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Test and Evaluation

SYMPOSIUM

IS AGILE RIGHT FOR HARDWARE?

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AGENDA

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- Background
- Ground Rules
- Road Map
- Lessons Learned
- Advantages & Disadvantages
- Conclusion

BIO

- Gina Parodi de Reid works for Boeing Test & Evaluation (BT&E) for the C-17 program. Gina is the C-17 T&E Technical Lead Engineer and roles include project management and system engineering for C-17 avionics simulation laboratories. Gina earned a B.S in Industrial Technology at California State University Los Angeles and is currently pursuing a M.S in Systems Engineering at the University of Missouri Science & Technology. In 2012 Gina earned the Amelia Earhart Society (AES) Woman of High Potential award and 3rd place best presentation at the ITEA Symposium. Gina is associated with AES, SAE, INCOSE, ITEA, and SWE.

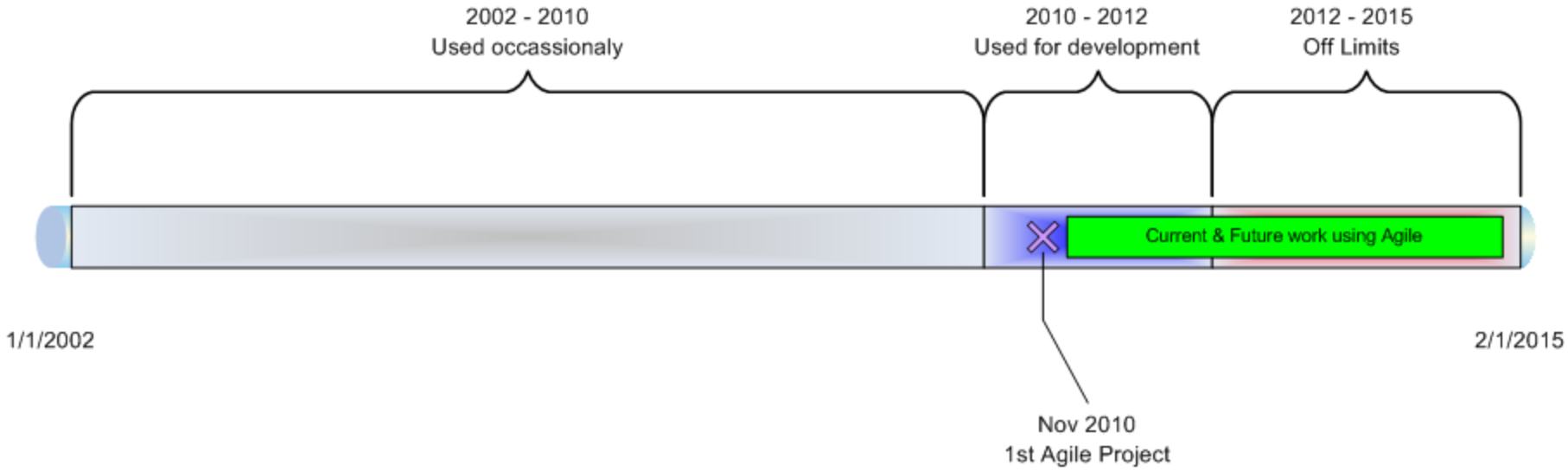
ABSTRACT

- Boeing has a flight simulator with a partial cockpit that enables pilot in the loop interaction with the simulation and real Line Replacement Units (LRUs) for a particular aircraft. The capability enables users to conduct system and subsystem integration testing to support the development needs of the Operational Flight Program (OFP). Currently, this capability is under enhancement and off limits until 2015. In order to continue supporting the needs of both internal and external customers an alternative solution was suggested and implemented. This alternative solution used the modularity of existing hardware and software while integrating the Boeing Agile Software Process (BASP) to address a hardware centric solution.
- This paper reviews the steps Boeing has taken to integrate hardware in the Agile process, challenges the team faced, lessons learned, and finally advantages and disadvantages of using such a process for hardware development. Ultimately the decision to use Agile for hardware development depends on many factors; however, the goal of this paper is to provide insight on how the process was used and could be improved.

BACKGROUND

- Boeing has a flight simulator that provides partial cockpit functionality
- Capability rarely used until 2010 time frame when it gets updated
- Used more late 2010 to support agile projects
- August 2012 went offline for major infrastructure update

BACKGROUND CONTINUED



- **A temporary alternative method to provide user community developmental capability to support their agile processes was needed**

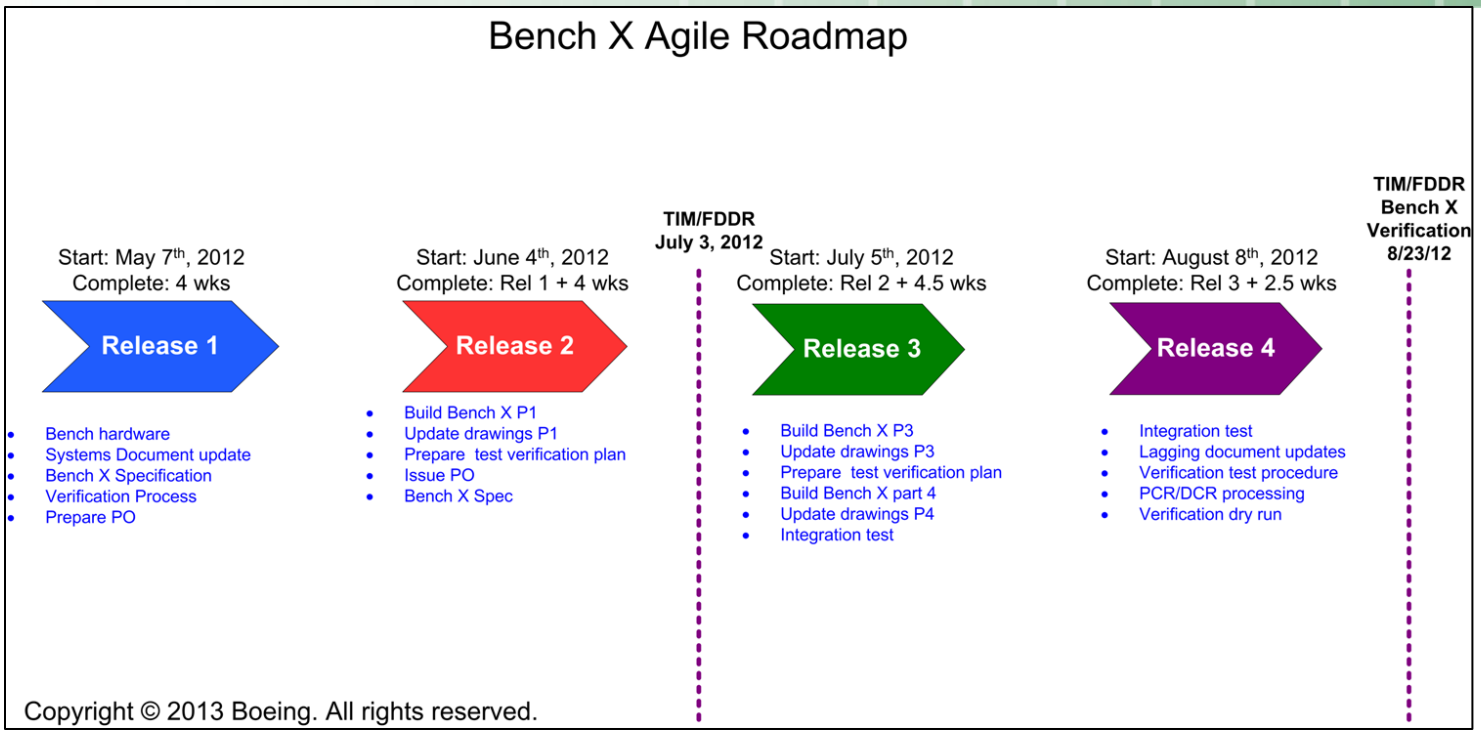
BACKGROUND CONTINUED

- Need date was 3 months away
  - Used Agile process instead of waterfall
  - Developed a concept which leveraged modularity of existing equipment and minor modification of a Pilot in the loop bench
  - Developed Ground Rules
  - Created the Road Map and planned the Releases
  - Started the daily scrums
  - Ground rules went out the door (not all but some)

WHAT WERE THE GROUND RULES?

- Bench X = Modular Equipment +Simulation Host Computer + Pilot in the loop Bench
- Use existing Simulation Host Computer and Modular Equipment to provide software simulation environment and MIL-STD-1553 interface to the Pilot in the loop Bench.
- Leverage existing design of the Pilot in the loop Bench to create a Redesigned Bench; therefore, modifications to drawings would be minimal to duplicate the drawing for the environment it was to operate in.
- Use existing simulation software and provide prototypes to support development needs
- Minimize cost and reduce schedule by decommissioning two legacy benches. Parts not available would be ordered.
- Use Agile process for Systems, Software, and Hardware Development
- Use less stringent but documented process for development of documentation (requirements, design, and test). Rationale: User community only needs development capability, thus the end product does not require formal qualification.
- Use existing Pilot in the loop Bench requirements and design, tailor as needed for required application.

THE ROAD MAP



- **Release 1-2 Iterations, each spanning 2 weeks**
- **Release 2- 2 Iterations, each spanning 2 weeks**
- **Release 3- 2 Iterations each spanning 2 weeks**
- **Iteration 4- 1 Iteration, spanning 2.5 weeks**

LESSONS LEARNED

- LL#1 System Lead should have engaged in the daily scrums
  - User community are the product owners; therefore requirements should be coordinated with them.
    - Facility & System level requirements missed because the PO were not familiar with the product as a system

- LL#2 Meeting Minutes mismatch
  - More tasks in the meeting minutes then planned in the backlog tasking due to not updating the backlog in a consistent manner
    - Documenting tasking in the backlog helps identify if scope of work is larger than it appears

- LL#3 Mismatch of credit between backlog status and meeting minutes
  - Credit was taking on meeting minutes, but backlog tasks still remained open
    - Need to be careful of appearing to take credit for “Good” metrics or having a resource without the right skill set perform a function.

LESSONS LEARNED CONTINUED

- **LL #4: Scope creep is inevitable for Hardware if requirements are not defined**
  - **Concept was agreed to prior to scrum sessions; but once started user community wanted changes. Ground Rules thrown out the window**
    - **To minimize re-work re-design there needs to be stable requirements**

- **LL #5: Configuration Catch up**
  - **Quality Assurance not involved in the beginning. Drawings now need to be formally released**
    - **The right people need to be identified so that strategy on the approach has buy in from everyone involved.**
    - **Ran out of time and budget, drawings still need to get redlines incorporated**

LESSONS LEARNED CONTINUED

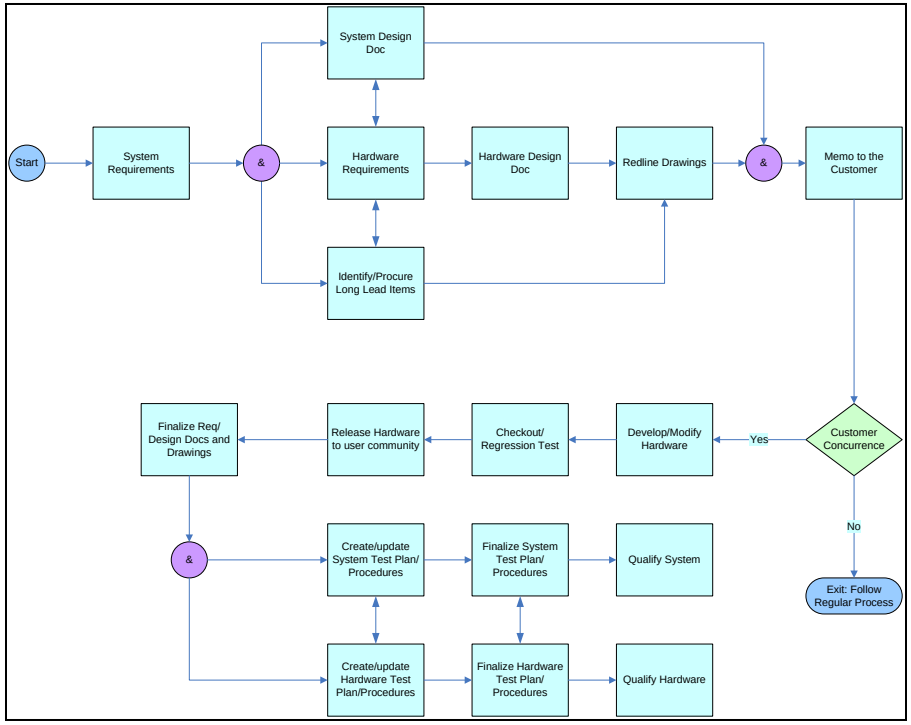
- LL #6: Purchase Order Lead Time
  - Consideration of the time required to identify and procure a part is not accounted for
    - Long and Short Lead items need to be identified ahead of time.

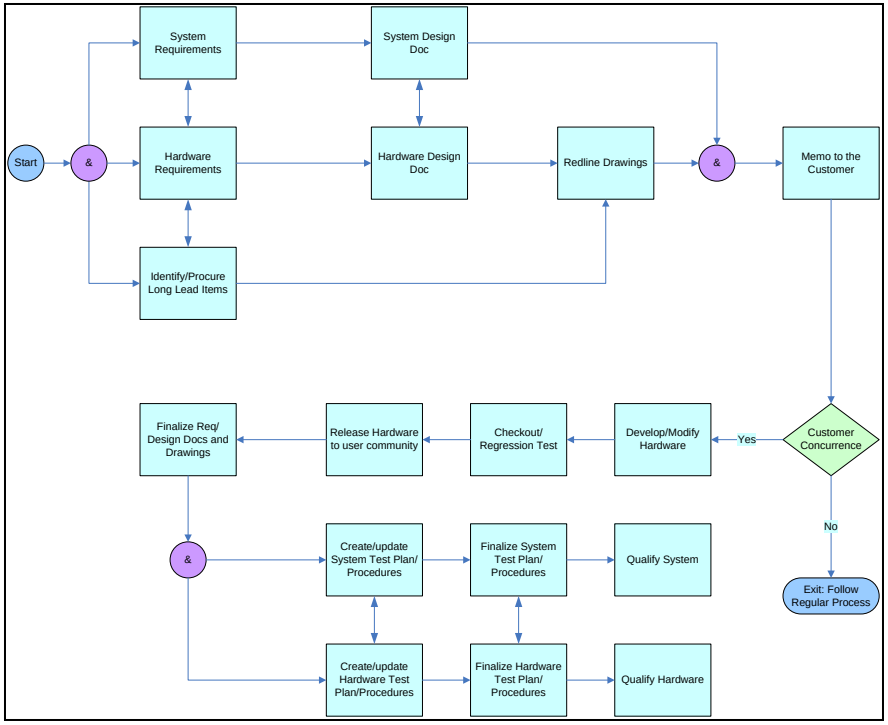
- LL #7Contradictions between Roadmap, Back Log, and Meeting Minutes
  - Roadmap items not captured as backlog items due to not needed
  - Additional time required to decipher completed tasking in meeting minutes
  - Unable to relate electronically stored artifacts to the tasks
    - Consistency is key. It helps with planning, customer visibility, earned value management, and audits.

ADVANTAGES & DISADVANTAGES

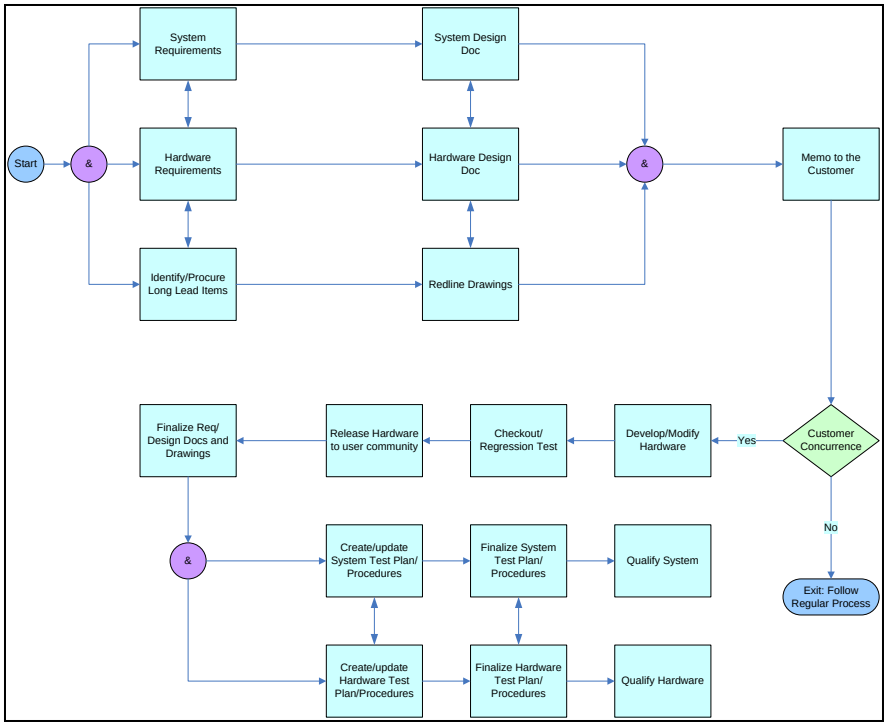
- **The Good:**
  - Great tool for planning, breaking out tasking, assigning resources, providing daily status, and resolving impediments
  - Opportunity for reducing redundant doc updates or processes
- **The Bad:**
  - Process is highly dependant on buy in
  - Need the right skill set to do the work
  - Hardware process is more rigid, therefore agile needs to be tailored
  - Additional emphasis on long lead times
- **The Ugly:**
  - Organizational adaptation and support to enable shift towards agile
  - Hardware processes may need changes to support versatility

ADVANTAGES & DISADVANTAGES CONTINUED





ADVANTAGES & DISADVANTAGES CONTINUED



CONCLUSION

- **Full immersion, agile process must be tailored for hardware**
  - **Can still integrate with software and systems, but there are certain steps that must be sequential**
- **Hybrid Approach**
  - **Feasible to "agilize" parts of the waterfall process**
  - **Start with documentation**

THANK YOU

QUESTIONS?