



Engineering, Operations & Technology
Boeing Test & Evaluation

Test & Eval

Thread Based Integrated Concurrent Engineering

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Biography:

Gina works for Boeing Test & Evaluation (BT&E) as a T&E engineer for the C-17 program. She serves interchangeable roles as project lead and lead system engineer for the C-17 Avionics Integration Support Facility (AISF), an avionics simulation laboratory.

Prior to Boeing, Gina was a test technician at Honeywell Engines Systems & Services for almost 10 years, primarily supporting the International Space Station Program.

Gina earned a B.S in Industrial Technology at California State University Los Angeles.

She is currently pursuing her Masters in Systems Engineering at the University of Missouri Science & Technology (MS&T).



Abstract

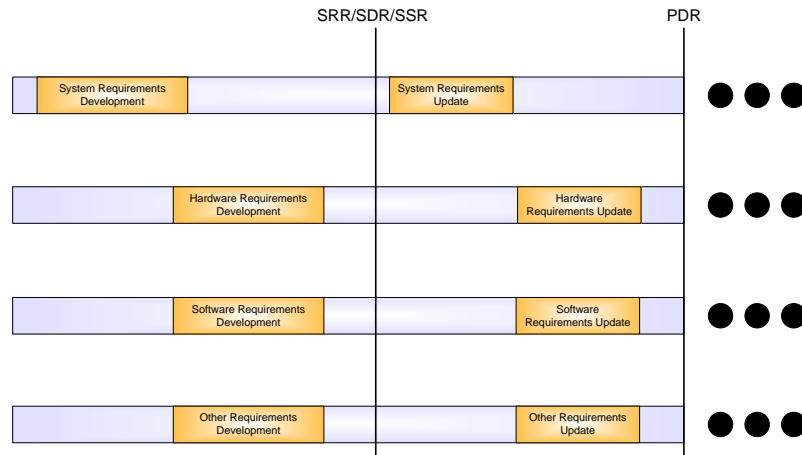
- The Thread Based Integrated Concurrent Engineering (TBICE) method enables multiple engineering disciplines to have tighter coupling of requirements across disciplines and fully develop detailed requirements with bi-directional traceability with a 70% reduction in engineering cycle time. Where a typical conventional engineering top-down requirements development approach (conventional approach) requires 10 months to complete, TBICE may accomplish the same results in as little as 3 months.
- The TBICE method enables multiple engineering disciplines to develop requirements concurrently with specific integration points that ensure quality and consistency throughout the requirements development, allocation and documentation process. What differentiates this method from the conventional approach is that the system and the lower level decomposition of hardware and software requirements are developed concurrently instead of layer by layer. Threading is initiated at the integration meetings whereby specific functionality to be decomposed is identified. The engineering disciplines are then directed to develop the requirements for their portion of the functionality. In between integration meetings, the engineering disciplines coordinate with each other to address gaps, and ensure the functions are captured and traceable in the requirements documentation. This allows the functionality to be threaded through the proper documentation in parallel.
- In the case of C-17, a project was awarded to develop an avionics certification facility that replicates the real C-17 aircraft by modifying an existing architecture. Due to the technical intricacies and the extremely compressed schedule, the conventional approach was not sufficient to execute this project. Implementation of TBICE allowed the project to conquer the schedule challenge.
- This paper will demonstrate how TBICE was applied to a C-17 project, the criteria for conducting TBICE, and how the method can be expanded across multiple engineering disciplines.



How it started

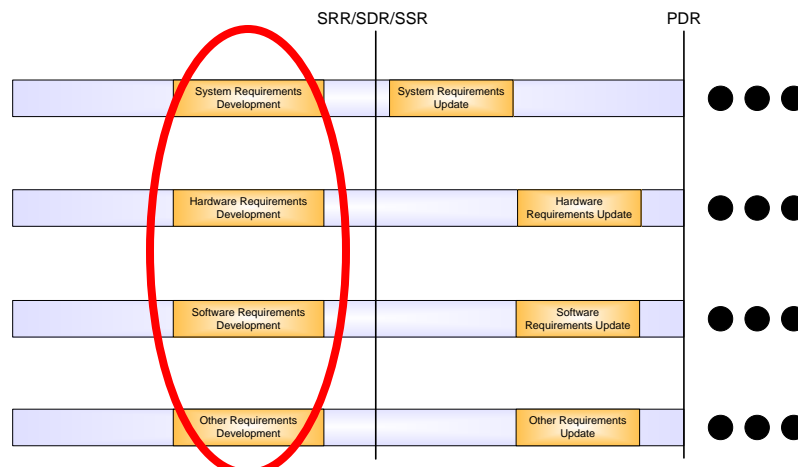
Requirements Development Prior to Schedule Baseline

Typical Water Fall Process



Requirements Development After Schedule Baseline

What's the process?



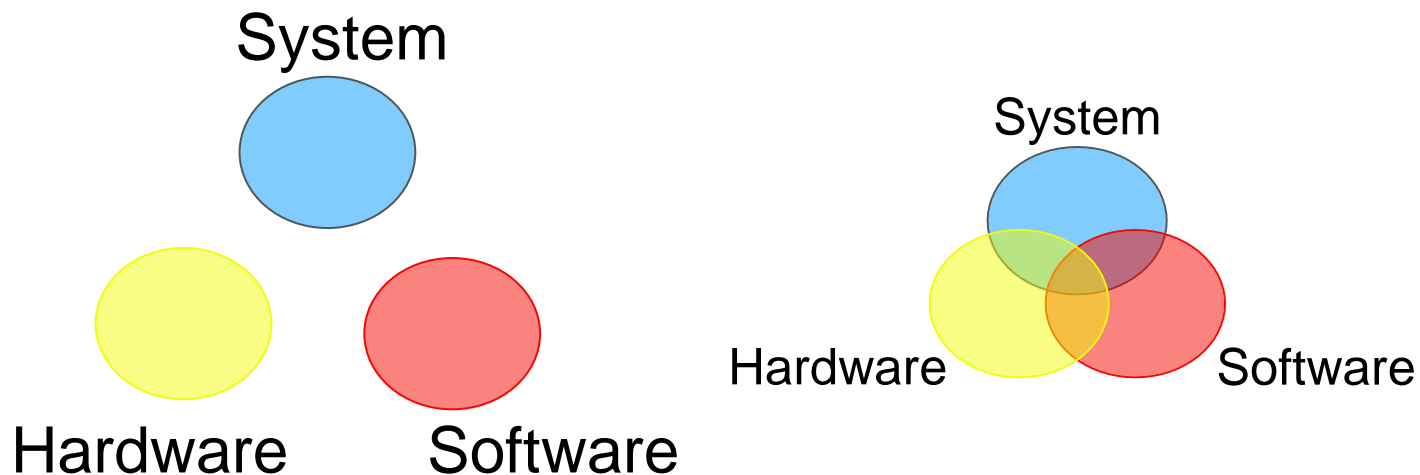


Concurrent Engineering

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- Engineering activities typically conducted in series that are instead conducted in parallel.
- With no existing process on how to execute the schedule, the parallel tasking positioned the project to concentrate on schedule instead of technical performance.

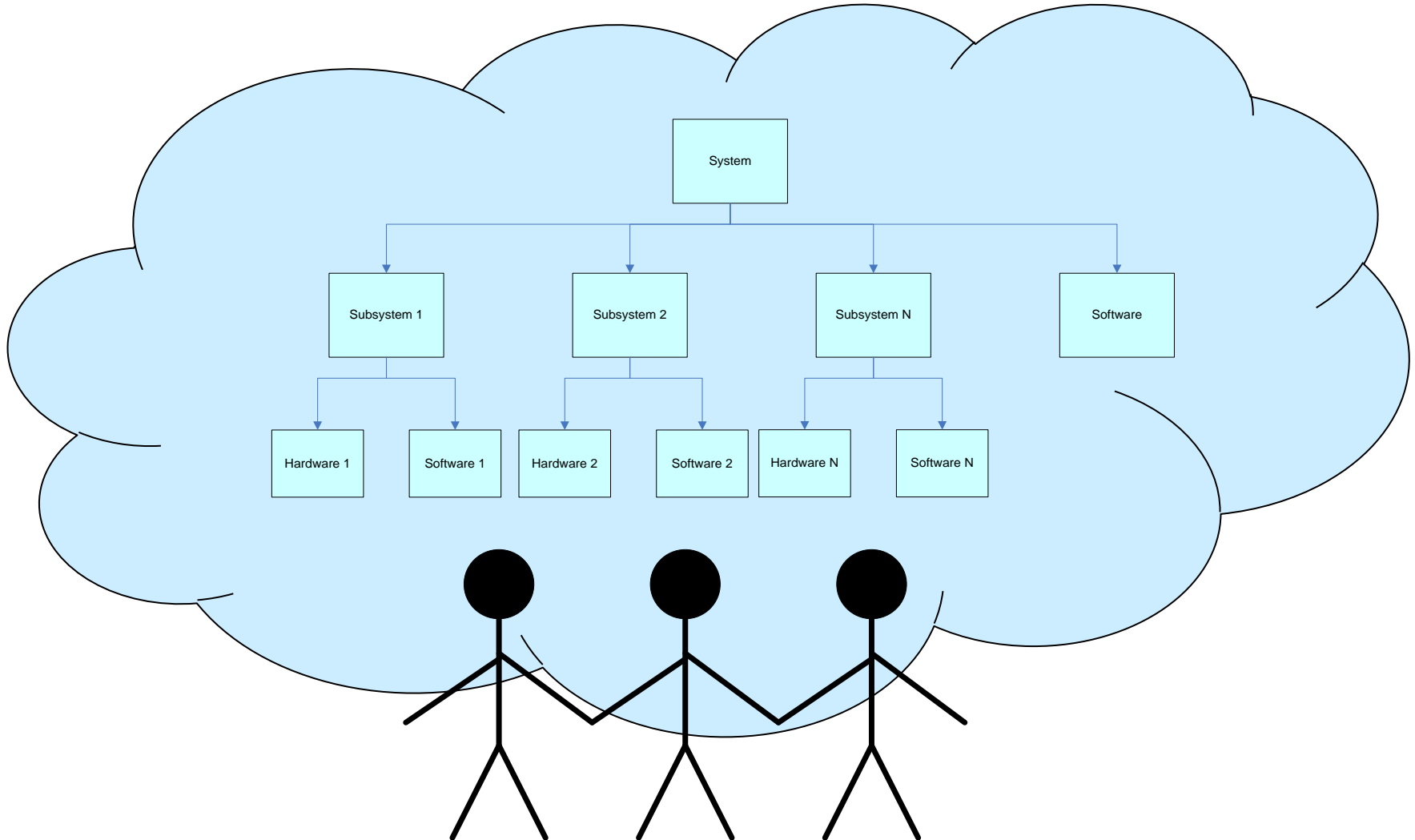




We needed to find a way

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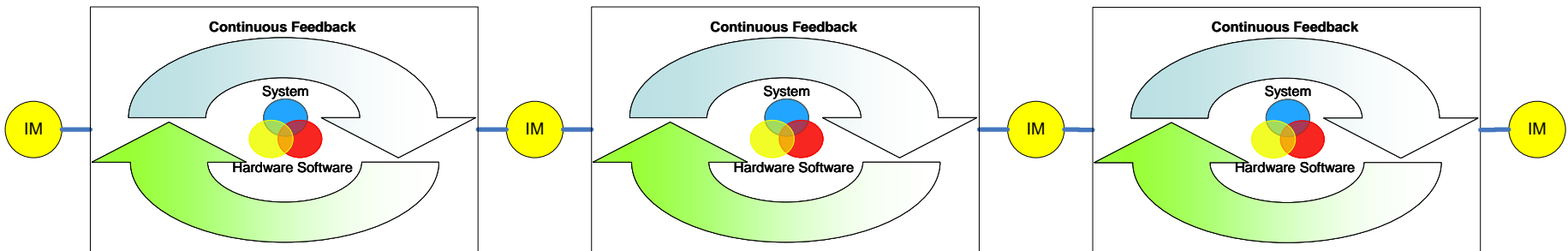
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What is TBICE?

- **Thread Based Integrated Concurrent Engineering**
 - Simultaneous coupling of requirements across multiple disciplines





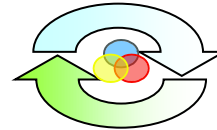
The Process

1

1st
Integration
Meeting
(IM)

- ✓ Establish ground rules
- ✓ Identify resource issues
- ✓ Review timeline
- ✓ Agree on architectural concept
- ✓ Assign resources to work specific areas of the requirements documentation and/or to resolve action items

In between IMs



2

- ✓ Engineering disciplines work assigned areas
- ✓ Engineering disciplines conduct handshakes with each other
- ✓ Ensures documentation changes are consistent
- ✓ Traceability across requirement specifications are correct.

3

Follow on
IMs

- ✓ Action Item Status
- ✓ Address new concerns
- ✓ Assign Action Items
- ✓ Discuss next area to work
- ✓ Assign work



4

- ✓ Coordinate peer review of documentation
- ✓ Make documentation updates
- ✓ Keep peer reviews open until all documents have been reviewed
- ✓ Make additional updates based on driven changes from other documents
- ✓ Close out peer review



Results

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- Met Milestone commitments
- No requirement re-work due to TBICE
- Tighter coupling of requirements and bi-directional traceability
- 70% reduction in cycle time



Why

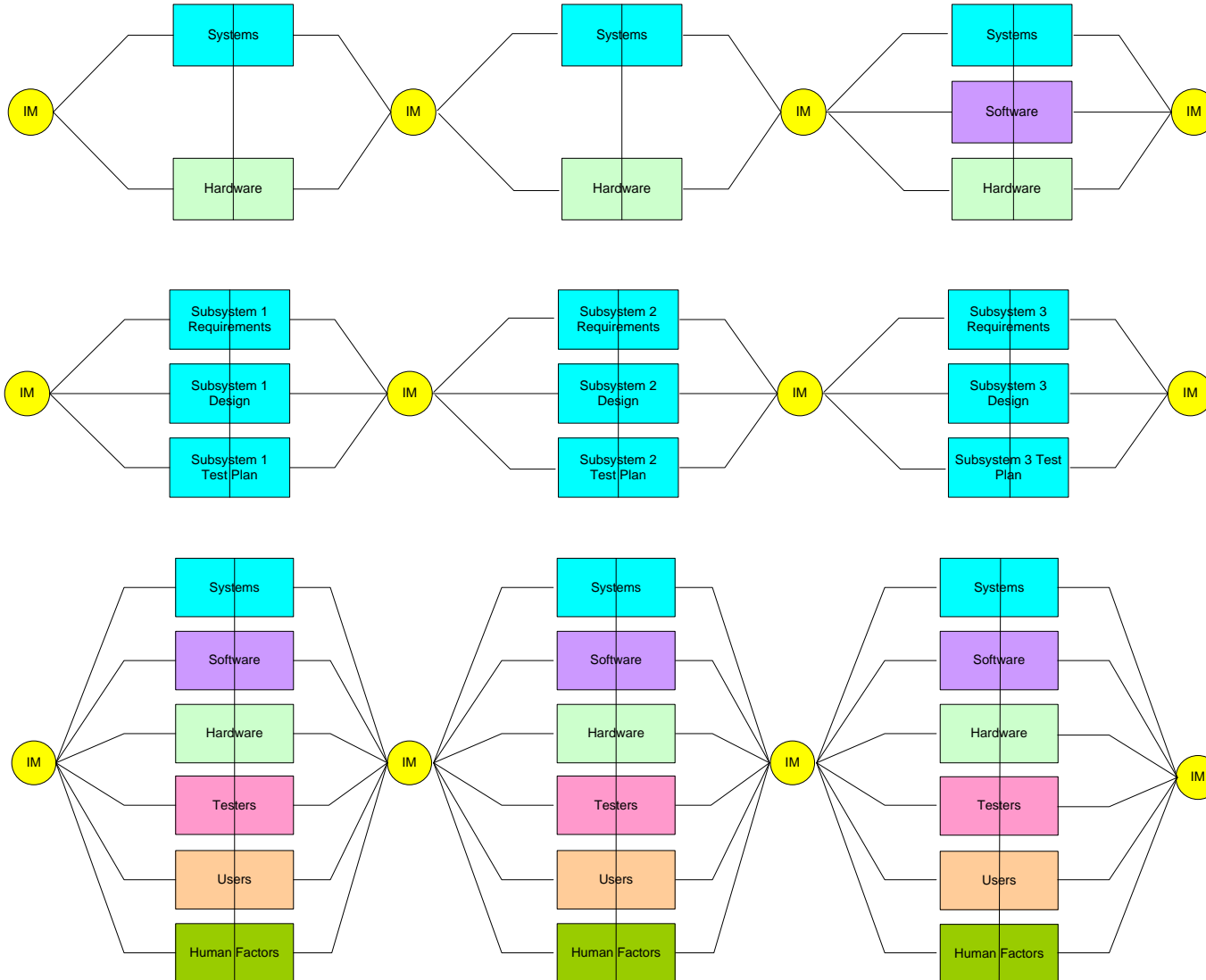
- **Why the process worked**
 - Future state of architecture is based on an existing architecture with supporting documentation
 - Resources had tribal knowledge
 - Modifications are well known and understood by stakeholders
- **Why it was used**
 - Project had a challenging schedule
 - Unable to change the baselined schedule without impacting milestone reviews and award fee.
 - Shared resources with other critical projects



Other Applications

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Considerations

- During Integration Meetings, facilitate meetings effectively
- Ensure Integration Meetings are value added for the multiple disciplines involved
- If work is centric to a particular discipline, obtain consensus during Integration Meeting if attendance is required or optional to other disciplines.



Thank you



Questions