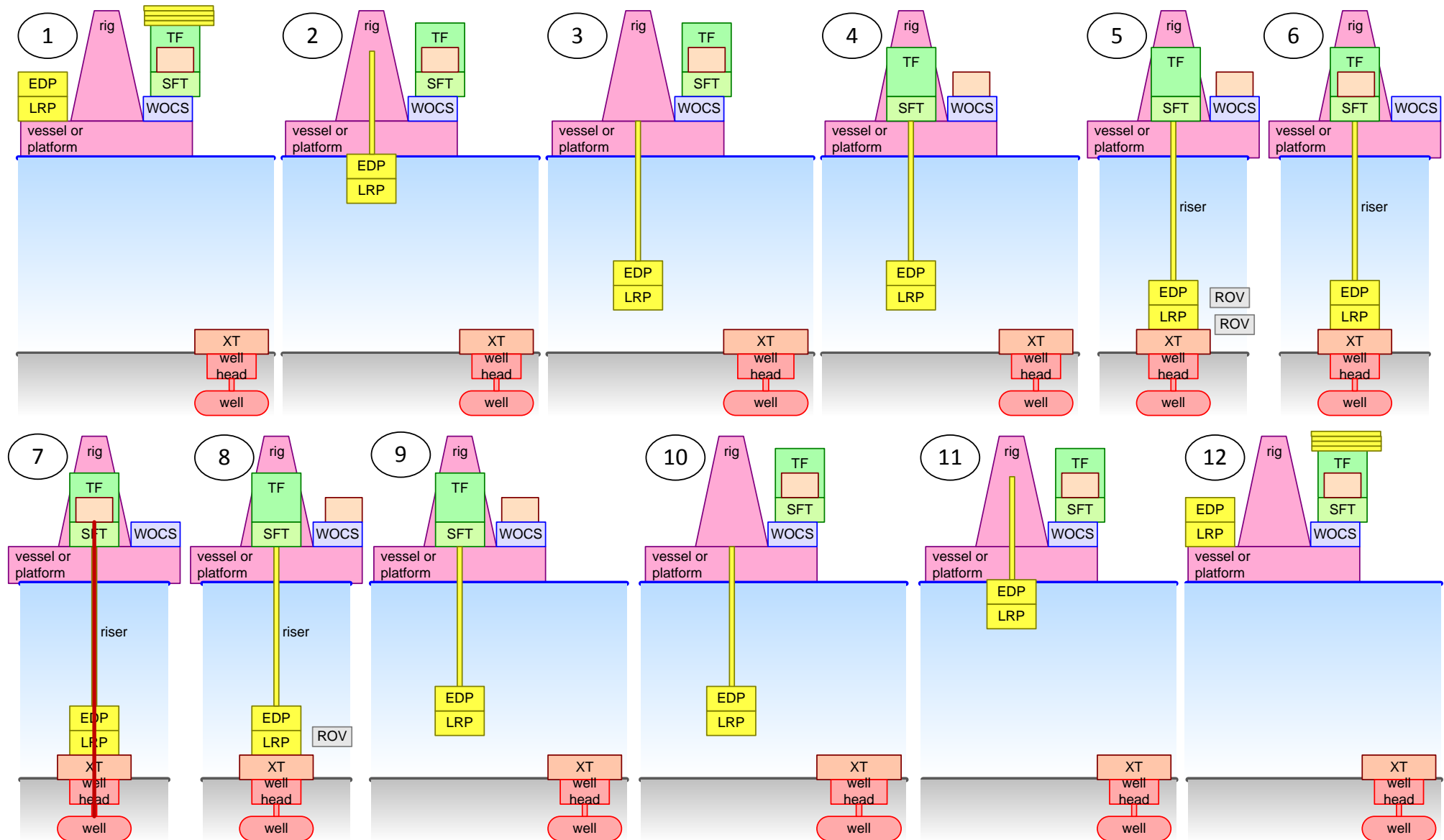
State Diagram



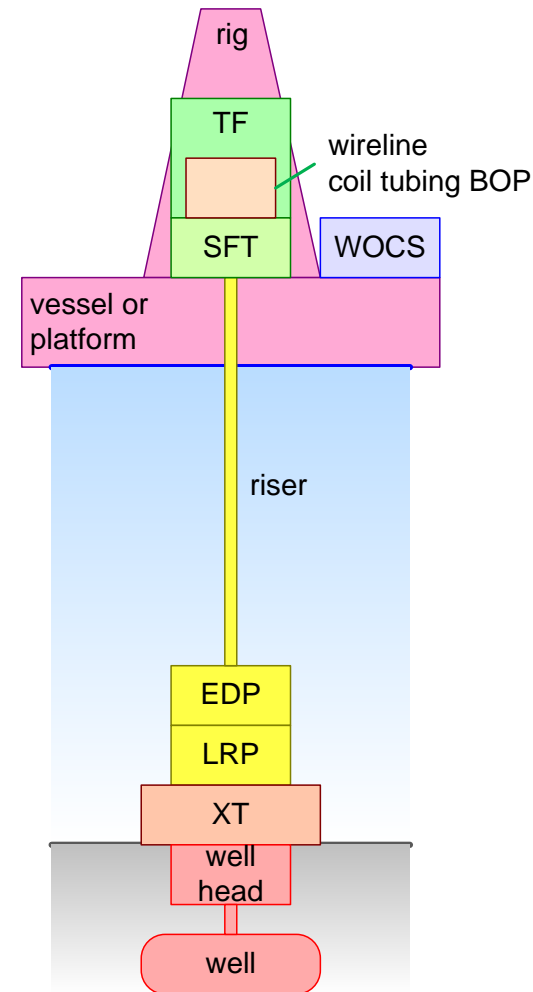
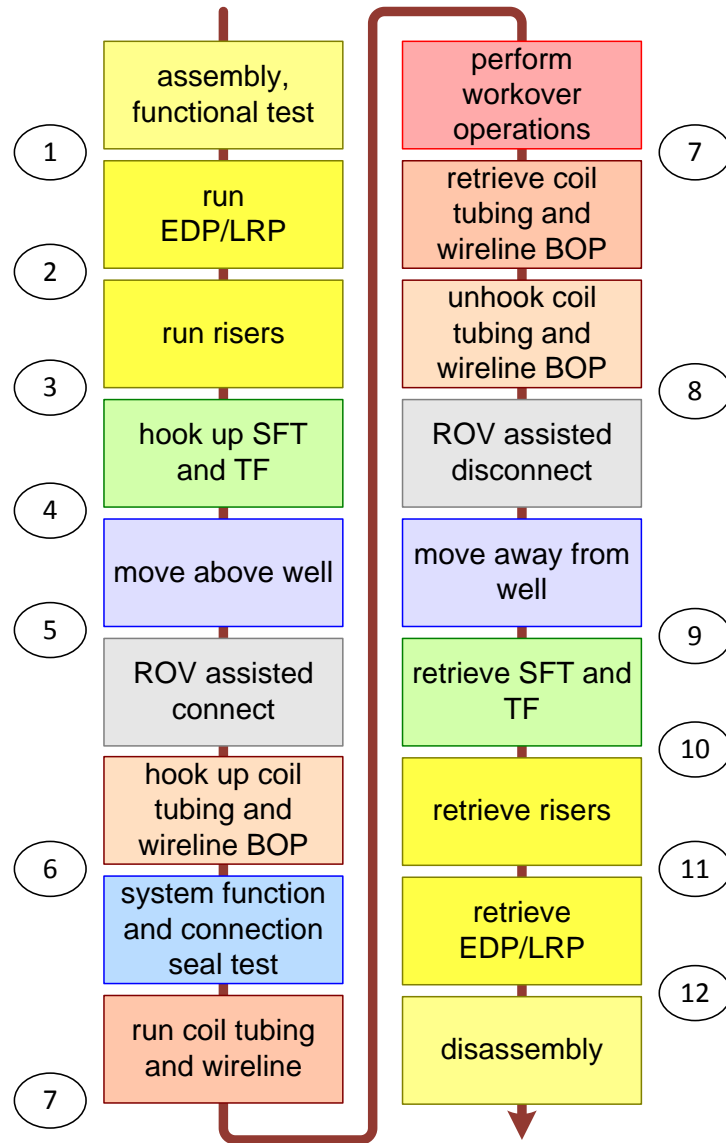
Example Functional Model of Information Flow



"Cartoon" Workflow



Workflow as Functional Model



Workflow as Timeline

assumptions:

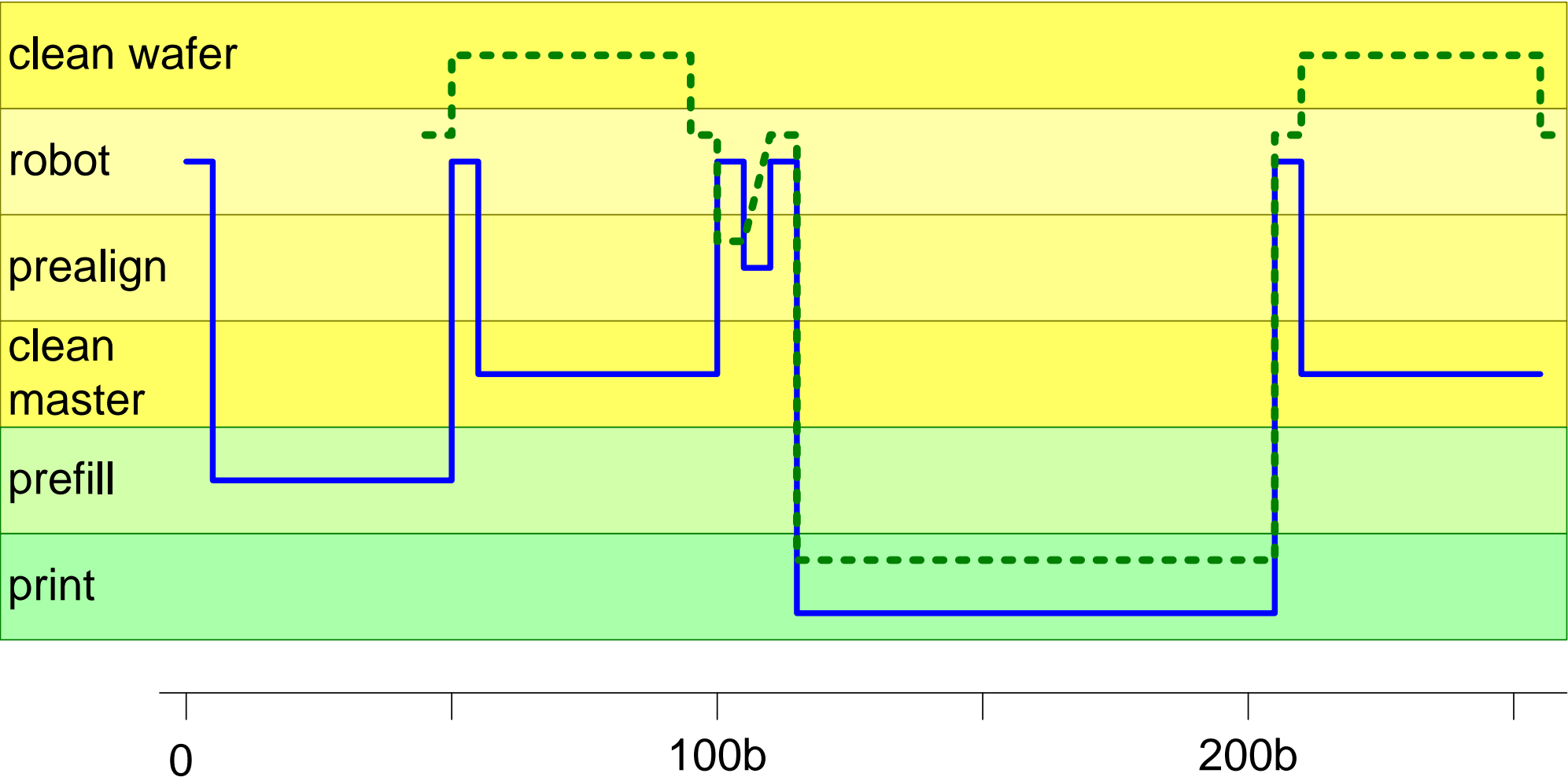
running and retrieving risers: 50m/hr

running and retrieving coiled tubing/wireline: 100m/hr

depth: 300m



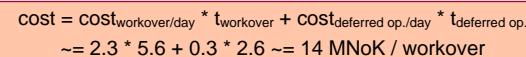
Swimming Lane Example



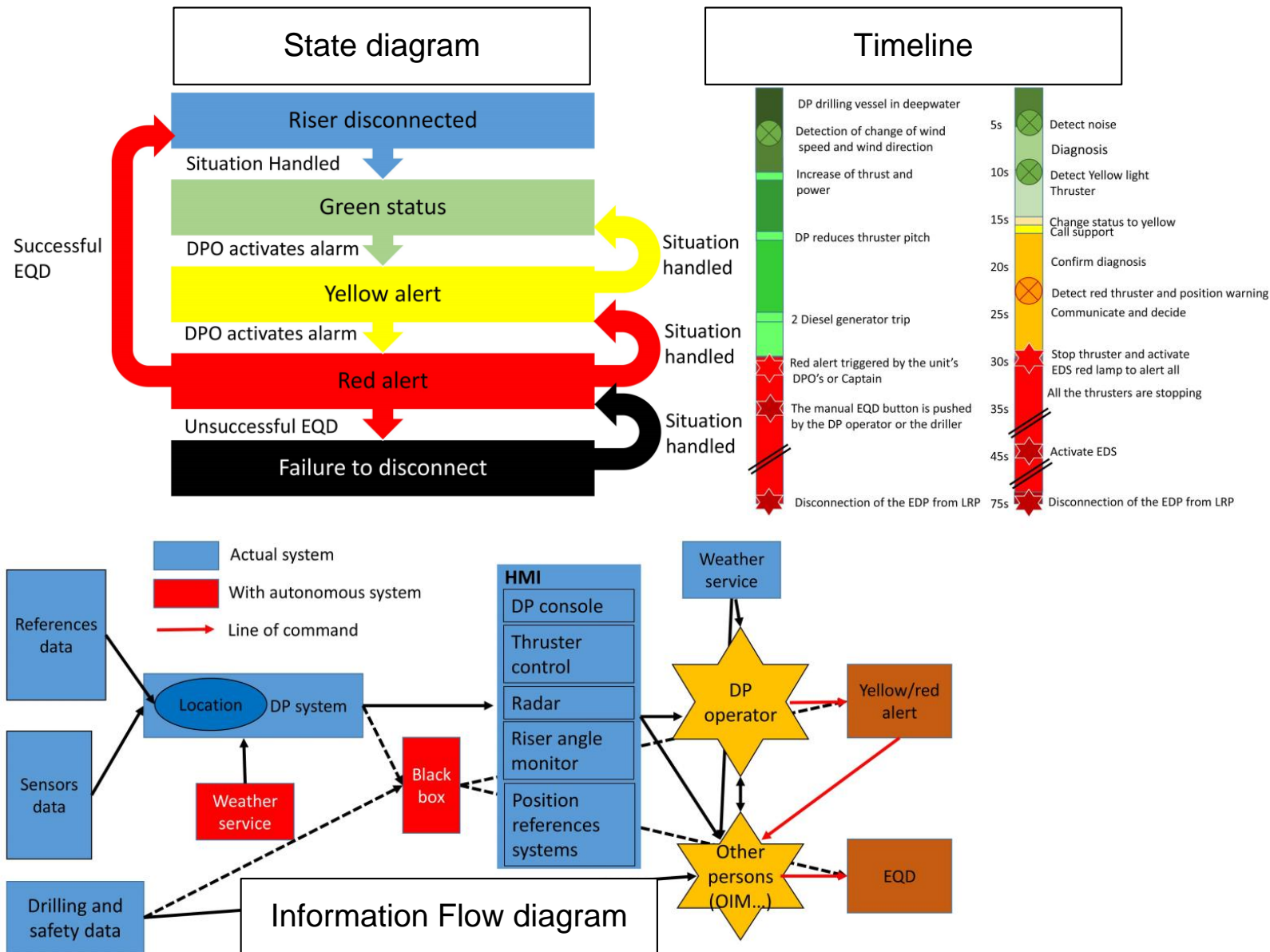
SoS Visualizing Dynamic Behavior
11 Gerrit Muller

Gerrit Müller

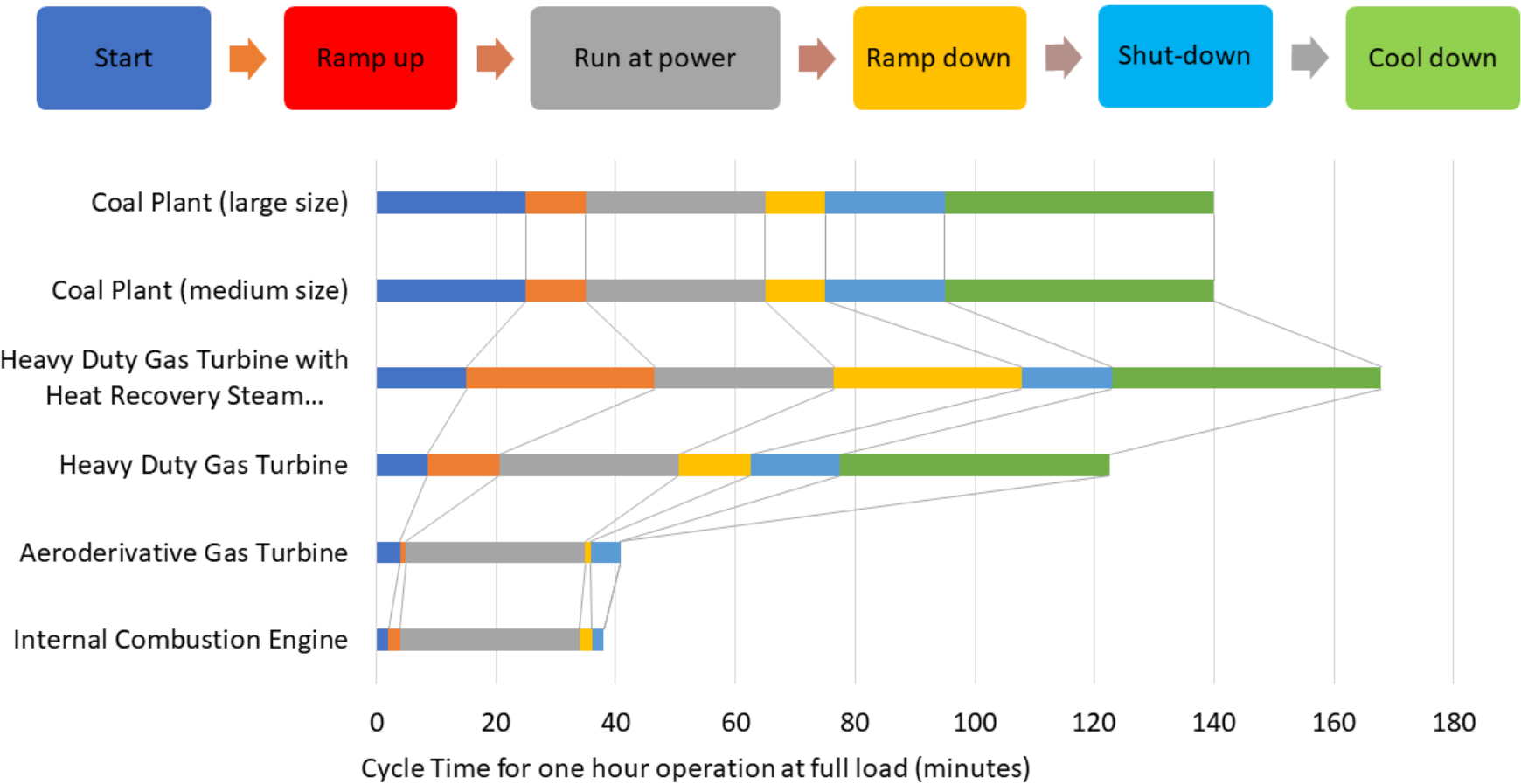
SSMEoverviewA3Labeled



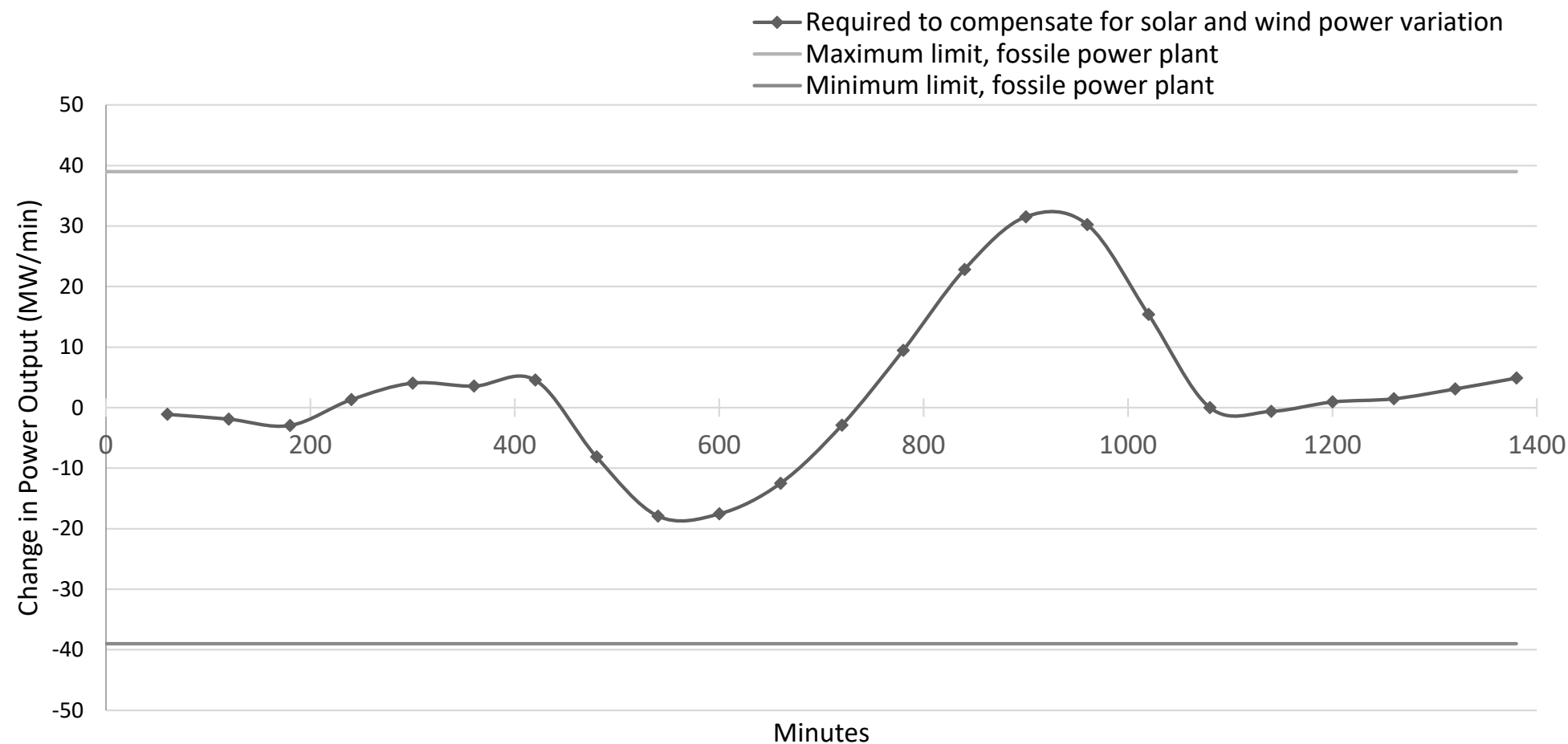
Emergency Disconnect System



Example Cycle Time Power Generators



Example Timeline Power Demand



Our case studies identified **common challenges** associated with **integrating independent systems**:

- **Understand** the impact on the **workflow** (how to handle) and the **impact on time and cost** with workflow disruptions.
- Compare impact on **installation sequence** and means for various concepts.
- Evaluate obstacles in **information flow** in emergency systems that **interact with human beings**.
- **Understand technical constraints** in existing technologies when interfacing new technologies.