

# Application of SPM Tools To Case Study

## Production of Forward Command Vehicle (FCV)



Team Members

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Sponsor

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# Presentation Outline

- Project Overview
- Motivation
- Project Approach and Tool
- Case Analysis
- Take Away and Conclusion

# Project Background

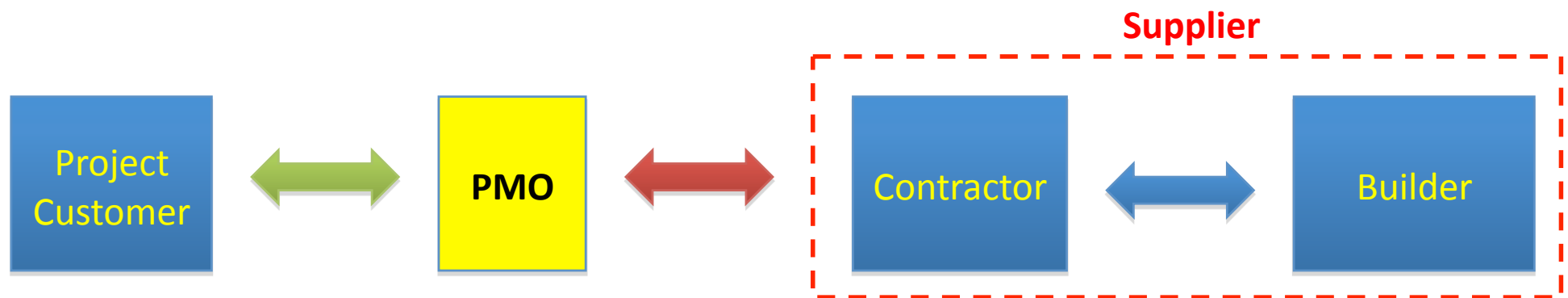
- 2 FCV are required for security operations
- Production schedule slip
- Project nearly failed to meet customer's requirement to use FCV for security operation at a national event
- Managed to deploy the systems after risk mitigation measures were employed



(Source: The Straits Times, 17 Apr 2009)

# Project Organization

- Unique Project Arrangement – Project Management Office (PMO) does not have a control over project resources



# Project **Motivation**

- **Understand how ESD. 36 PM Tools can assist PMO** to assess feasibility of Contractor's construction plan and customer requirements/schedule
- **Gain lesson learned** from the past project for next similar project
- **Comprehend task dependencies** and the project dynamics



# Product Background

## Forward Command Vehicle (FCV)

- A rapidly deployed, mobile command center for Police Force to manage incidents onsite.
- Customized shelter system with workstations, integrated onto a truck chassis.
- Comes with two version – expandable (Layout 1) and non-expandable (Layout 2) version





# Project Approach



- Collect project production WBS and schedule from project sponsors
- Conduct a questionnaire interview with the project manager in PMO
- Apply the tools used in ESD.36 to evaluate feasibility of the production schedule to meet the customer milestone
  - Project graph
  - PERT Analysis & Signal Flow
  - DSM
- Document key take-away

## Example of Interview Questions

- Based on your experience in past projects and from what you saw during the FCV's production phase from May to July 08, which were the tasks that required unplanned reworks?
- Which were the activities that have strong dependency on each other i.e. we could have anticipated that any update in one task would impact another and should have factored more time?
- Where are the resource constraints bottlenecks that you might have observed?

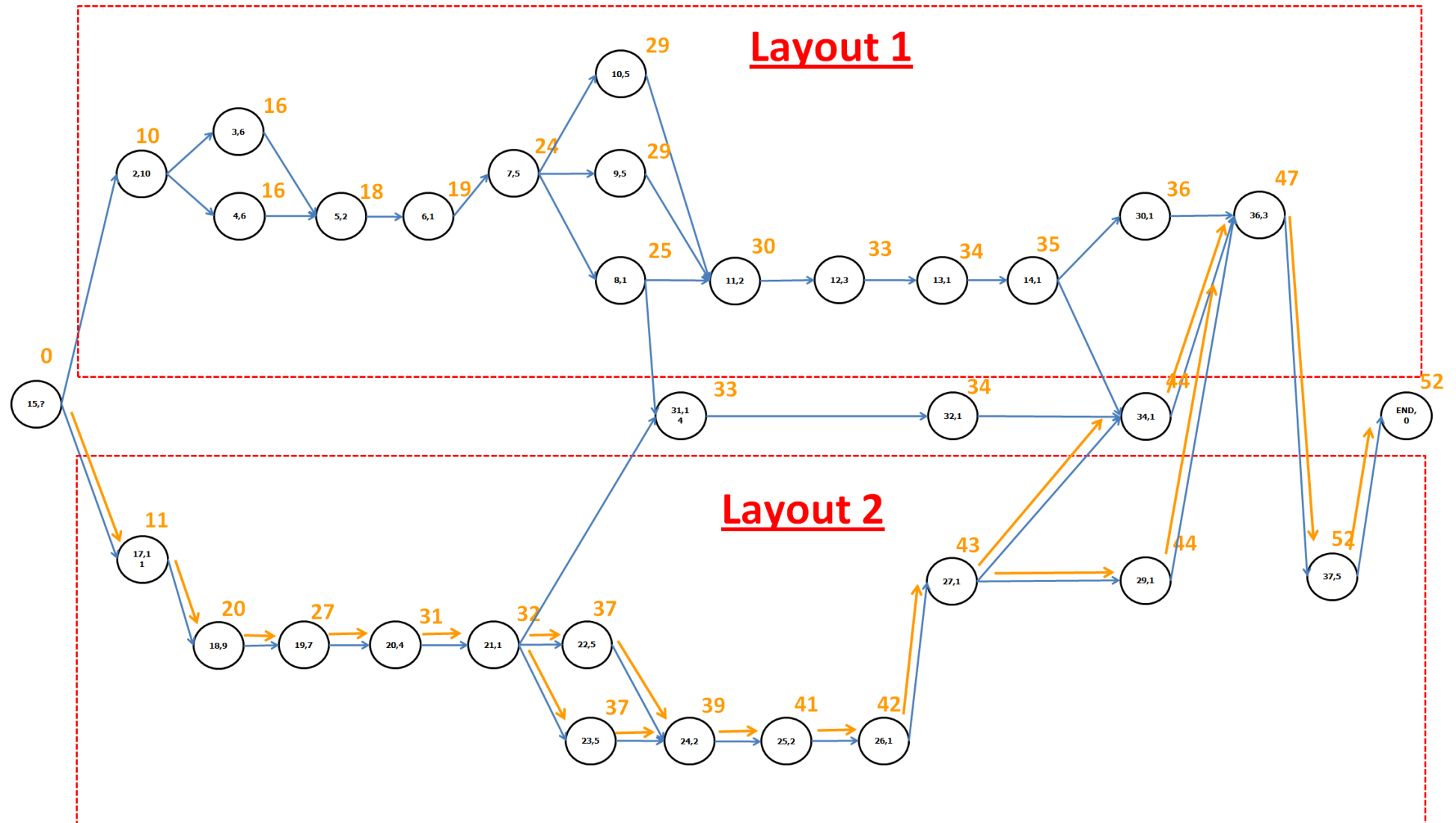


## **Task Dependencies** Found in the Project

- Side Cabin Automation Assembly Work & External Body Work
- Interior Body Work and Electrical Installation Work
- Painting Works and Platform Acceptance Test
- Electrical Installation Work and Furnishing Work
- **Electrical Installation Work and ICT equipment Testing/Integration**
- Platform Acceptance Test and Regulatory Approval
- External Body Work and Platform Acceptance Test



# Project Graph

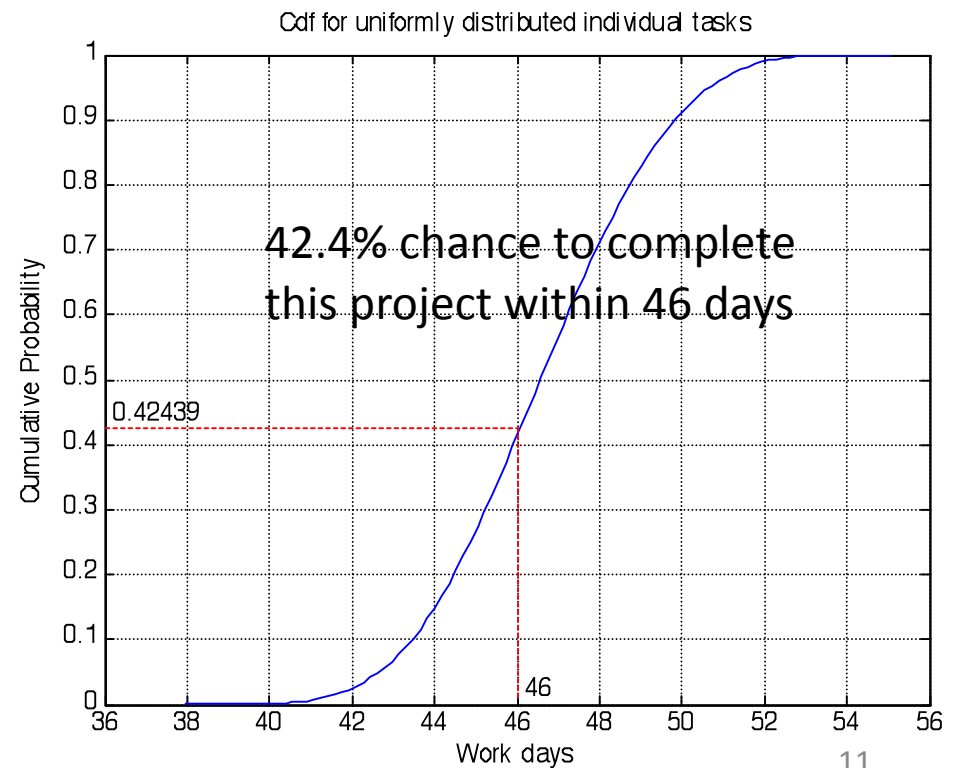
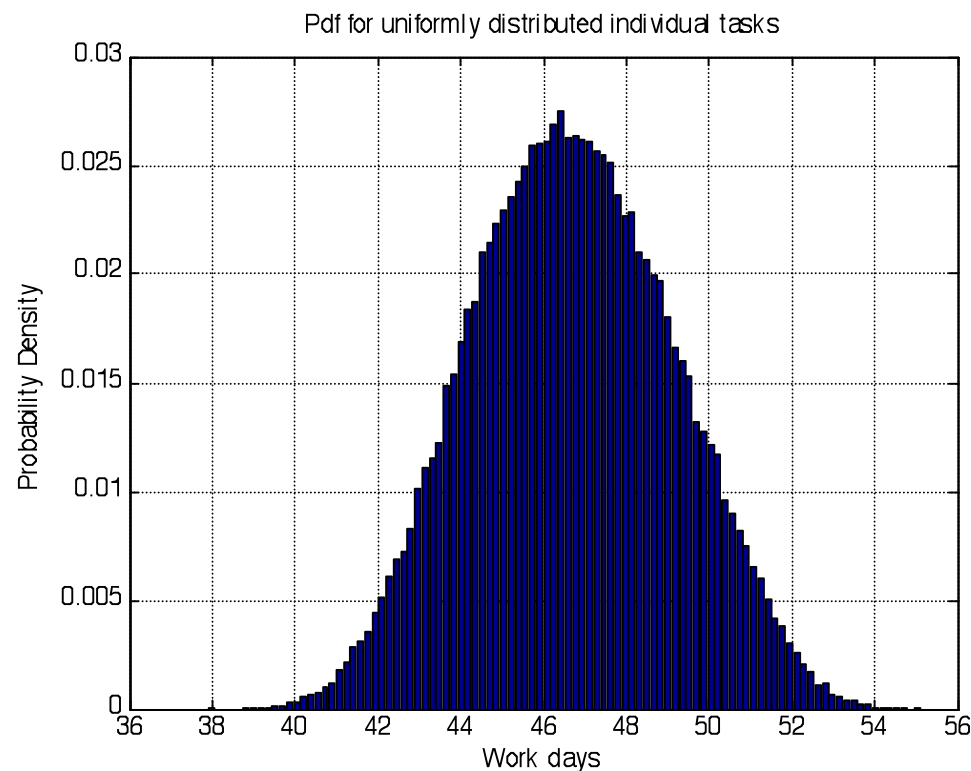


# PERT Analysis

## Pert Assumptions

- No feedback loops
- Optimistic and Pessimistic durations as  $\pm 25\%$  of task duration
- Individual task durations are uniformly distributed

## PERT analysis of actual planned schedule



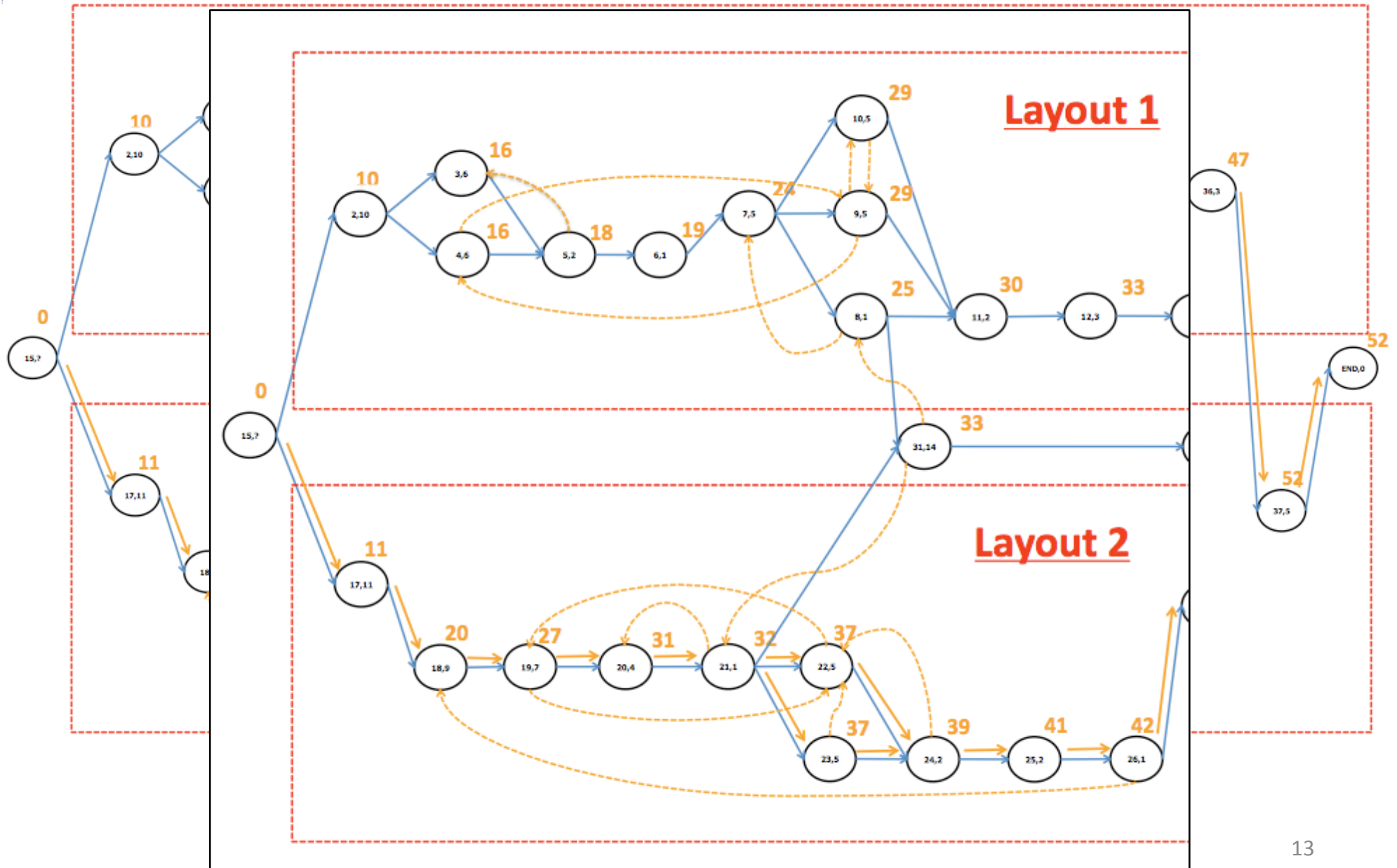
# Findings from PERT

## Sensitivity Analysis of PERT

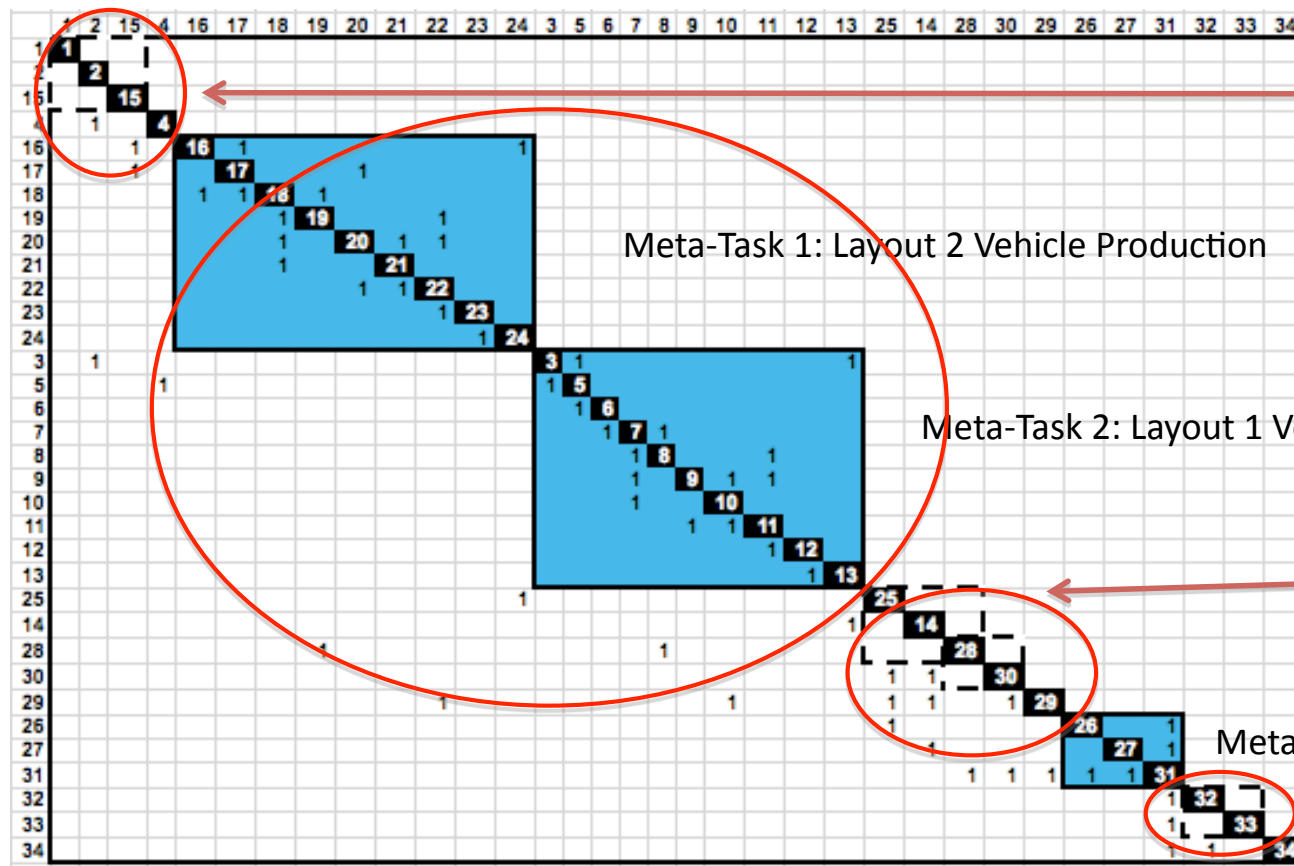
Confidence level of completing in 46 days with deviation of optimistic and pessimistic durations.

Sensitivity	±10%	±25%	±50%
Confidence Level	65.3%	42.4%	23.6%

# Project Graph with Iterations



# Project DSM Partitioned



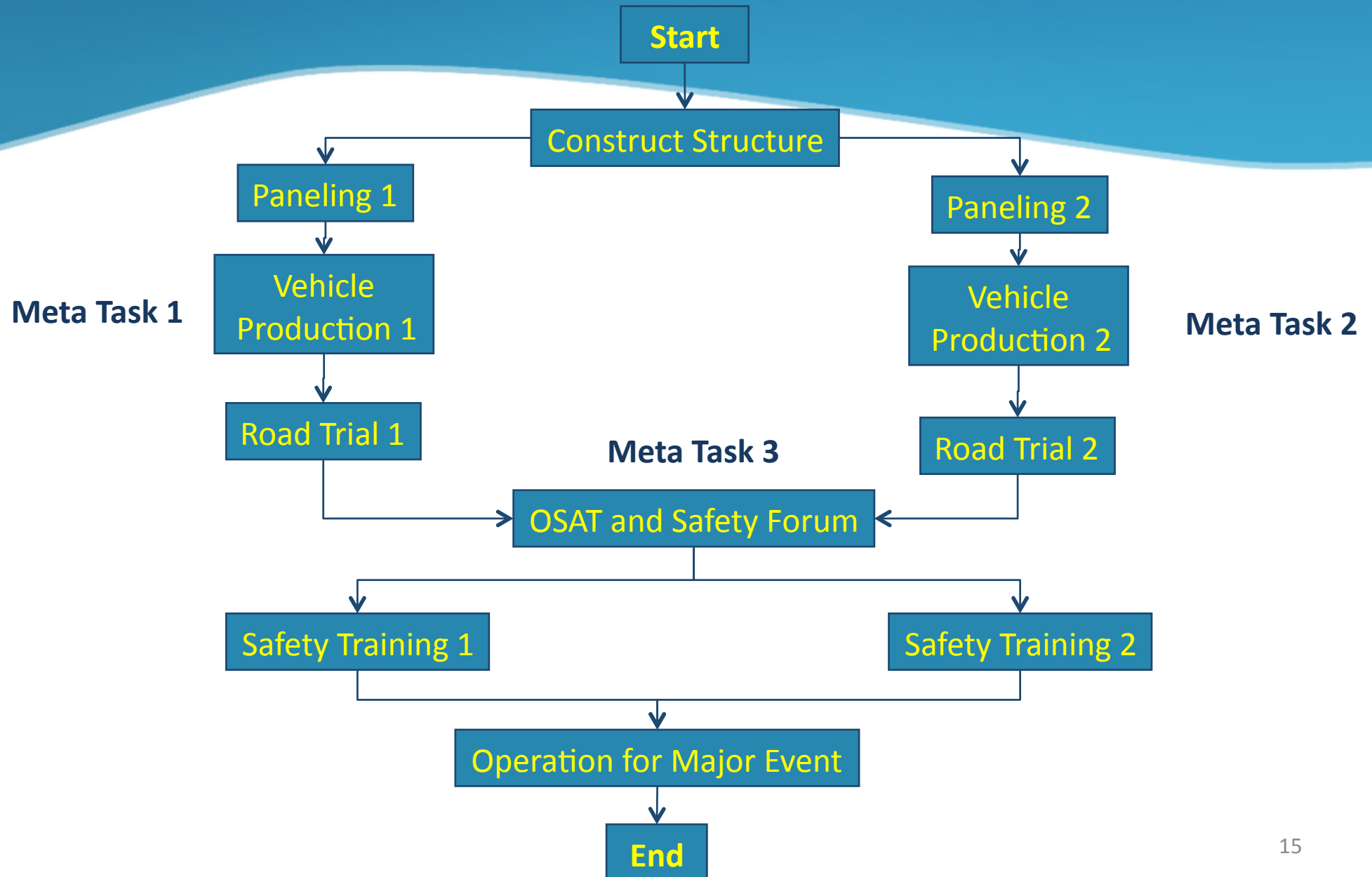
Paneling Vehicle Layout 1 and Paneling Vehicle Layout 2 can be done **in parallel**

Layout 1, 2 off road trials and LTA submission can be done **in parallel**

Training Layout 1 and 2 can be done **in parallel**

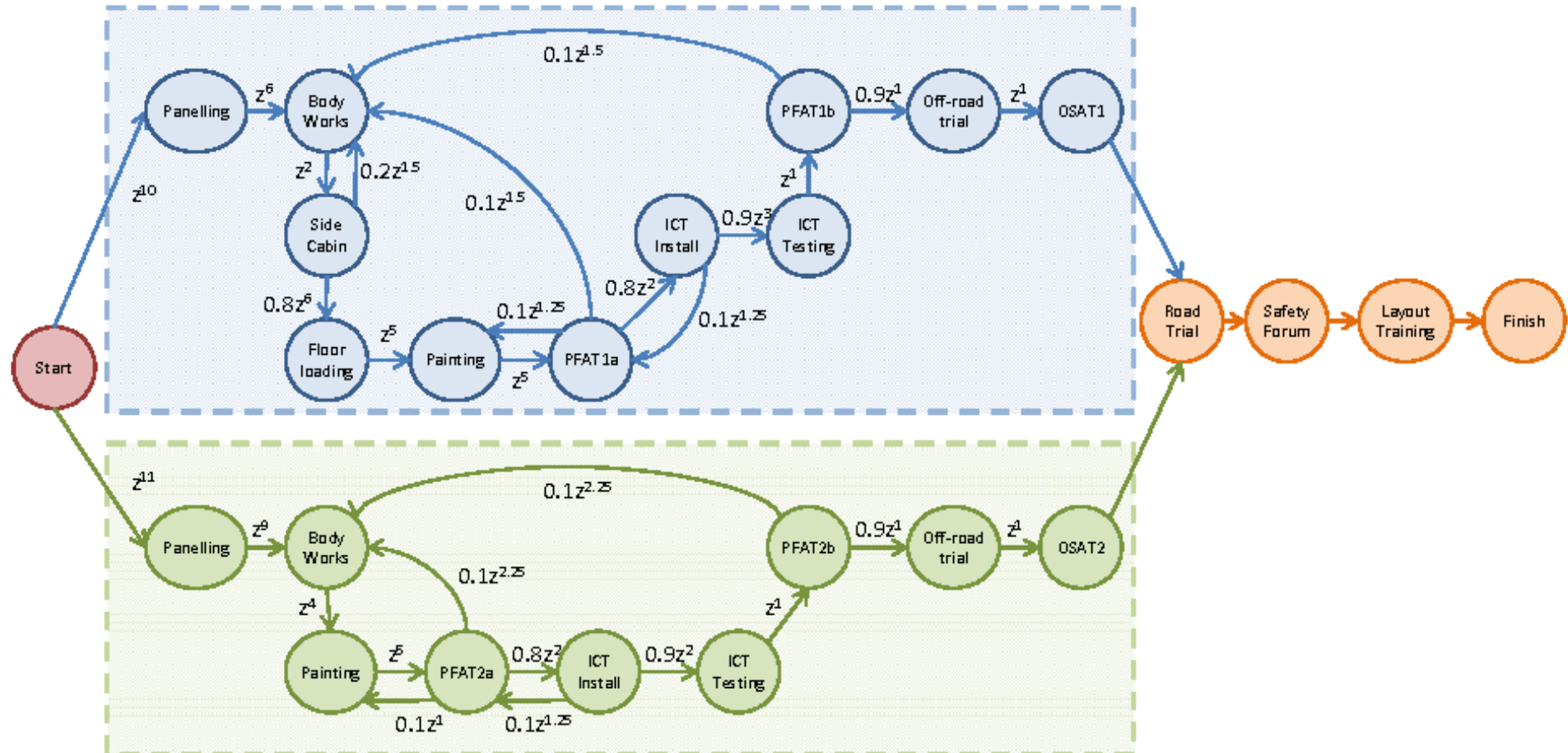
Note that Meta Task 1 and 2 can be done in parallel

# Simplified Project WBS





# Signal Flow



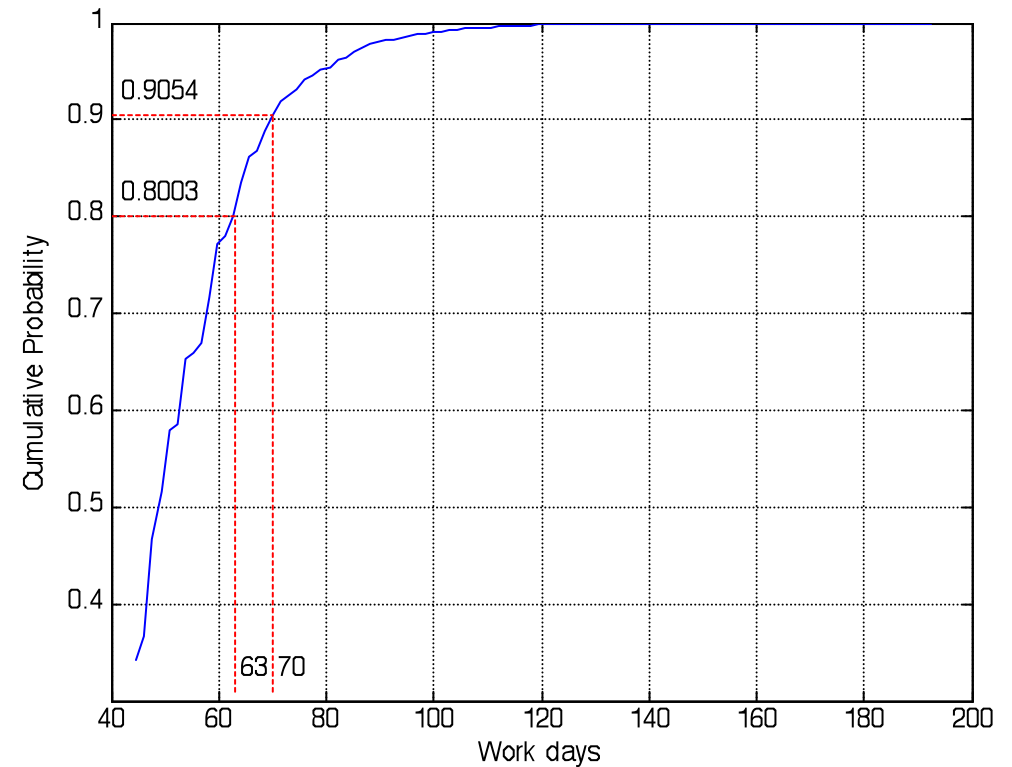
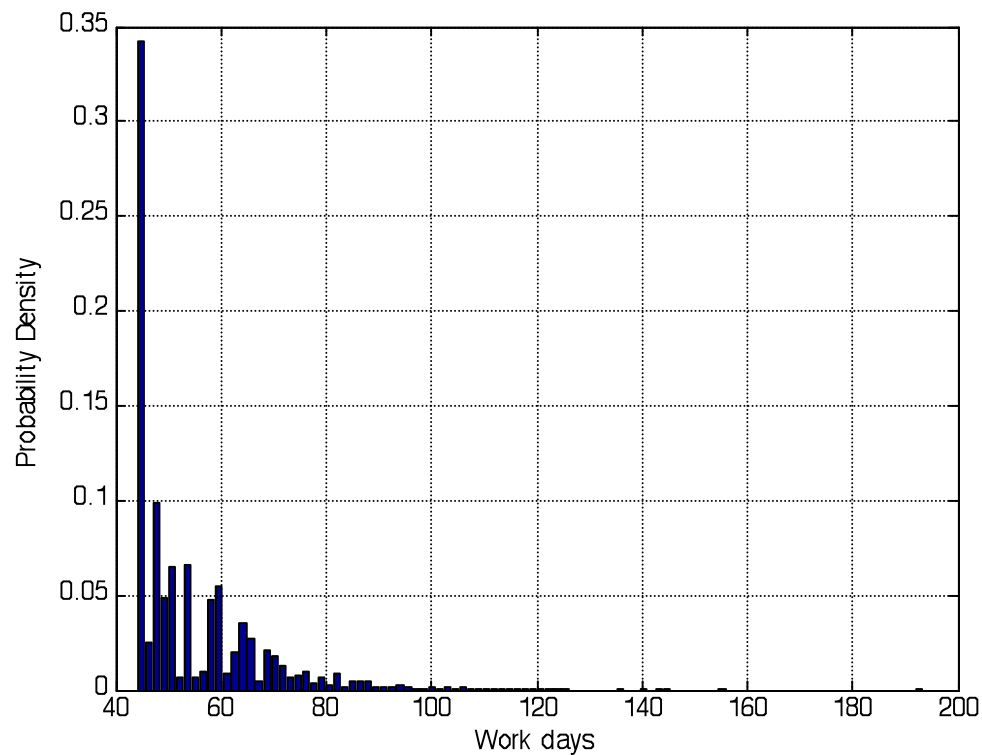
## Issues

- Signal flow graph cannot be used for parallel tasks
- Signal flow analysis done for each platform

## Assumptions

- Each rework takes up 25% of original task duration
- The full production is only iterated once<sup>16</sup>

# Signal Flow Analysis



Probability of completing by National Day (70 days) : 90.54%

Probability of completing by National Day Preview (63 days) : 80.03%

# Key Project Dynamics Observed

- Due to schedule pressure, the contractor provided more ad-hoc workers (e.g. electricians) at late stage of the project, which results in:
  - ✓ Inexperienced workers caused reworks
  - ✓ Quality on Quality Effect
  - ✓ More haste, less speed
- Also, increase in workweek, leading to:
  - ✓ Morale of workers drops
  - ✓ Productivity drops
- Reworks causes more fire-fighting on the ground and resources were stretched



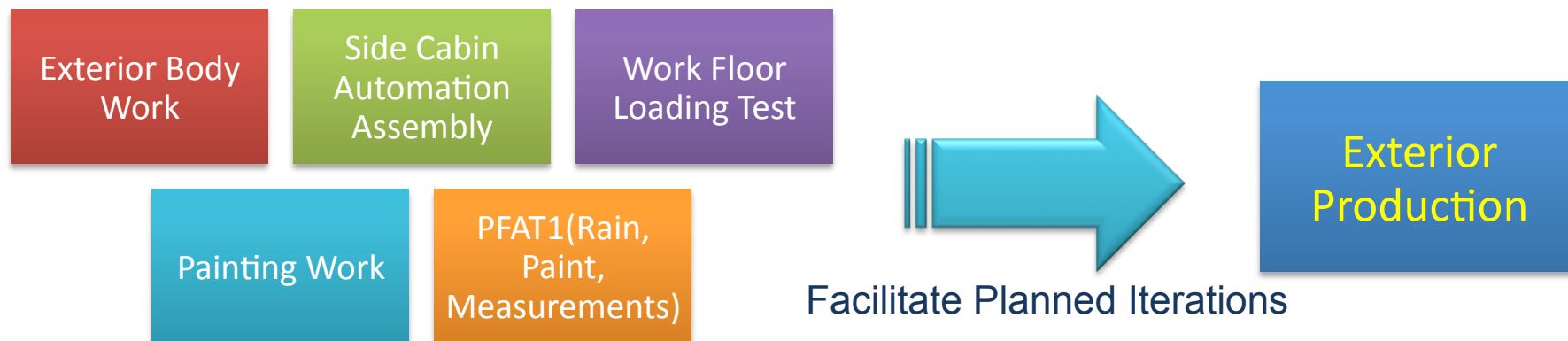
# Risk Management: Mitigating Actions Taken in Actual Scenario

- The Off Road Trial was postponed to after the customer's milestone event
- The Safety Assessment was endorsed with limitations. The system was only certified to be operated on a static mode at the event. Full endorsement on its safety was obtained subsequently
- Outstanding works from the OSAT was postponed to after the customer's milestone event

# Key Take-Away from Project Analysis

DSM

- There **are task dependencies** in the project that lead to work iterations. These are not reflected as planned iterations in the Gantt chart, which may cause a project delay
- **Dependent tasks can be grouped together as a meta task** to reduce the required work iterations by increasing coordination level among team member



- A revised workflow may help to reduce large meta-tasks into smaller meta-tasks. This could eventually speed up the overall project

# Key Take-Away from Project Analysis

## PERT & Signal Flow

- PERT can provide a quick view on the project timeline feasibility. However, it cannot provide the accurate estimation of the project duration due to the difficulty of getting task duration statistics
- Lack of work iteration Information in PERT leads to optimistic project evaluation, which could be a risk
- Signal Flow shows that the probability of completing the project on week before the national event (63 days) is only 80%. There is a 20% chance that the tasks in the production stage cannot be completed before the national event, which corresponds to what happened in the actual scenario
- There are tasks overlaps, which are not easy to present in the PM tools