



Acquisition Research Program:  
Creating Synergy for Informed Change

# Reducing F414 Cycle Time Through Employment of Organizational Modeling

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# Outline

- Objective
- Methodology
- Model Development
- Modeling Results / Conclusions
- Real-World Results / Conclusions
- Recommendations for Further Study



# Objective

- Identify options for reducing F414 cycle time
- Characterize relative benefit of options
- Recommend way ahead



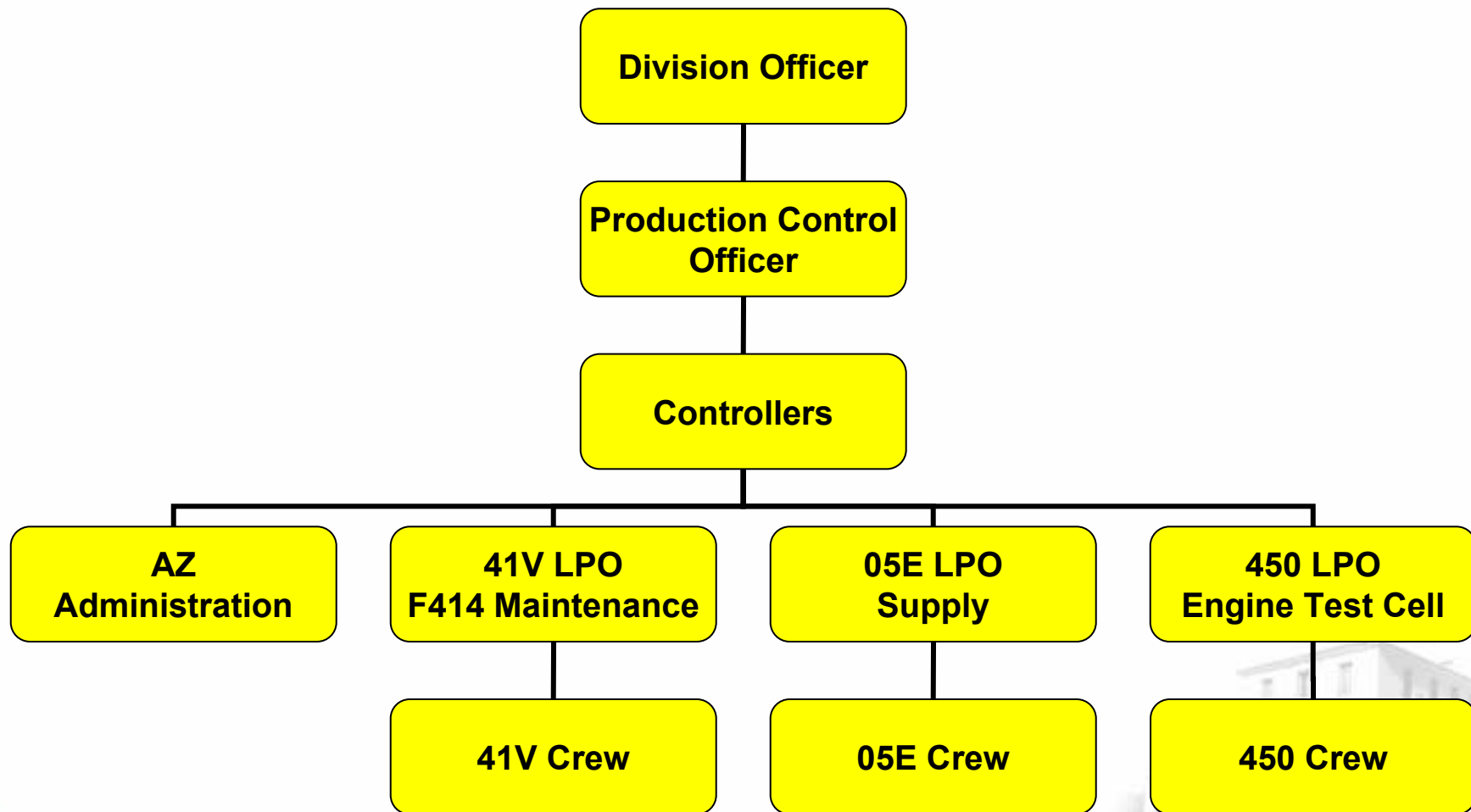
# Background

- NAS Lemoore AIMD 400 Division – F/A-18E/F F414
  - Improvements via *AirSpeed* - Lean, Six-sigma, etc.
  - Engine maintenance efficiency & quality
- Employed organizational modeling
  - Similar to FEM & CFD modeling
  - Focuses on more efficiently moving information
  - Virtual Design Team techniques developed at Stanford
  - Describes work in terms of information flow
    - J.R. Galbraith
    - Doing work effectively requires effective information flow

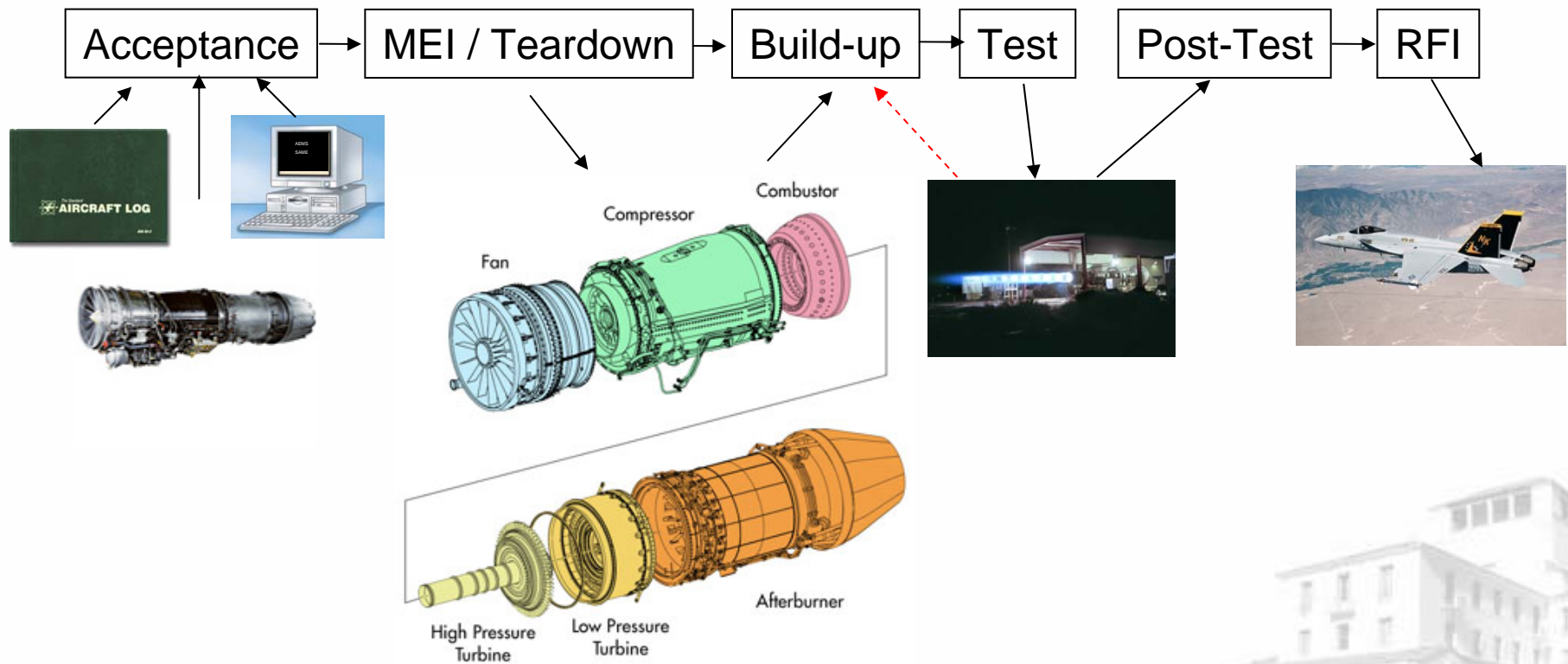
*AirSpeed* focus - **item** moving through the organization  
Org. Modeling focus - **information** moving through the organization



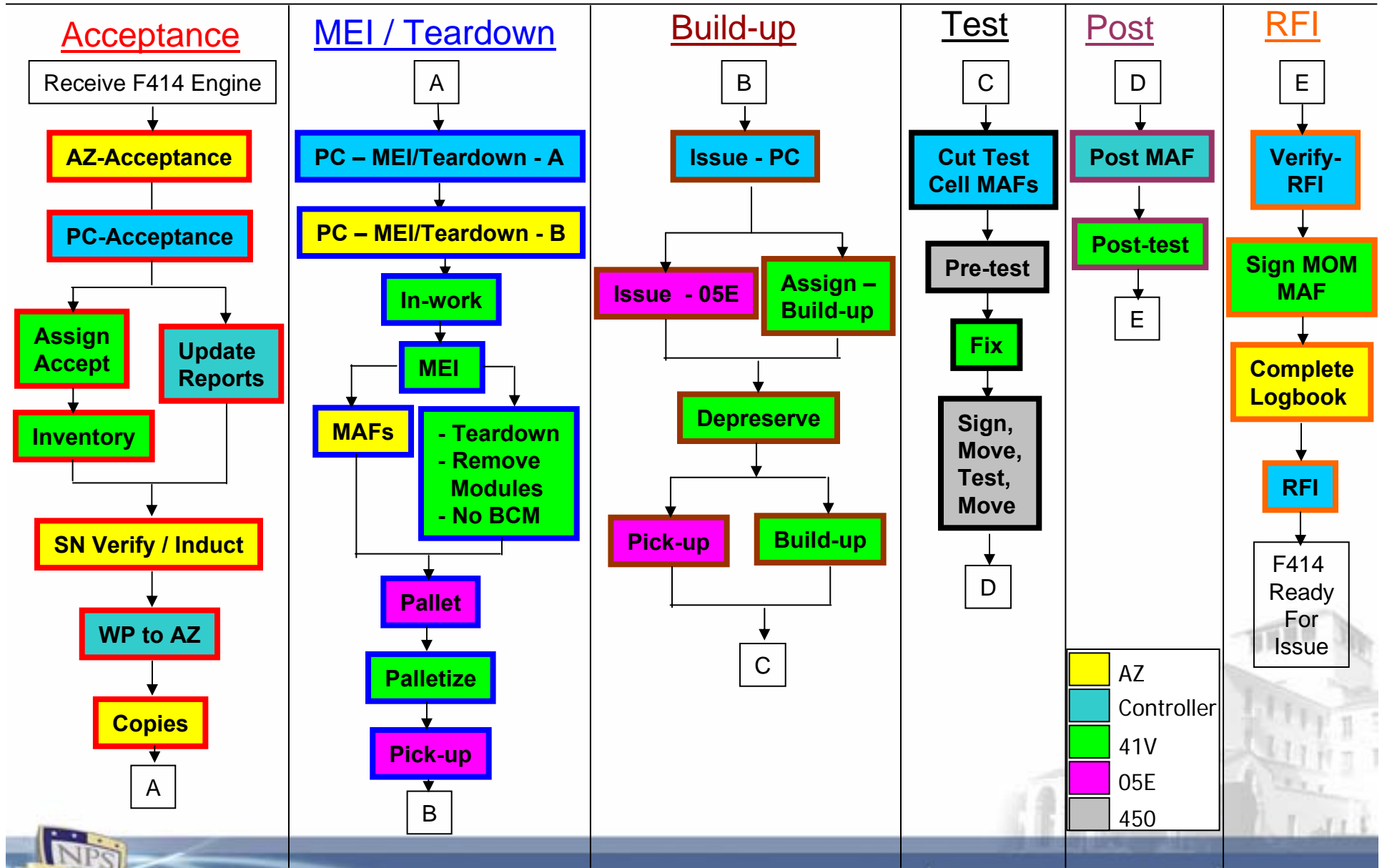
# 400 Division F414 Organization



# F414 Maintenance Process Top Level



# F414 Detailed Maintenance Process



# Model Development Methodology

- Developed model of 400 Division F414 maintenance
- Model included off-core tasks
- Assumptions / Simplifications
  - Modeled single engine
  - Modeled single shift
  - Modeled engine Acceptance process as 14 day duration
  - Did not model delay due to parts
- Once baseline model verified - Modified model
  - Identify potential courses of action for reducing cycle time
  - Modeled 7 interventions + best of 7





# Model Variable Definition

## Project variable definitions

Variable	Value Based On...
Work Day	8 hrs / day
Work Week	5 day / week
Team Experience	Medium - Assessment of interviewed 400 Div. personnel
Centralization	High - Assessment of interviewed 400 Div. personnel – PC controlling
Formalization	Low - Assessment of interviewed 400 Div. personnel
Matrix Strength	Medium - Assessment of interviewed 400 Div. personnel
Communication Probability	0.30 - Nominal range is 0.2 to 0.9. Tasks are relatively routine and executed by skilled personnel
Functional Exception Probability	0.075 – Nominal range is 0.05-0.10. Design inefficiencies are very low. No technology problems associated with accomplishing this project.
Project Exception Probability	0.075 – Nominal range is 0.05-0.10. There are few interface problems with this work – module assembly

## Position variable definitions

Variable	Value Based On...
Culture	All Generic. Not a concern in this study
Role	OIC – PM, PC officer & Controller - SL, all others ST
Application Experience	Medium – Varies with individuals PCSing. Results generally applicable when set to Medium
Full-time-equivalent	FTE = (# personnel assigned to that position) * (average % time spent working F414 tasks) * (1/6 to account for working a single engine)
Salary	All set to \$50. Concern here is relative vs. absolute values
Skill Rating	All positions have High skill rating for their position's skill, Medium skill rating for the skills of the positions they supervise, and low for any skills associated with positions lower in the chain of command



# Model Variable Definition

## Primary Task variable definitions

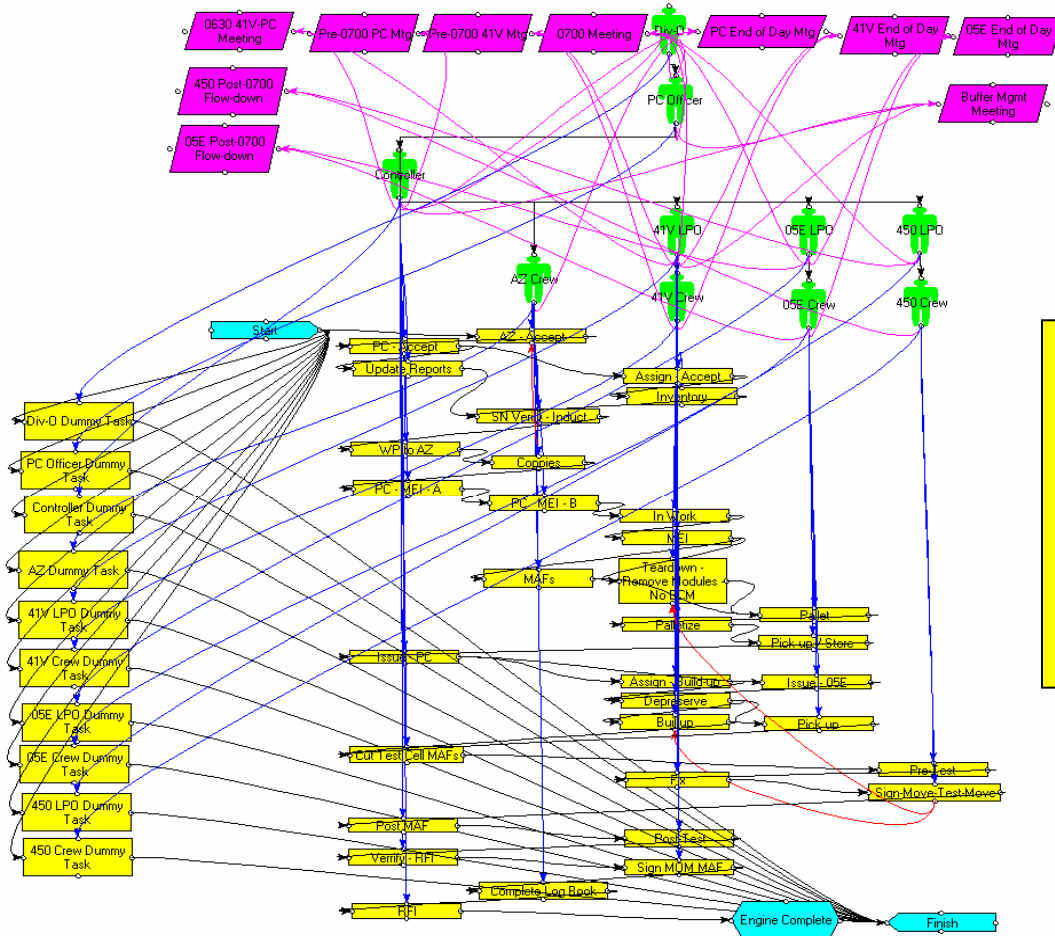
Variable	Value Based On...
Effort	400 Division value stream analysis
Effort Type	Assessment of interviewed 400 Div. personnel
Required Skill	Assessment of interviewed 400 Div. personnel
Priority	All tasks set to high, All off-core tasks set to low
Requirement Complexity	All set to low. Requirements for all tasks are well understood
Solution Complexity	All set to low. How to complete each task is well understood
Uncertainty	Assessment of interviewed 400 Div. personnel
Fixed Cost	All set to \$50. Concern here is relative vs. absolute values
Assigned Position Allocation	Assessment of interviewed 400 Div. personnel

## Meeting variable definitions

Variable	Value Based On...
Priority	All set to High
Duration	Assessment of interviewed 400 Div. personnel
Interval	Assessment of interviewed 400 Div. personnel
Repeating	All meetings are repeating. Frequency defined by interviewed 400 Div. personnel
Schedule to end	All meetings scheduled to end
Meeting Time	Start time defined by interviewed 400 Div. personnel. Time is referenced relative to the Start milestone
Meeting Attendance	Assessment of interviewed 400 Div. personnel
Meeting Attendance Allocation	Assessment of interviewed 400 Div. personnel. Based on percentage of personnel assigned to a position who attend the meeting



# Organizational Model



- Verified baseline model
- Comparing actual vs. modeled cycle time durations
- 21.09 vs 21.77 days - 3%Δ



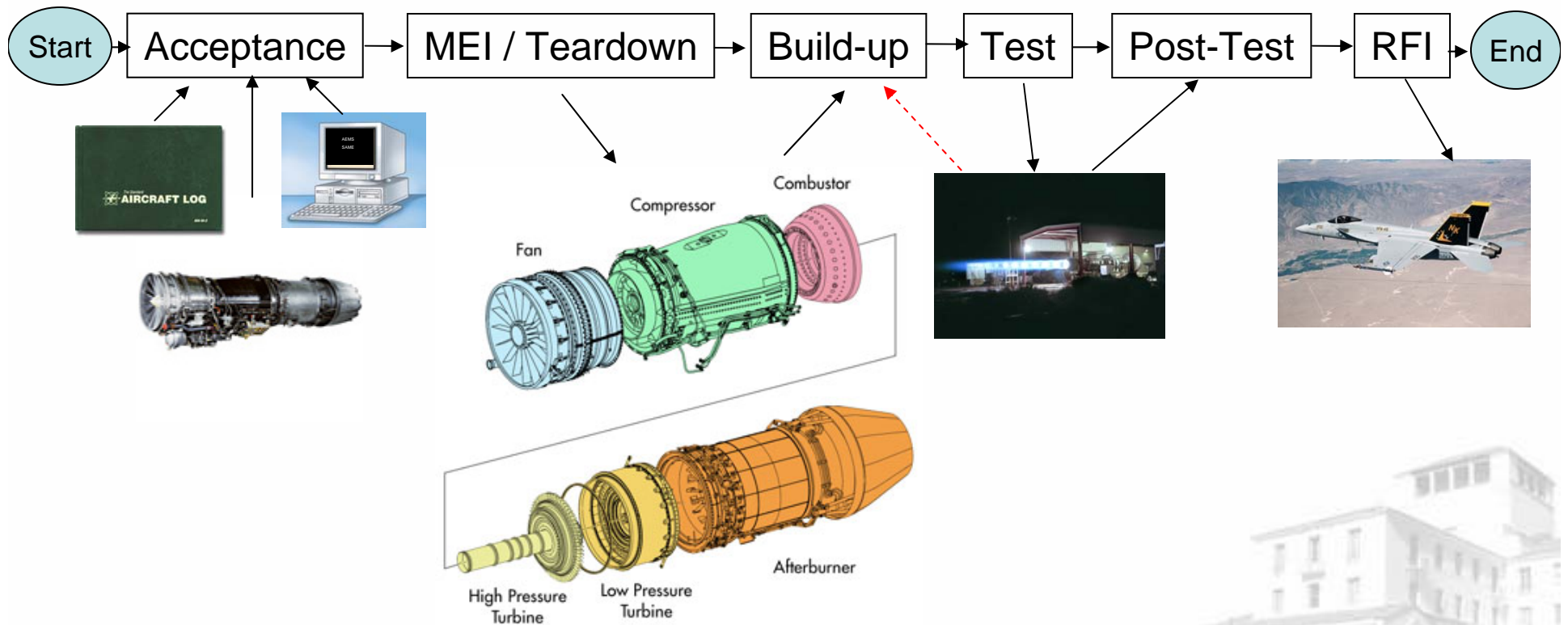
# Organizational Interventions

- #1 Parallel Acceptance process w/ other F414 tasks
- #2 Combine Controller & AZ positions
  - Without skill retraining
  - With skill retraining
- #3 Combine 41V and 450 Positions
  - Without skill retraining
  - With skill retraining
- #4 Decreasing Centralization
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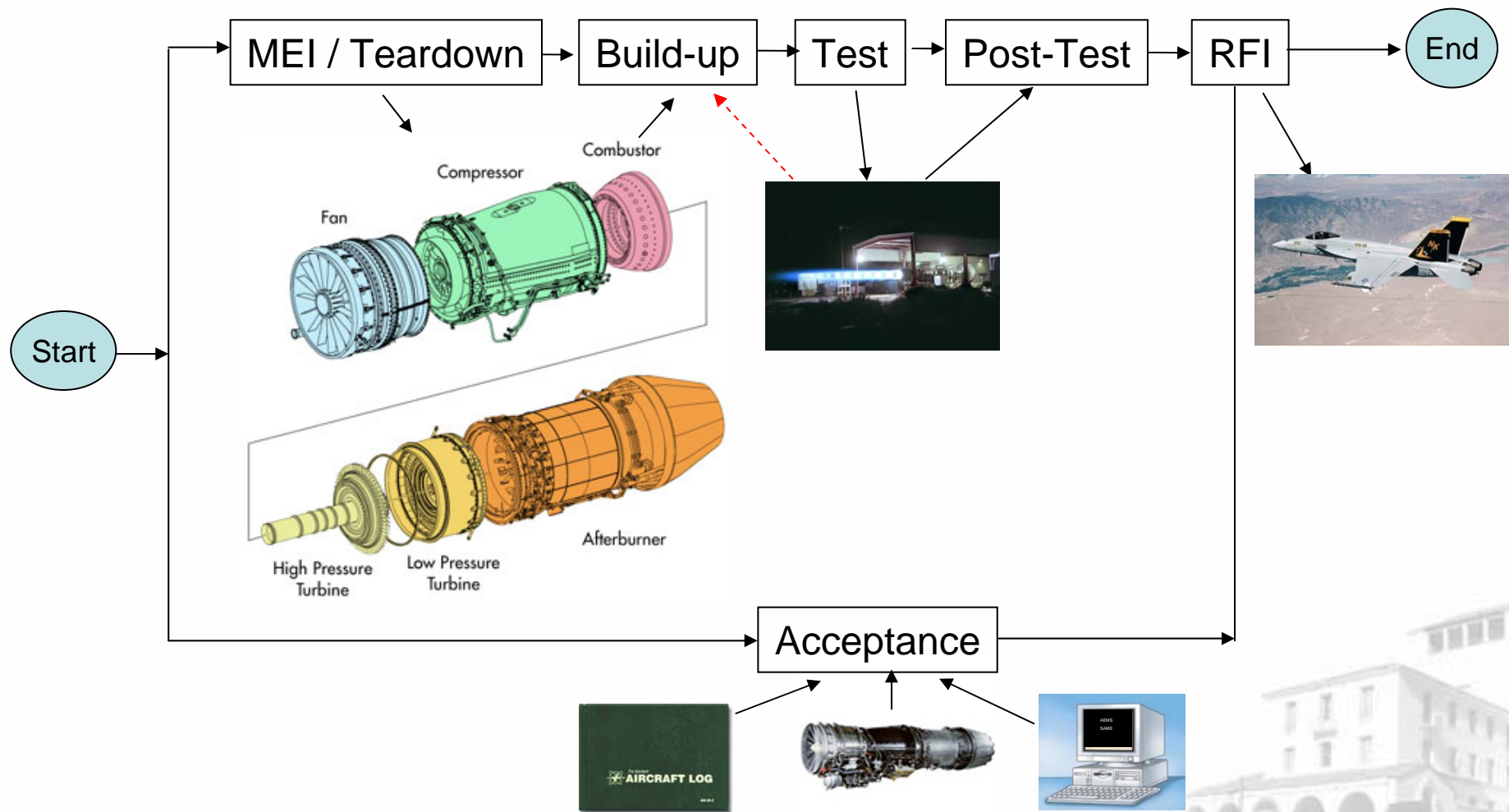


# Evaluation of Intervention #1

## Current F414 Process

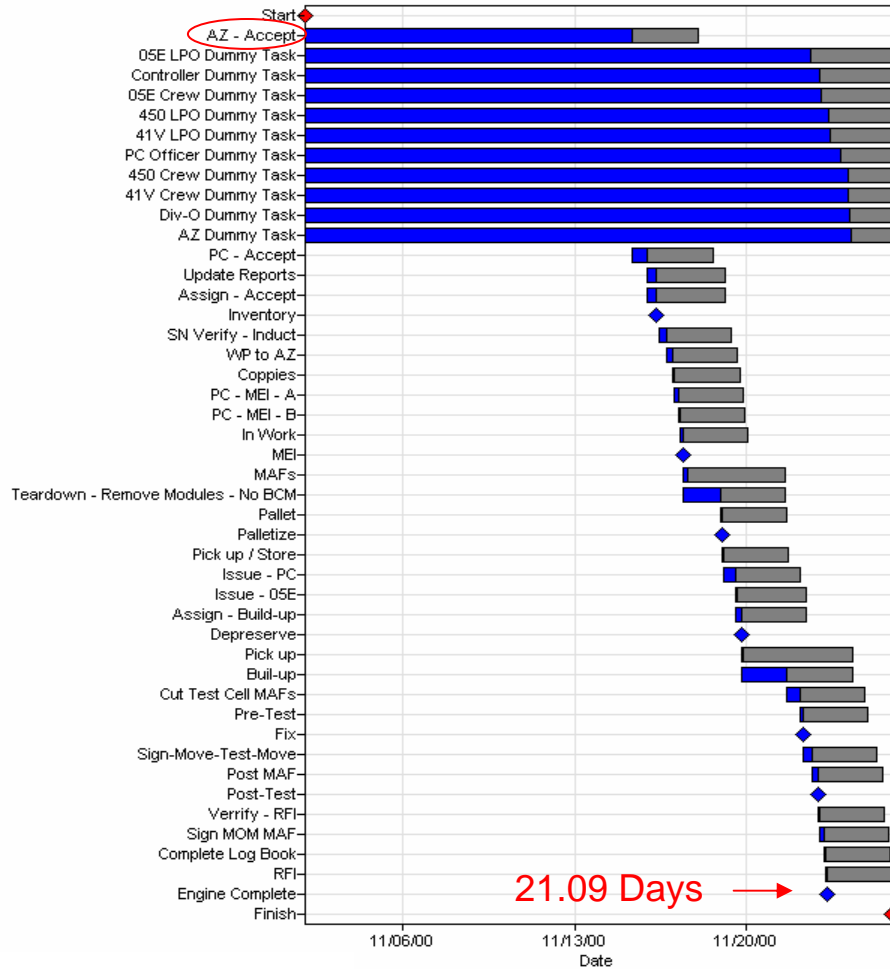


# F414 Maint. w/ Intervention #1

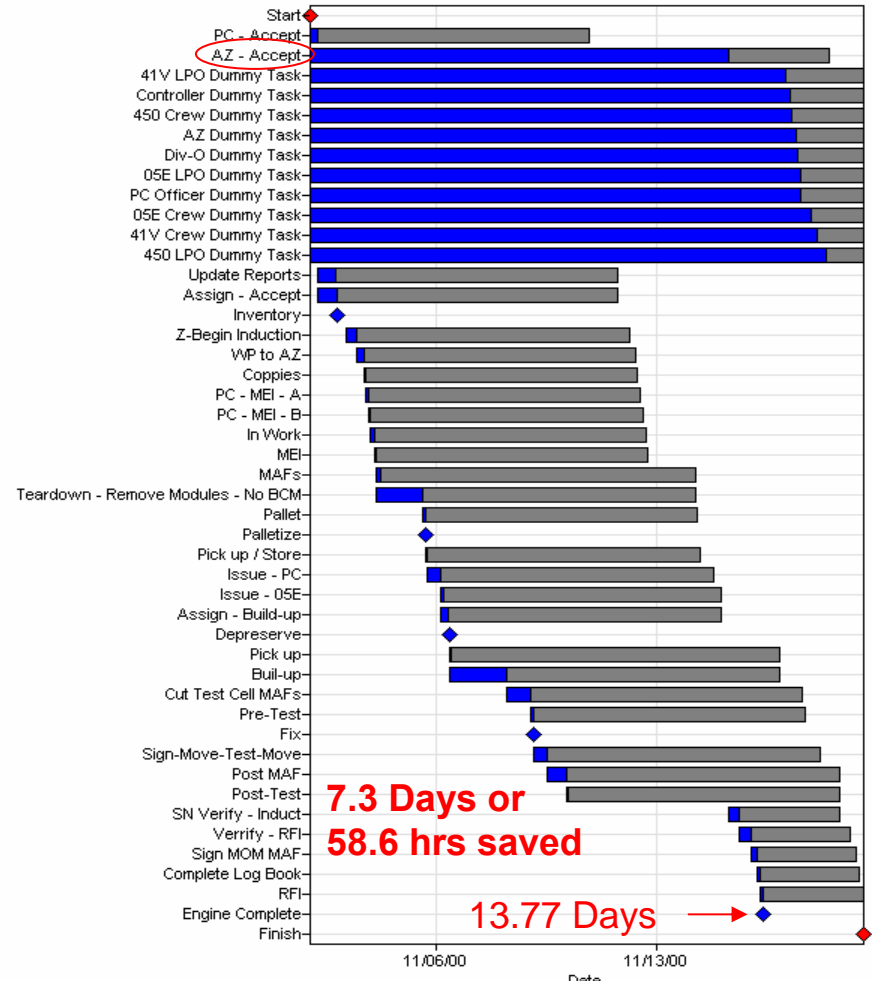


# Impact - Schedule

## Current Process



## Paralleling Acceptance / On-Engine Work

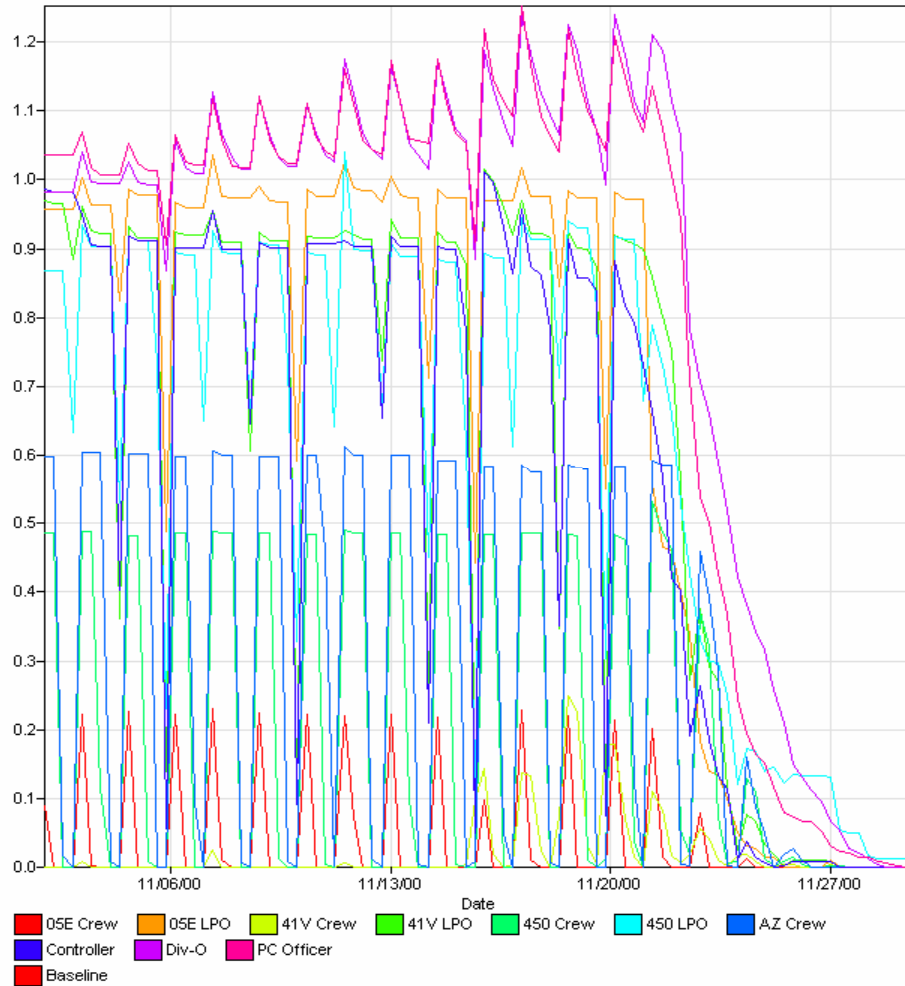


**Significant Decrease in Schedule Duration – 35%**

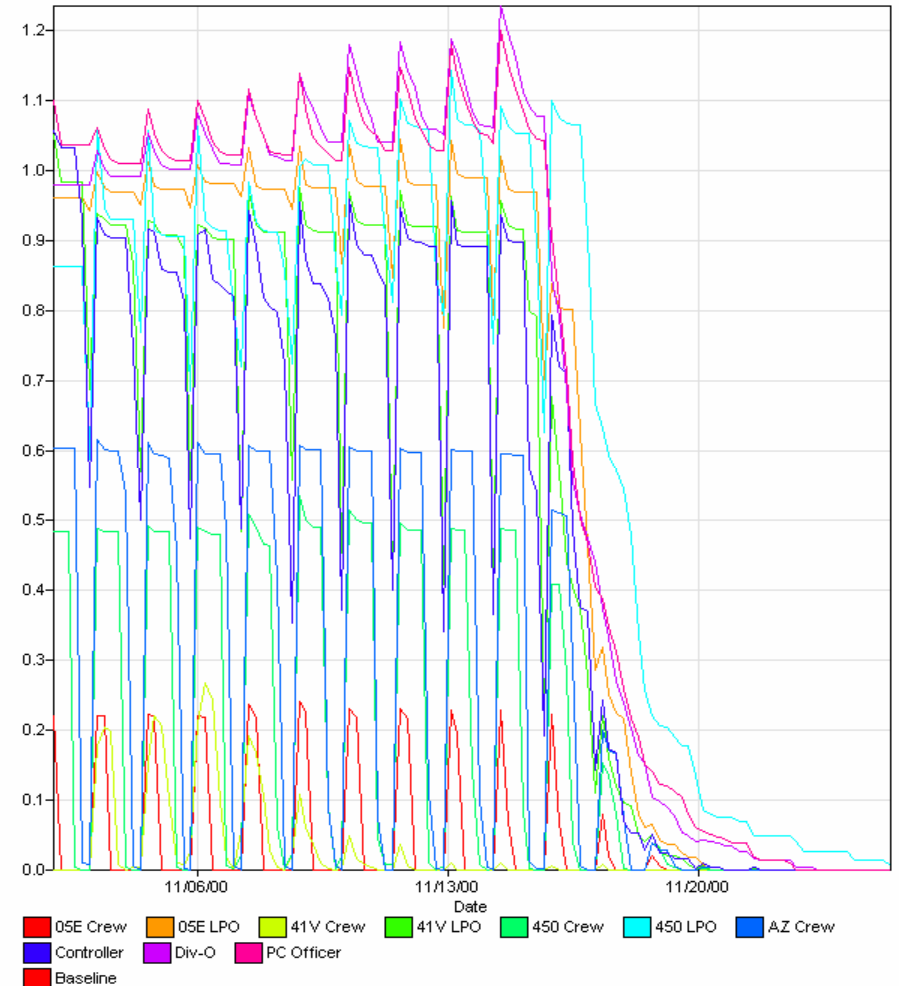


# Impact - Backlog

## Current Process



## Paralleling Acceptance / On-Engine Work



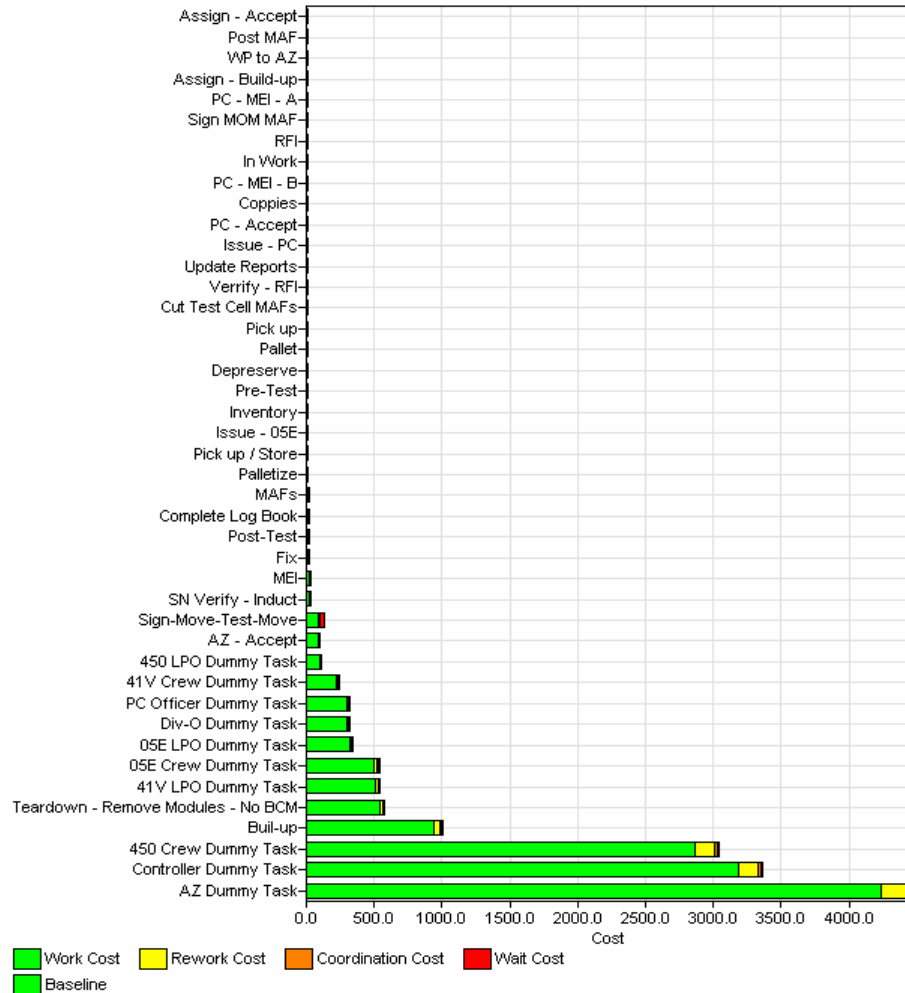
Slight Decrease in Backlog



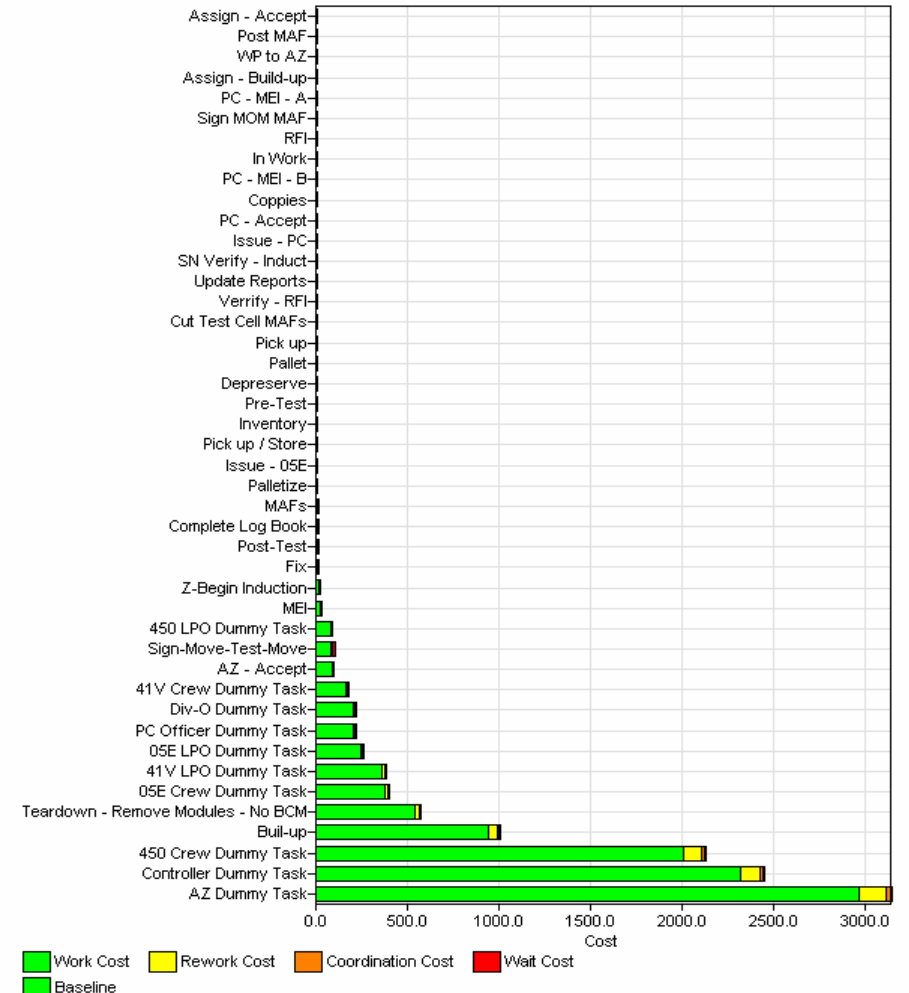


# Impact - Cost

## Current Process



## Paralleling Acceptance / On-Engine Work



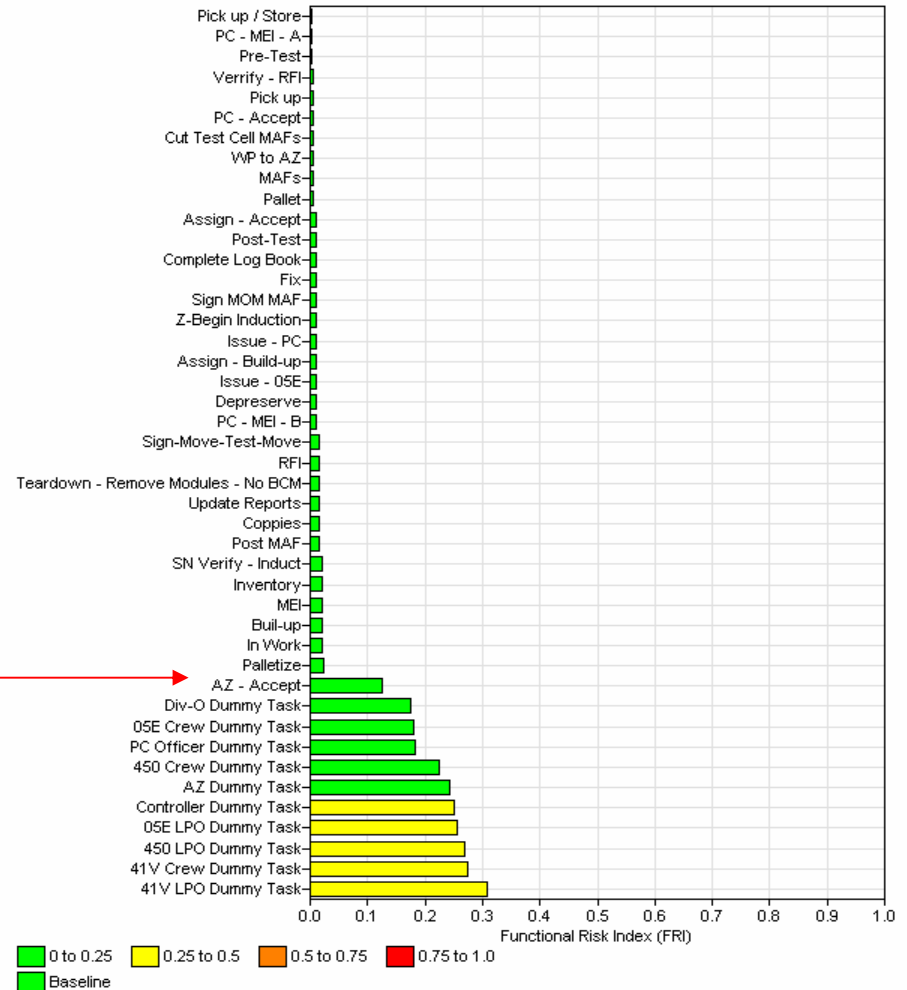
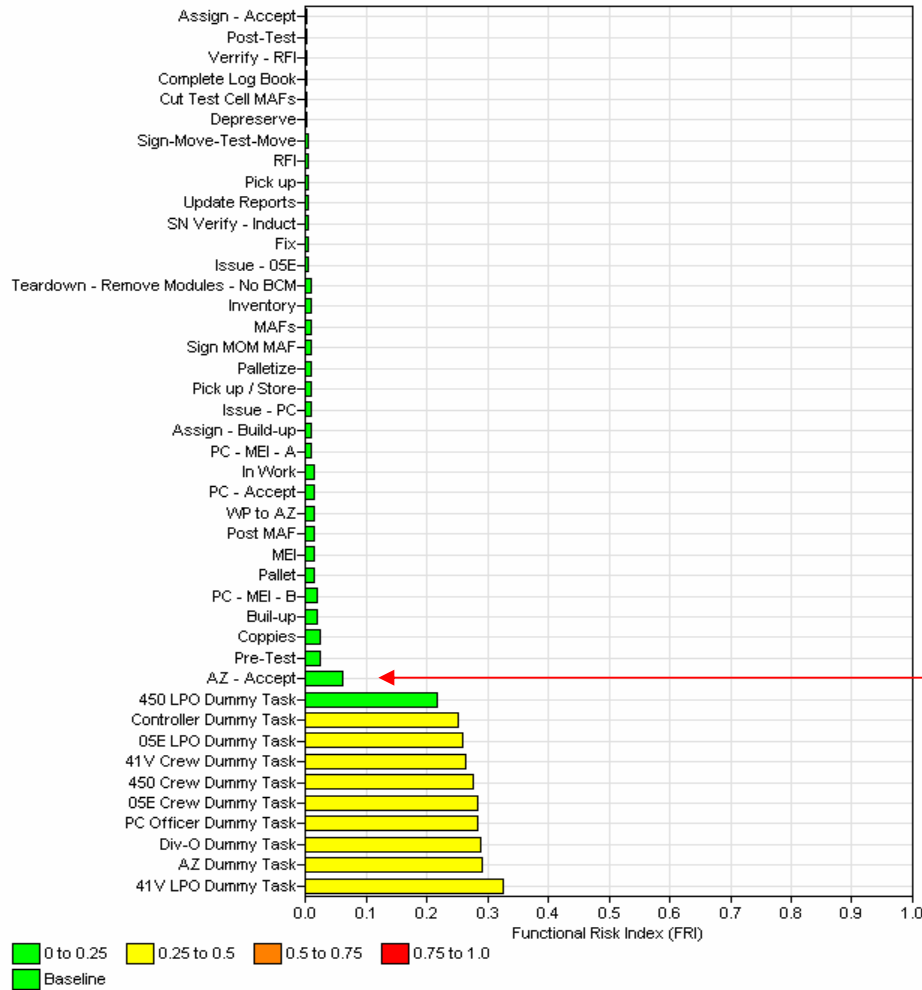
No Significant Impact



# Impact - Task Functional Risk

## Current Process

## Paralleling Acceptance / On-Engine Work



Slight Increase in AZ Acceptance Risk



# Summary - Single Intervention

Intervention	Affect On...			
	Project Duration	Backlog	Cost	Risk
Parallel engine acceptance <span style="background-color: #e0e0e0; padding: 2px;">?</span>	58.56 hour decrease	Decrease for most positions	No significant impact	Increase in AZ Acceptance task Risk
Combine Controller & AZ positions Without Training				
Combine Controller & AZ positions With Training				
Combine 41V & 450 positions Without Training				
Combine 41V & 450 positions With Training				
Decreased Centralization				



# Summary - Single Intervention

Intervention	Affect On...			
	Project Duration	Backlog	Cost	Risk
Parallel engine acceptance ?	58.56 hour decrease	Decrease for most positions	No significant impact	Increase in AZ Acceptance task Risk
Combine Controller & AZ positions Without Training ?	110 hour increase	Decrease in Controller and AZ backlog. Increase in Div-O and PC backlog over time	AZ Acceptance task work and rework cost increase by 205.6 & 11.72 respectively	Increase in AZ Acceptance Task Risk
Combine Controller & AZ positions With Training ?	56.7 hour increase	Decrease in Controller and AZ backlog. Increase in Div-O and PC backlog over time	AZ Acceptance task work and rework cost increase by 140.1 & 4.18 respectively	Increase in AZ Acceptance Task Risk
Combine 41V & 450 positions Without Training ?	132.6 hour increase	Slight decrease in 41V and 450 backlogs	Increase in Buildup and rework costs – 267.16 & 7.2 Increase in Test work, rework, & wait costs – 1082.21, 61.52, & 230.24	3/4 top risk areas assigned to combined 41V-450 positions vs. 2/4 currently
Combine 41V & 450 positions With Training ?	67.6 hour increase	Slight decrease in 41V and 450 backlogs	Increase Buildup cost 267.15 & decrease rework costs – 3.29 Increase in Test work, rework, & wait costs – 303.4, 5.63, & 93.41	3/4 top risk areas assigned to combined 41V-450 positions vs. 2/4 currently
Decreased Centralization ?	4.4 hour decrease	No significant impact	Slight increase in Buildup task rework cost of 9.86	No significant impact



# Summary - Single Intervention

Intervention	Affect On Predicted Project Duration	Affect On Functional Risk
Add AZ Personnel ?	1.87 min saved / individual	No significant impact
Add Controller Personnel ?	6.82 min lost / individual	No significant impact
Add 41V Crew Personnel ?	0.91 min lost / individual	No significant impact
Add 05E Crew Personnel ?	10.51 min saved / individual	No significant impact
Add 450 Crew Personnel ?	4.42 min saved / individual	No significant impact
Vary 0700 meeting duration & frequency ?	Greatest benefit from Less Frequent meetings = 6.56 hrs	No correlation between risk and meeting interval or duration
Vary 0630 Meeting frequency ?	Greatest benefit from increasing time between meetings to greater than 2 days. Max benefit = 1.6 hours	Slight increase in risk when increasing time between meetings
Combine Morning Meetings leaving End of Day meetings Separate ?	No significant impact	No significant impact to Functional Risk when combining meetings
Separately Combine Morning meetings and End of Day Meetings ?	Greatest benefit from increasing time between meetings to greater than 1 day Max benefit = 7.28 hrs	No significant impact to Functional Risk when combining meetings



# Combined Interventions

- Parallel engine Acceptance process
- Decreased centralization
- Combine morning meetings
  - Time between meetings set to 2 days
- Combine end of day meetings
  - Time between meetings set to 2 days

Intervention	Affect On...			
	Project Duration	Backlog	Cost	Risk
<b>Combined Interventions</b> <span style="background-color: #ADD8E6; padding: 2px;">?</span>	58.96 hour or 35% decrease – Driven by acceptance paralleling effort	Backlog of most positions decrease. 450 LPO backlog increases	26.3 decrease in Buildup rework and 10.49 increase in teardown rework	No significant impact



# Modeling Conclusions

Modeling indicated that...

- Assuming current avg. induction delays, & no parts delays, the following interventions effectively reduce F414 cycle time:
  1. Parallel engine acceptance
  2. Separately combining morning and end of day meetings
  3. Decreasing meeting frequency
  4. Decreased centralization
- Combined interventions can reduce cycle time up to 59 hrs (7.4 days)



# Recommendations for 400 Div.

- Walk first...
  - Separately combining morning & end of day meetings
  - Decrease meeting frequency
  - Assess impact
- Then run...
  - Parallel Acceptance process
  - Assess impact
- Once Induction process delays resolved
  - Combine AZ & Controller positions w/ training
  - Assess impact
- Keep NPS informed on results

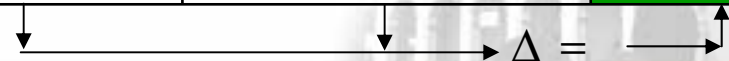




# Study Impact

- 400 Div chose to implement highest-payoff intervention – Paralleling AZ Acceptance

Engine S/N	Received	SAME Problems	SAME Problems Resolved	Engine Maintenance Start	Days Saved
868472 VFA-106	20 Oct 06	20 Oct 06	7 Nov 06	23 Oct 06	16
868083 VFA-2	25 Oct 06	26 Oct 06	13 Nov 06	29 Oct 06	16
868265 USS Lincoln	5 Sep 06	5 Sep 06	16 Oct 06	6 Sep 06	46



# Study Impact

- 400 Div chose to combine morning meetings
  - 0630 PC-LPO coordination meeting and 0700 meeting
  - Modification to a study recommendation
- Results were positive
  - Less time spent coordinating
  - More time spent turning wrenches



# Study Conclusion

- Real-world instances of F414 cycle time reduction exceed model predicted reduction by 2X
- Organizational modeling is an effective tool for improving organizational performance – NAS Lemoore AIMD
- Organizational modeling complements conventional process improvement techniques employed under *AirSpeed*



# Further Study

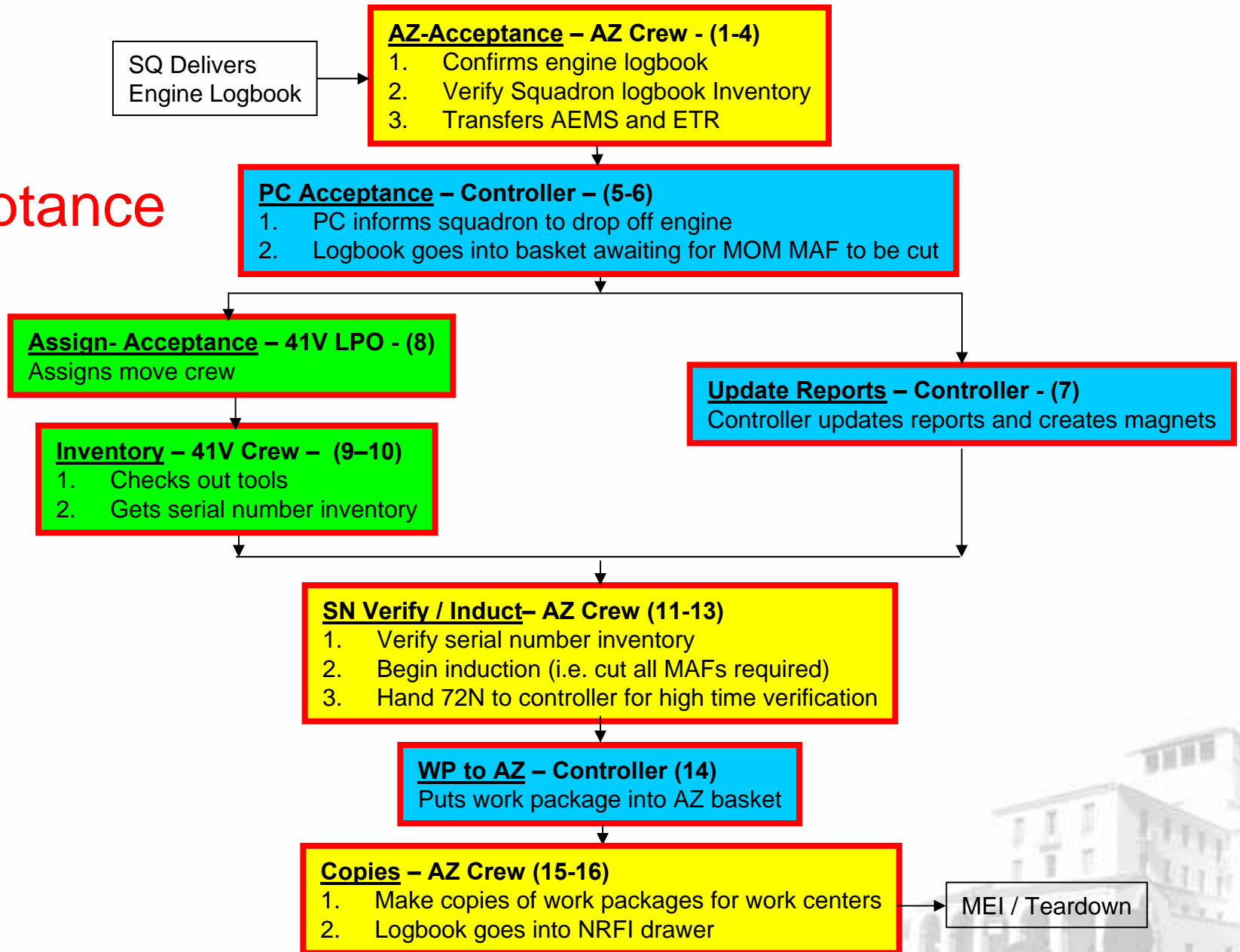
- Continue tracking implementation of study recommendations
- Model other AIMD sites
  - Before and after *AirSpeed* implementation
  - Individual site interventions
  - Other AIMD processes, e.g., Airframe, Avionics
- Model integrated AIMD processes using newly developed Stanford SW
  - SW specific to maintenance processes
  - Facilitates comprehensive evaluation of *AirSpeed*



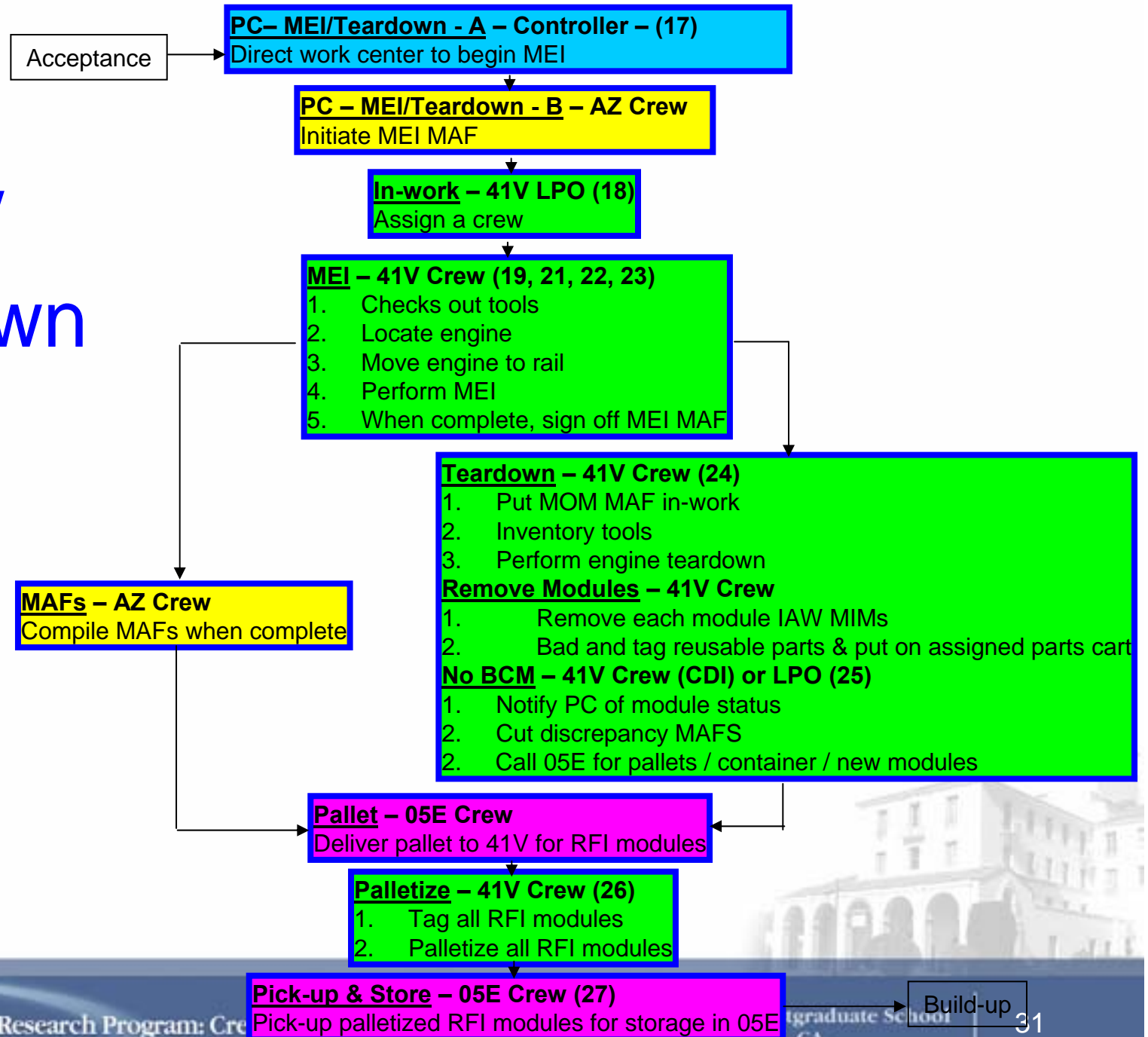
# Back-up Slides



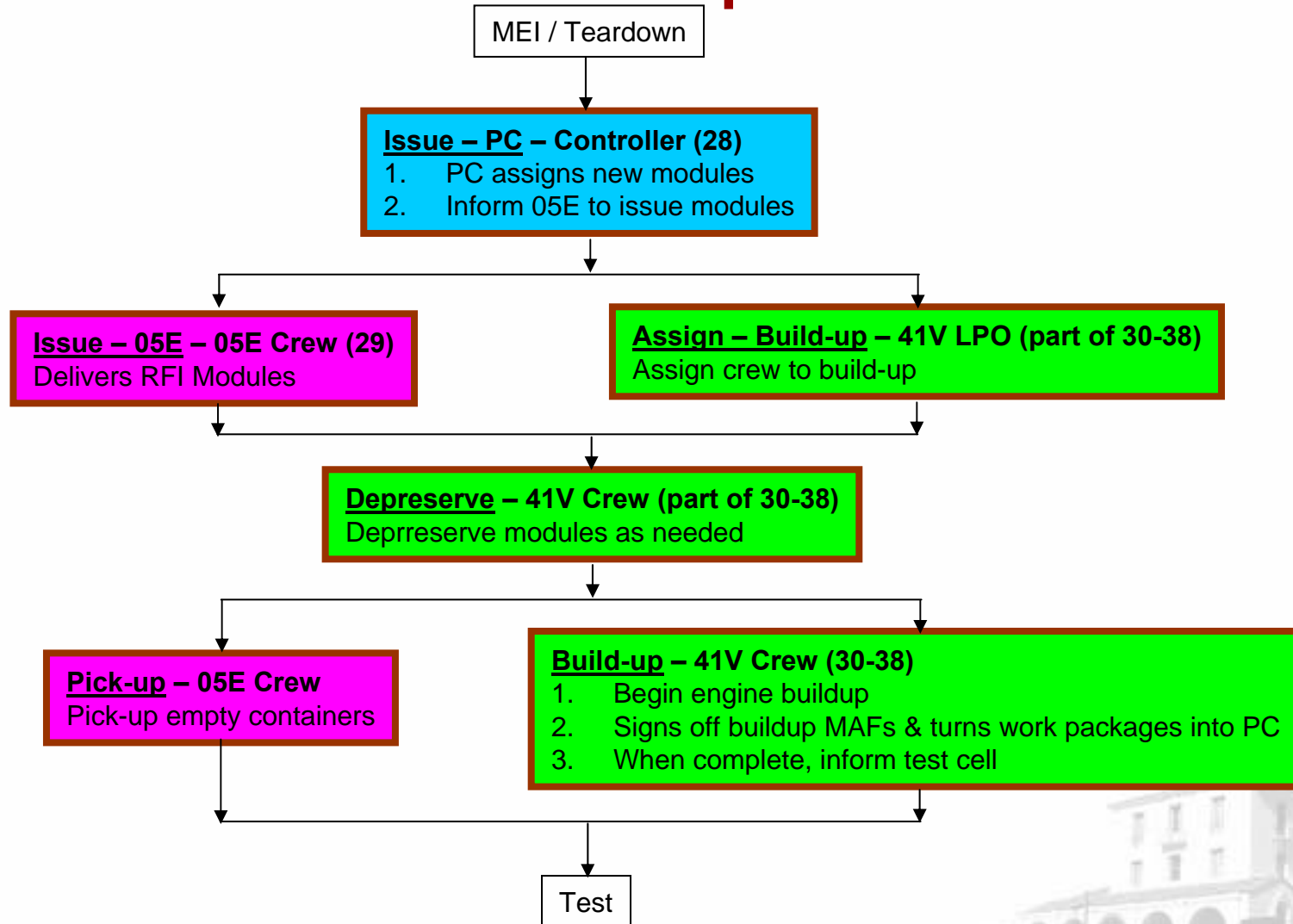
# Acceptance



# MEI / Teardown

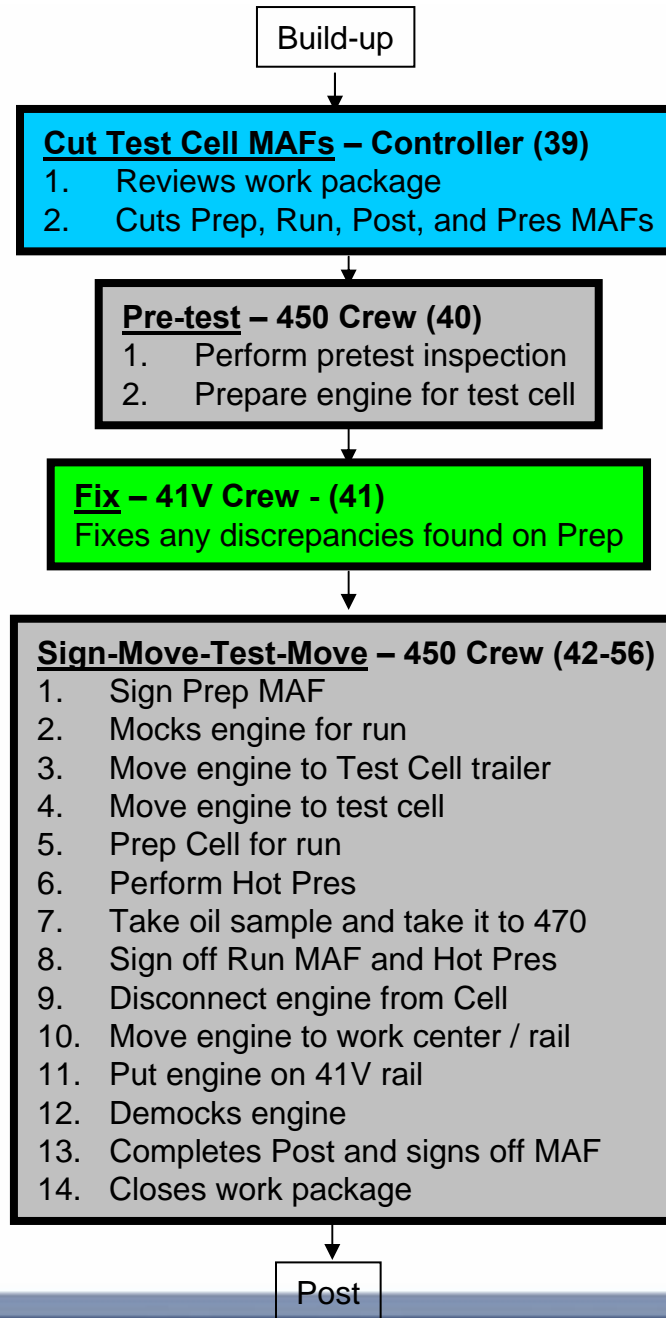


# Build-up





# Test



# Post Test

Test

**Post MAF – Controller - (57)**  
Cuts Post MAF to 41V

**Post-test – 41V Crew - (58-60)**

1. Perform post test cell inspection
2. Write MAFs for all discrepancies
3. Fix all discrepancies
4. Complete work package
5. MAF Signoff

RFI

# RFI

Post

**Verify - RFI – Controller - (61)**  
Reviews work package and signs off 024 MAF

**Sign MOM MAF – 41V LPO – (62)**  
Verify all MAF paperwork complete

**Complete Logbook – AZ Crew – (63)**

1. Complete logbook
2. Sign logbook

**RFI – Controller – (64)**

1. Updates reports and engine is moved to RFI pool
2. RFI Asset

F414 ready for issue

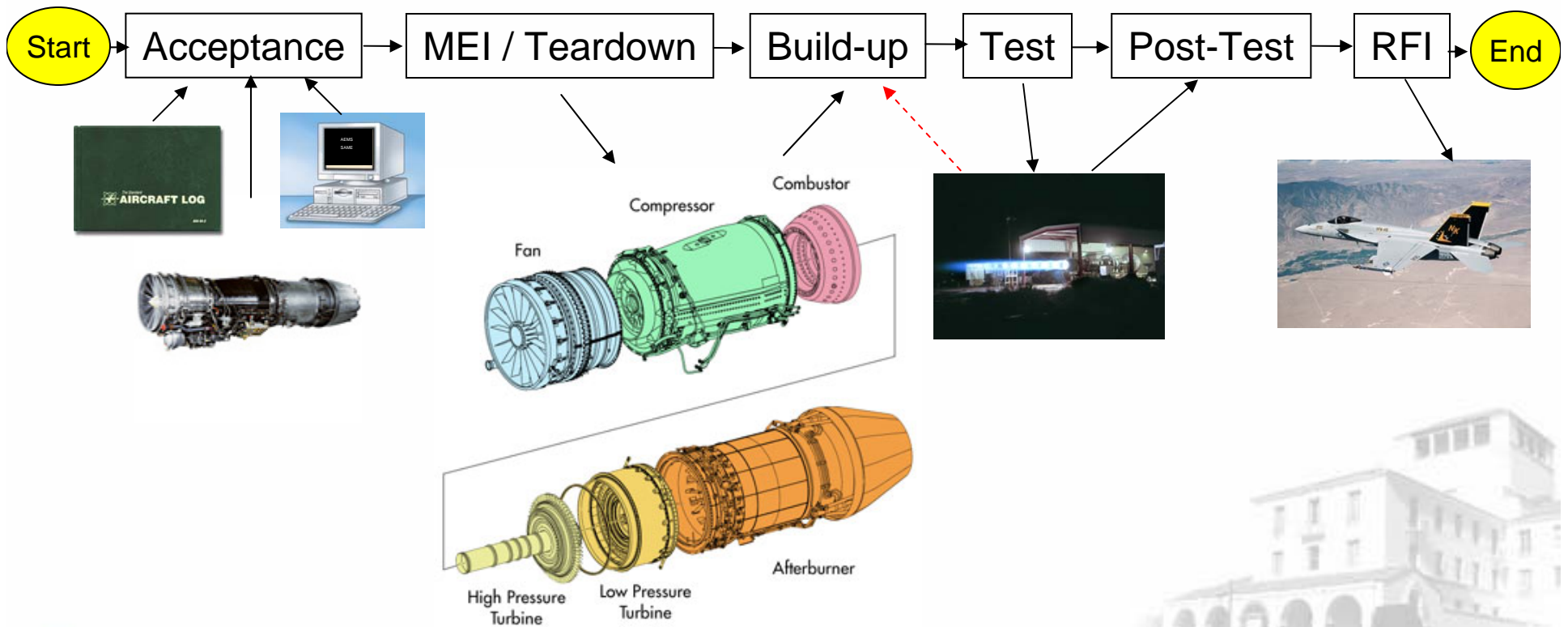


# Organizational Interventions

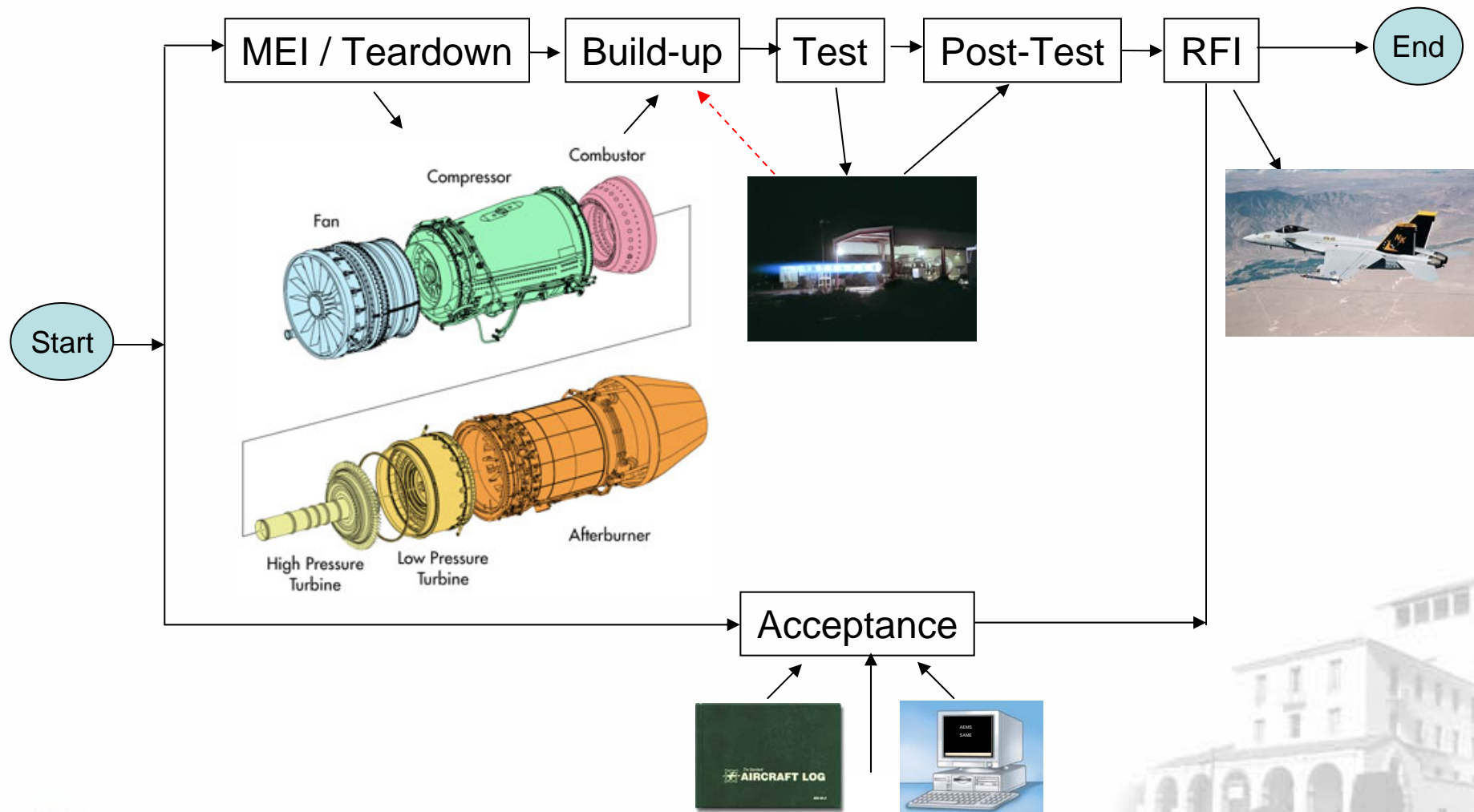
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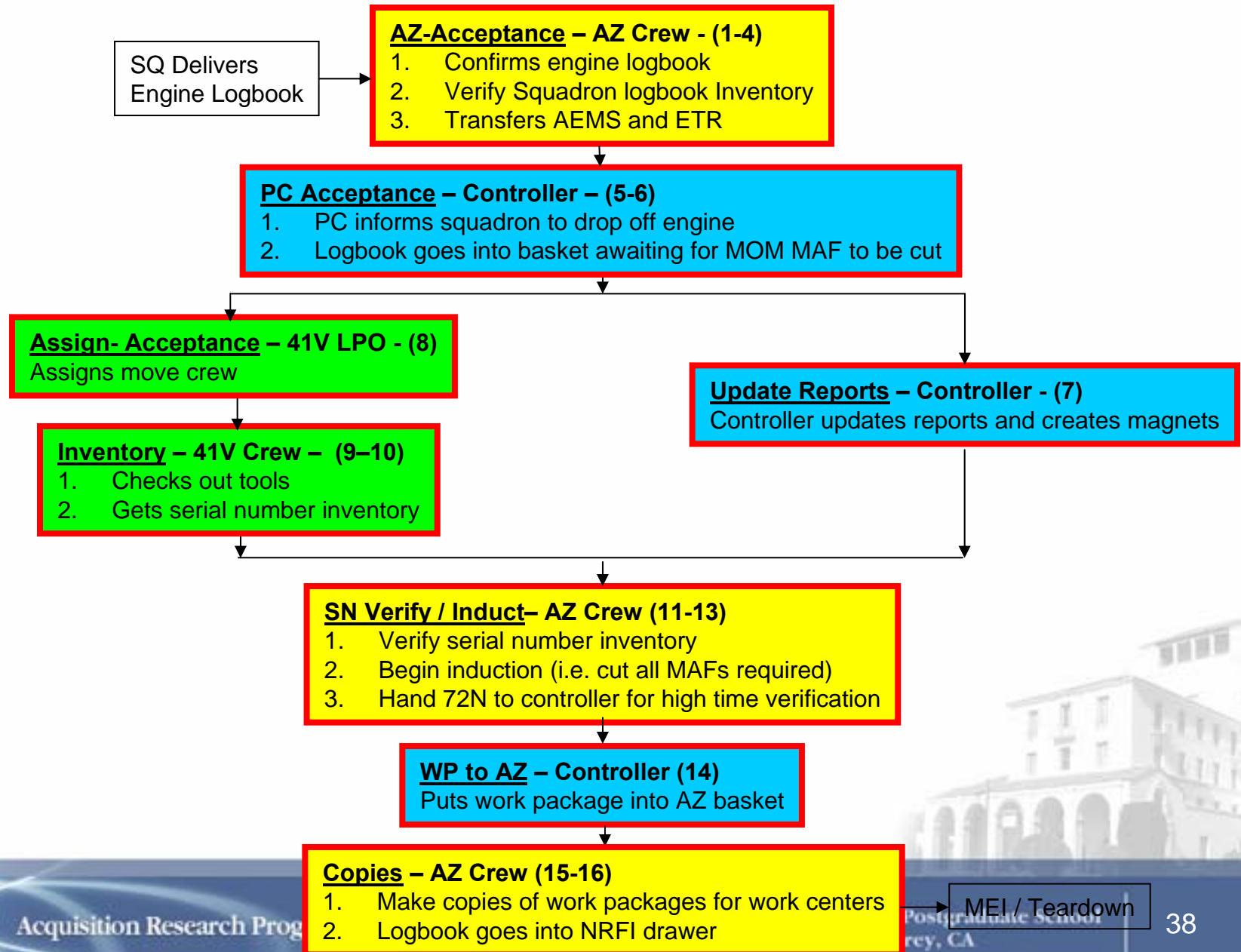
# Current F414 Process



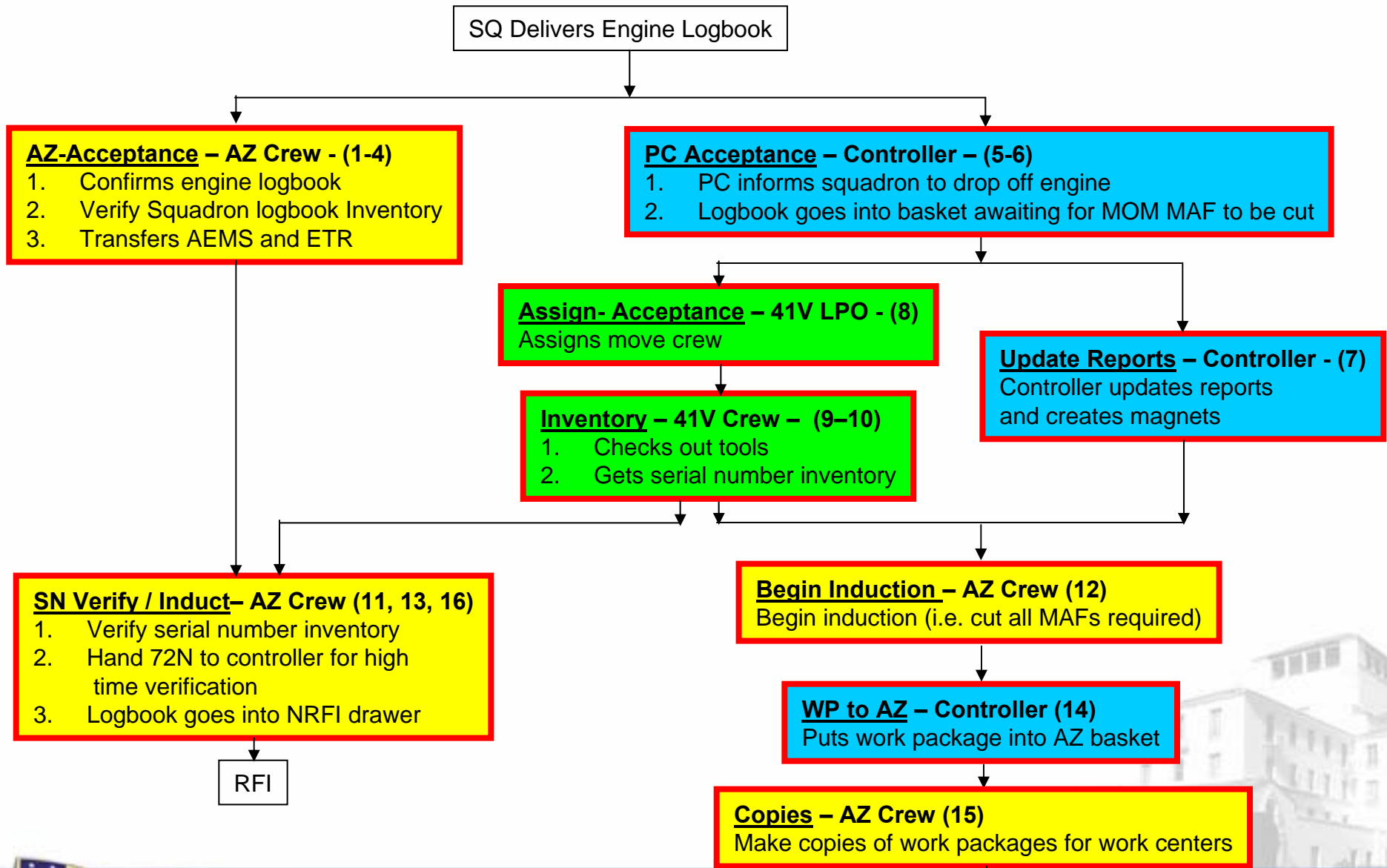
# Intervention #1



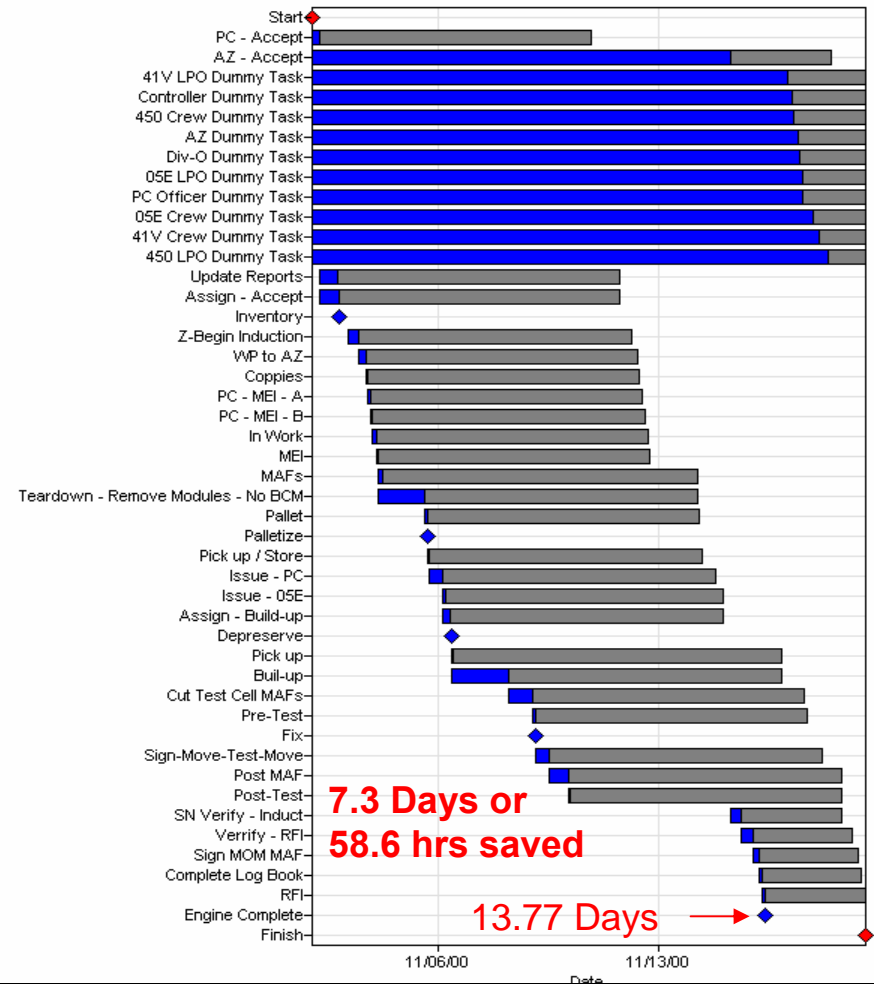
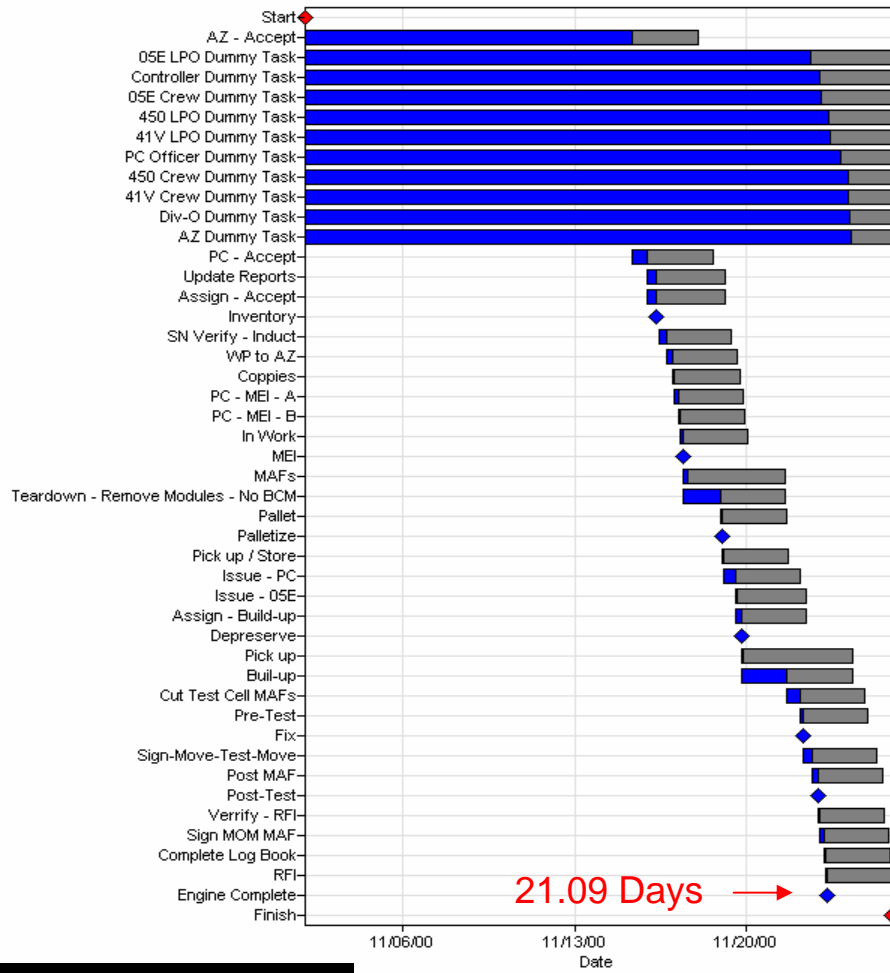
# Current Acceptance Process



# Intervention #1



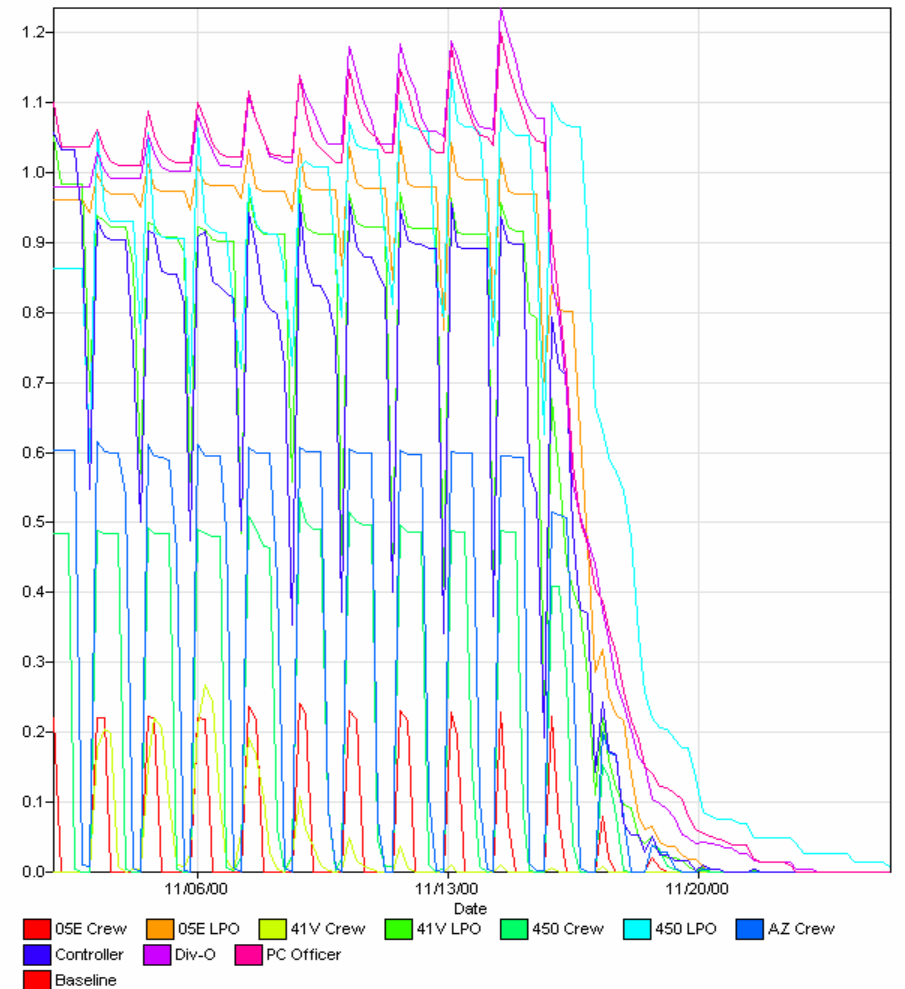
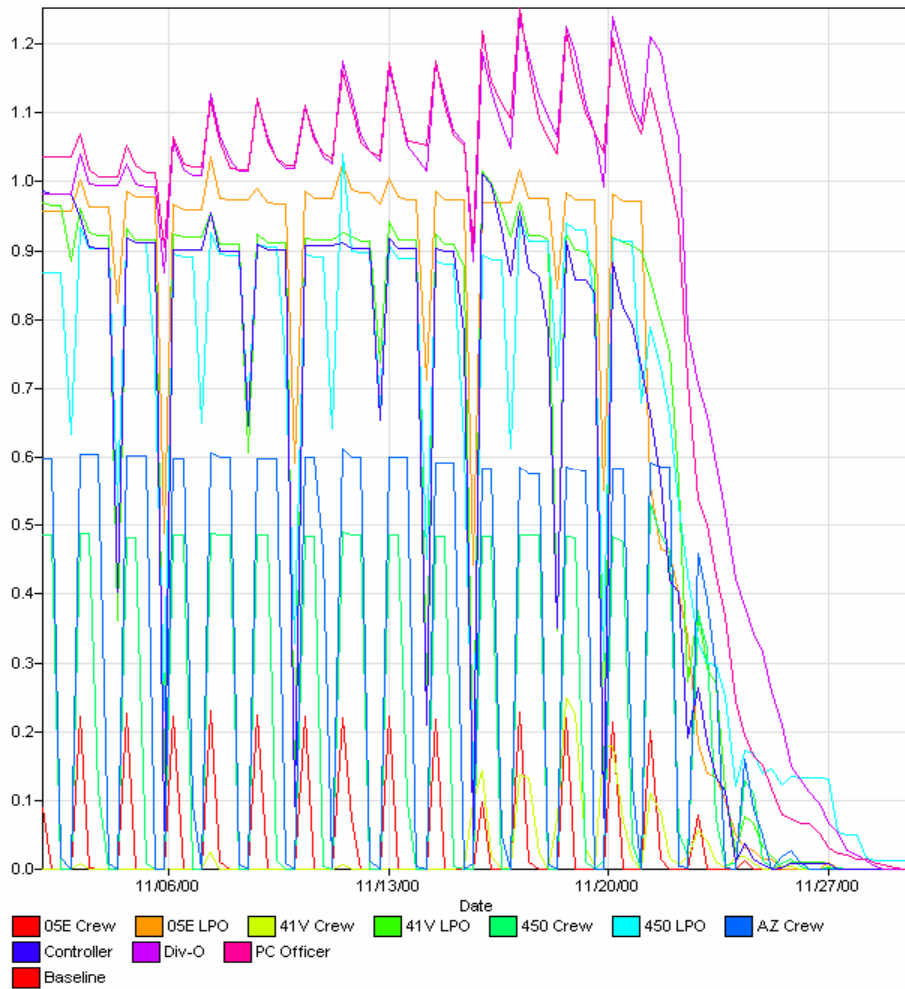
# Impact - Schedule



Significant Decrease in Schedule Duration – 35%

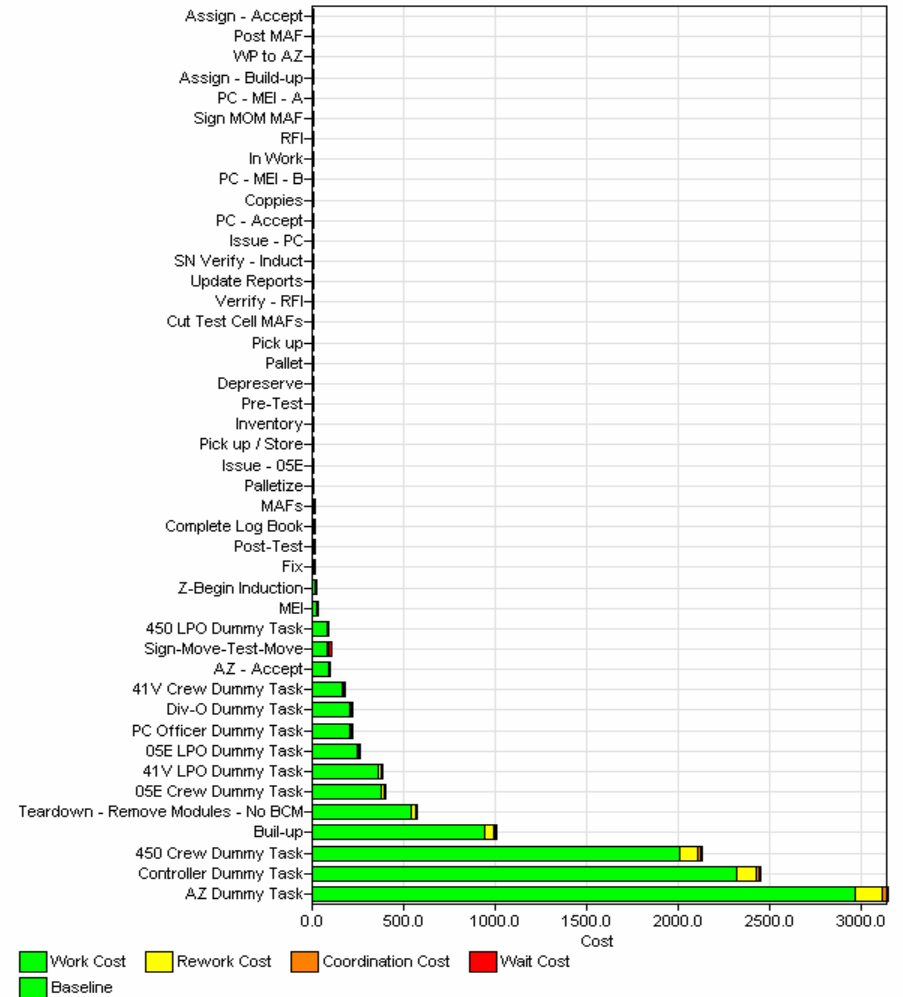
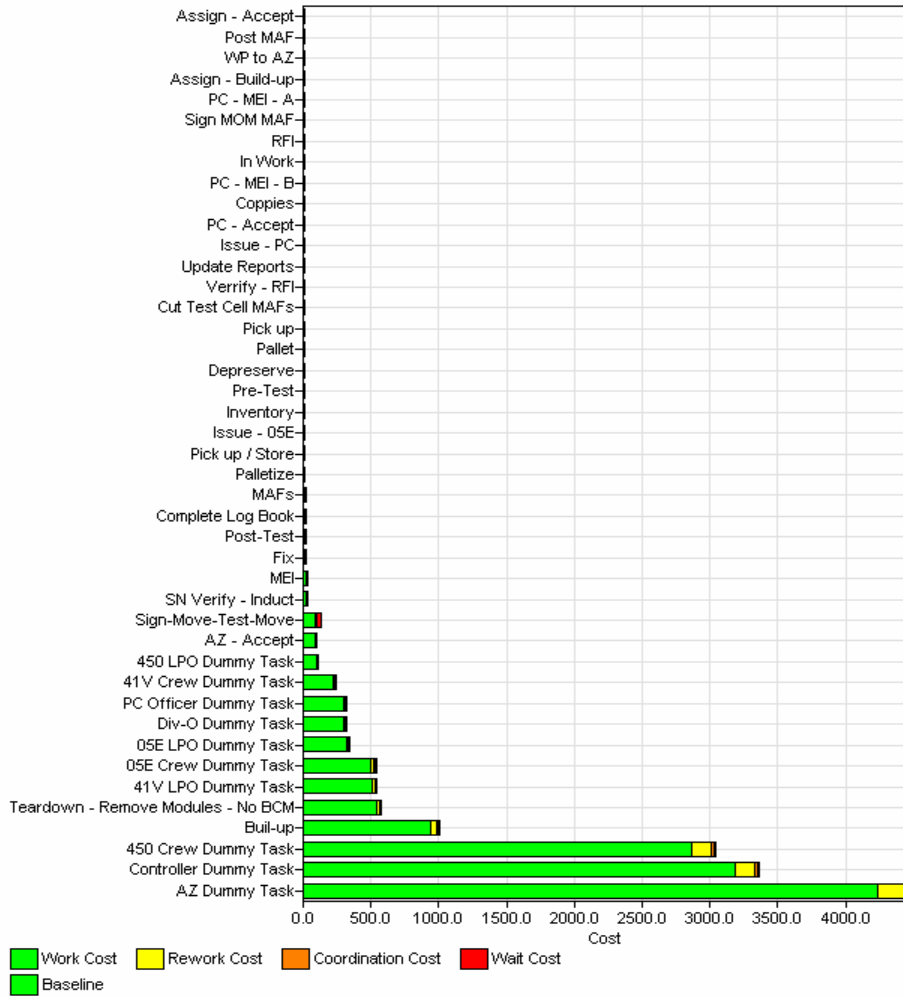


# Impact - Backlog



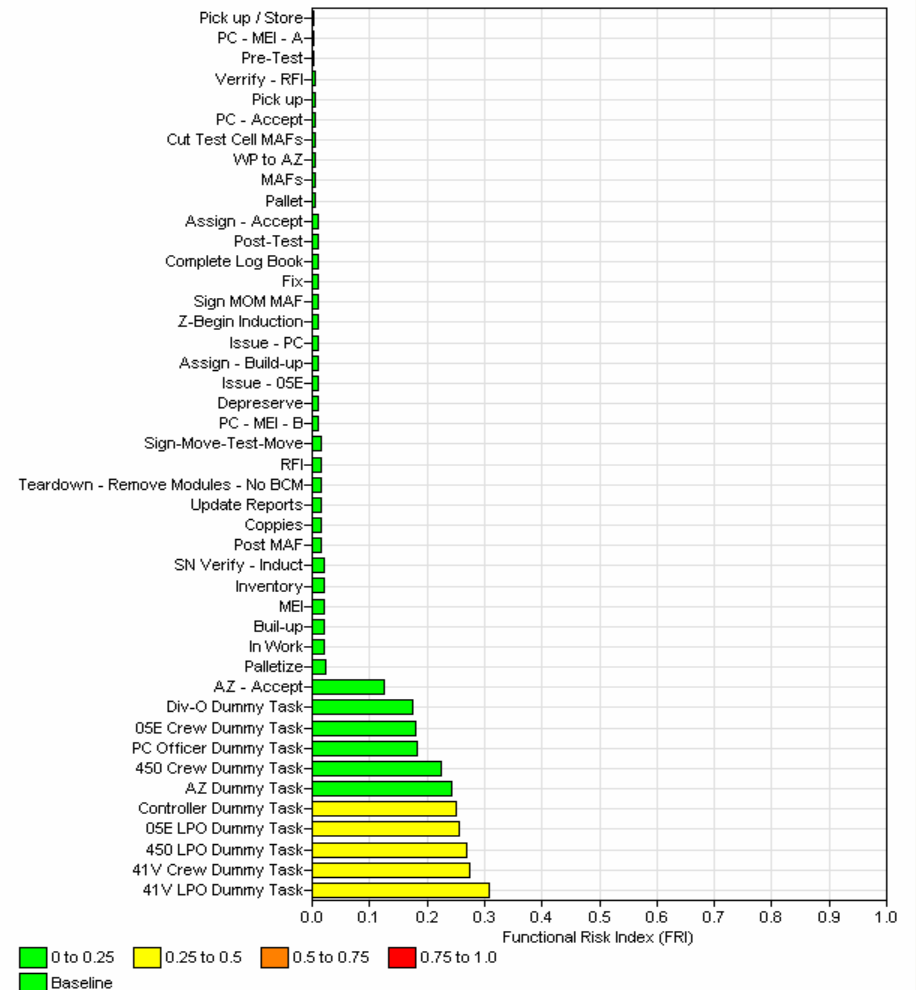
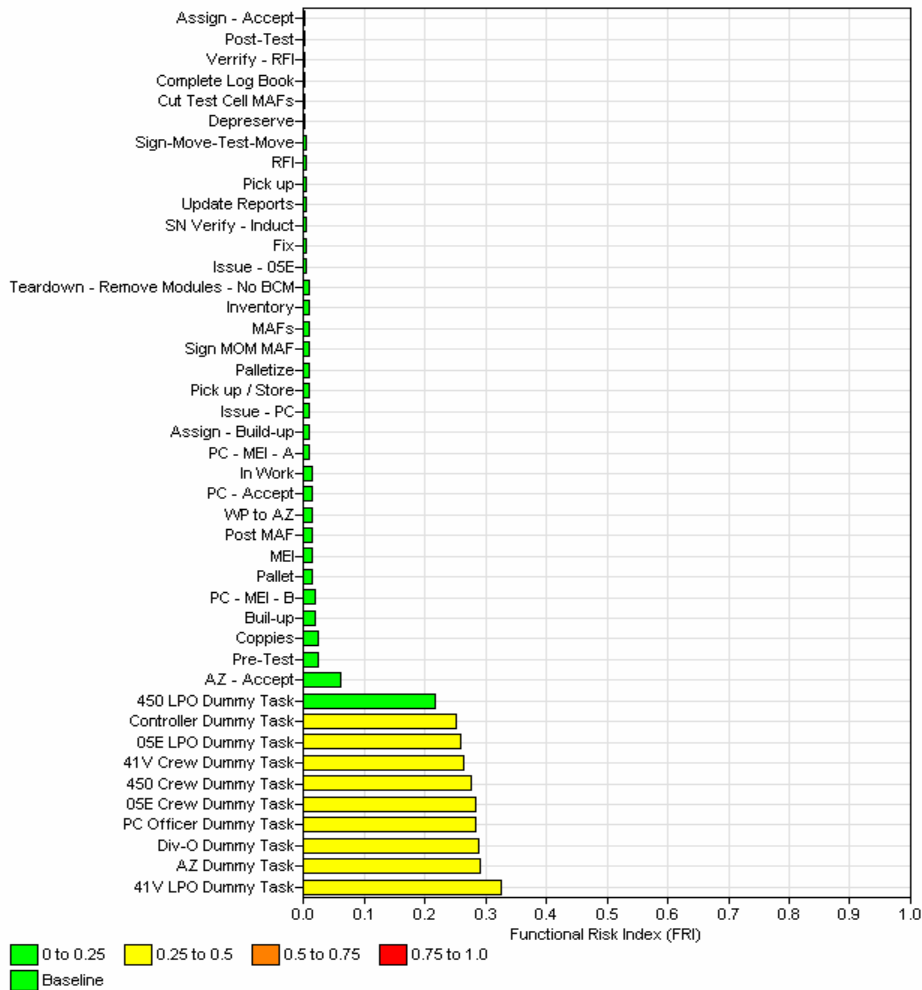
Slight Decrease in Backlog

# Impact - Cost



No Significant Impact

# Impact - Task Functional Risk



Slight Increase in AZ Acceptance Risk

# Organizational Interventions

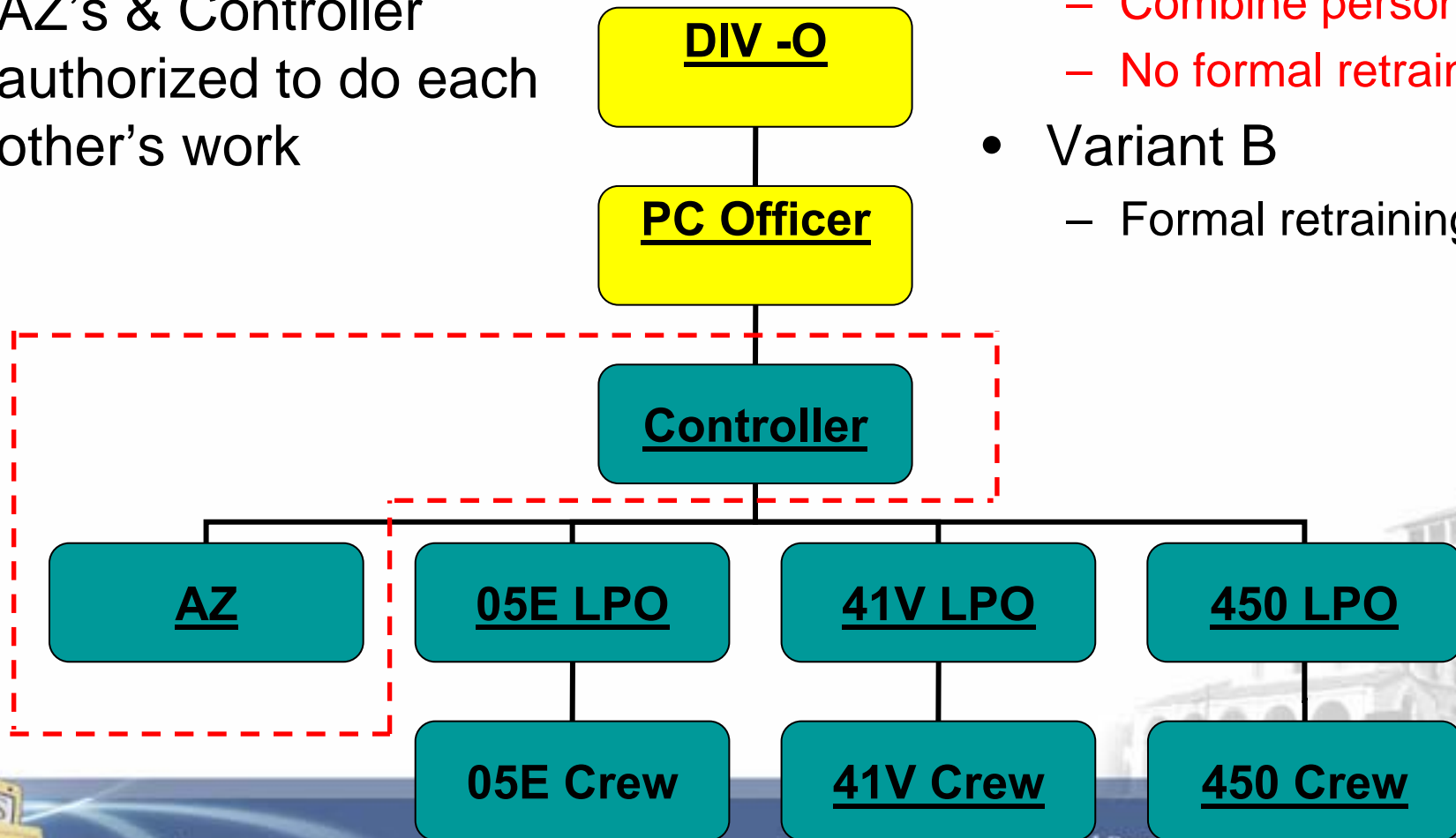
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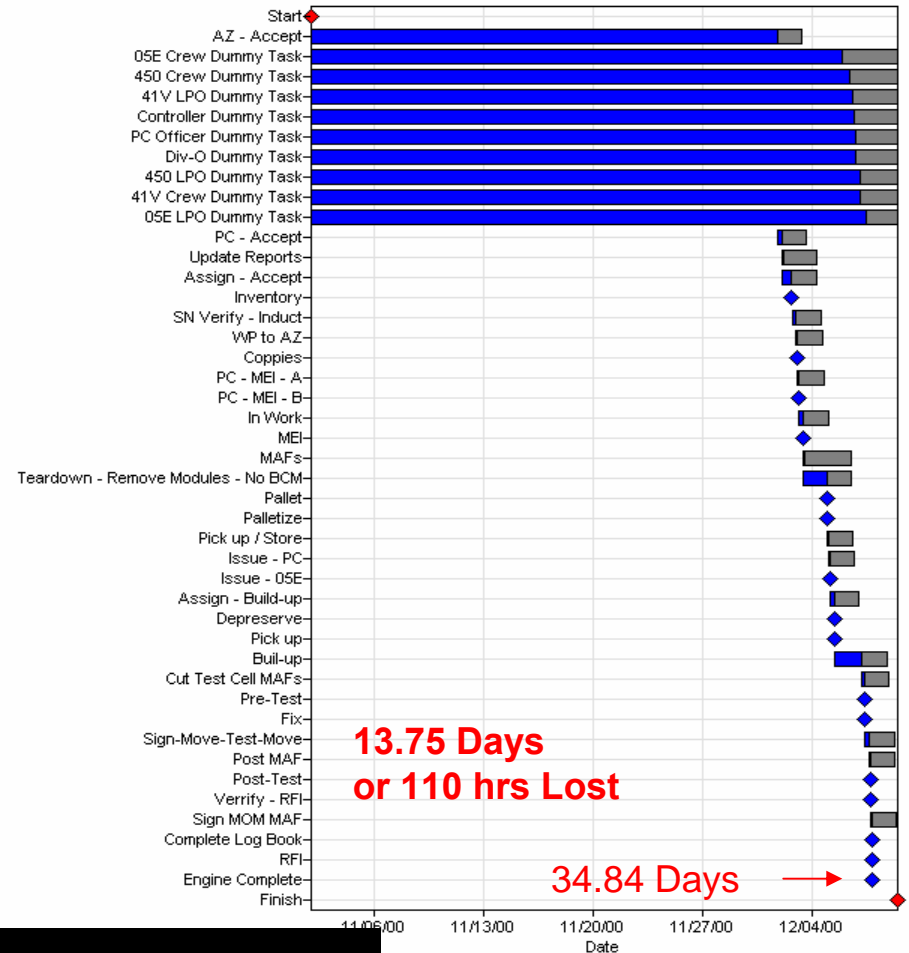
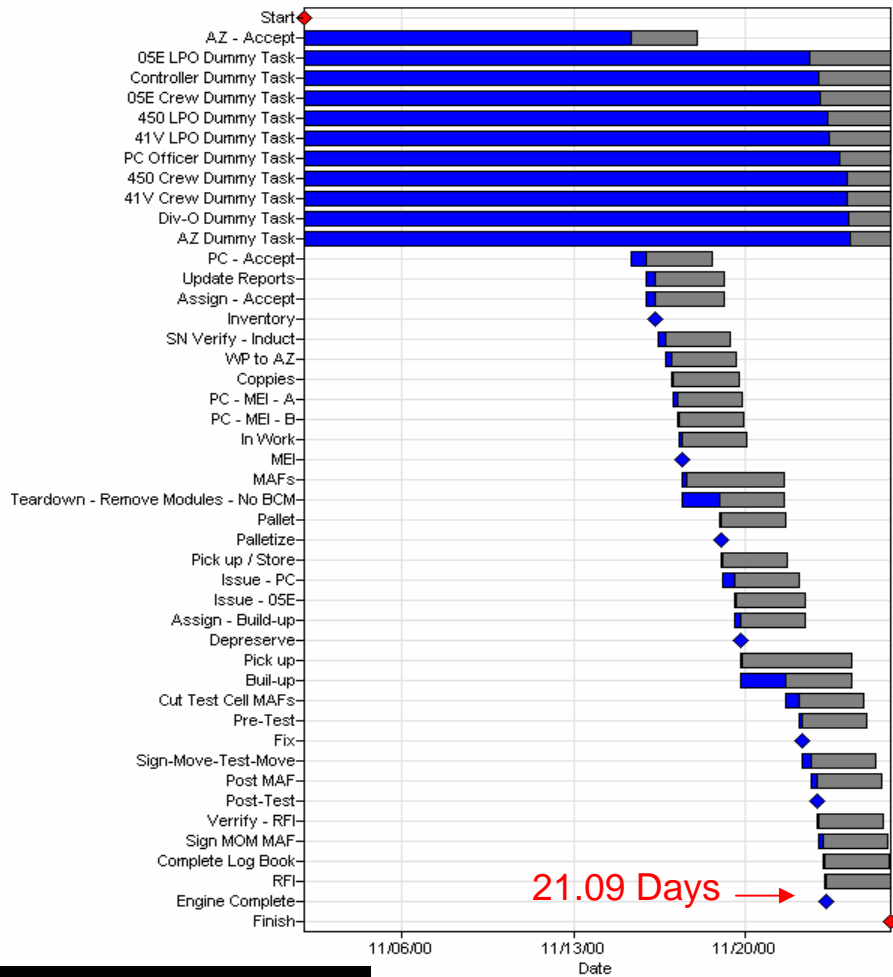
# #2 - Combine Controller and AZ Positions

- Same workload
- AZ's & Controller authorized to do each other's work

- **Variant A**
  - Combine personnel
  - No formal retraining
- **Variant B**
  - Formal retraining

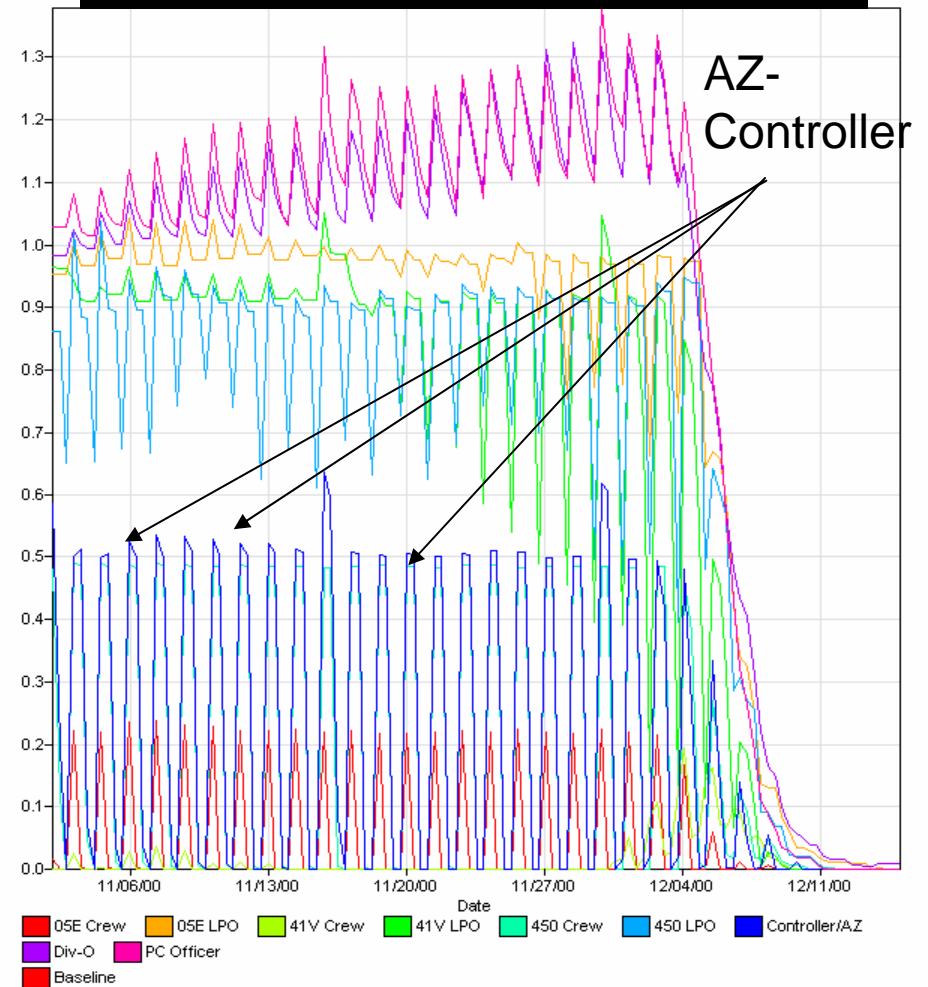
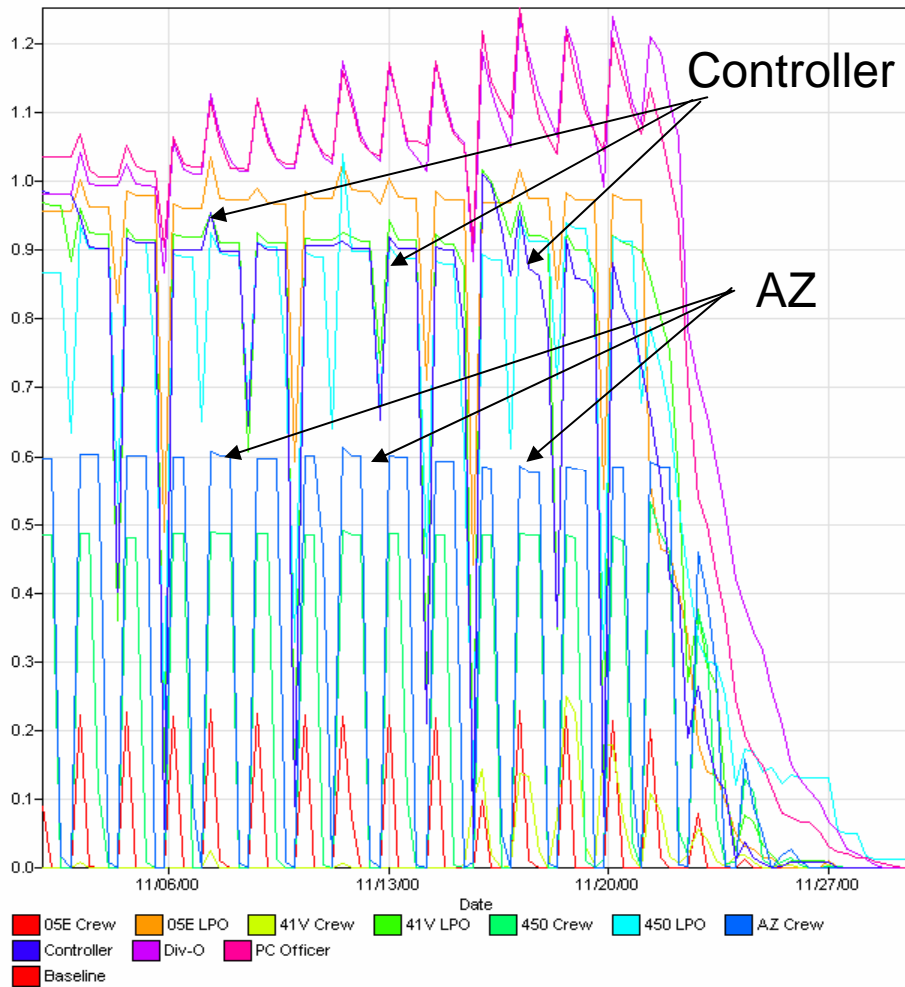


# Impact - Schedule



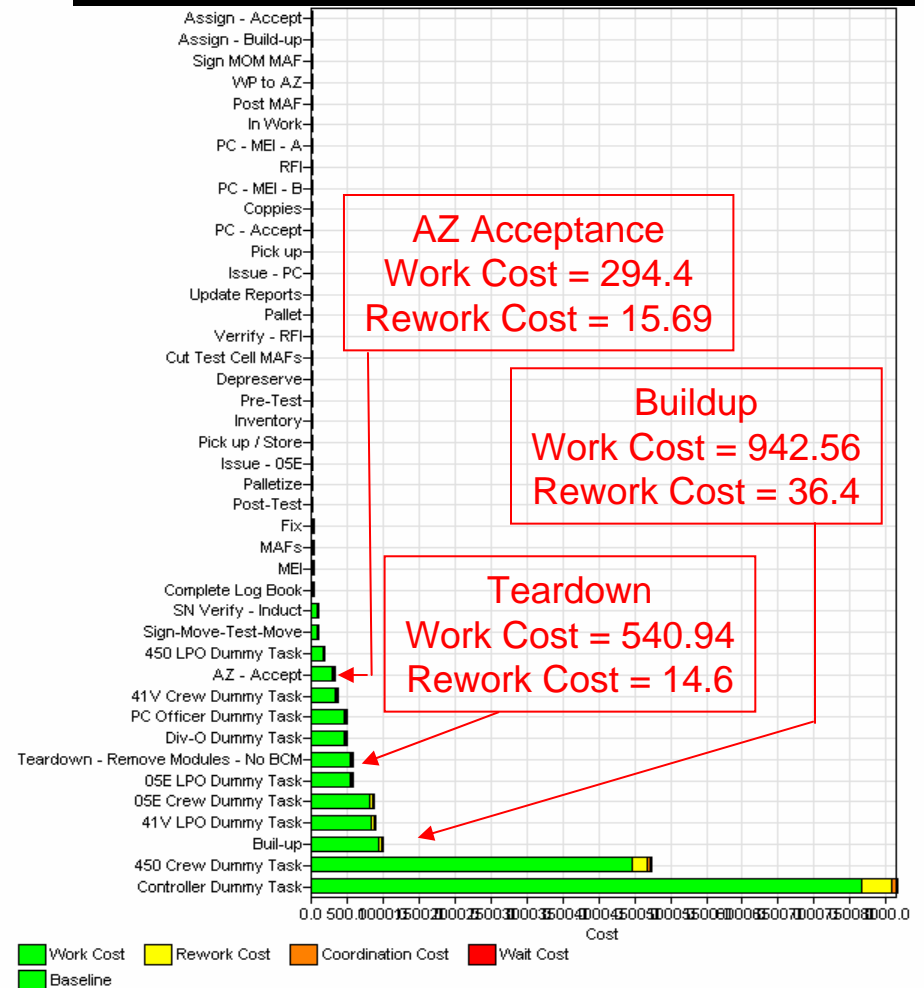
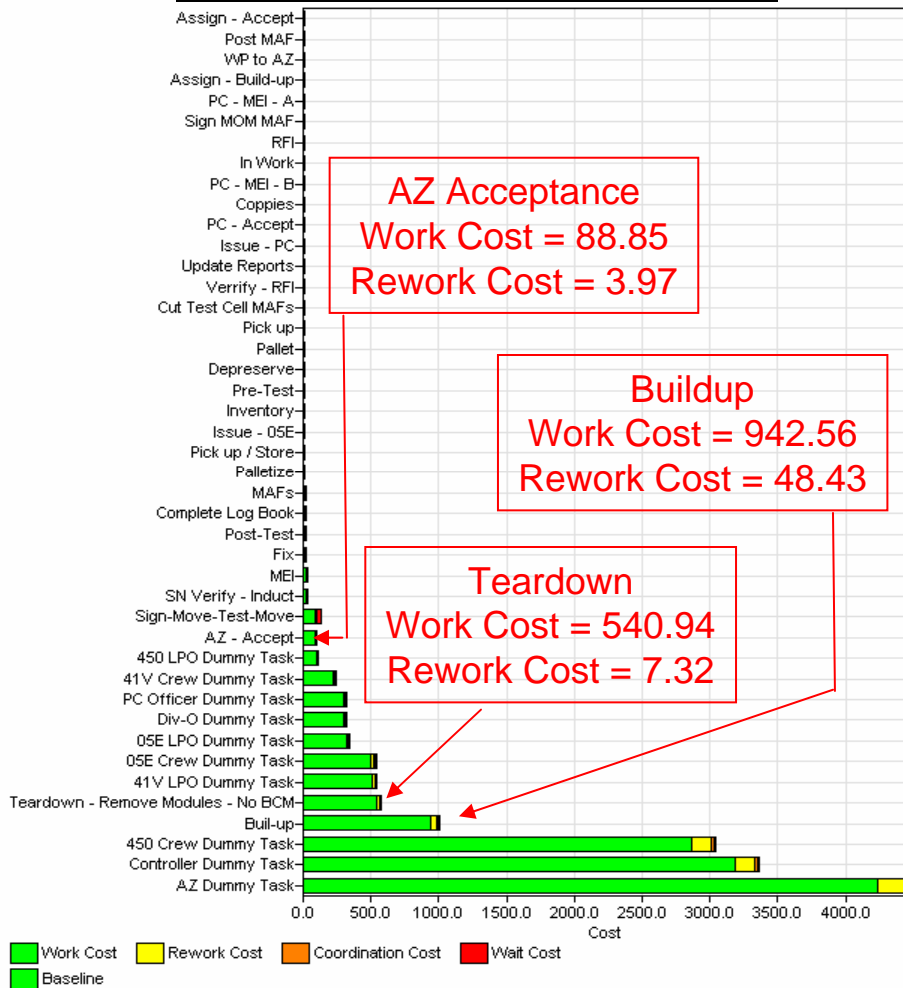
Significant Increase in Schedule Duration

# Impact - Backlog



Decrease in Controller & AZ backlog / Increase in Div-O & PC backlog over time

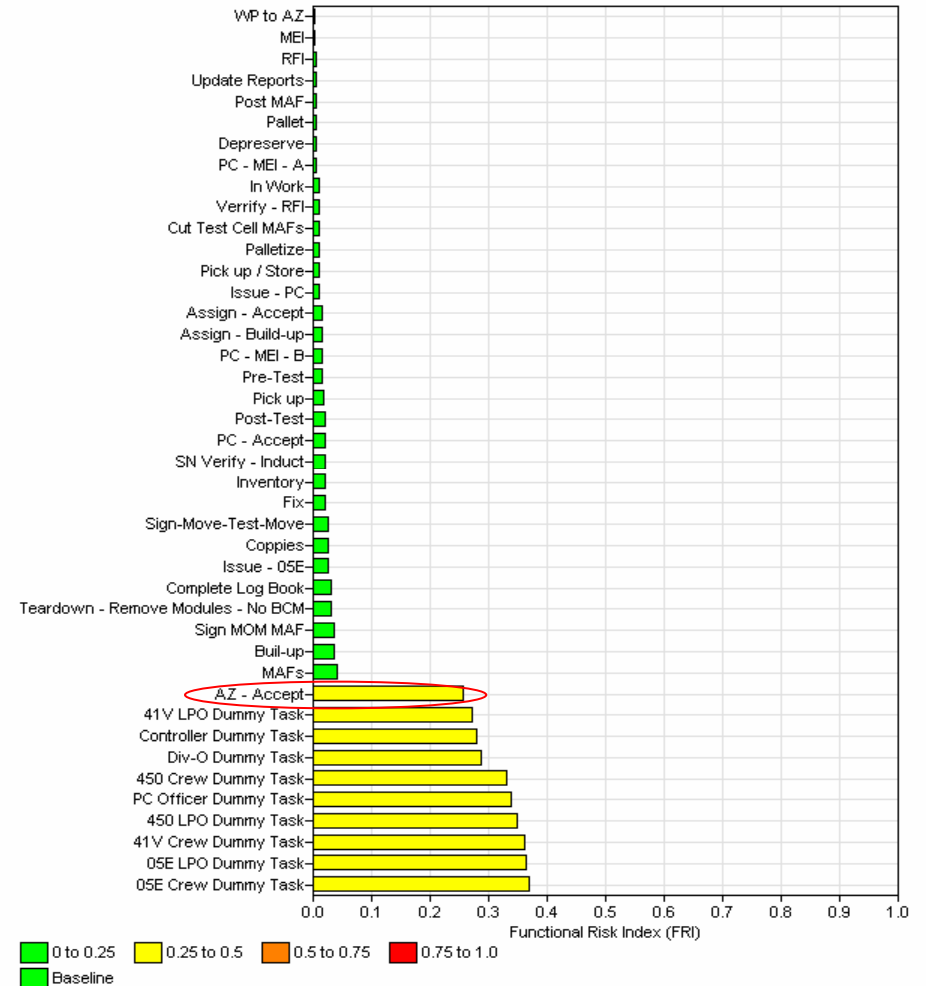
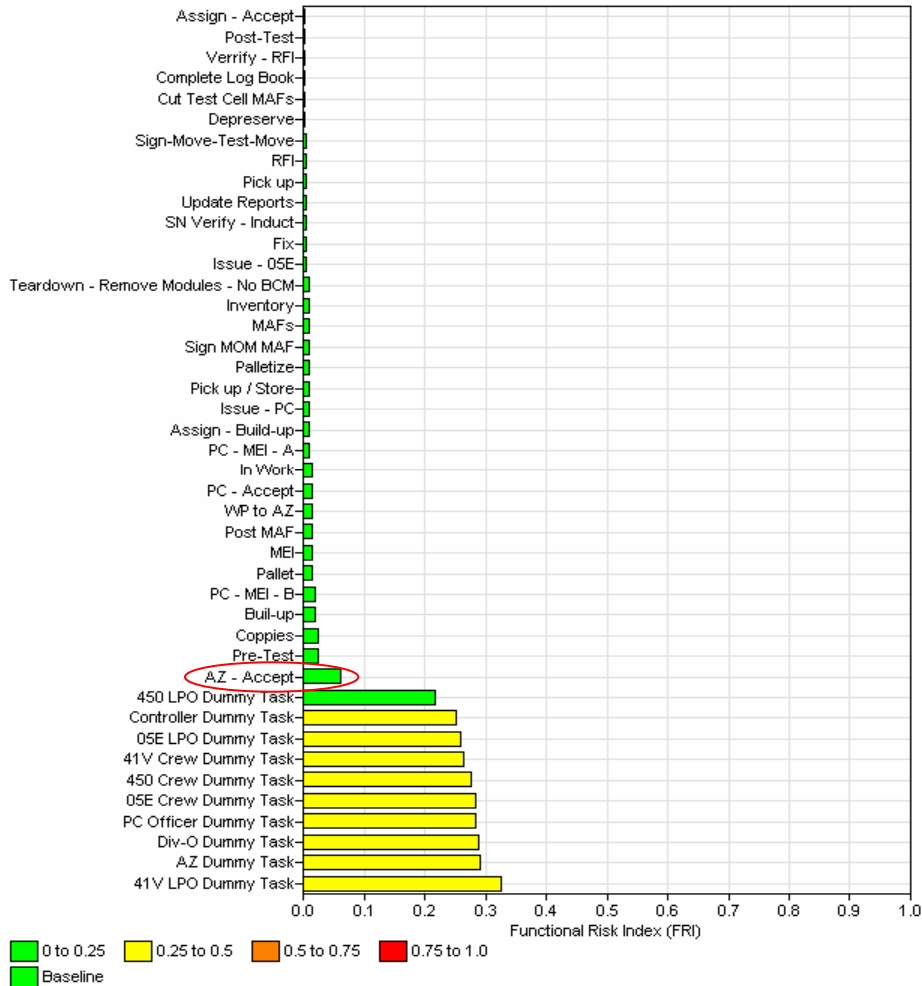
# Impact - Cost



AZ Acceptance cost increase. Build-up Rework decrease, Tear-down Rework increase



# Impact - Task Functional Risk



Significant increase in AZ Acceptance task risk

# Organizational Interventions

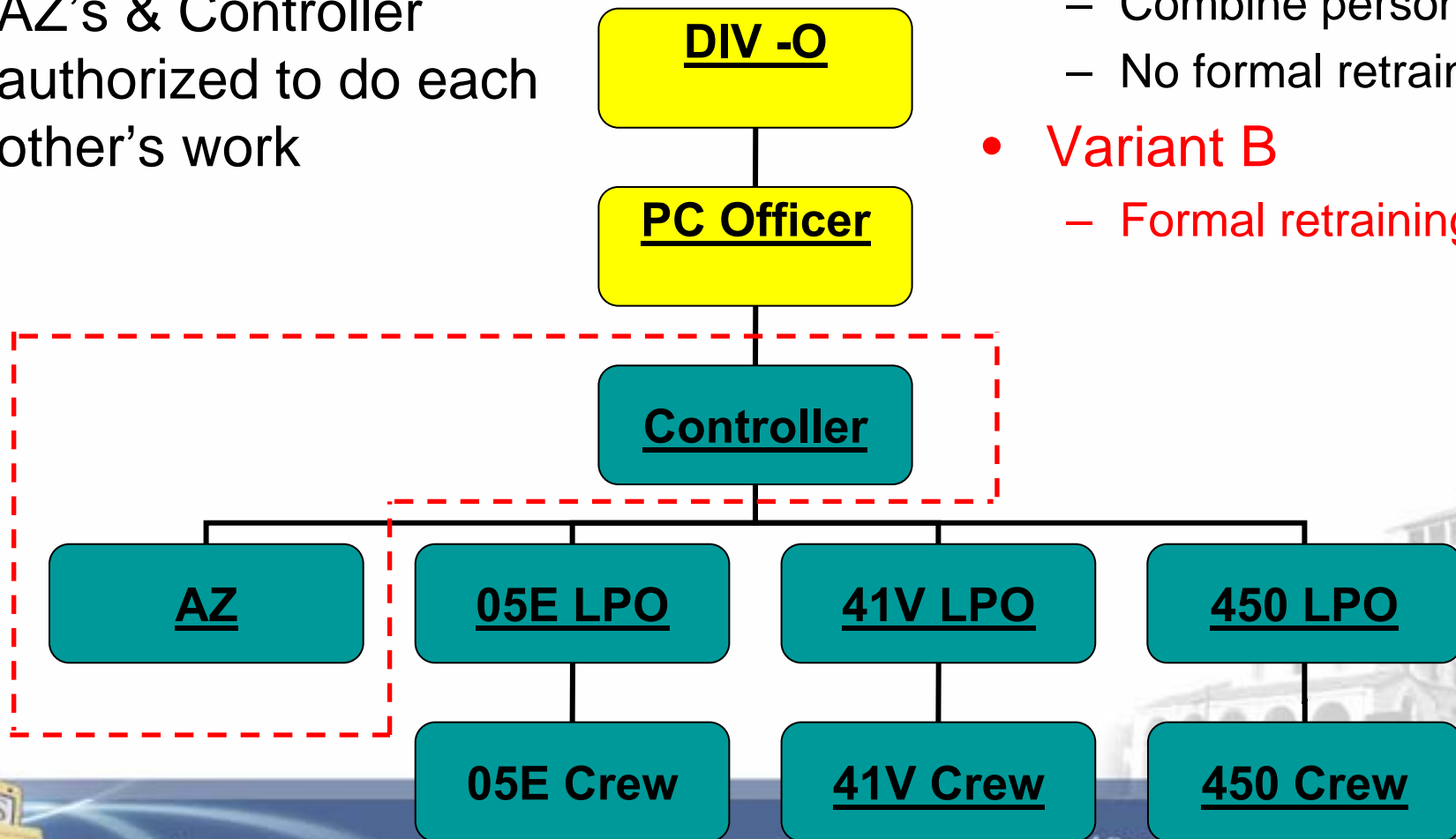
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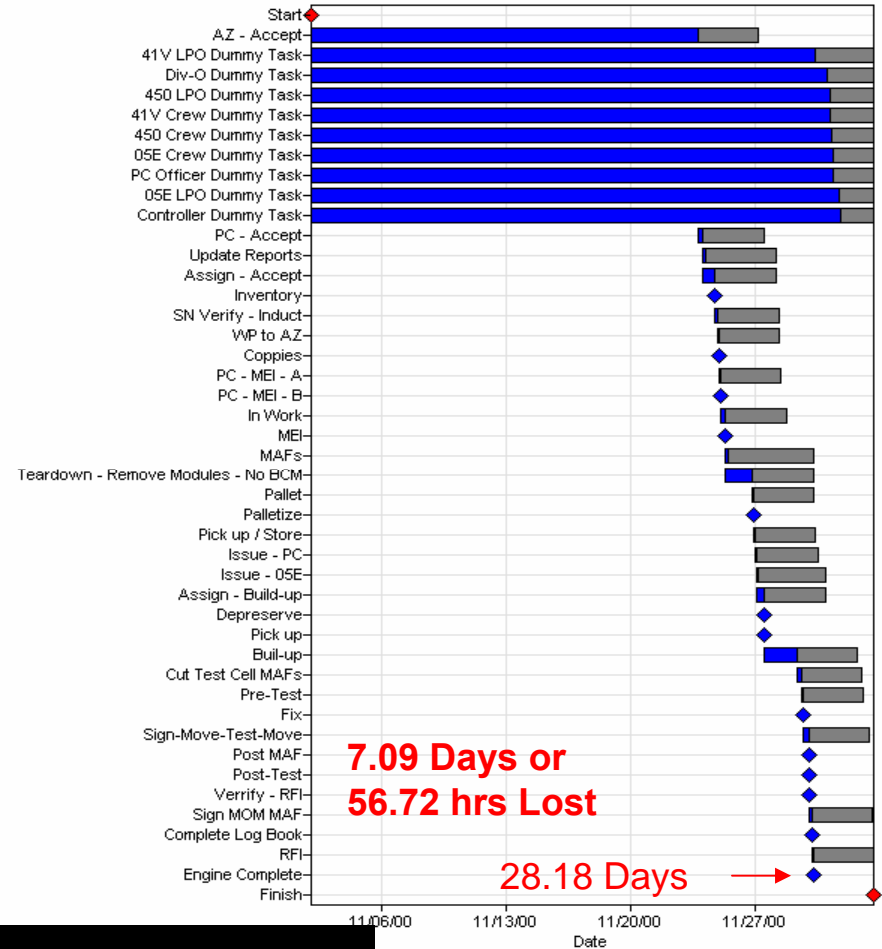
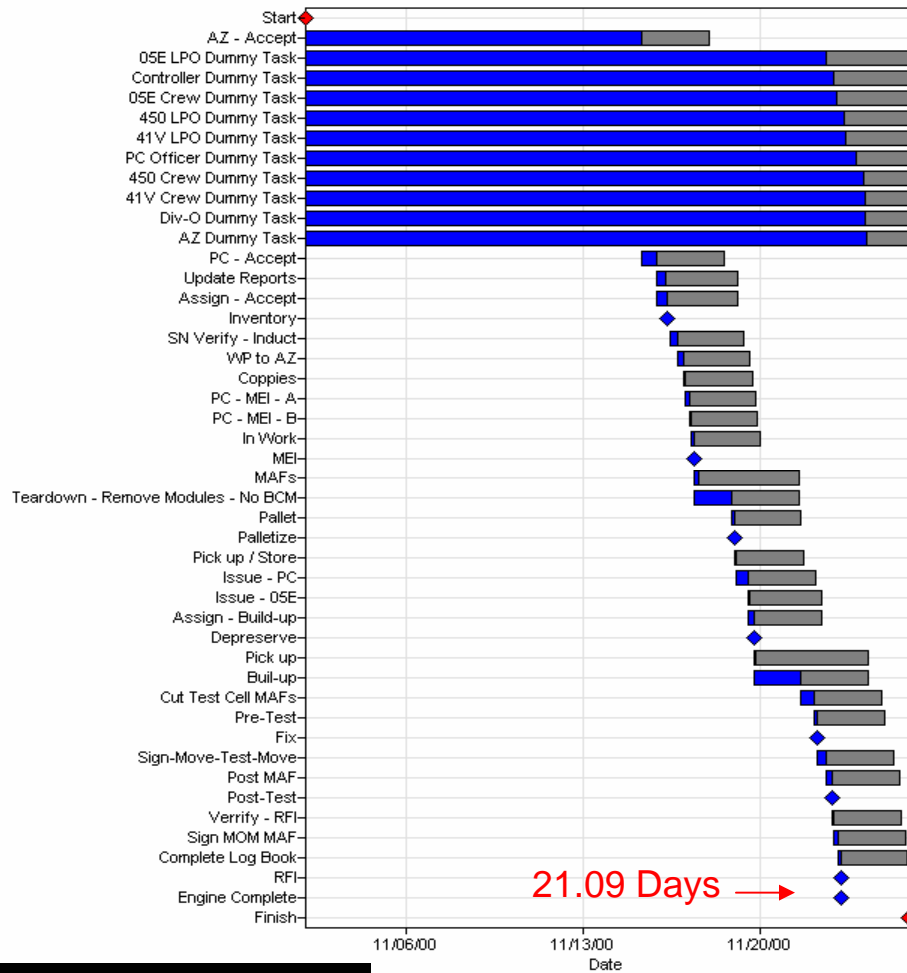
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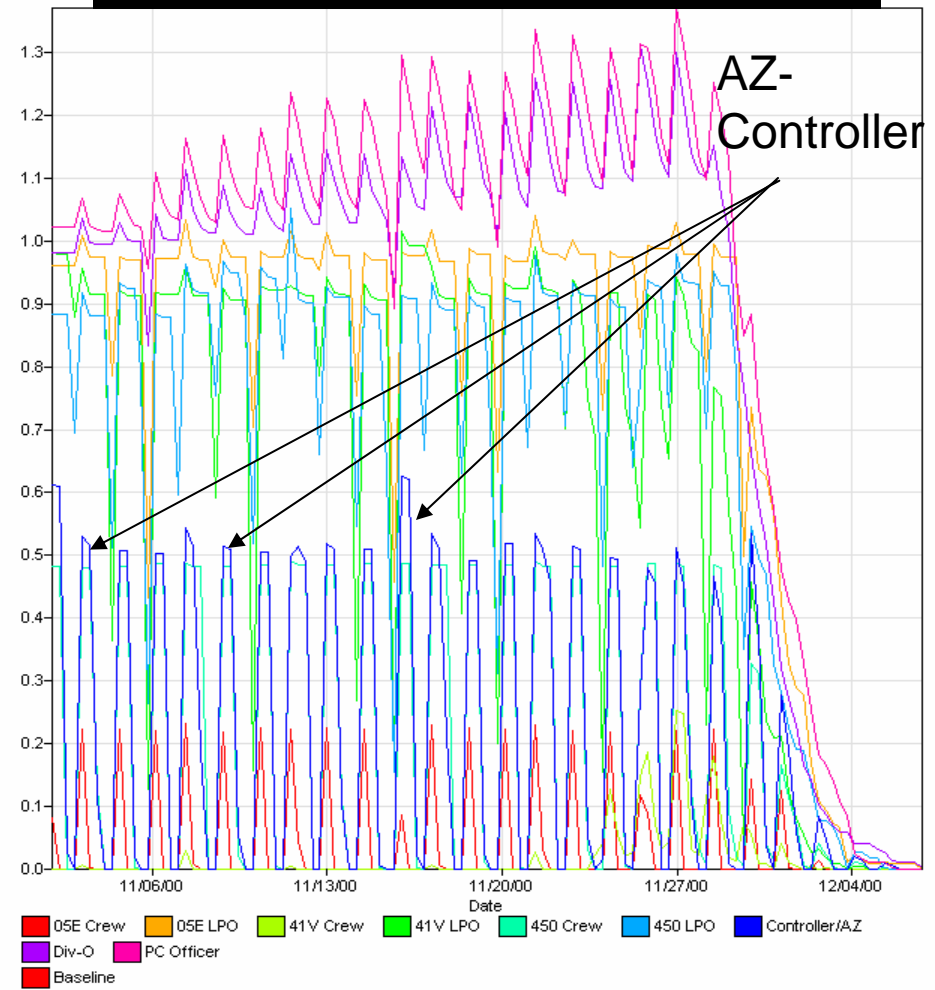
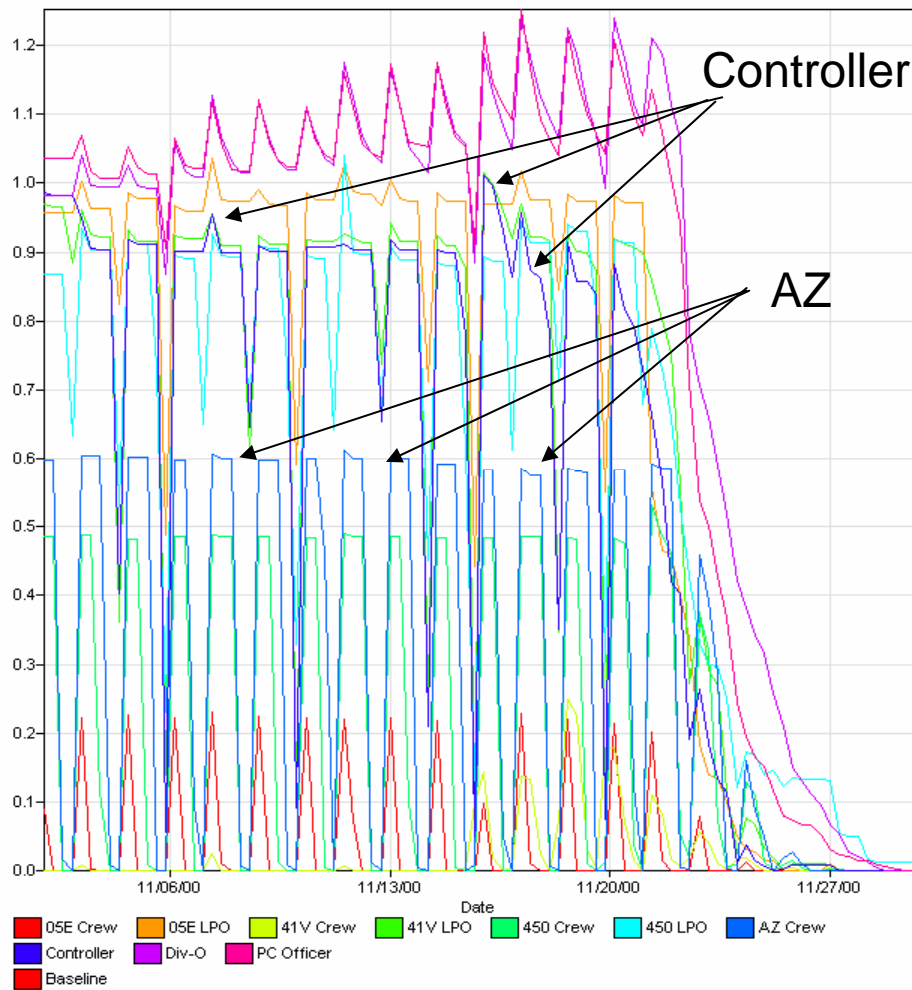


# Impact - Schedule



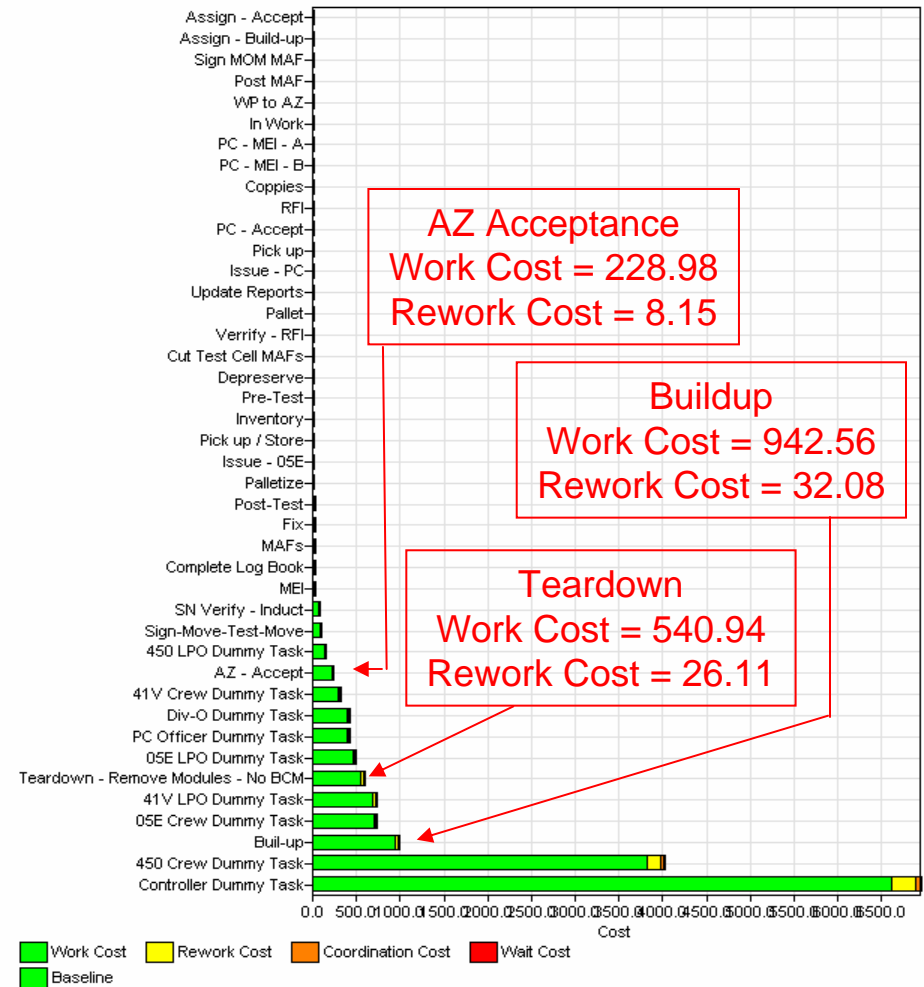
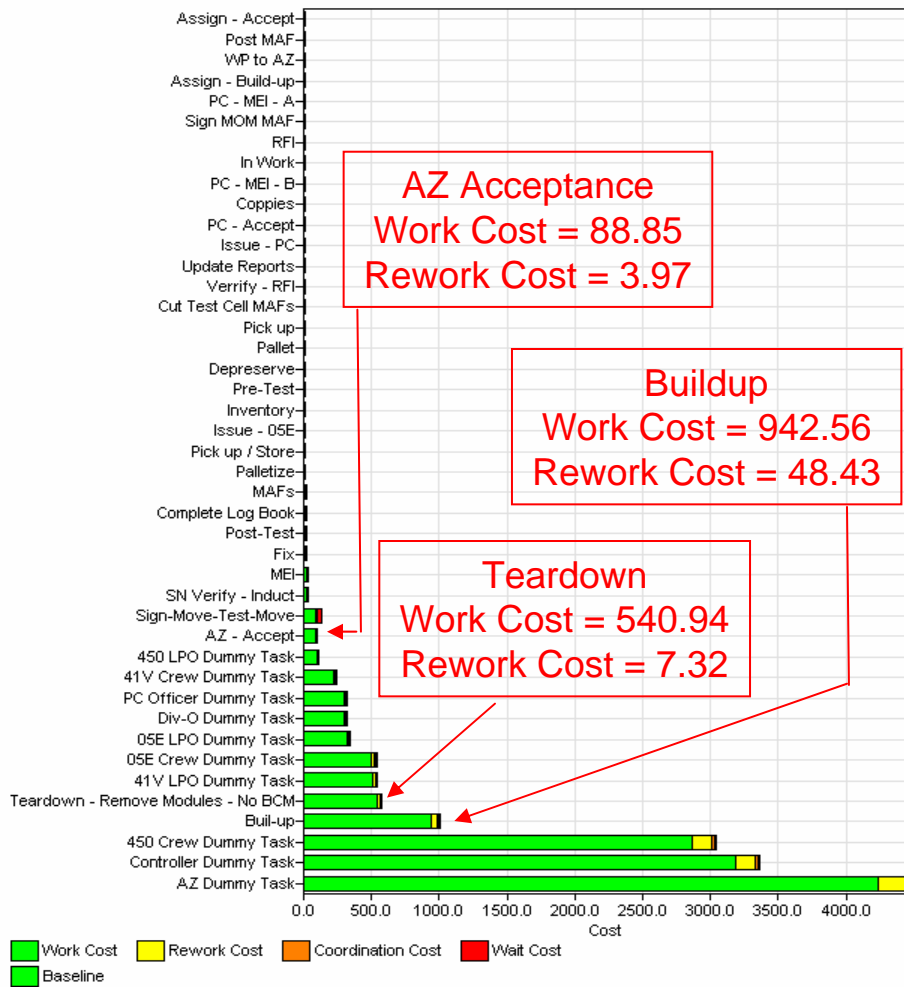
Increase in Schedule Duration

# Impact - Backlog



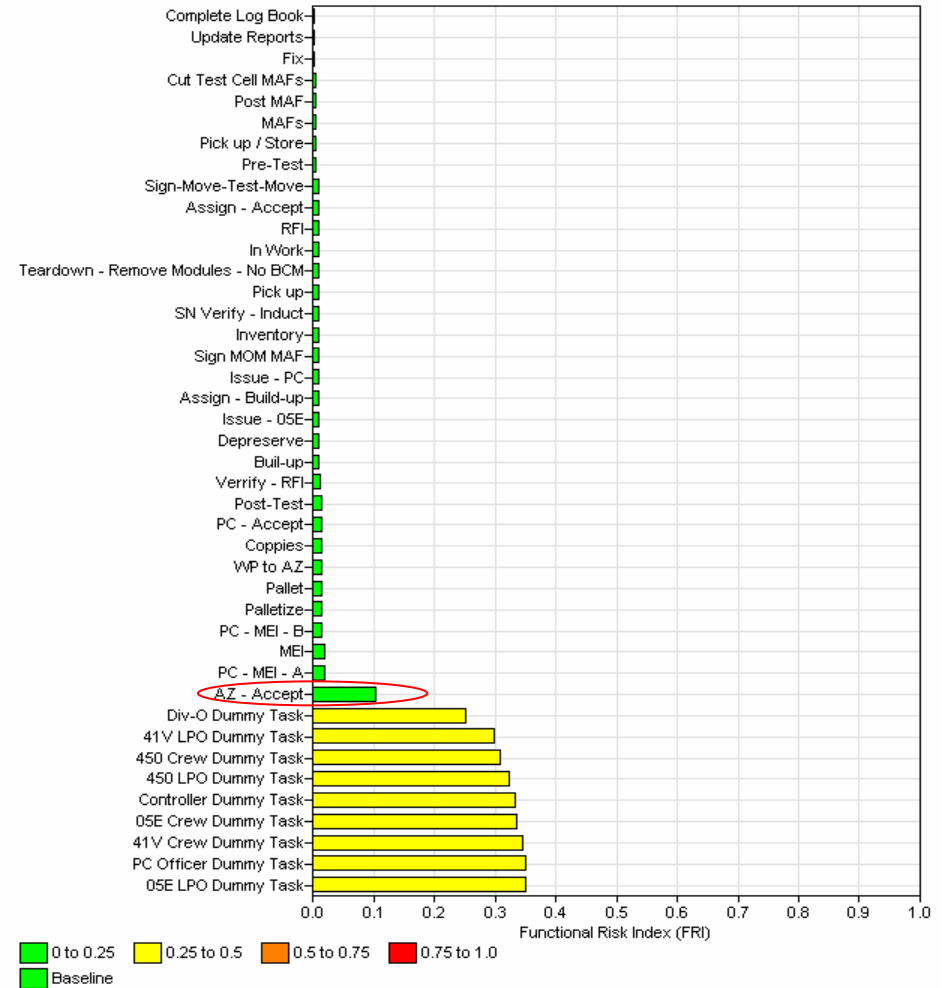
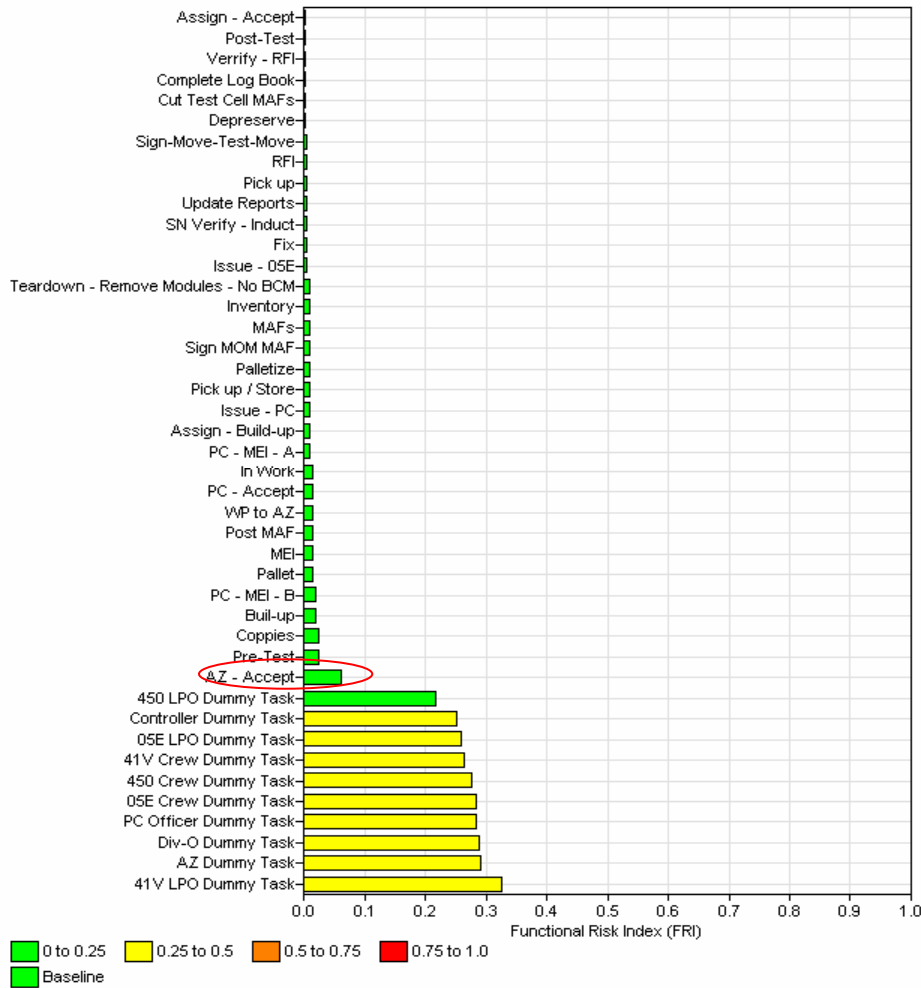
Decrease in Controller & AZ backlog / Increase in Div-O & PC backlog over time

# Impact - Cost



AZ Acceptance cost increase. Build-up Rework Increase, Tear-down Rework Decrease

# Impact - Task Functional Risk



Slight increase in AZ Acceptance task risk

# Organizational Interventions

- #1 Parallel Acceptance process with all on-engine activities
- #2 Combine Controller & AZ positions
  - Without skill retraining
  - With skill retraining
- #3 Combine 41V and 450 Positions
  - Without skill retraining
  - With skill retraining
- #4 Decreasing Centralization
- #5 Adding Additional Personnel to Positions
- #6 Altering duration and frequency of meetings
- #7 Eliminating meetings
- #8 Combination of the best of #1 - #7

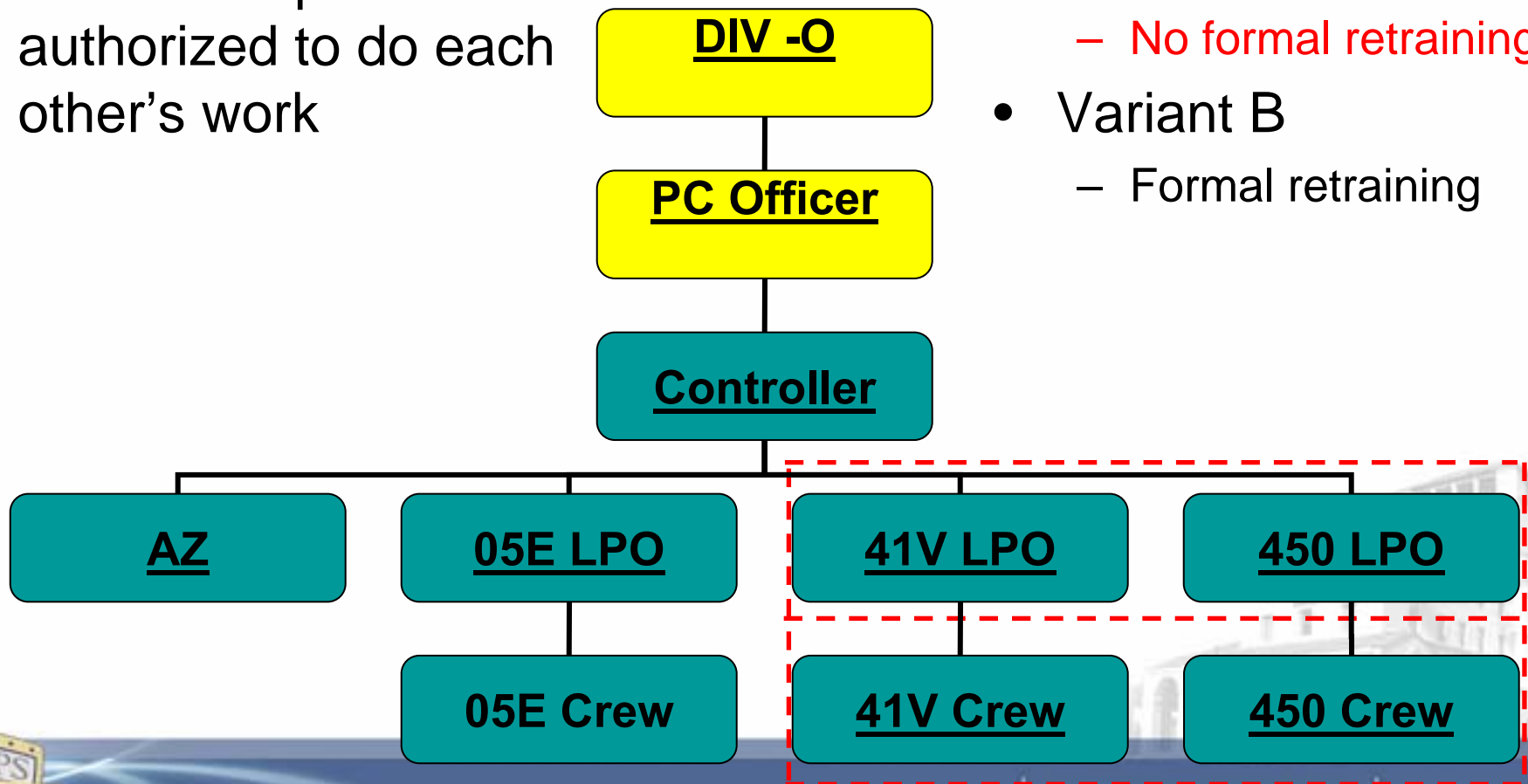




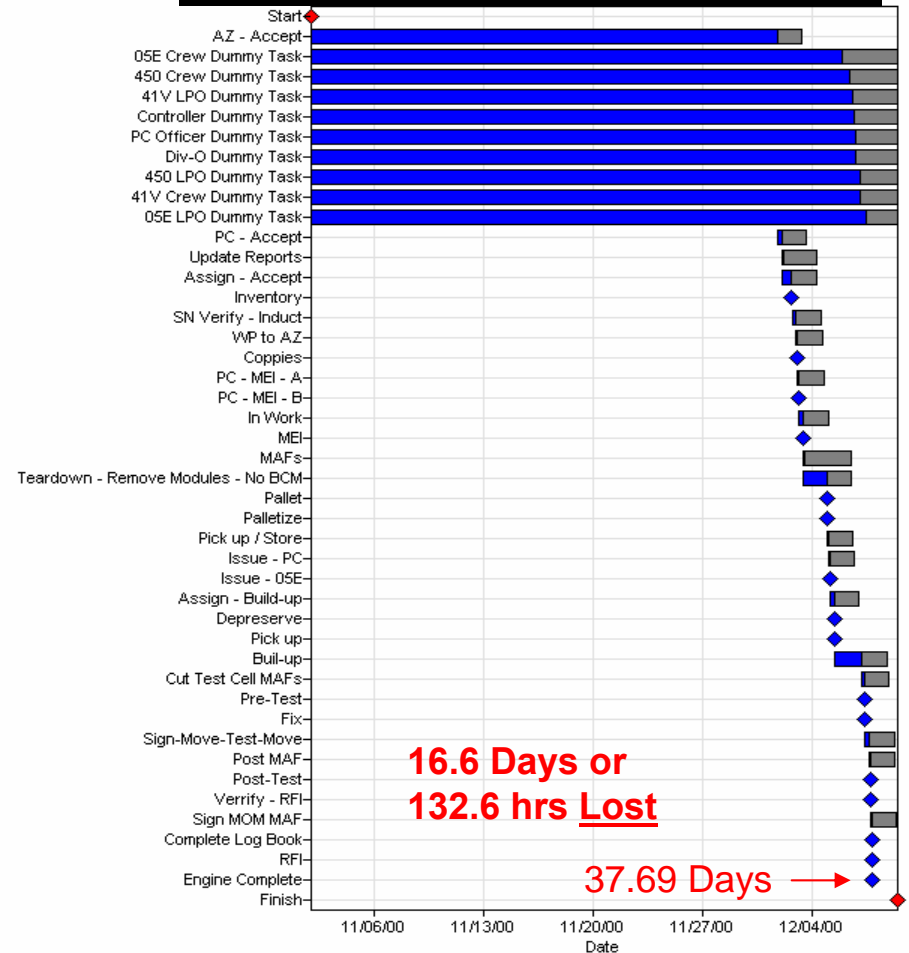
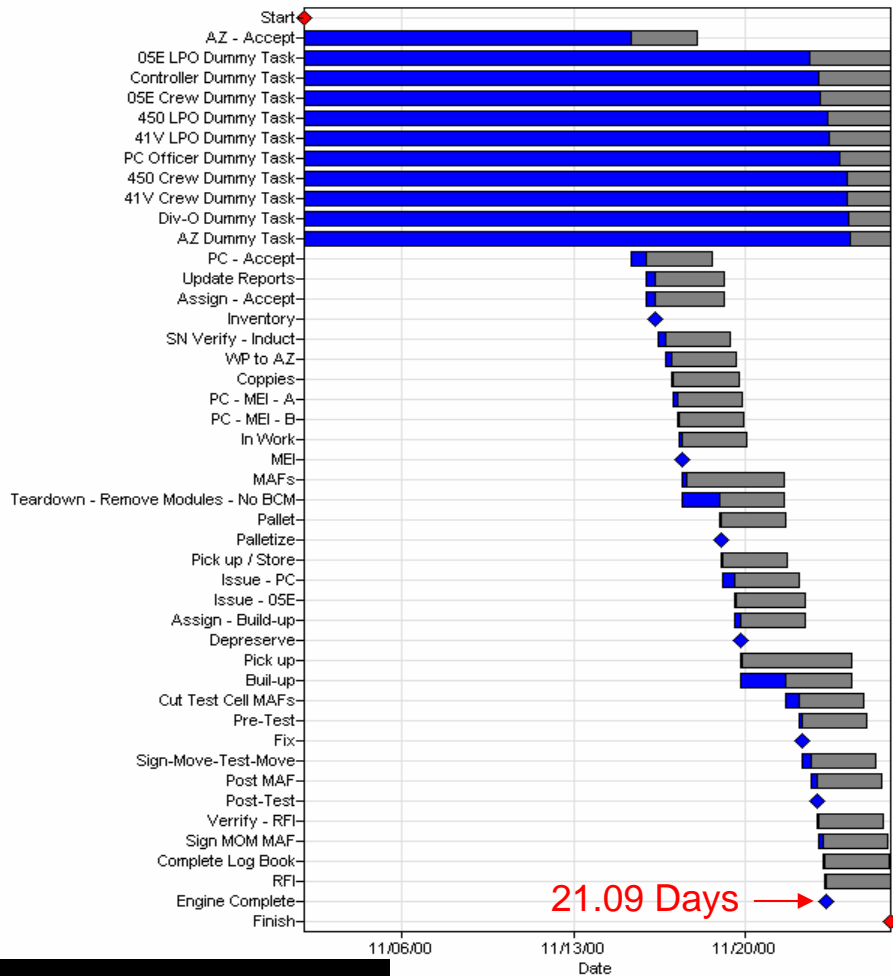
# #3 Combine 41V & 450 Positions

- Same workload
- 41V & 450 personnel authorized to do each other's work

- **Variant A**
  - Combine personnel
  - No formal retraining
- **Variant B**
  - Formal retraining

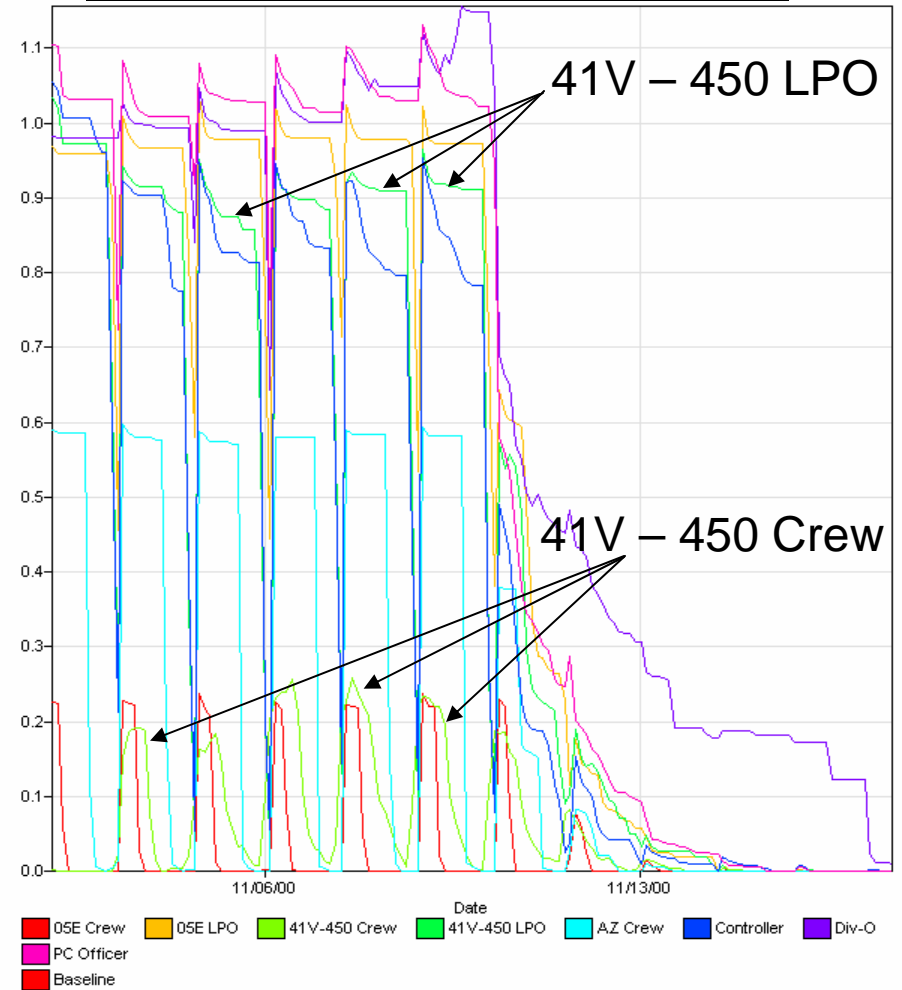
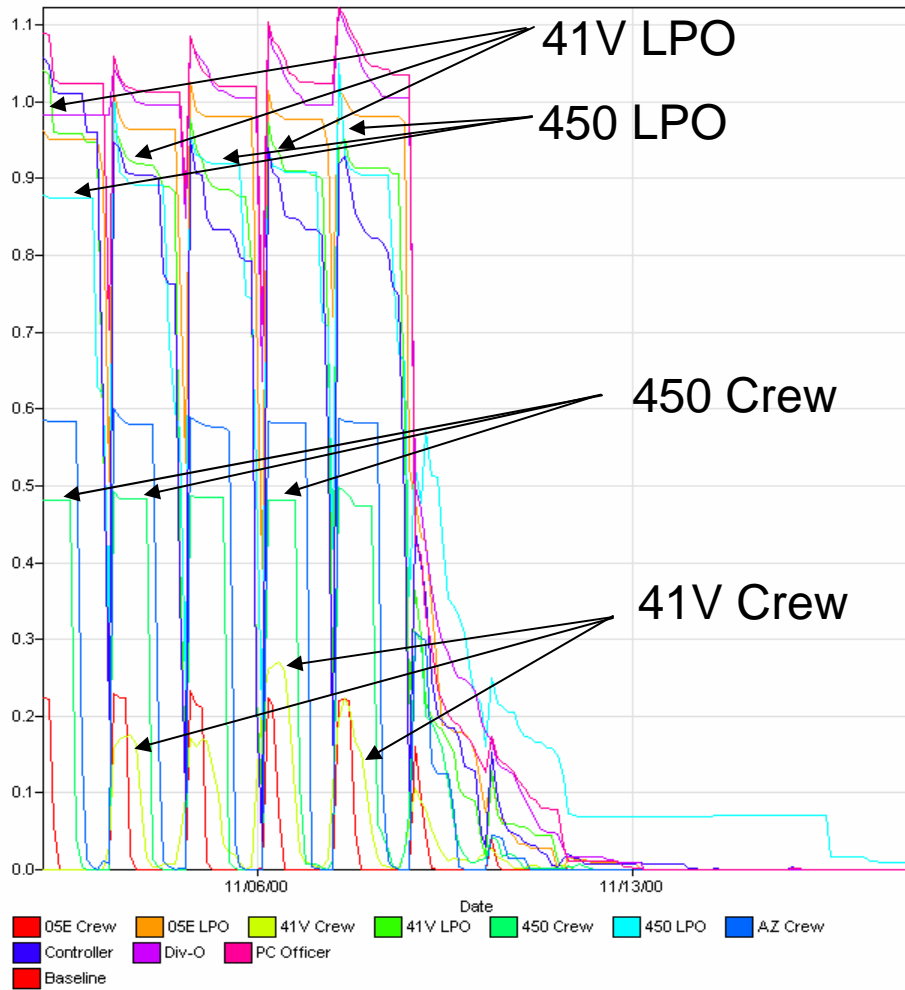


# Impact - Schedule



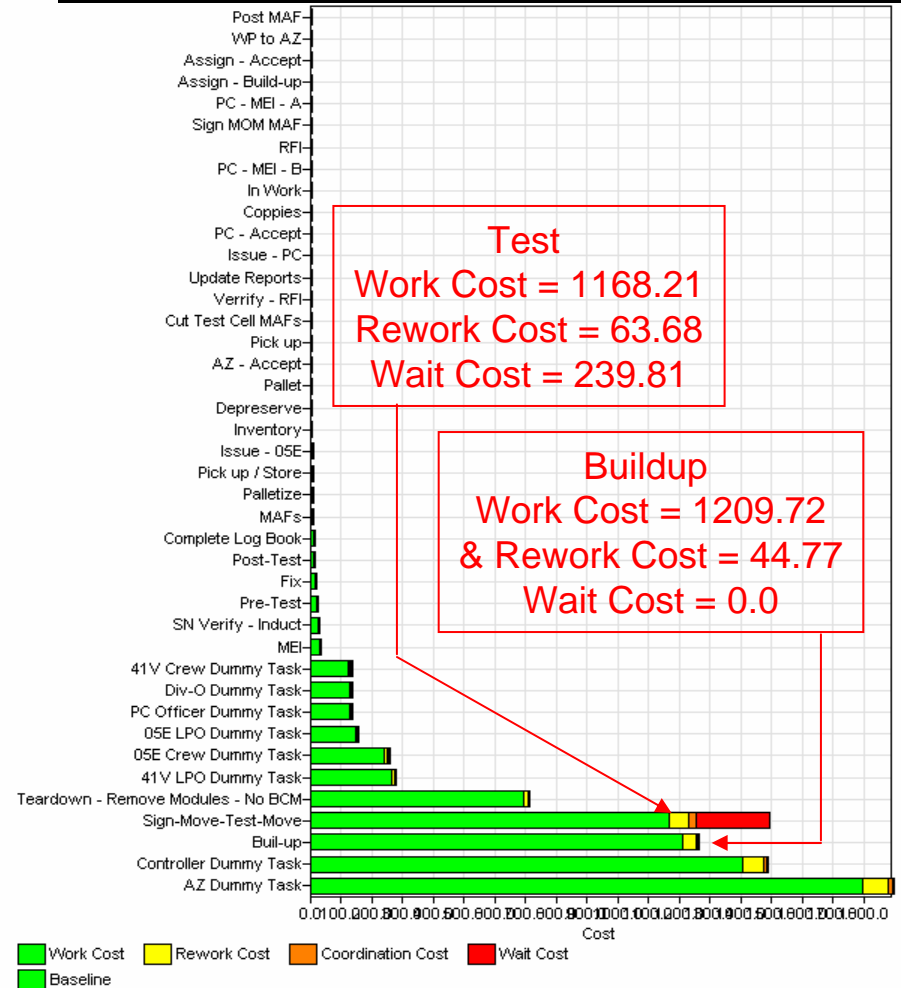
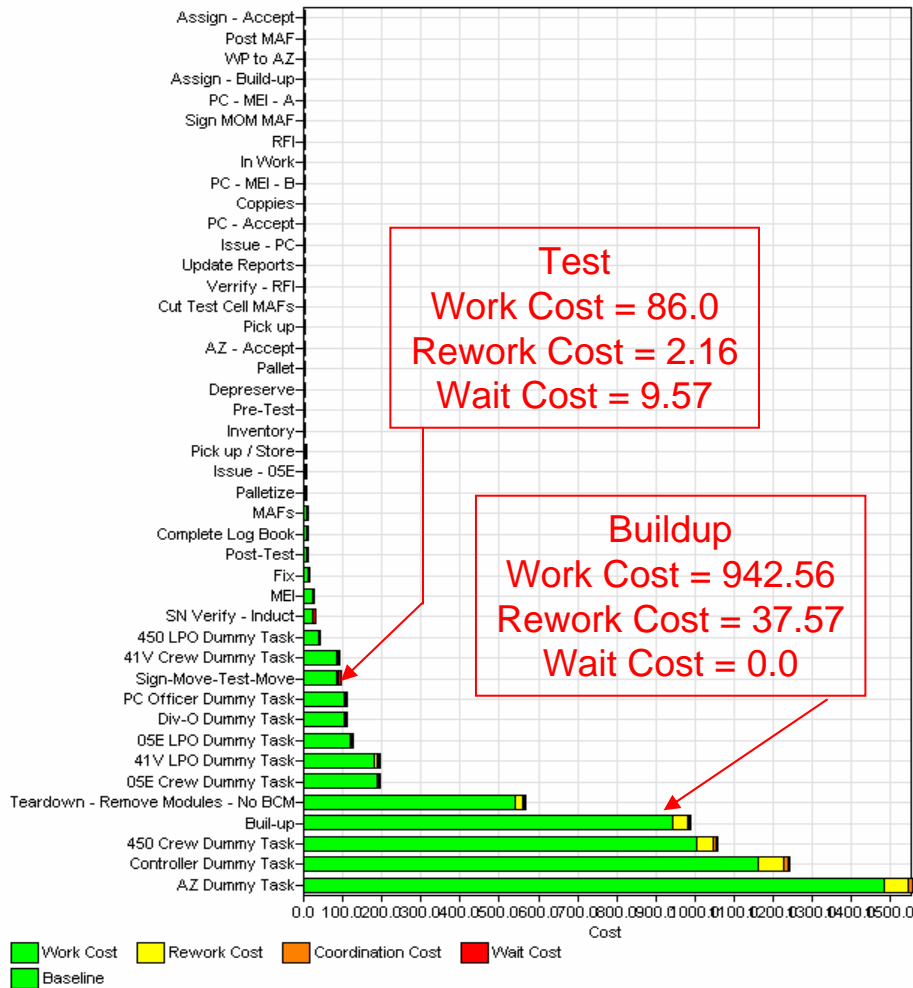
Duration Increased – Adverse Impact of Training Deficiency

# Impact - Backlog



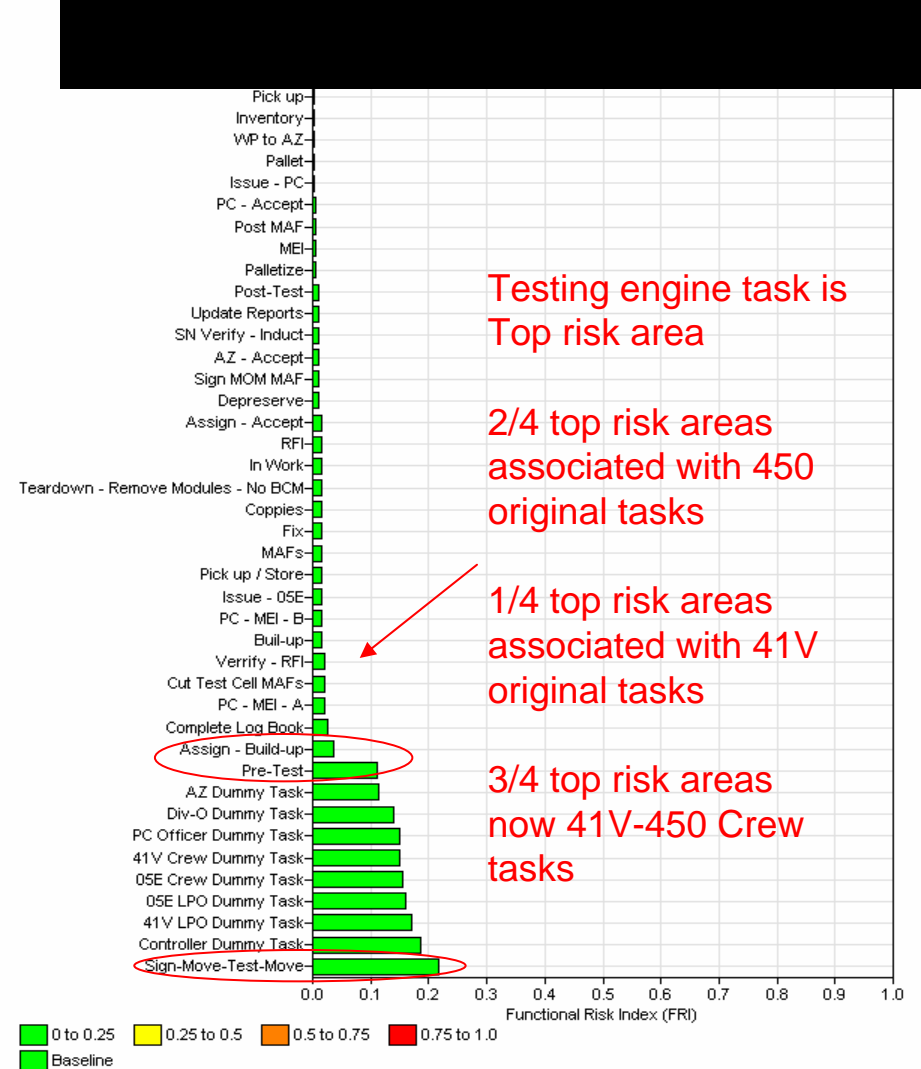
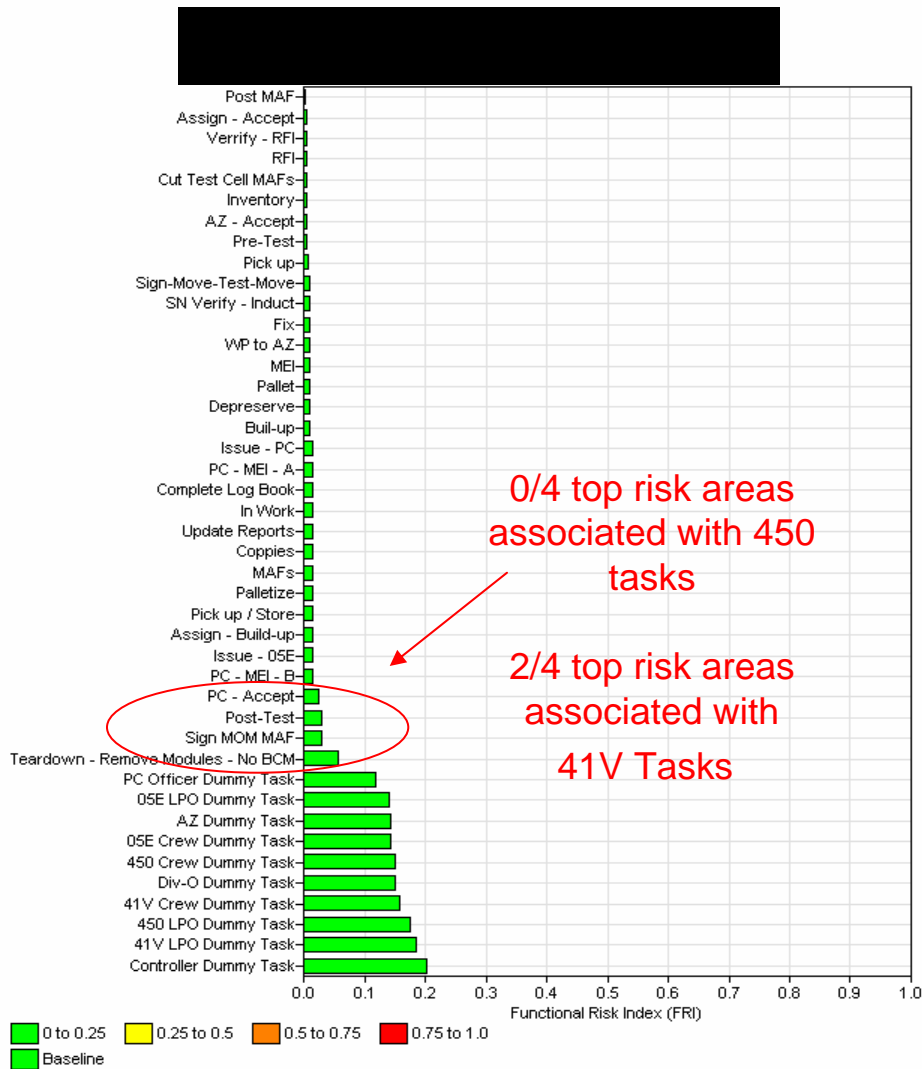
Decrease in backlog for both LPO and Crew position

# Impact - Cost



41V and 450 Tasks Increase in Cost

# Impact - Task Functional Risk



Lack of appropriate skills increases risk

# Organizational Interventions

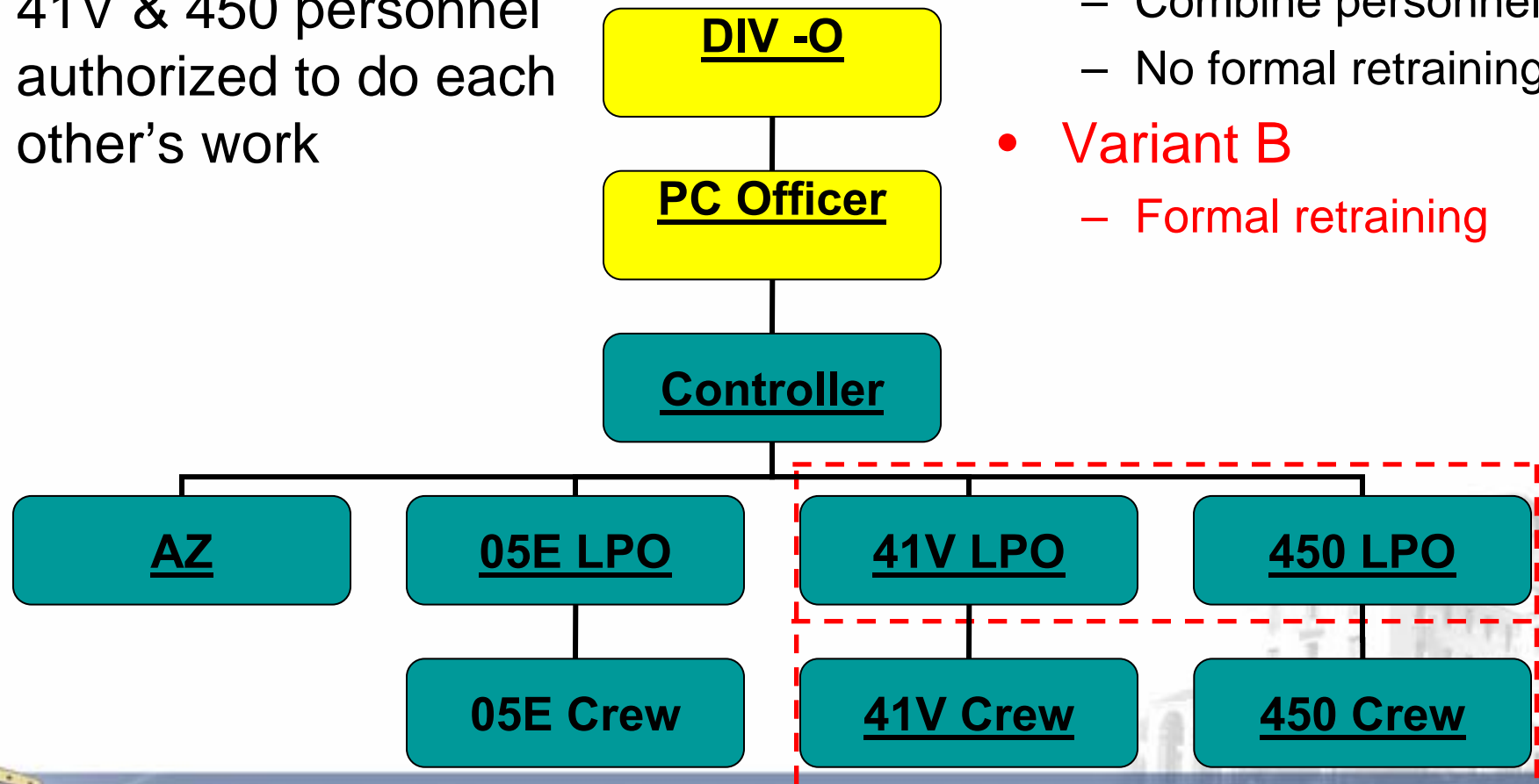
- #1 Parallel Acceptance process with all on-engine activities
- #2 Combine Controller & AZ positions
  - Without skill retraining
  - With skill retraining
- #3 Combine 41V and 450 Positions
  - Without skill retraining
  - With skill retraining
- #4 Decreasing Centralization
- #5 Adding Additional Personnel to Positions
- #6 Altering duration and frequency of meetings
- #7 Eliminating meetings
- #8 Combination of the best of #1 - #7



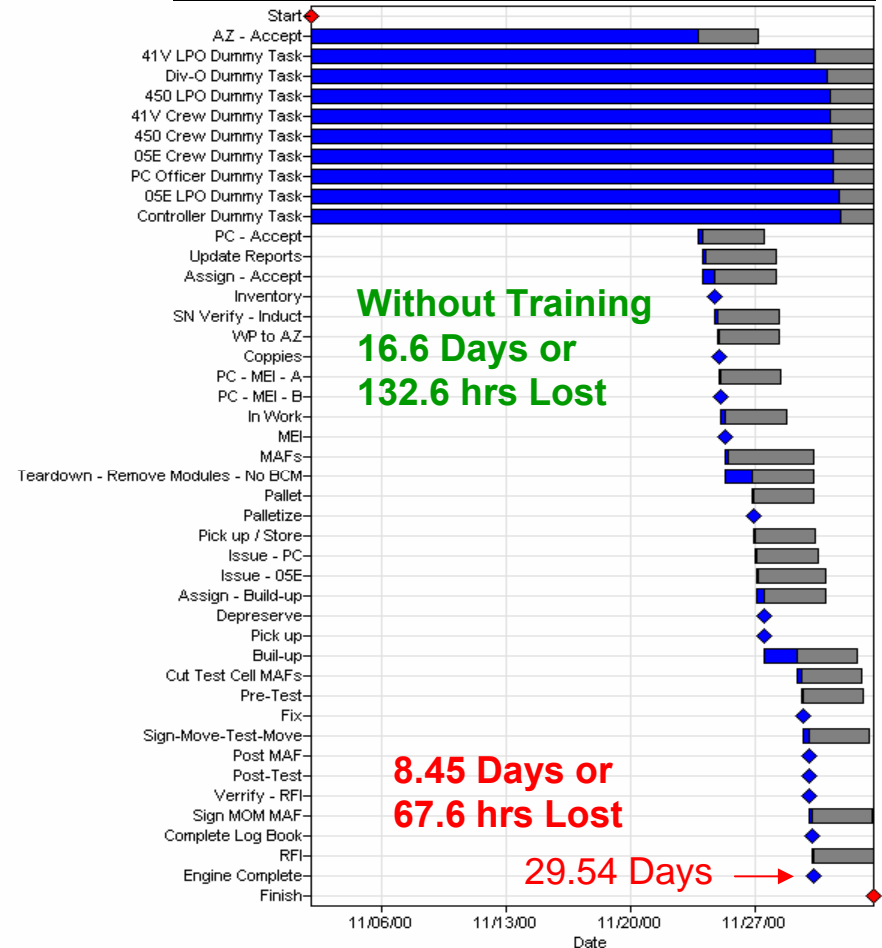
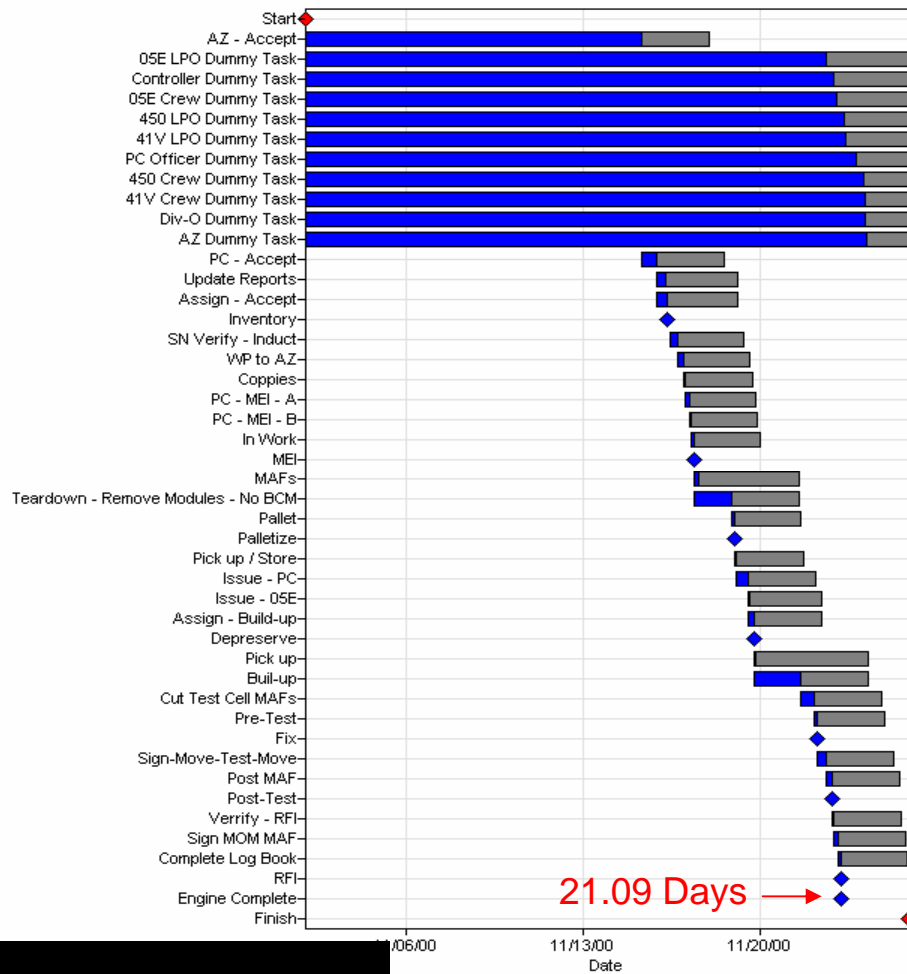
# #3 Combine 41V & 450 Positions

- Same workload
- 41V & 450 personnel authorized to do each other's work

- Variant A
  - Combine personnel
  - No formal retraining
- Variant B
  - Formal retraining



# Impact - Schedule

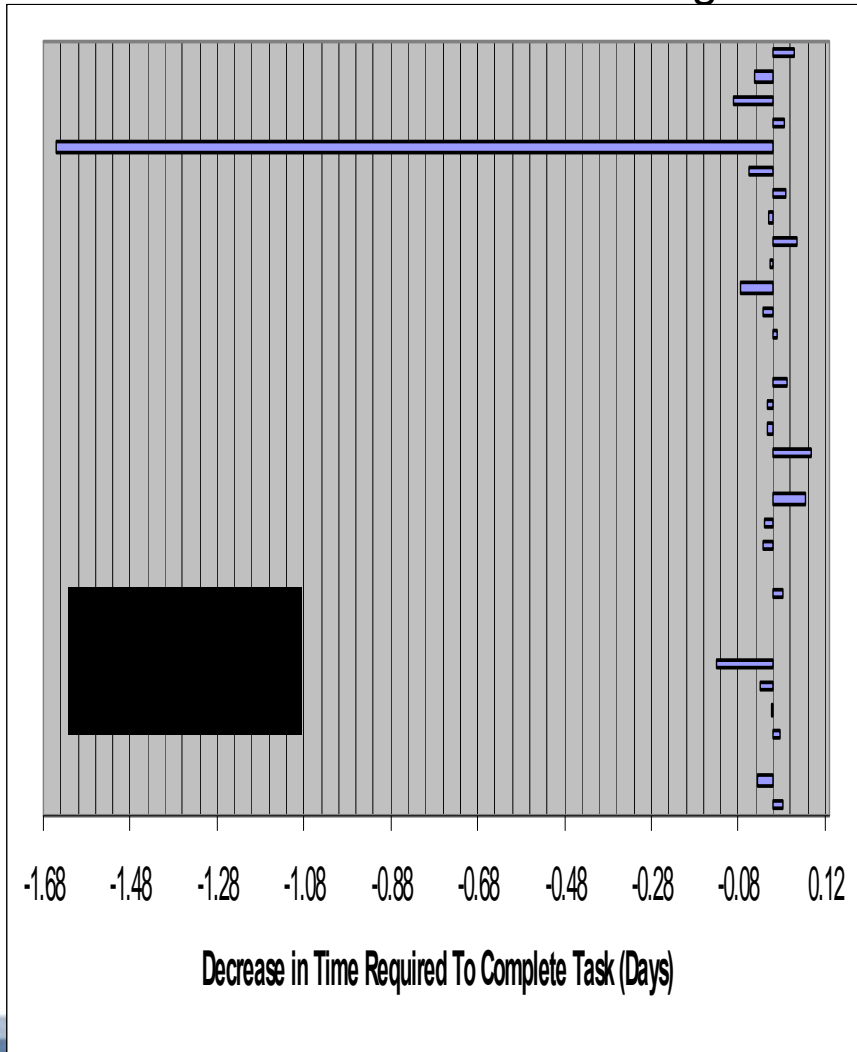


Training doesn't overcome increased duration resulting from combining 41V & 450

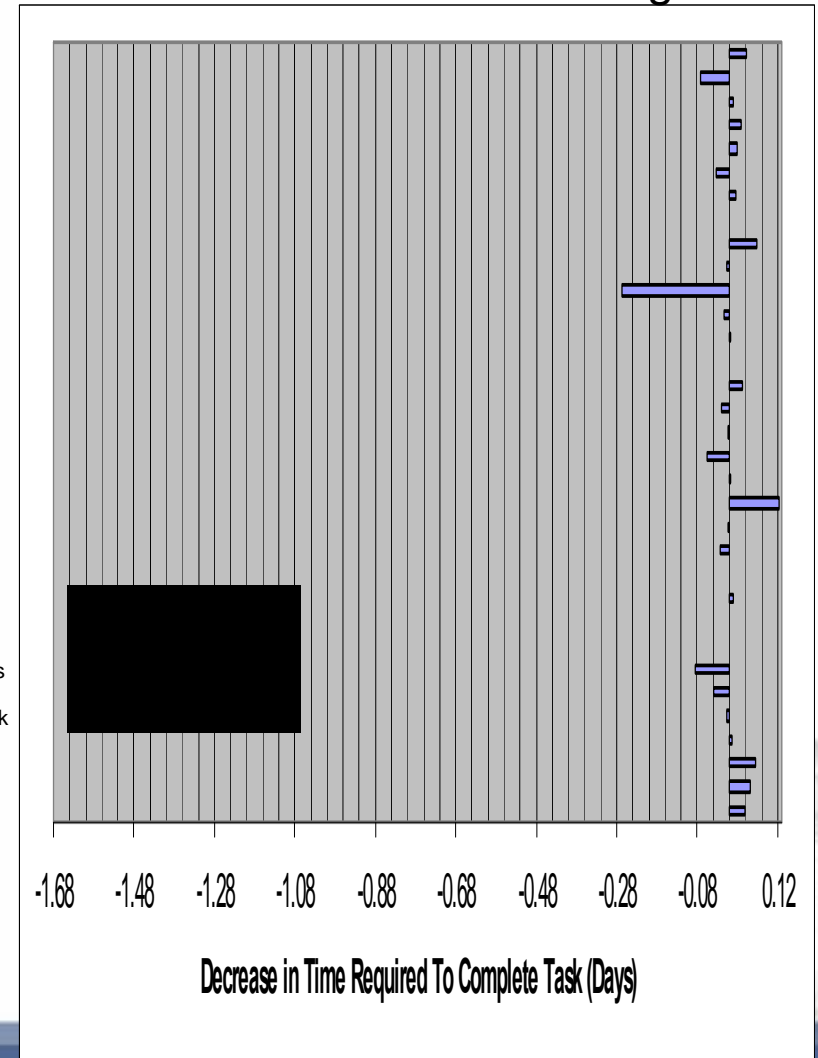


# Changes in Task Duration

Without Formal Training



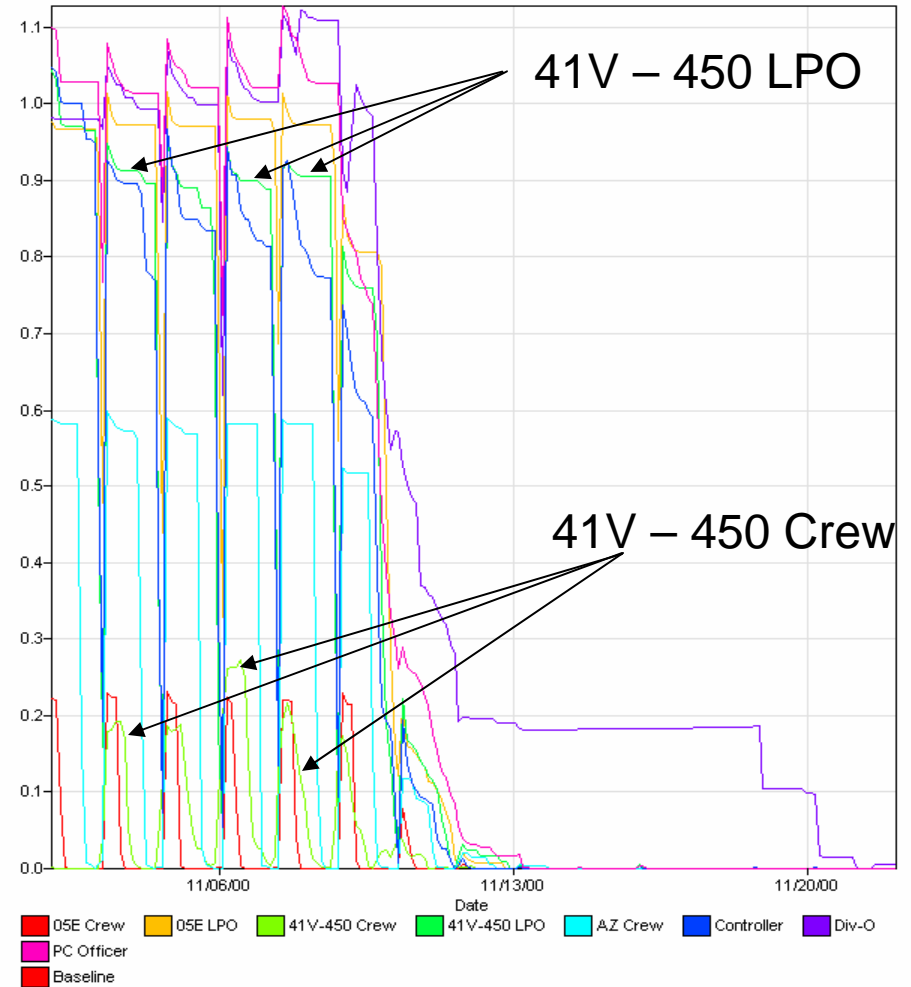
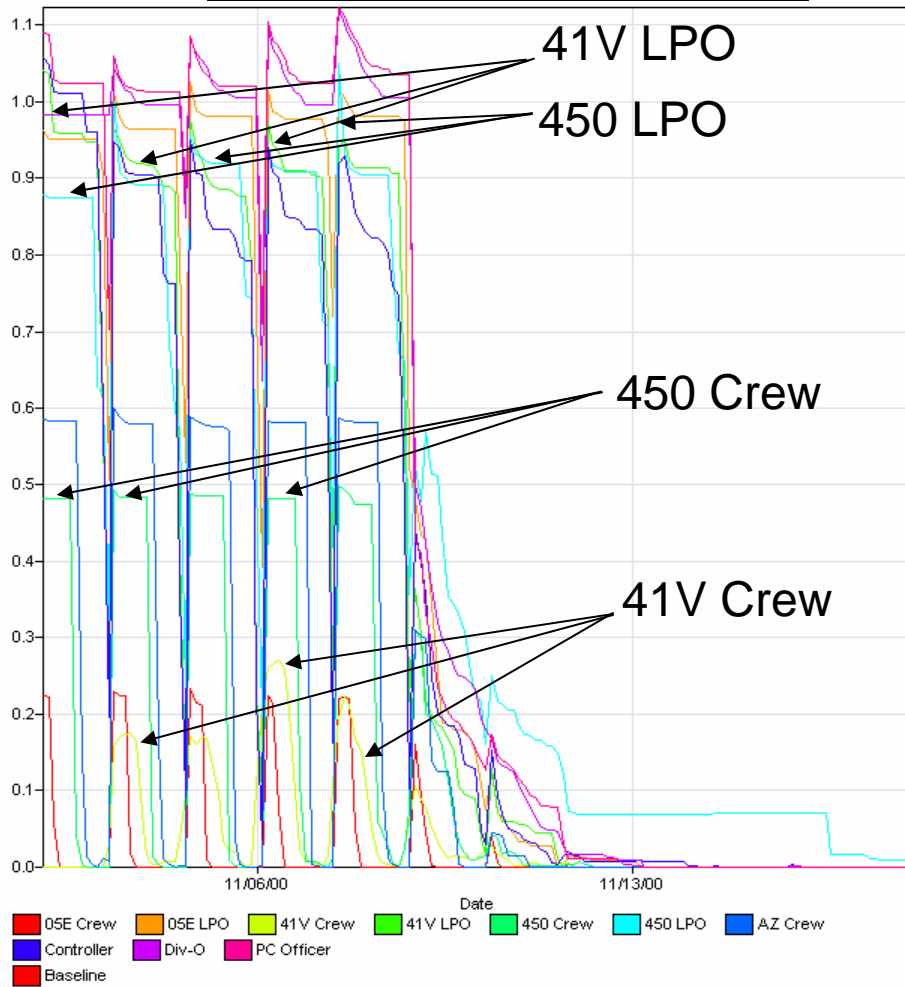
With Formal Training



- WP to AZ
- Verify - RFI
- Update Reports
- Teardown
- Test
- Sign MOM MAF
- SN Verify - Induct
- RFI
- Pre-Test
- Post-Test
- Post MAF
- Pick up / Store
- Pick up
- Palletize
- Pallet
- PC - MEI - B
- PC - MEI - A
- PC - Accept
- MEI
- MAFs
- Issue - PC
- Issue - 05E
- Inventory
- In Work
- Fix
- Depreserve
- Cut Test Cell MAFs
- Copies
- Complete Log Book
- Build-up
- Assign - Build-up
- Assign - Accept
- AZ - Accept

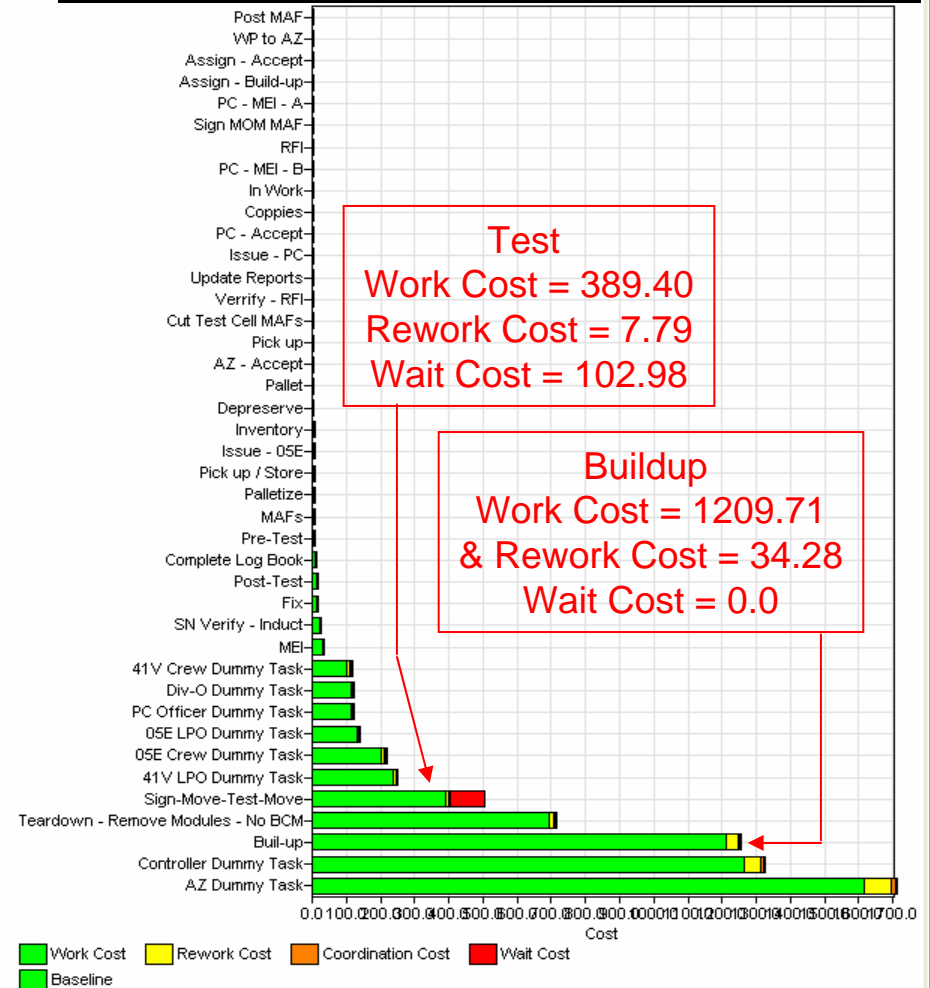
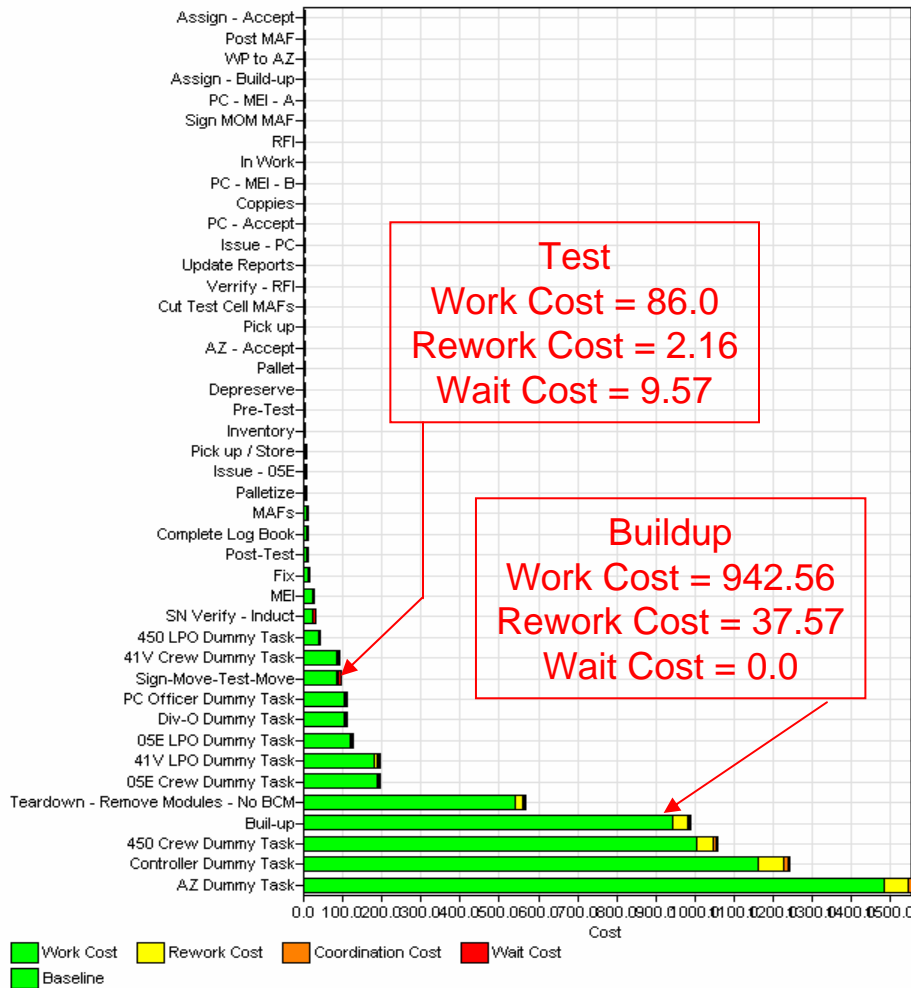
**Training significantly decreases duration of tasks associated with engine testing**

# Impact - Backlog



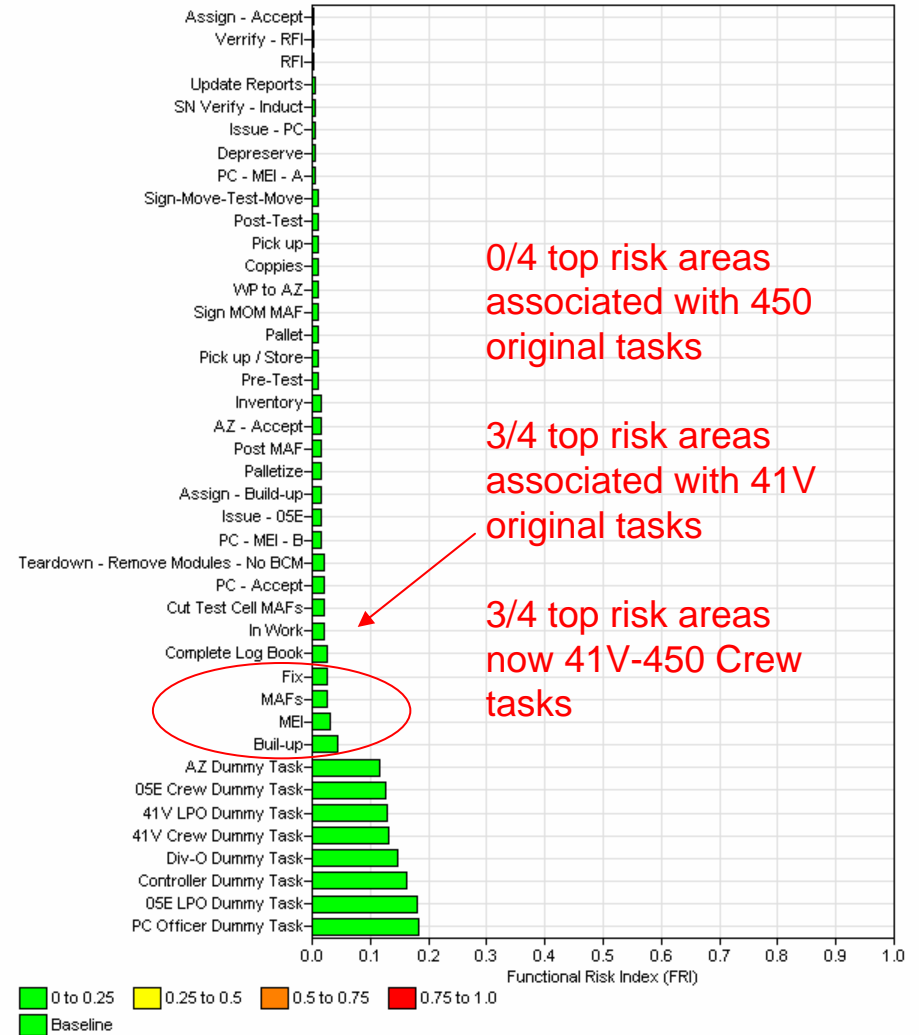
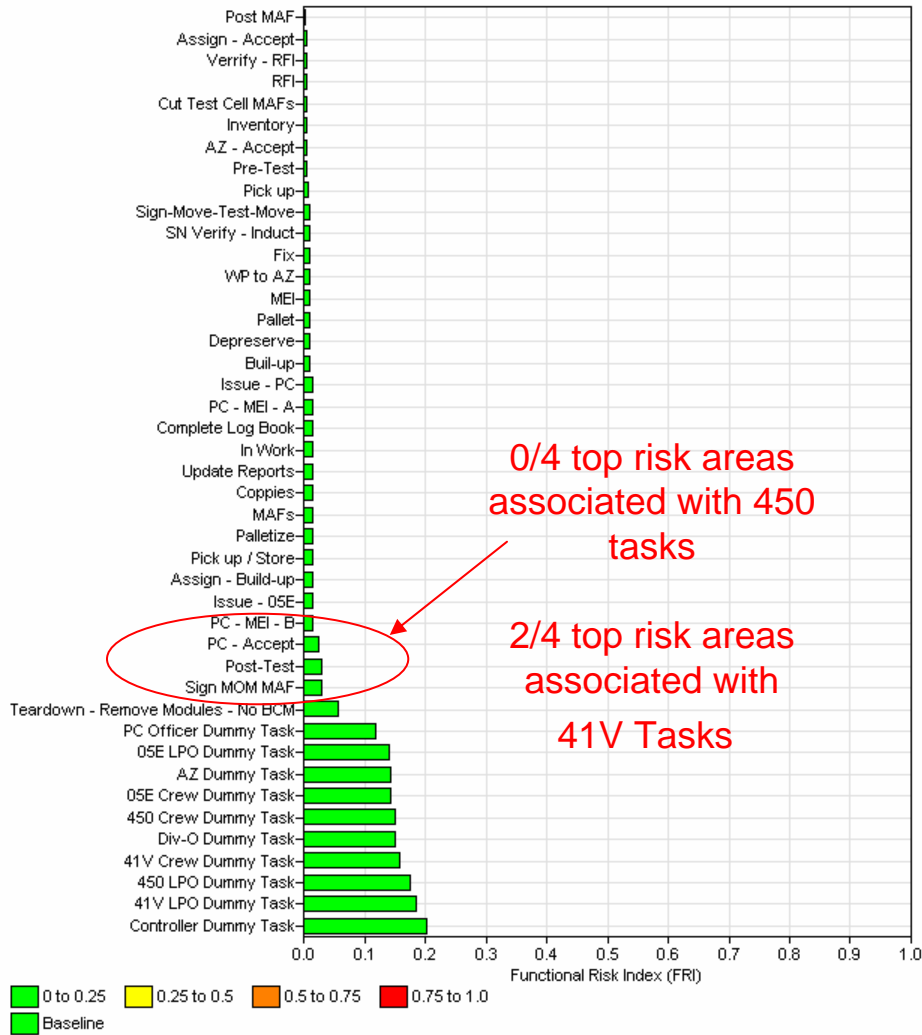
Decrease in backlog for both LPO and Crew position

# Impact - Cost



41V and 450 Tasks Increase in Cost

# Impact - Task Functional Risk



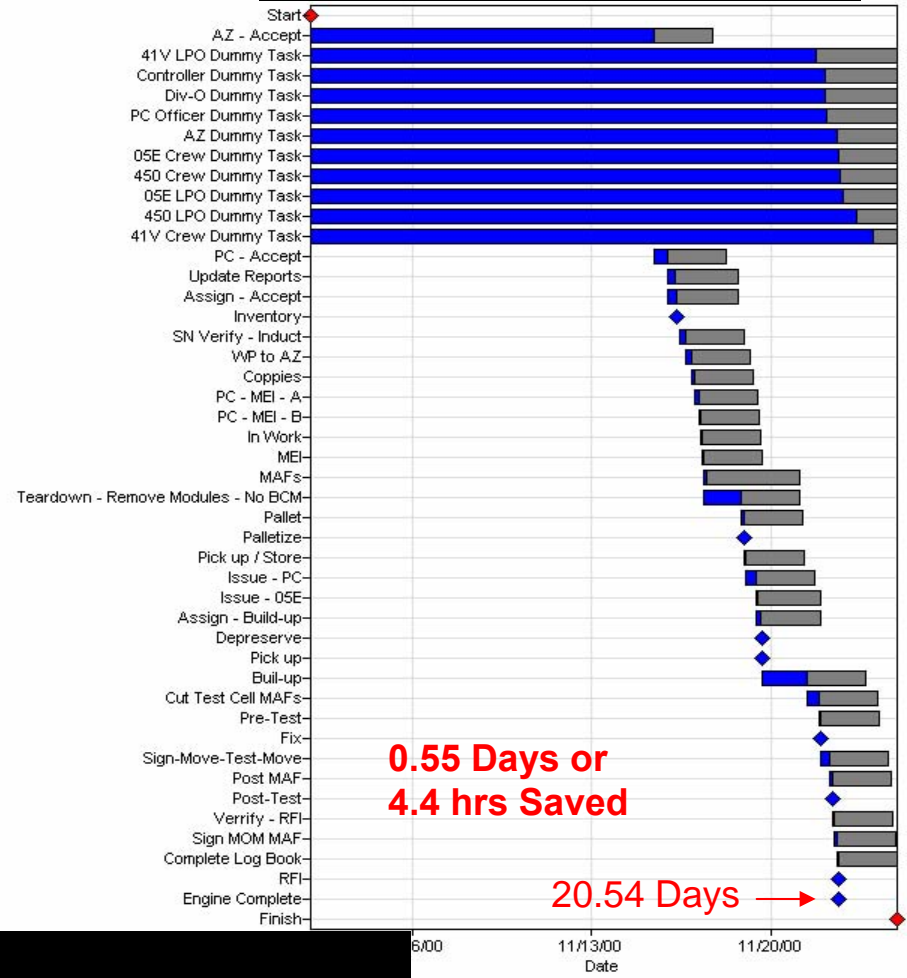
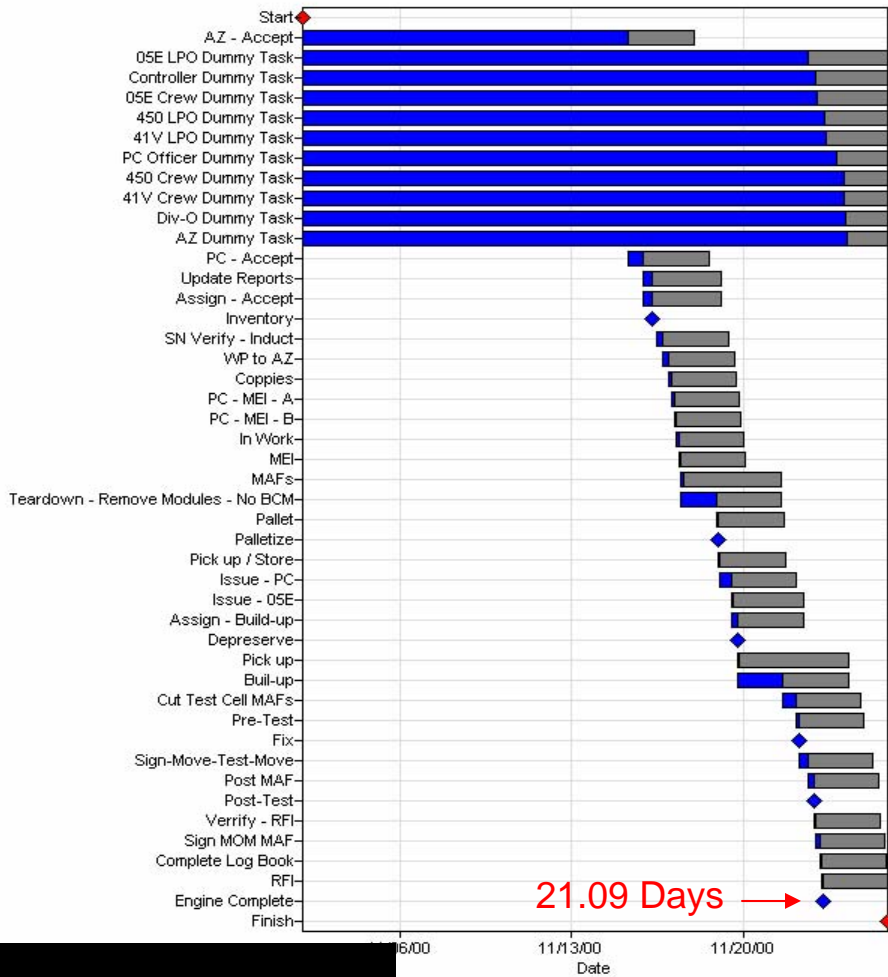
**Training decreases risk of Test task, Combined 41V-450 tasks have highest risk**

# Organizational Interventions

- #1 Parallel Acceptance process with all on-engine activities
- #2 Combine Controller & AZ positions
  - Without skill retraining
  - With skill retraining
- #3 Combine 41V and 450 Positions
  - Without skill retraining
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- #4 Decreasing Centralization
- #5 Adding Additional Personnel to Positions
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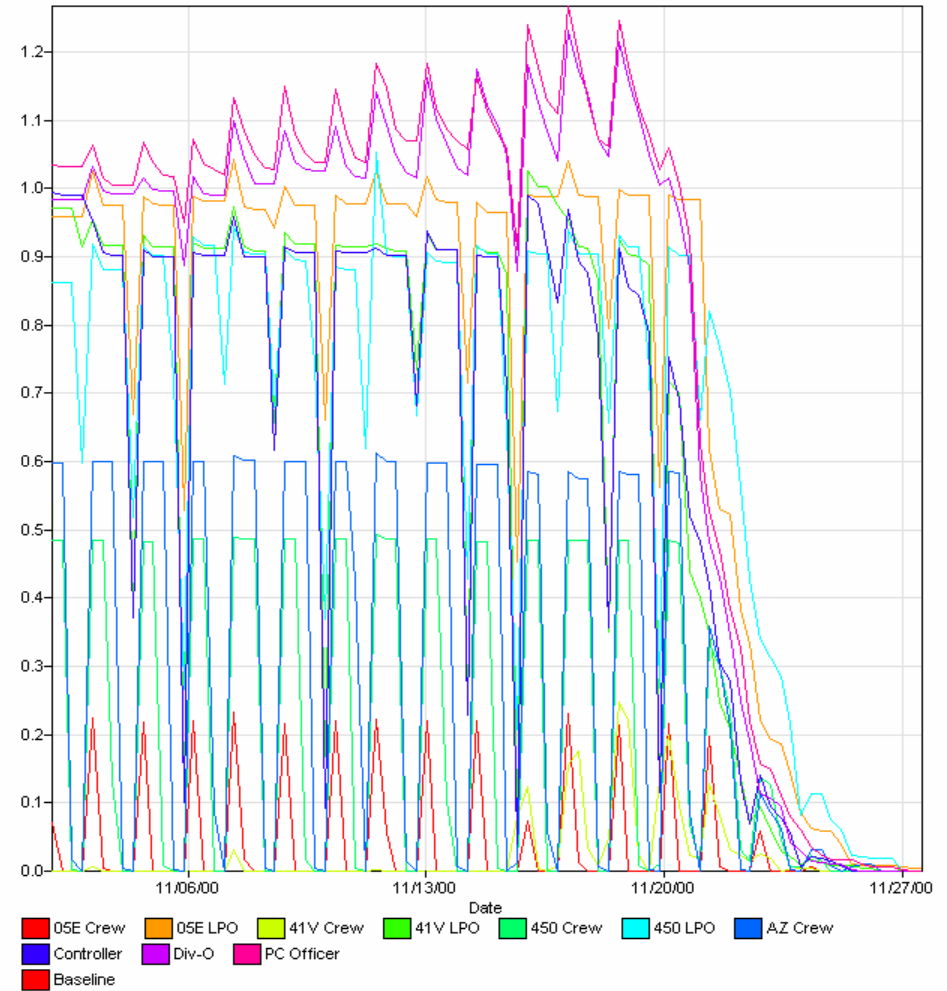
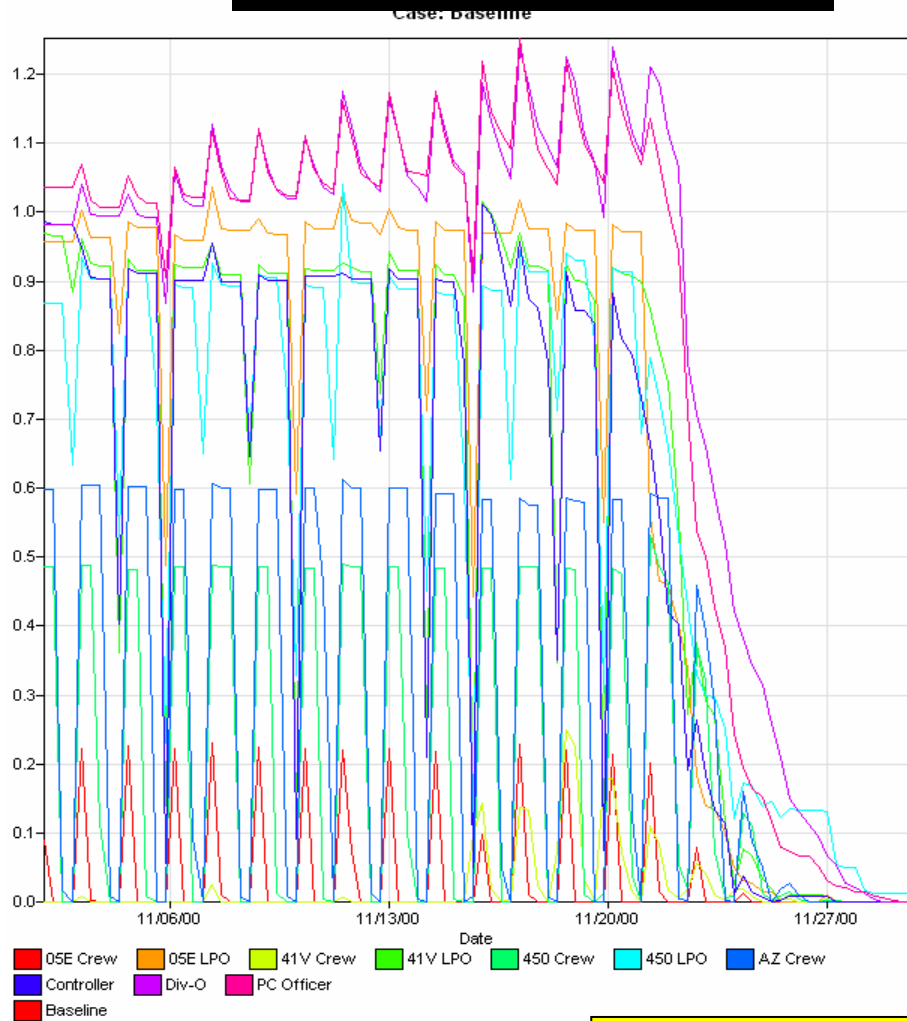


# Impact - Schedule



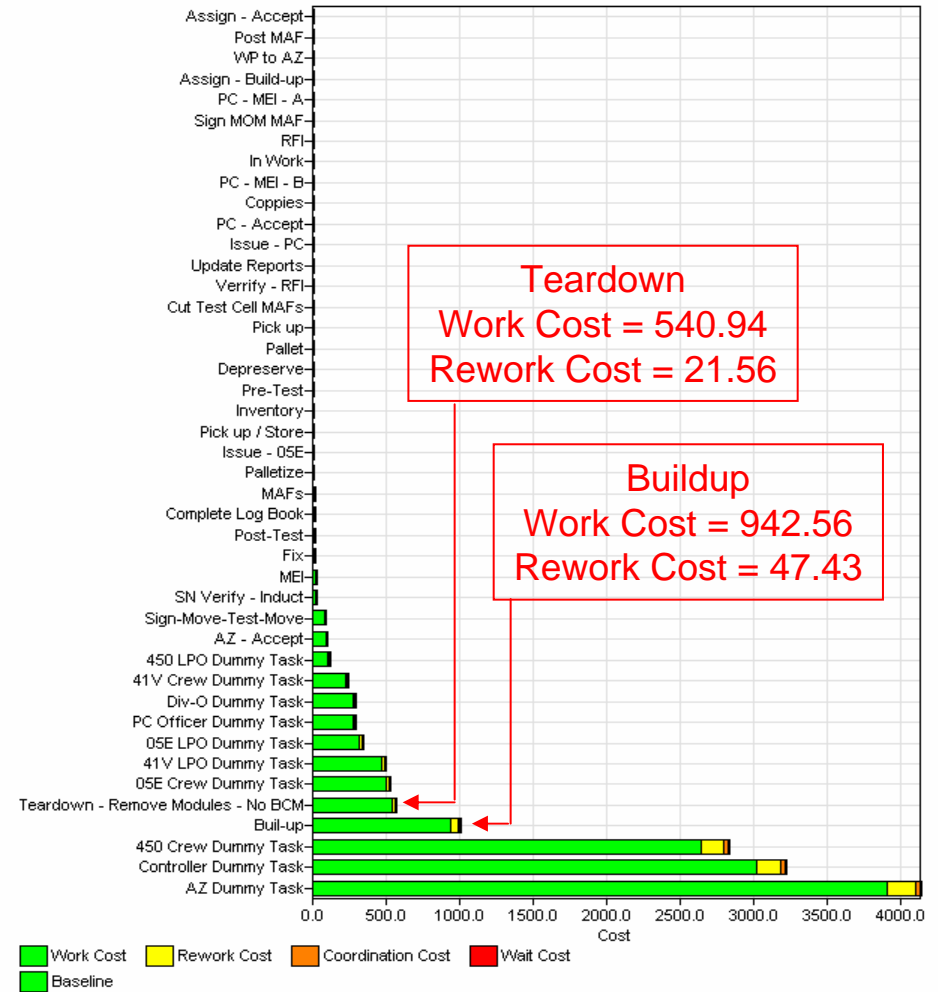
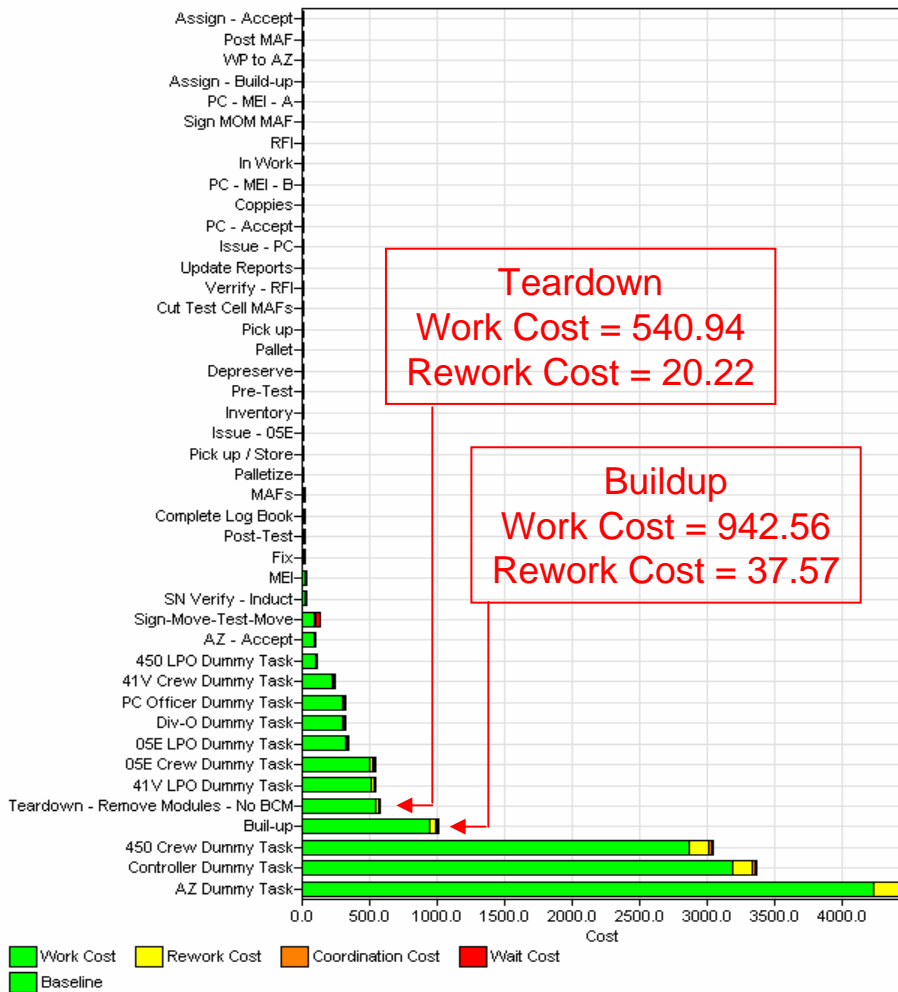
**Decrease in schedule duration**

# Impact - Backlog



No Significant Impact to Backlog

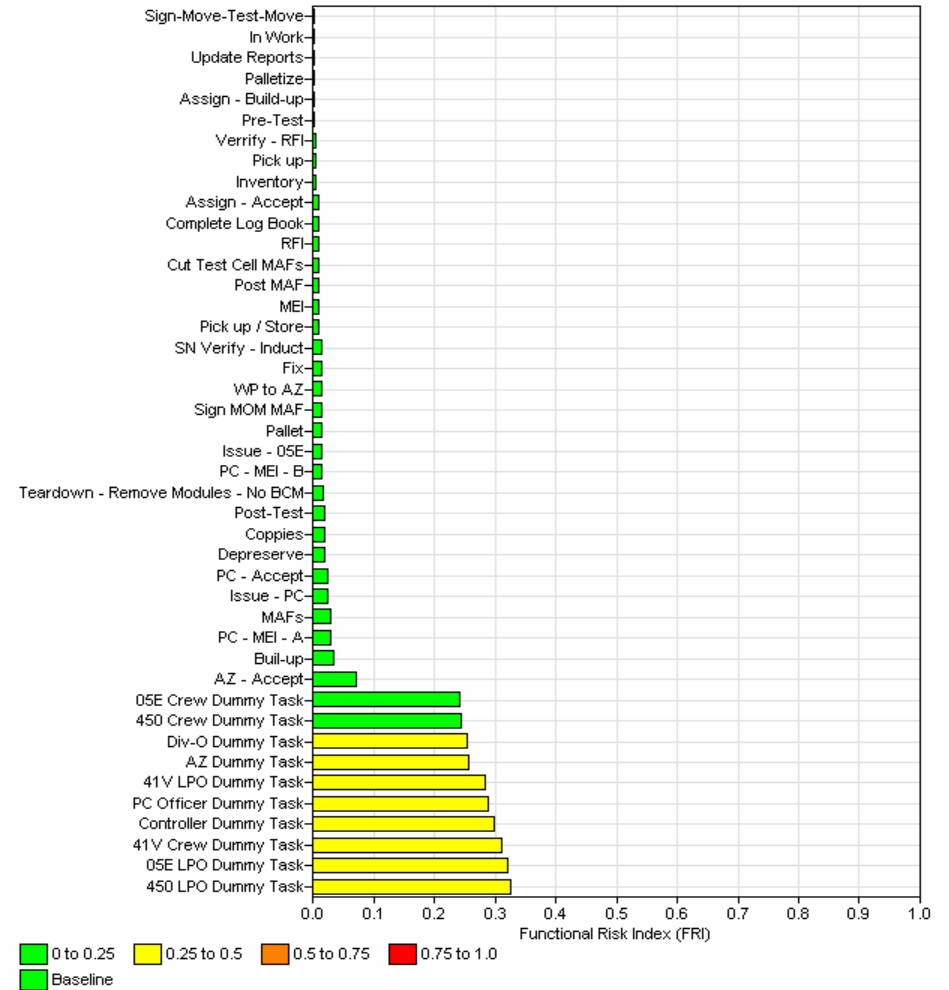
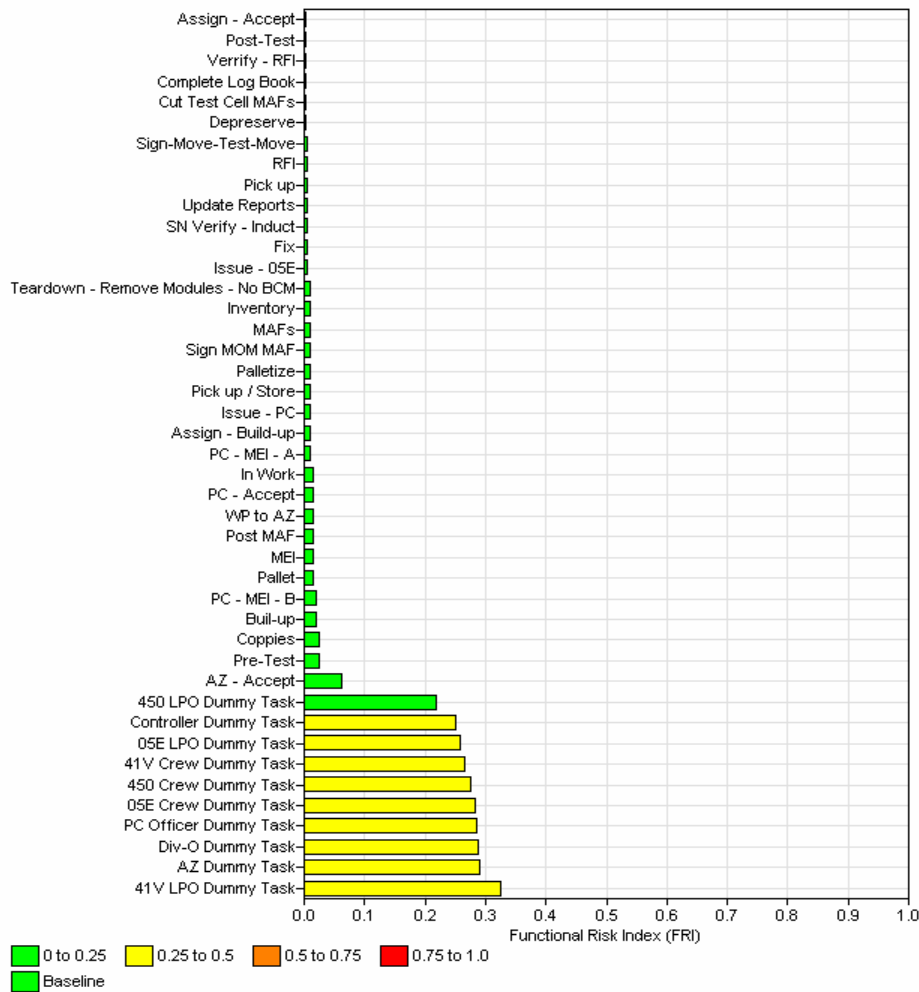
# Impact - Cost



Slight increase in both Build-up Rework Costs



# Impact - Task Functional Risk



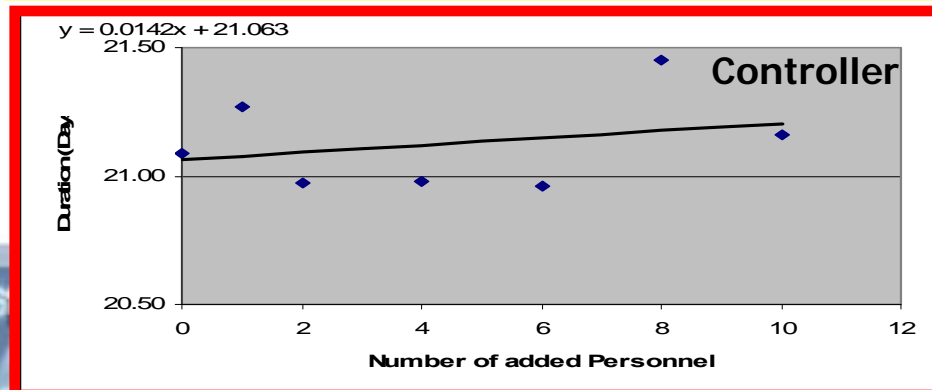
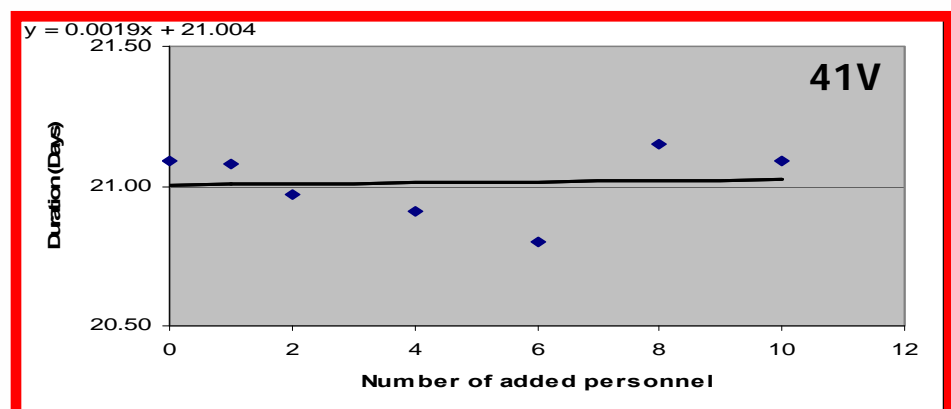
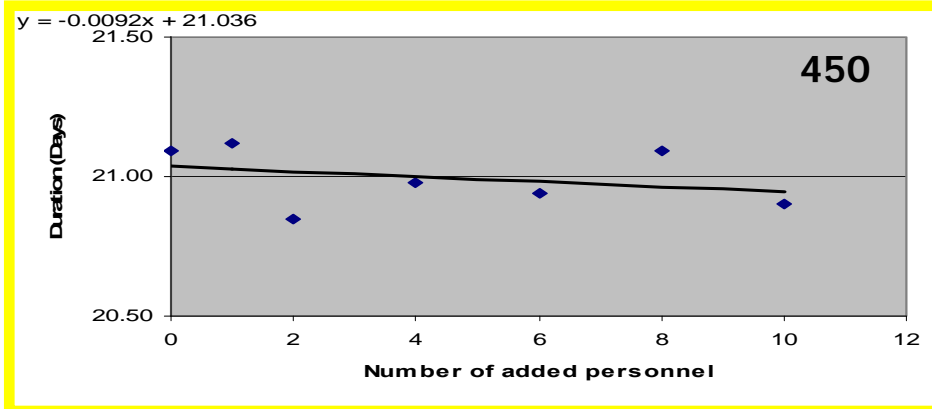
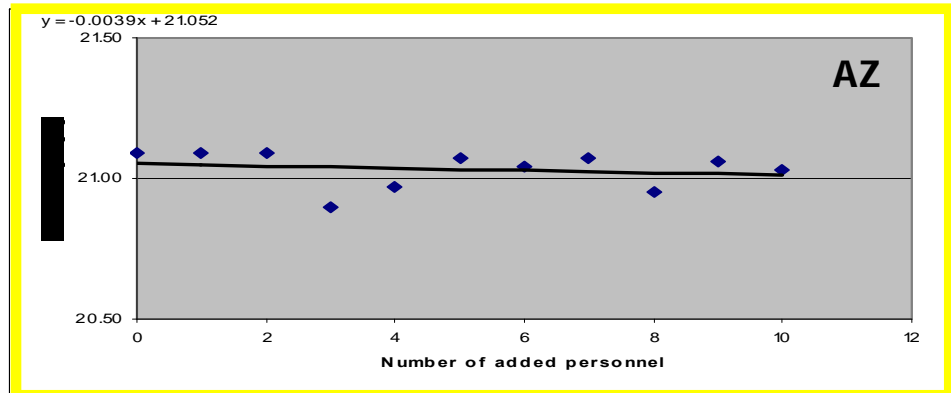
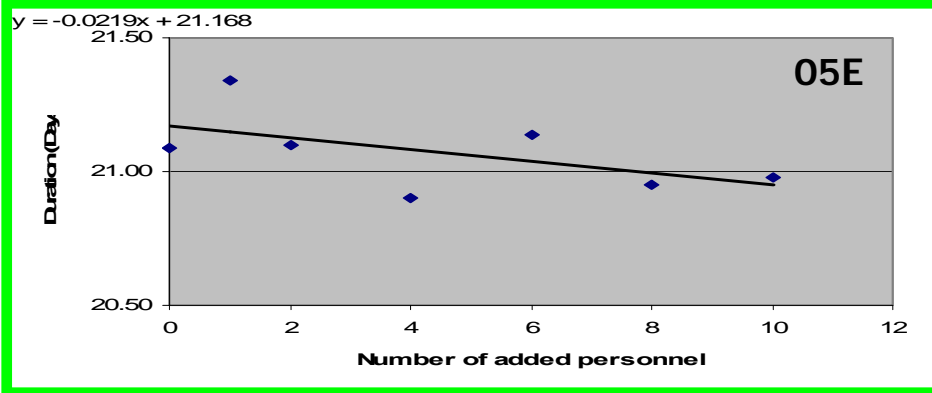
No Significant Impact

# Organizational Interventions

- #1 Parallel Acceptance process with all on-engine activities
- #2 Combine Controller & AZ positions
  - Without skill retraining
  - With skill retraining
- #3 Combine 41V and 450 Positions
  - Without skill retraining
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- #5 Adding Additional Personnel to Positions
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- #8 Combination of the best of #1 - #7

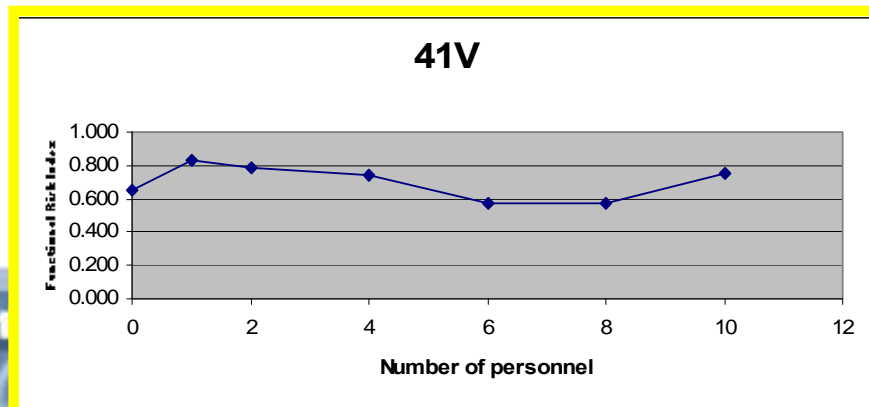
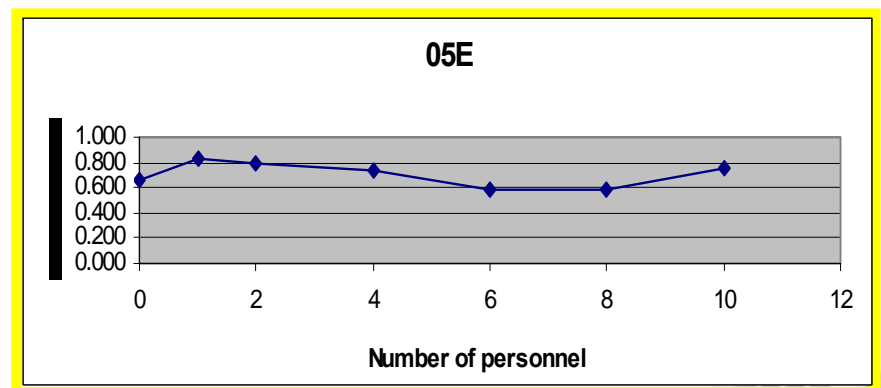
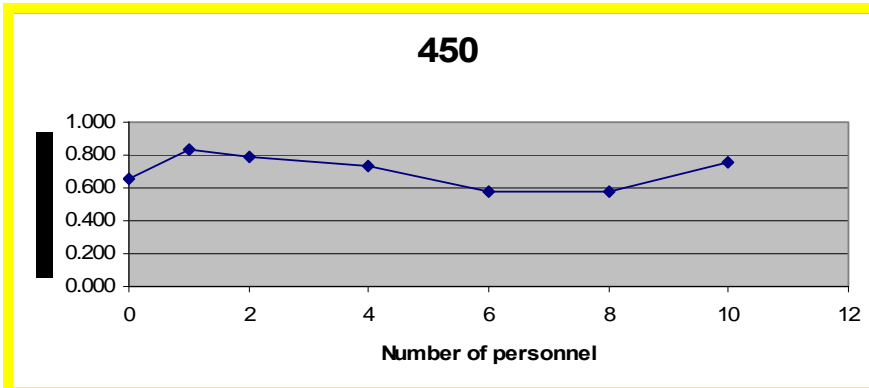
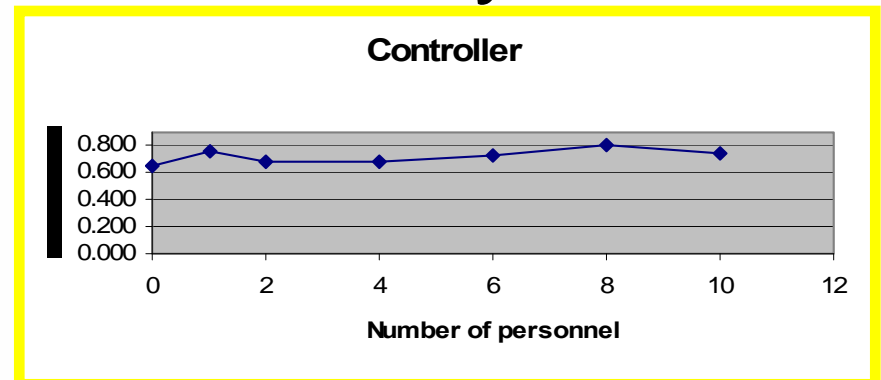
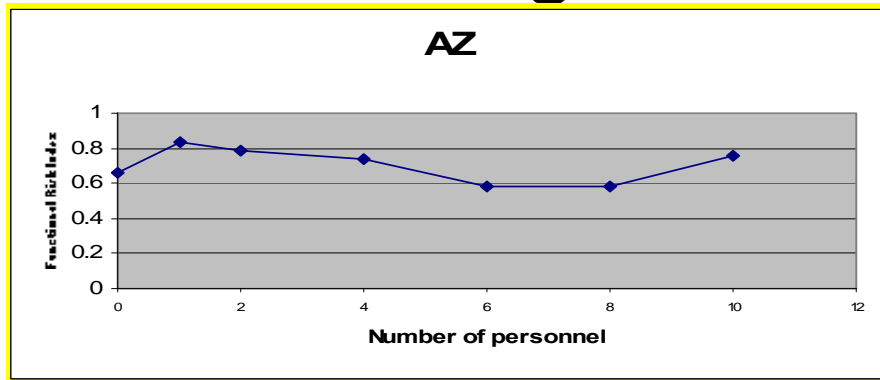


# Adding Personnel



Add Personnel to 05E:  
 Average duration rate of change with respect to additional personnel = 10.5 min / person  
 Additional personnel impact low since most tasks are "duration" tasks

# Adding Personnel-Risk Analysis



Adding personnel has no significant impact on the Functional Risk Index



# Organizational Interventions

- #1 Parallel Acceptance process with all on-engine activities
- #2 Combine Controller & AZ positions
  - Without skill retraining
  - With skill retraining
- #3 Combine 41V and 450 Positions
  - Without skill retraining
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- #4 Decreasing Centralization
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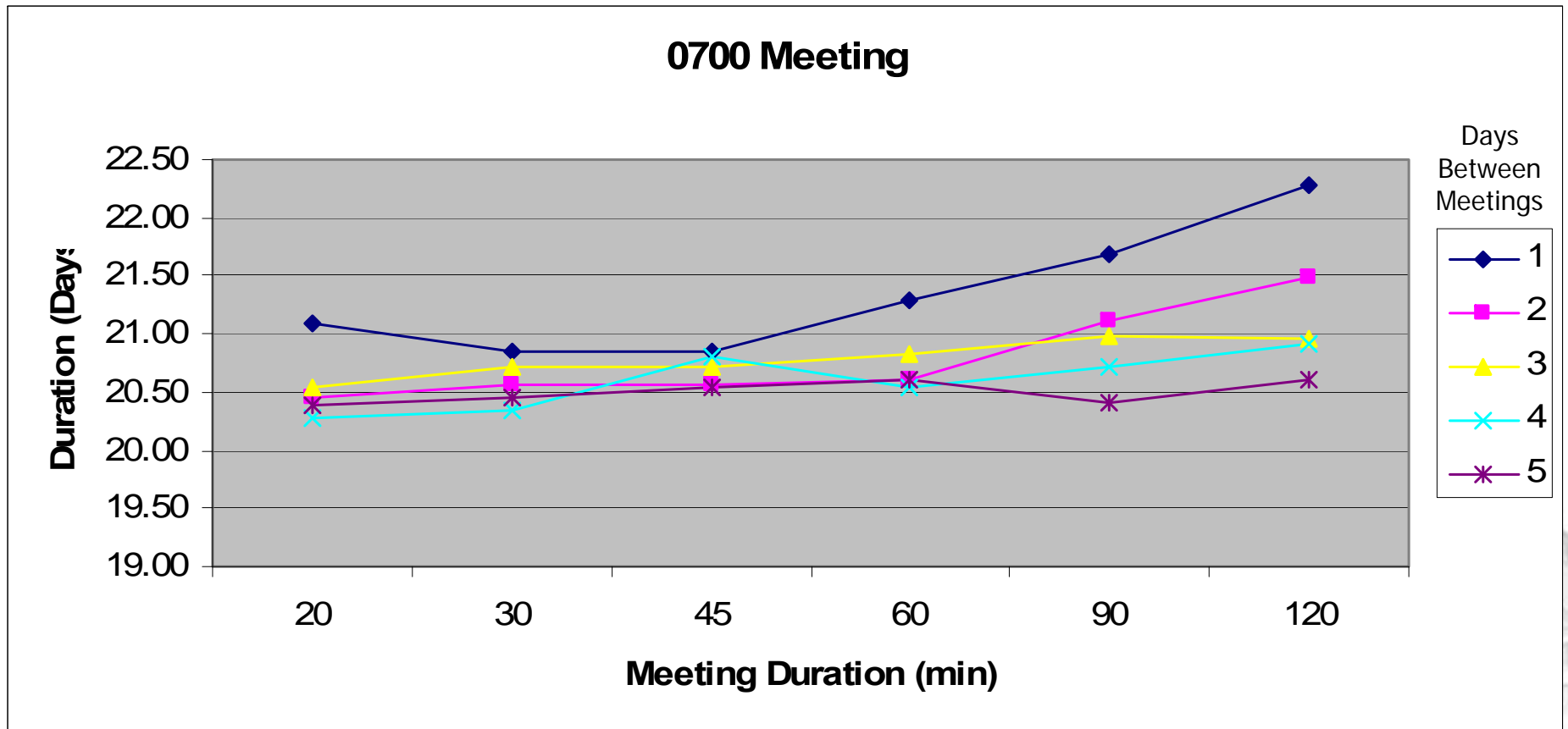


# Duration Impact - 0700 Mtg

Project Duration (Days)	Interval Between Meetings (Days)					
		1	2	3	4	5
Meeting Duration (Min)	20	21.09	20.46	20.53	20.27	20.39
	30	20.85	20.56	20.72	20.34	20.46
	45	20.85	20.56	20.72	20.80	20.55
	60	21.29	20.6	20.82	20.53	20.61
	90	21.69	21.12	20.98	20.72	20.40
	120	22.29	21.48	20.95	20.92	20.60

Shorter Duration/Less Frequency = Greatest Improvement: 0.84 days or 6.56 hrs

# Duration Impact - 0700 Mtg



Greatest benefits result from increasing time between meetings to greater than 1 day

# Duration/Risk Impact - 0700 Mtg

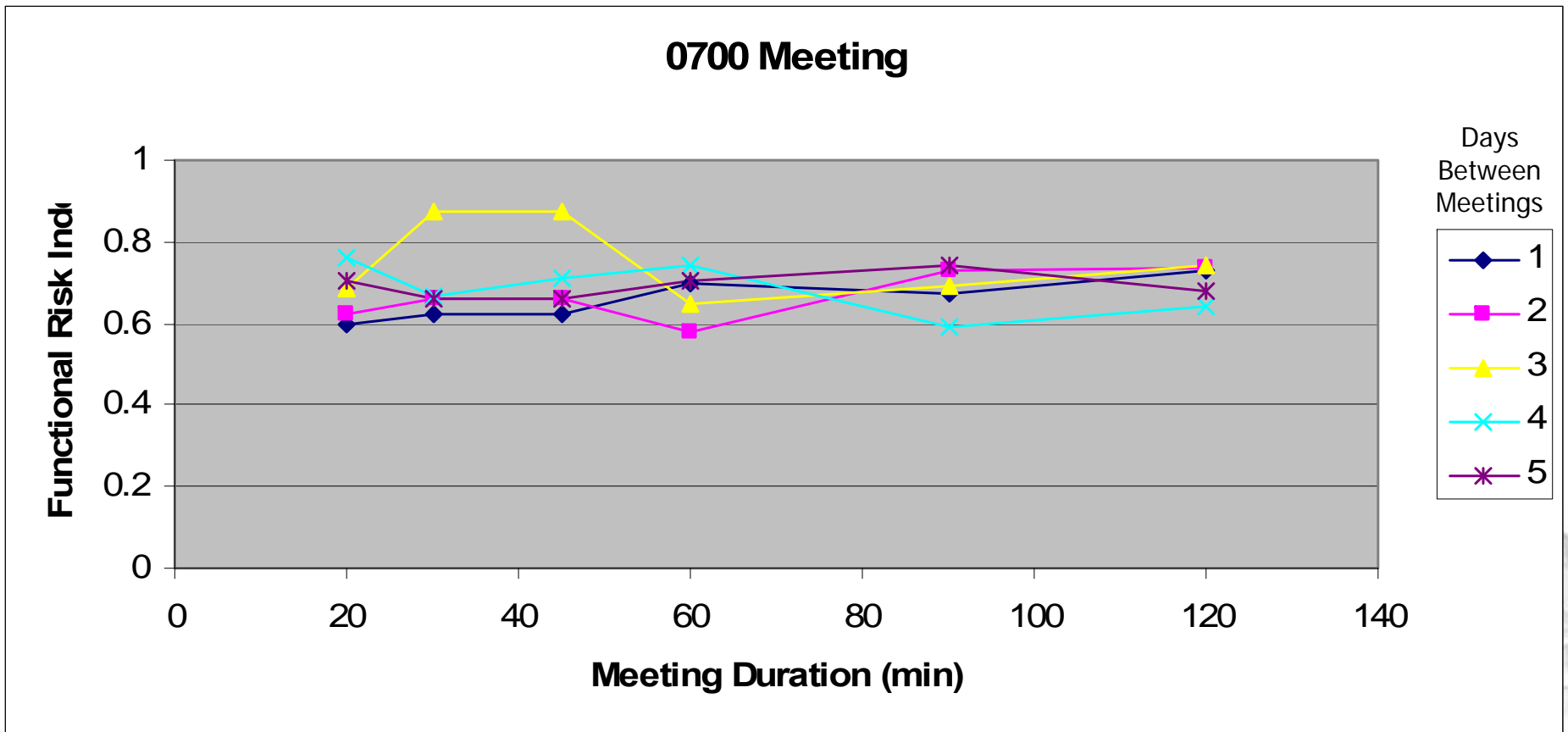
Project Duration (Days) Functional Risk Index	Interval Between Meetings (Days)					
		1	2	3	4	5
Meeting Duration (Min)	20	21.09 0.59	20.46 0.62	20.53 0.69	20.27 0.76	20.39 0.70
	30	20.85 0.62	20.56 0.66	20.72 0.87	20.34 0.67	20.46 0.66
	45	20.85 0.62	20.56 0.66	20.72 0.87	20.80 0.71	20.55 0.66
	60	21.29 0.70	20.6 0.58	20.82 0.65	20.53 0.75	20.61 0.71
	90	21.69 0.67	21.12 0.73	20.98 0.69	20.72 0.59	20.40 0.74
	120	22.29 0.73	21.48 0.73	20.95 0.74	20.92 0.64	20.60 0.68

No correlation between risk and meeting interval or duration





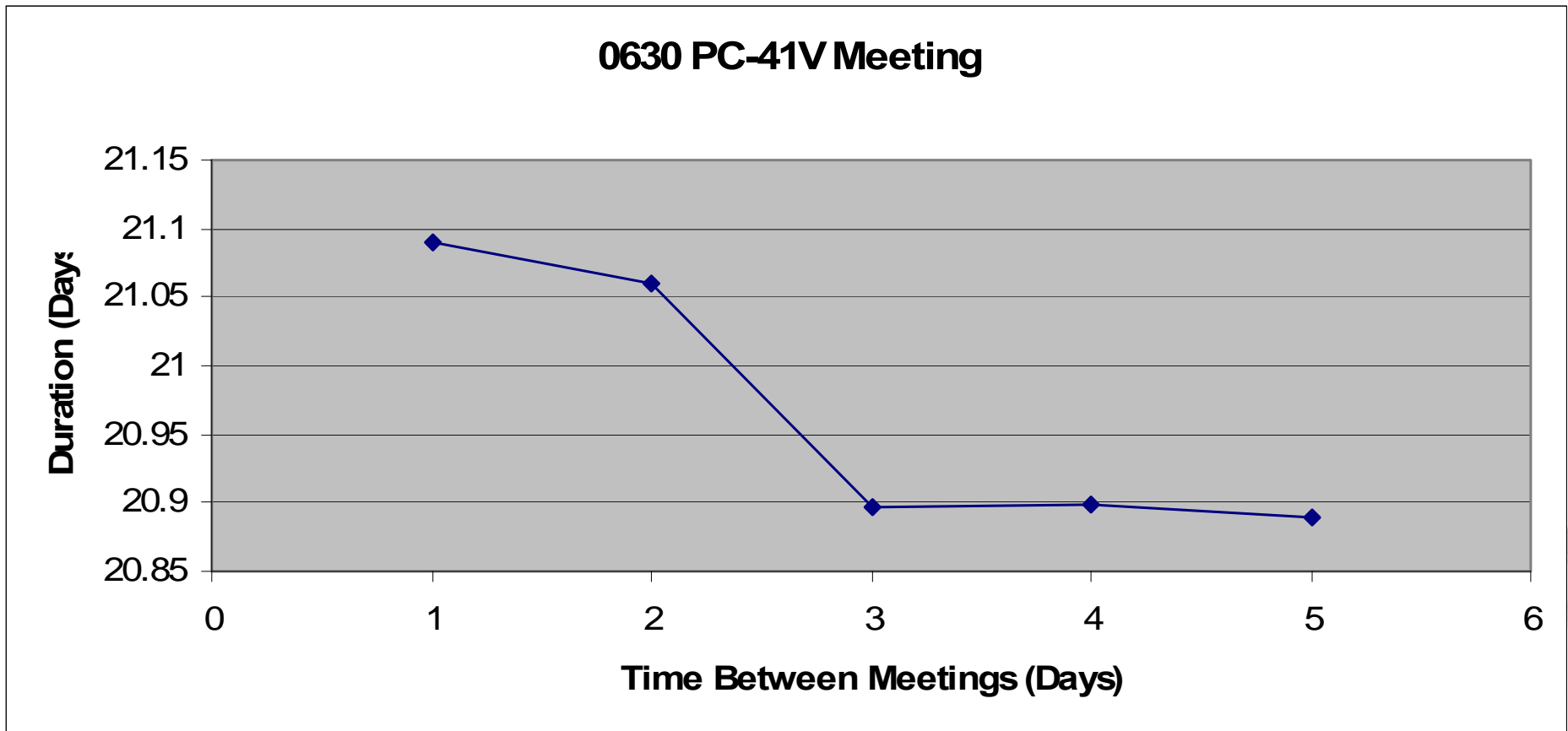
# Duration/Risk Impact - 0700 Mtg



No correlation between risk and meeting interval or duration

# Duration Impact - 0630 Mtg

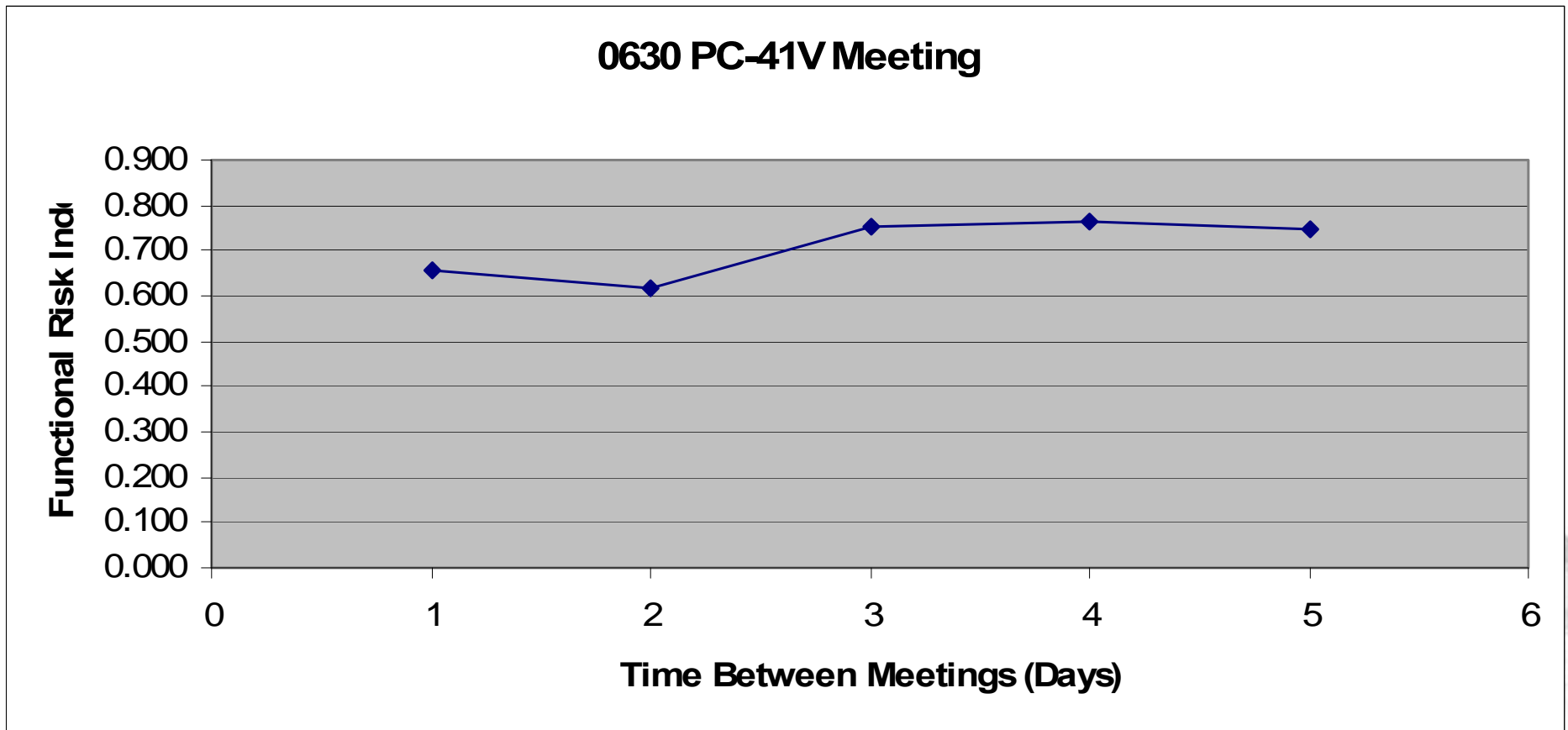
Meeting duration constant at 8 min



Greatest benefit from increasing time between meetings to greater than 2 days  
Max Benefit = 0.2 Days or 1.6 hours

# Duration/Risk Impact - 0630 Mtg

Meeting duration constant at 8 min



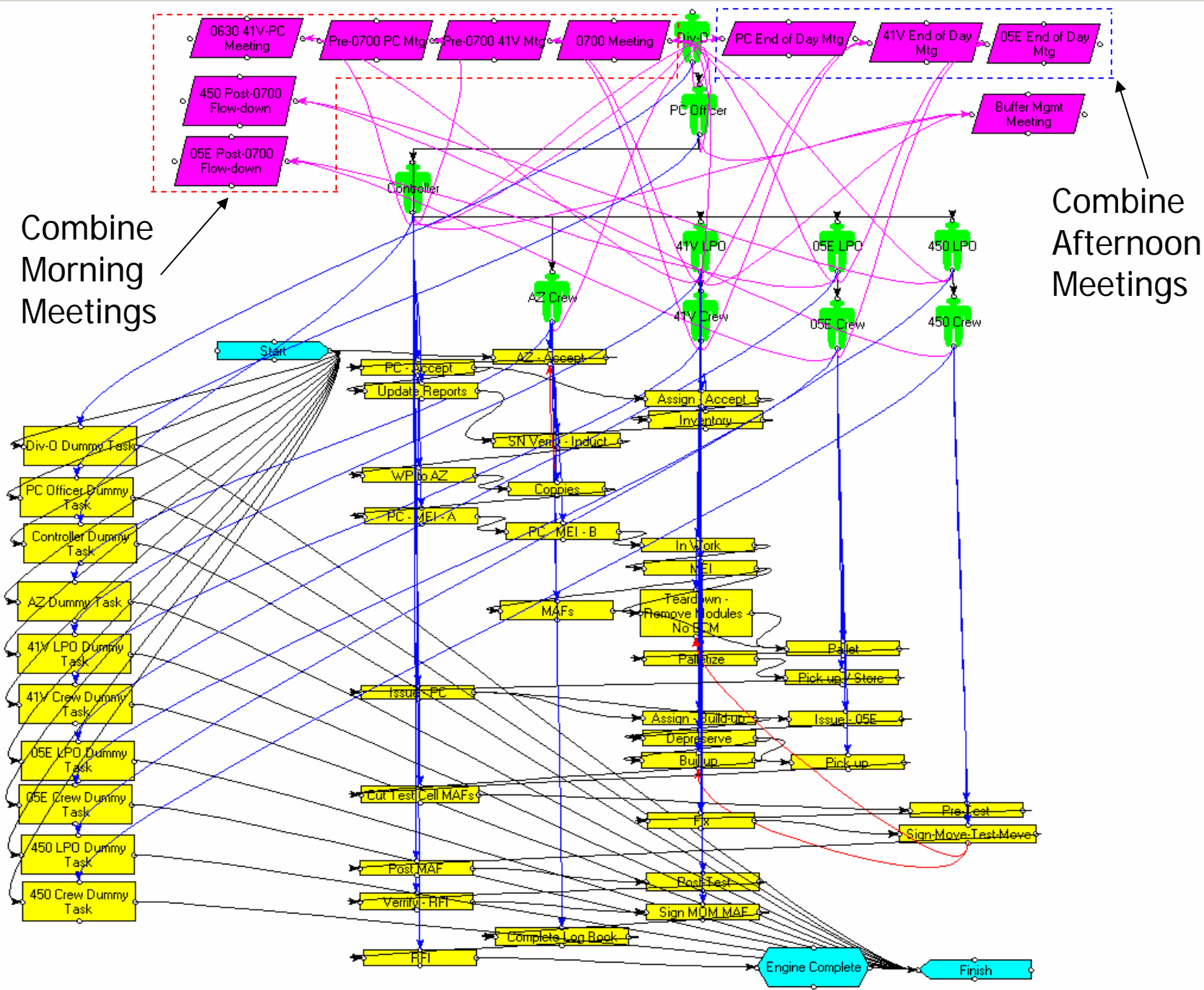
Slight increase in risk when increasing time between meetings



# Organizational Interventions

- #1 Parallel Acceptance process with all on-engine activities
- #2 Combine Controller & AZ positions
  - Without skill retraining
  - With skill retraining
- #3 Combine 41V and 450 Positions
  - Without skill retraining
  - With skill retraining
- #4 Decreasing Centralization
- #5 Adding Additional Personnel to Positions
- #6 Altering duration and frequency of meetings
- #7 Eliminating meetings
- #8 Combination of the best of #1 - #7

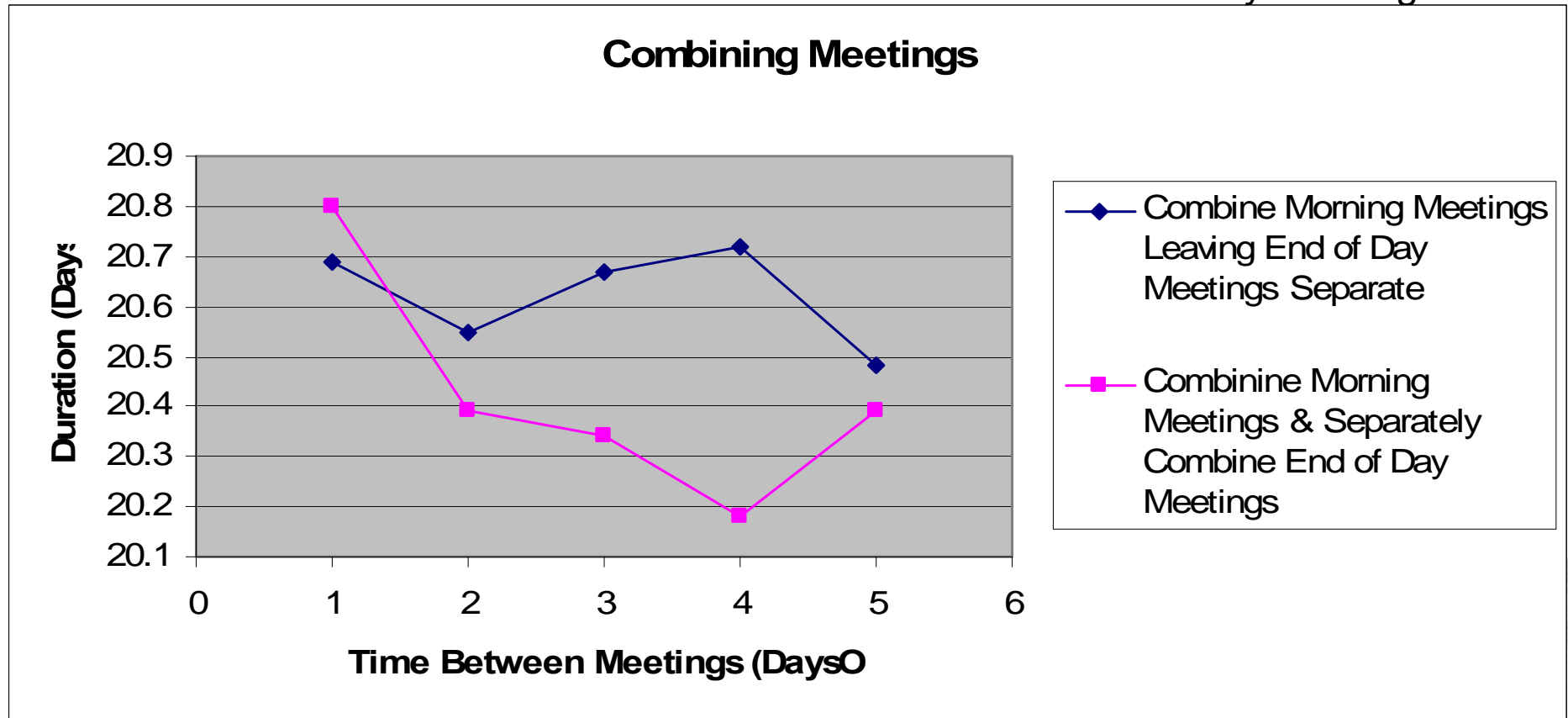




# Duration Impact - Combined Mtgs

Morning Meeting: 20 min

End of Day Meeting: 20 min



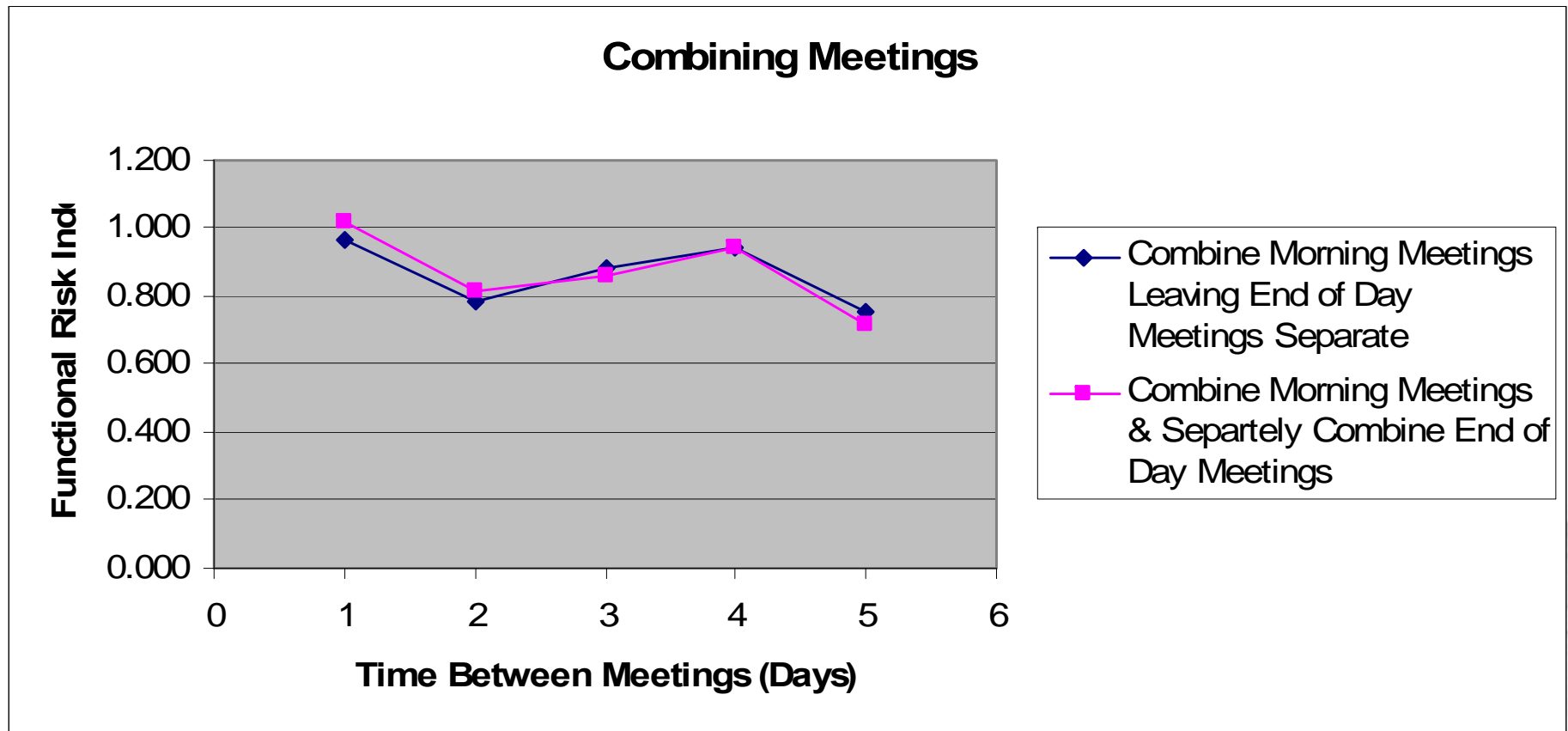
Greatest benefits result from separately combining morning and end of day meetings & increasing time between meetings to greater than 1 day

Max benefit = 0.91 Days or 7.28 hrs (relative to baseline of 21.09 days)

# Risk Impact - Combined Mtgs

Morning Meeting: 20 min

End of Day Meeting: 20 min

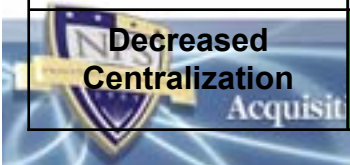


No significant impact to Functional Risk when combining meetings



# Summary - Single Intervention

Intervention	Affect On...			
	Project Duration	Backlog	Cost	Risk
Parallel engine acceptance	58.56 hour decrease	Decrease for most positions	No significant impact	Increase in AZ Acceptance task Risk
Combine Controller & AZ positions Without Training	110 hour increase	Decrease in Controller and AZ backlog. Increase in Div-O and PC backlog over time	AZ Acceptance task work and rework cost increase by 205.6 & 11.72 respectively	Increase in AZ Acceptance Task Risk
Combine Controller & AZ positions With Training	56.7 hour increase	Decrease in Controller and AZ backlog. Increase in Div-O and PC backlog over time	AZ Acceptance task work and rework cost increase by 140.1 & 4.18 respectively	Increase in AZ Acceptance Task Risk
Combine 41V & 450 positions Without Training	Not considered			
Combine 41V & 450 positions With Training	Not considered			
Decreased Centralization	4.4 hour decrease	No significant impact	Slight increase in Buildup task rework cost of 9.86	No significant impact





# Summary - Single Intervention

Intervention	Affect On Predicted Project Duration	Affect On Functional Risk
Add AZ Personnel	1.87 min saved / individual	No significant impact
Add Controller Personnel	6.82 min lost / individual	No significant impact
Add 41V Crew Personnel	0.91 min lost / individual	No significant impact
Add 05E Crew Personnel	10.51 min saved / individual	No significant impact
Add 450 Crew Personnel	4.42 min saved / individual	No significant impact
Vary 0700 meeting duration & frequency	Greatest benefit from Shorter Duration / Less Frequent meetings Greatest benefit = 6.56 hrs	No correlation between risk and meeting interval or duration
Vary 0630 Meeting frequency	Greatest benefit from increasing time between meetings to greater than 2 days. Max benefit = 1.6 hours	Slight increase in risk when increasing time between meetings
Combine Morning Meetings leaving End of Day meetings Separate	No significant impact	No significant impact to Functional Risk when combining meetings
Separately Combine Morning meetings and End of Day Meetings	Greatest benefit from increasing time between meetings to greater than 1 day Max benefit = 7.28 hrs	No significant impact to Functional Risk when combining meetings

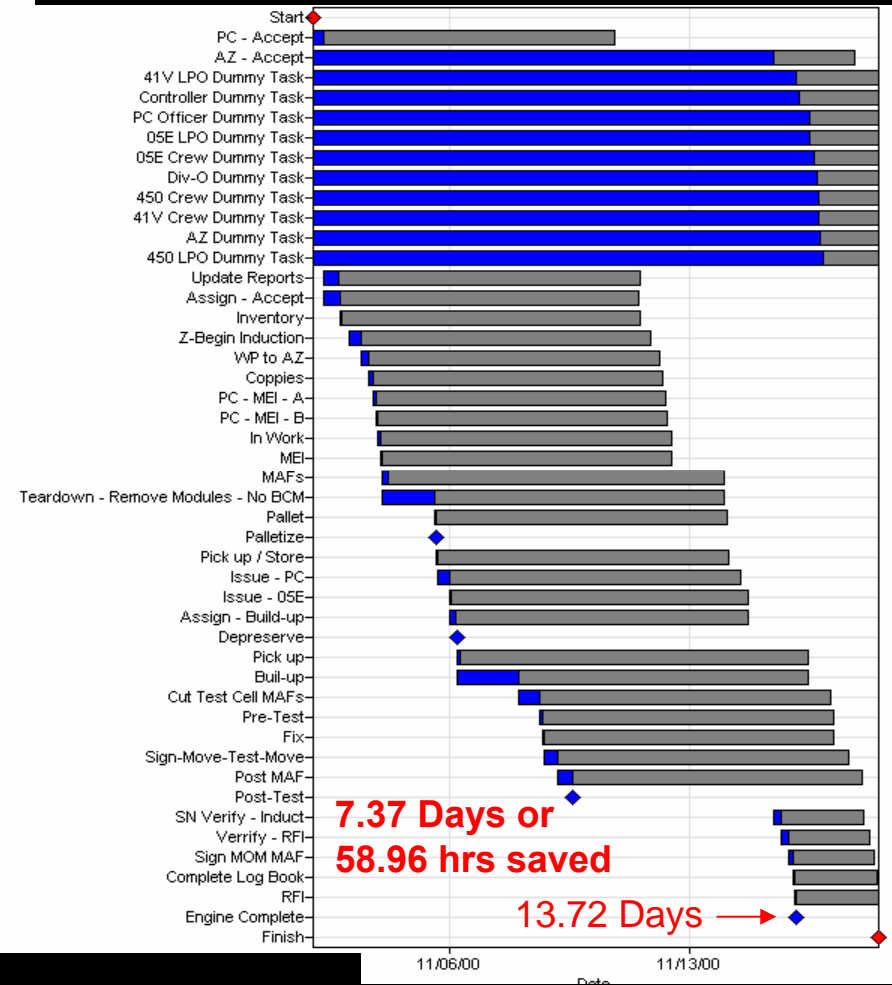
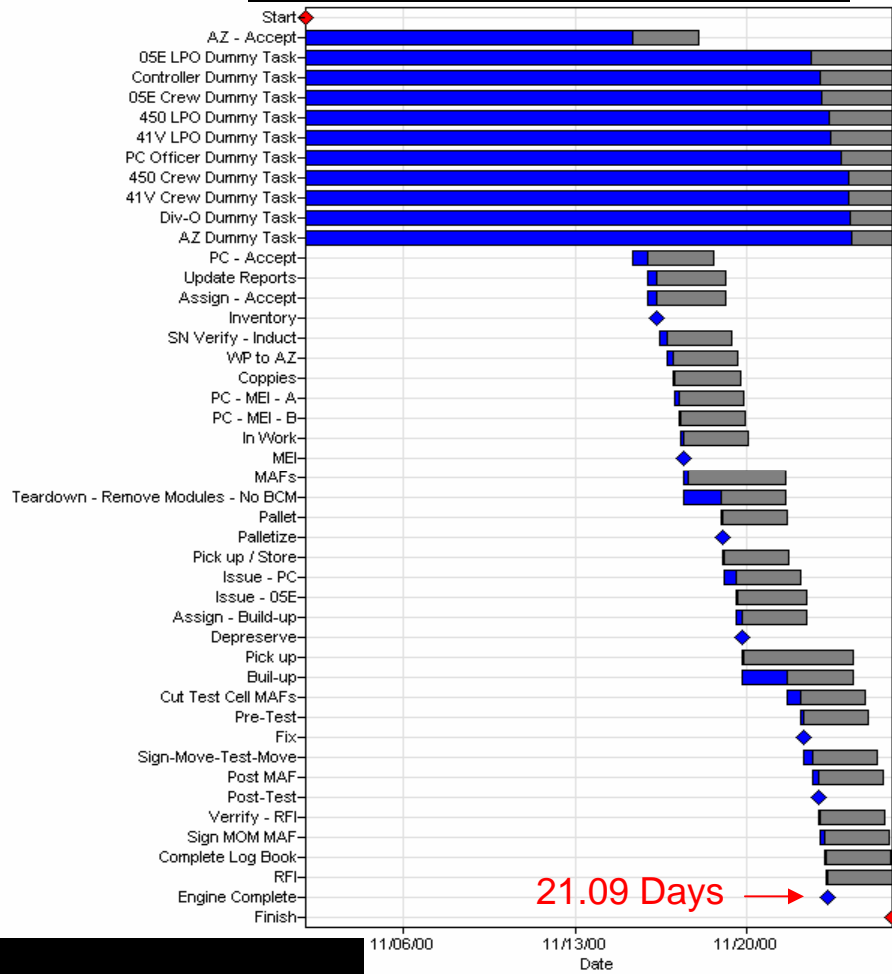


# Combined Interventions

- Parallel engine acceptance
- Decreased centralization
- Combine morning meetings
  - Time between meetings set to 2 days
- Combine end of day meetings
  - Time between meetings set to 2 days

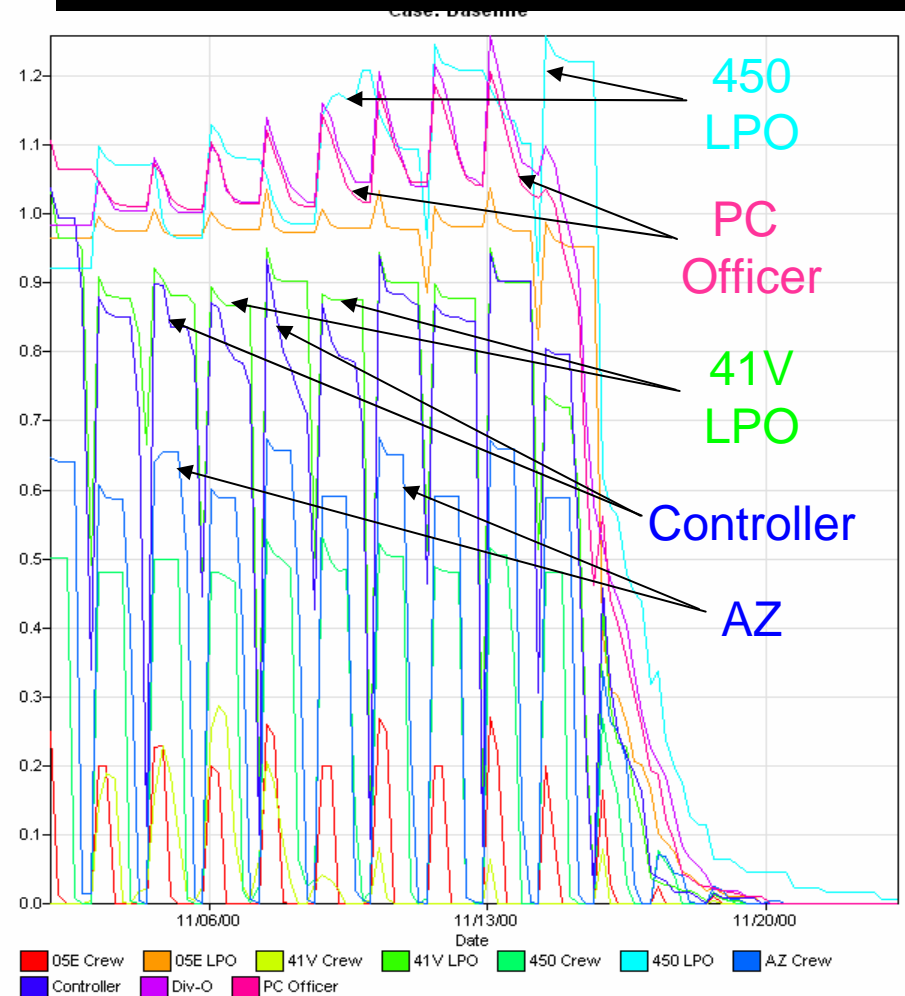
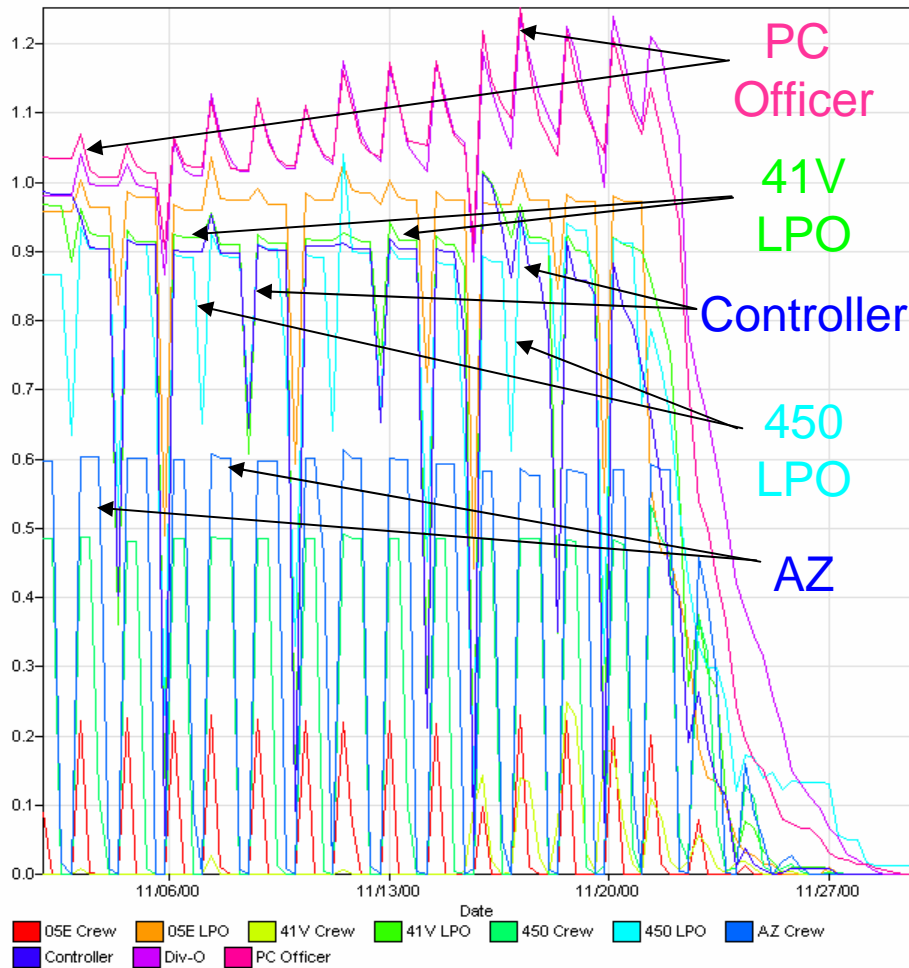


# Impact - Schedule



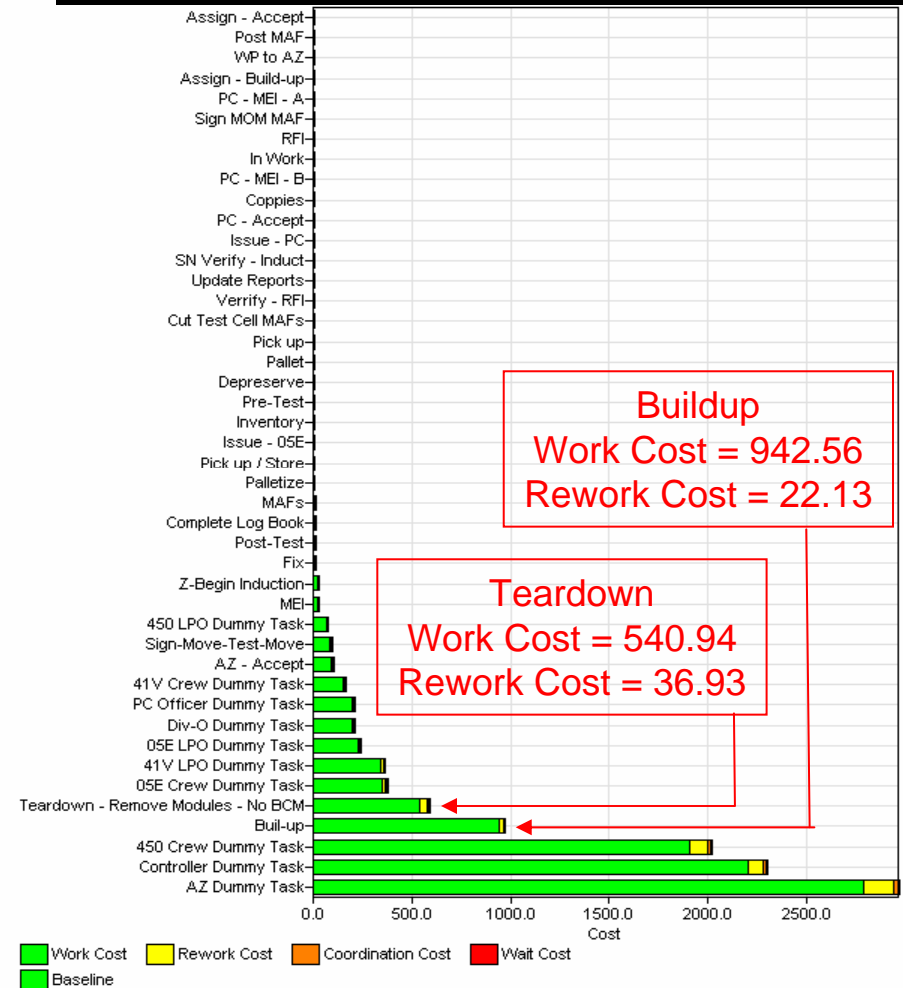
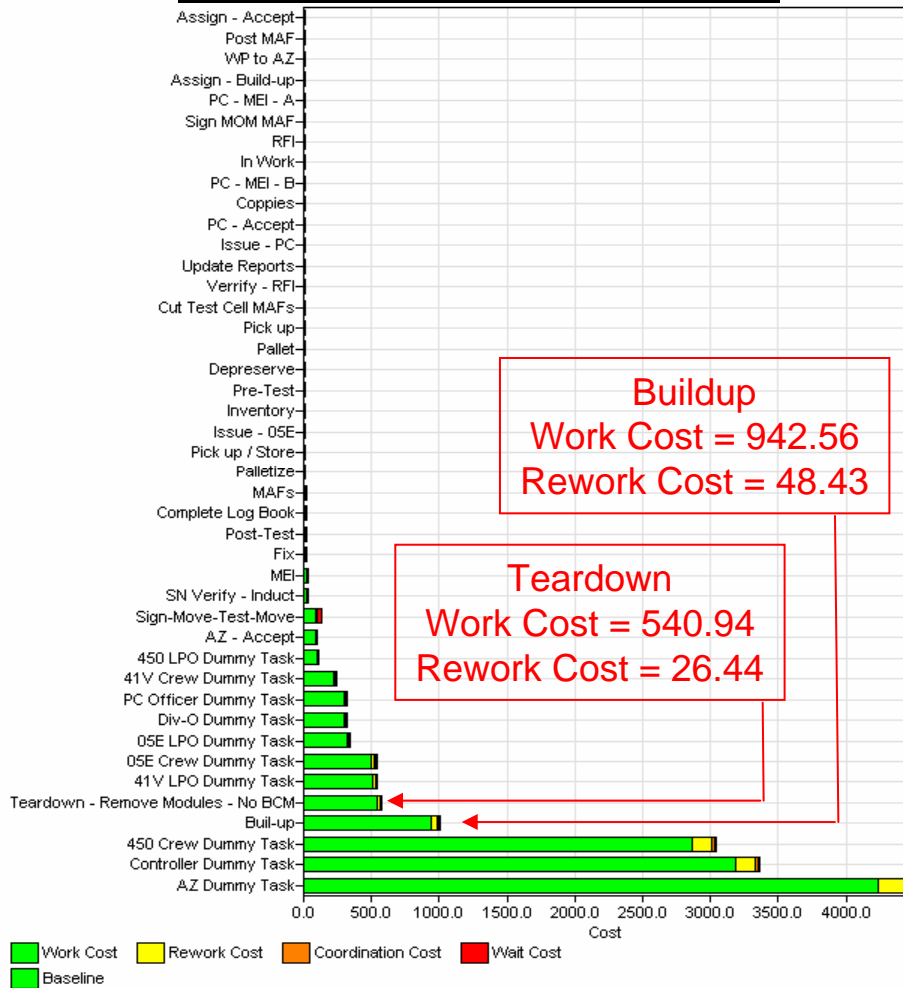
Decrease in schedule duration, driven primarily by Induction paralleling effort

# Impact - Backlog



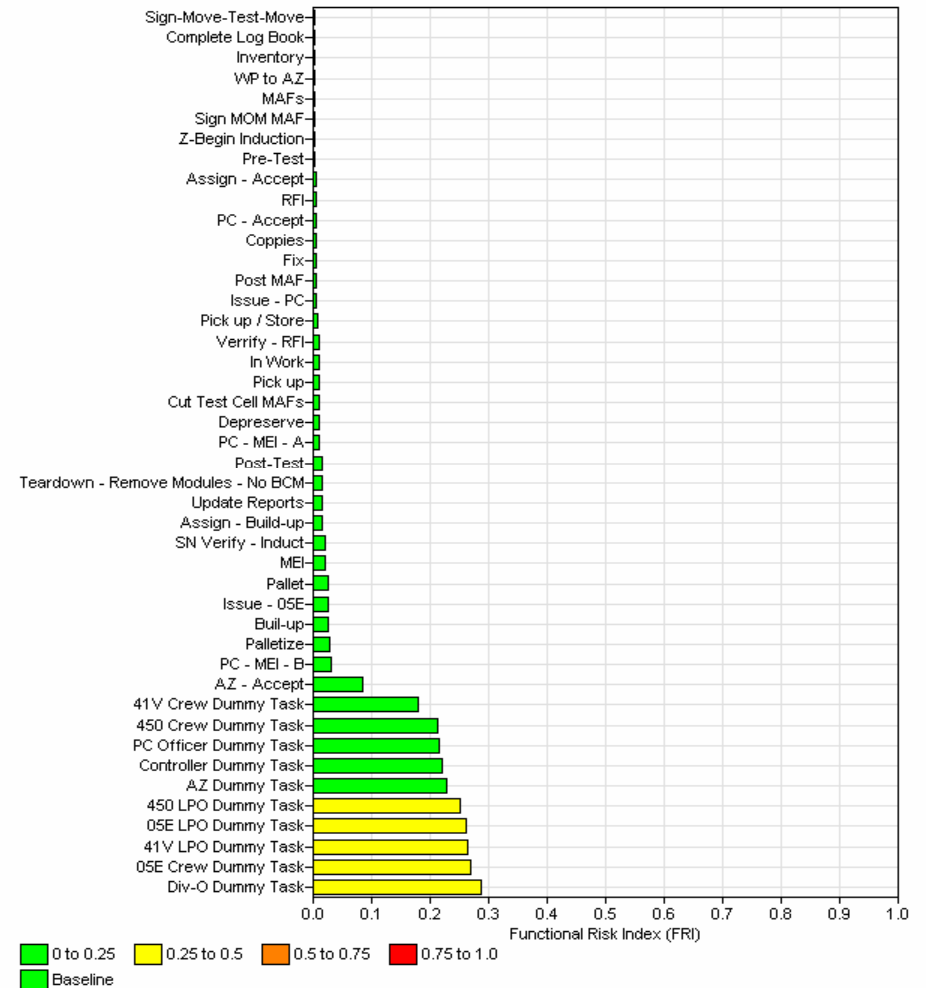
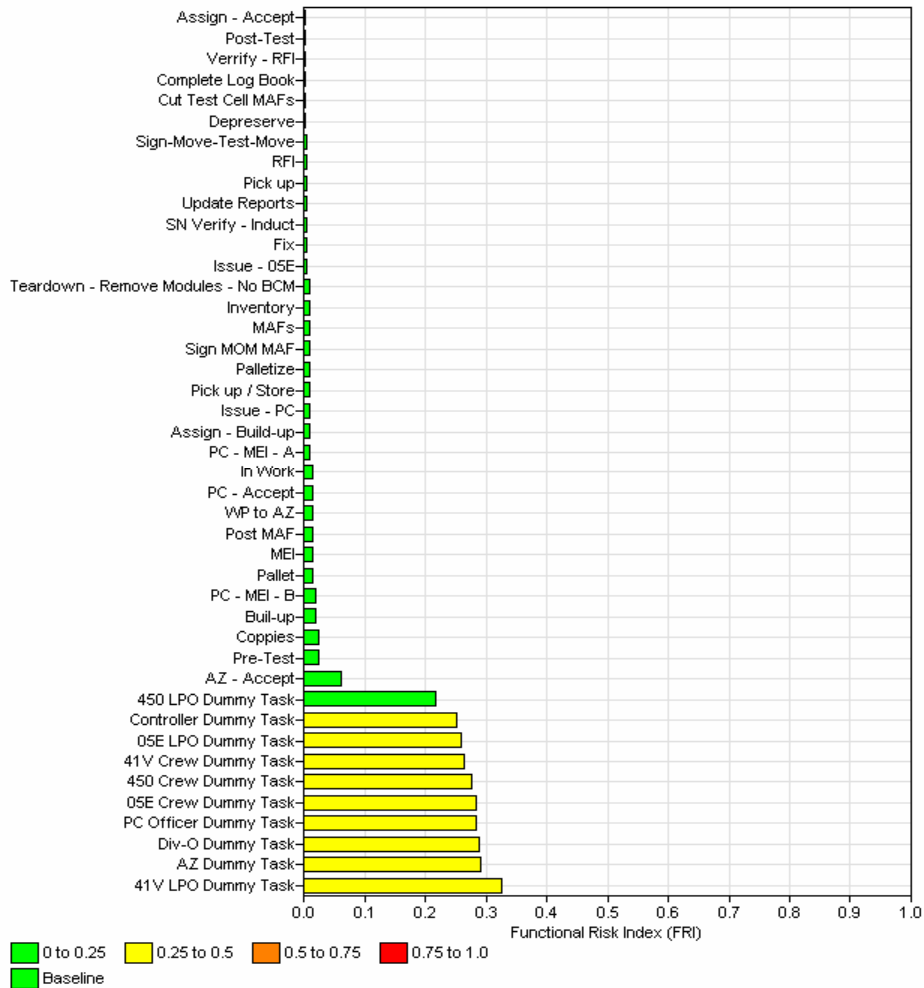
Backlog of most positions decrease. 450 LPO backlog increases

# Impact - Cost



Slight decrease in Buildup rework and slight increase in Teardown rework


# Impact - Task Functional Risk



No significant impact

# Combined Interventions

- Parallel engine acceptance
- Decreased centralization
- Combine morning meetings
  - Time between meetings set to 2 days
- Combine end of day meetings
  - Time between meetings set to 2 days

Intervention	Affect On...			
	Project Duration	Backlog	Cost	Risk
<b>Combined Interventions</b> 	58.96 hour or 35% decrease – Driven by acceptance paralleling effort	Backlog of most positions decrease. 450 LPO backlog increases	26.3 decrease in Buildup rework and 10.49 increase in teardown rework	No significant impact