TOC in Aerospace & MRO

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PRESENT: BUILDING ON SUCCESS 2017

BREAKTHROUGH RESULTS FOR GOVERNMENT AND BUSINESS

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TOC is all about improving **FLOW** in operations

"Improving FLOW is the Primary Goal of Operations"

Dr. Eli Goldratt

Operational Challenges in MRO

Fluctuating Demand / Workload

Varying work packages & TATs

Late adds, non-routine tasks, late findings

Parts not in shelf, long lead times to get parts

Vendor delays, Supply Chain issues

Competition for shared resources
(Inspectors, SM, NDT, Backshops, Hangar,….)

Competition for skilled resources
(Mech., Elec., Avionics,…)

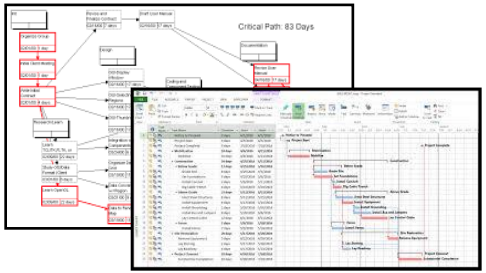
Customer delays, Engineering delays,…

Challenges in Aerospace Projects

Requirements change, Scope Creep

Timelines are aggressive

Tasks take longer than planned



Projects often start without clear requirements or sufficient staffing

Priorities change constantly, Priorities are often out-of-sync

Resources are not available when needed

Several issues are discovered during integration & testing

Multiple iterations occur before design is frozen

Exercise

A	1	△
B	2	□
C	3	○
D	4	△
E	5	□
F	6	○
G	7	△
H	8	□
I	9	○
J	10	△
K	11	□
L	12	○
M	13	△
N	14	□
O	15	○
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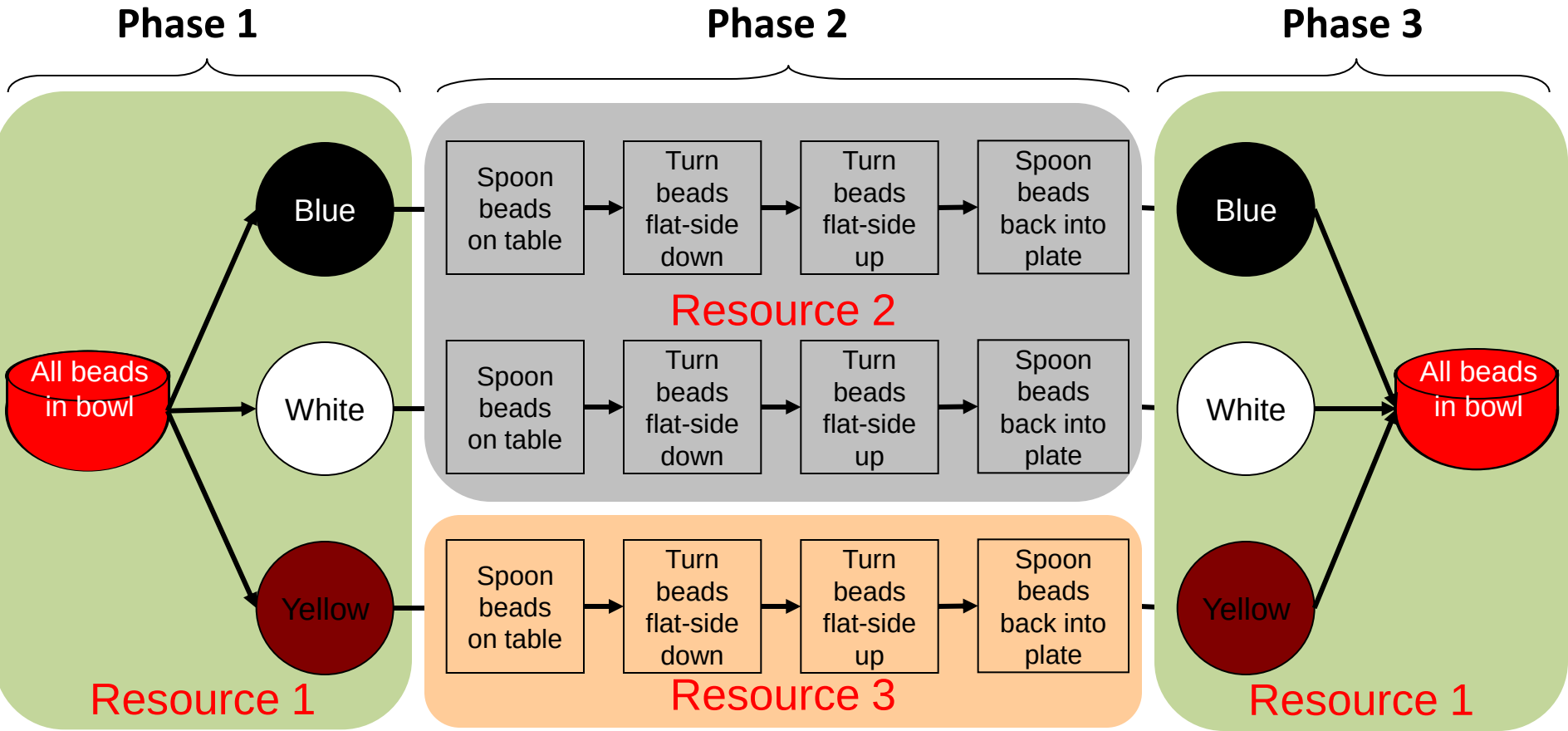
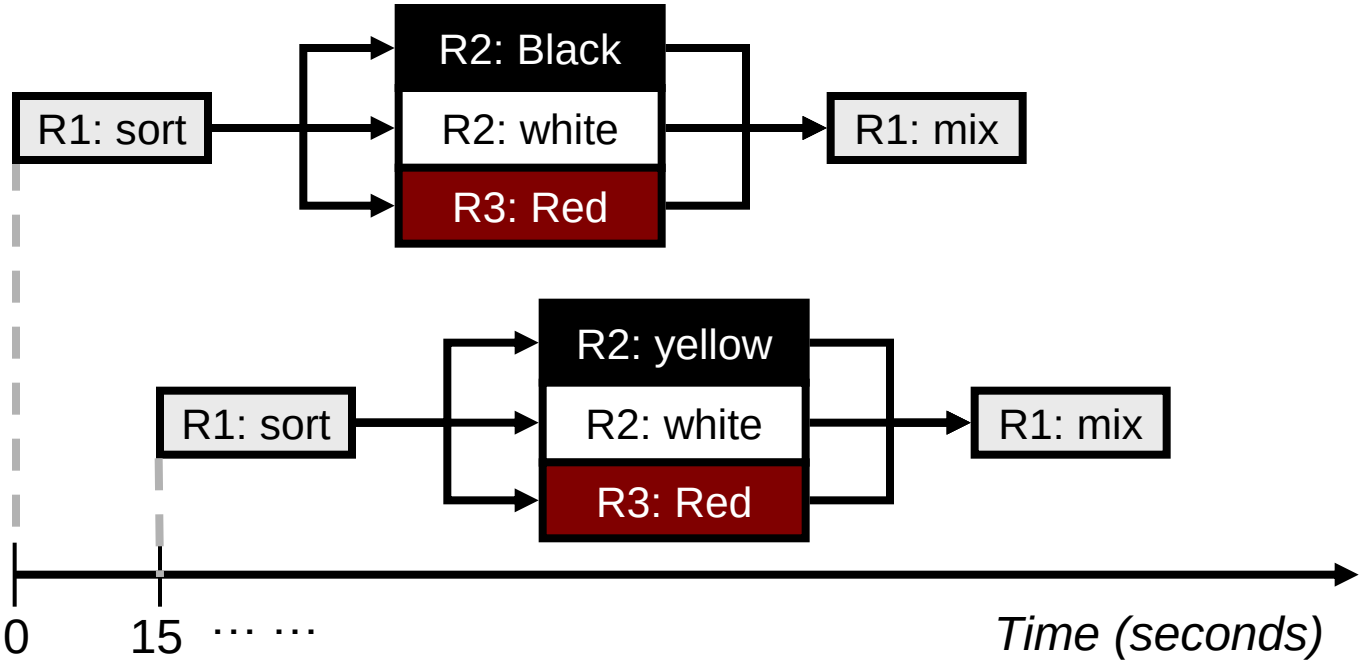
Bead Simulation



Bead Simulation – Round 1

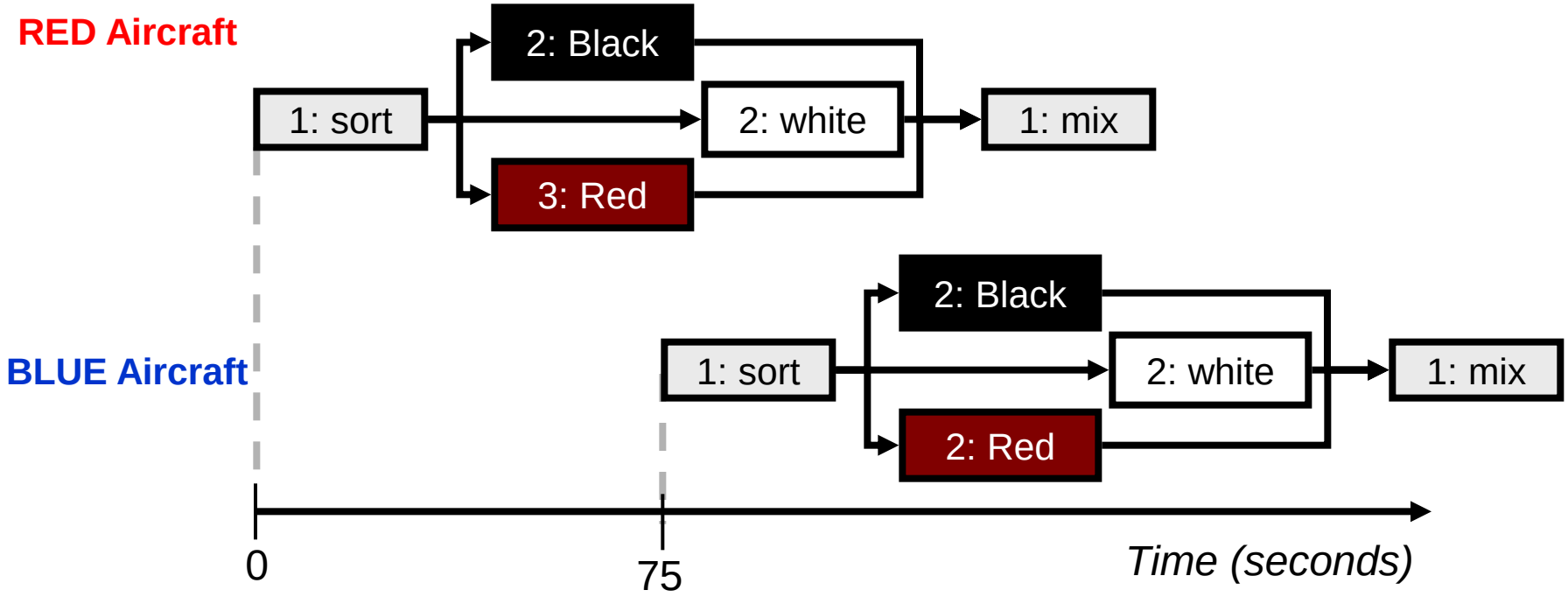
RED Aircraft

BLUE Aircraft



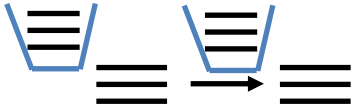
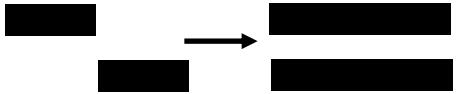
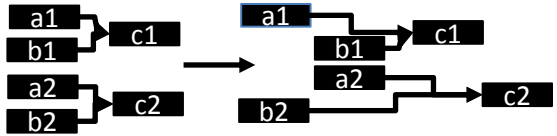
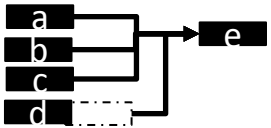
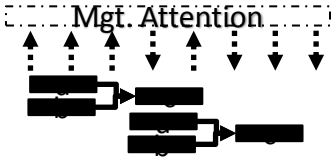
- The Blue aircraft comes 15 seconds after Red aircraft
- Resources must switch between aircrafts every 3 moves
- Aircraft Manager must keep resources focused on their aircraft
- A phase can only start after previous phase is completed

Bead Simulation – Round 2

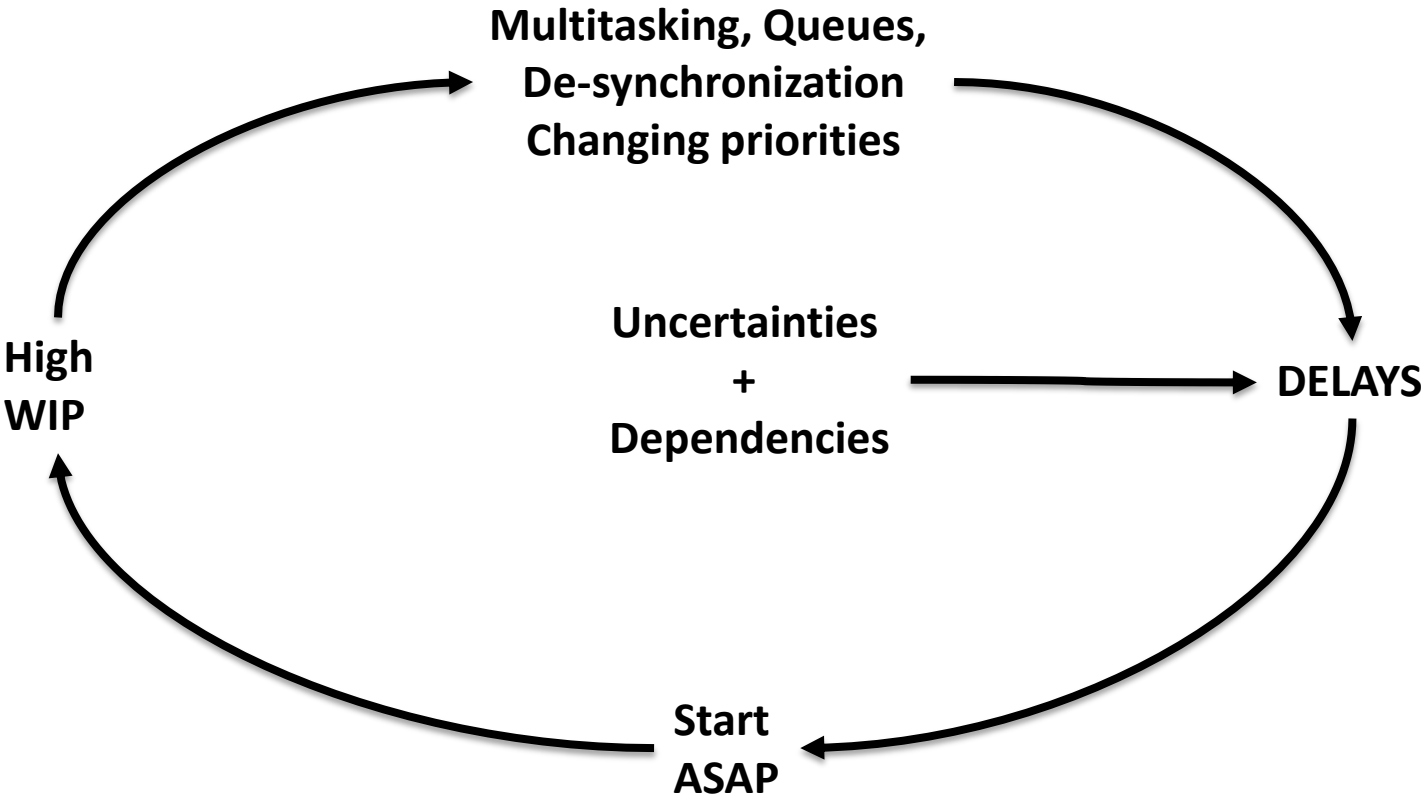


- Release Blue aircraft 75 sec after start of Red aircraft
- Resources finish Red aircraft work before Blue aircraft
- Aircraft Manager must keep resources focused on their aircraft
- A phase can only start after previous phase is completed

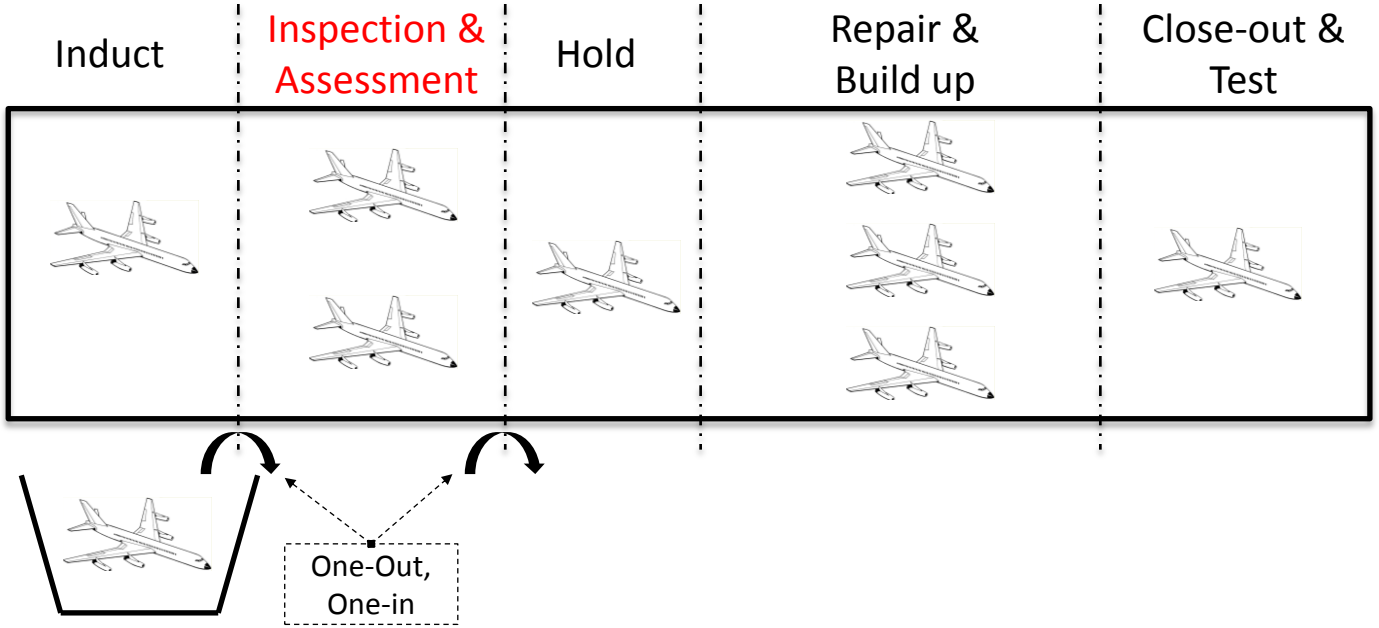
Impact of High WIP

Effects	How	Losses	Implications
Multitasking		• Switching (setup) cost • Wait time	• Low Productivity (Low T) • Long Cycle time
Queues		• Wait time	• Long Cycle time (slower response time)
Spreading thin		• Wait time for downstream resources	• Long Cycle time
De-sync		• Wait times • Peaks and valleys	• Low Productivity (Low T) • Long Cycle time • Lack of priority, Expediting
Integration points		• Wait times • Peaks and valleys	• Low Productivity (Low T) • Long Cycle time • Lack of priority, Expediting
Management / Experts Multitasking		• Wait times due to slow decision making • Rework	• Low Productivity (Low T) • Long Cycle time • Lack of priority, Expediting

Cause & Effect



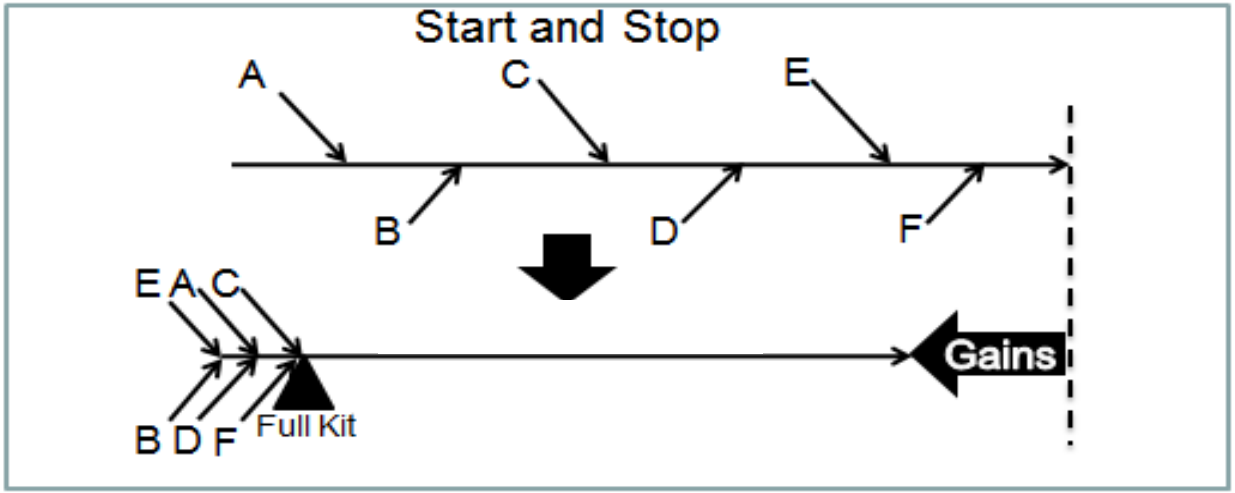
Operating under **Low WIP**



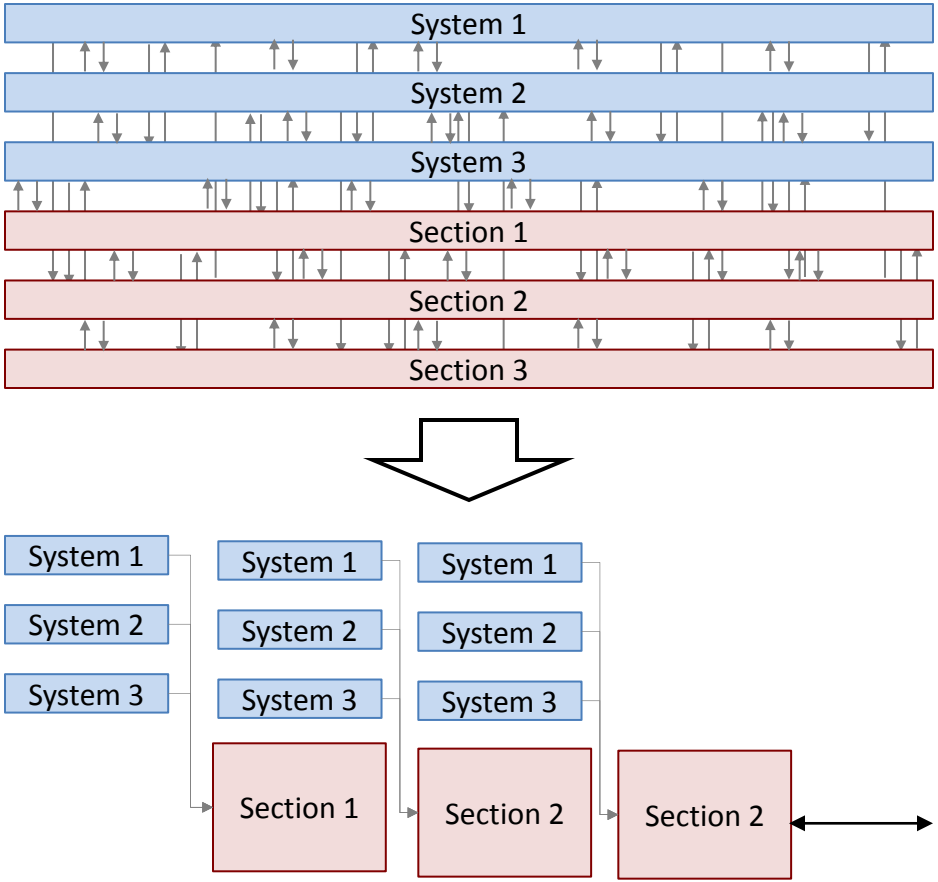
1. Identify constraint (pacing) phase
2. Set maximum work-in-process (WIP) limit & follow 1-out, 1-in rule
3. Concentrate Resources on fewer aircraft
4. **Full Kit** before releasing work

Full Kit

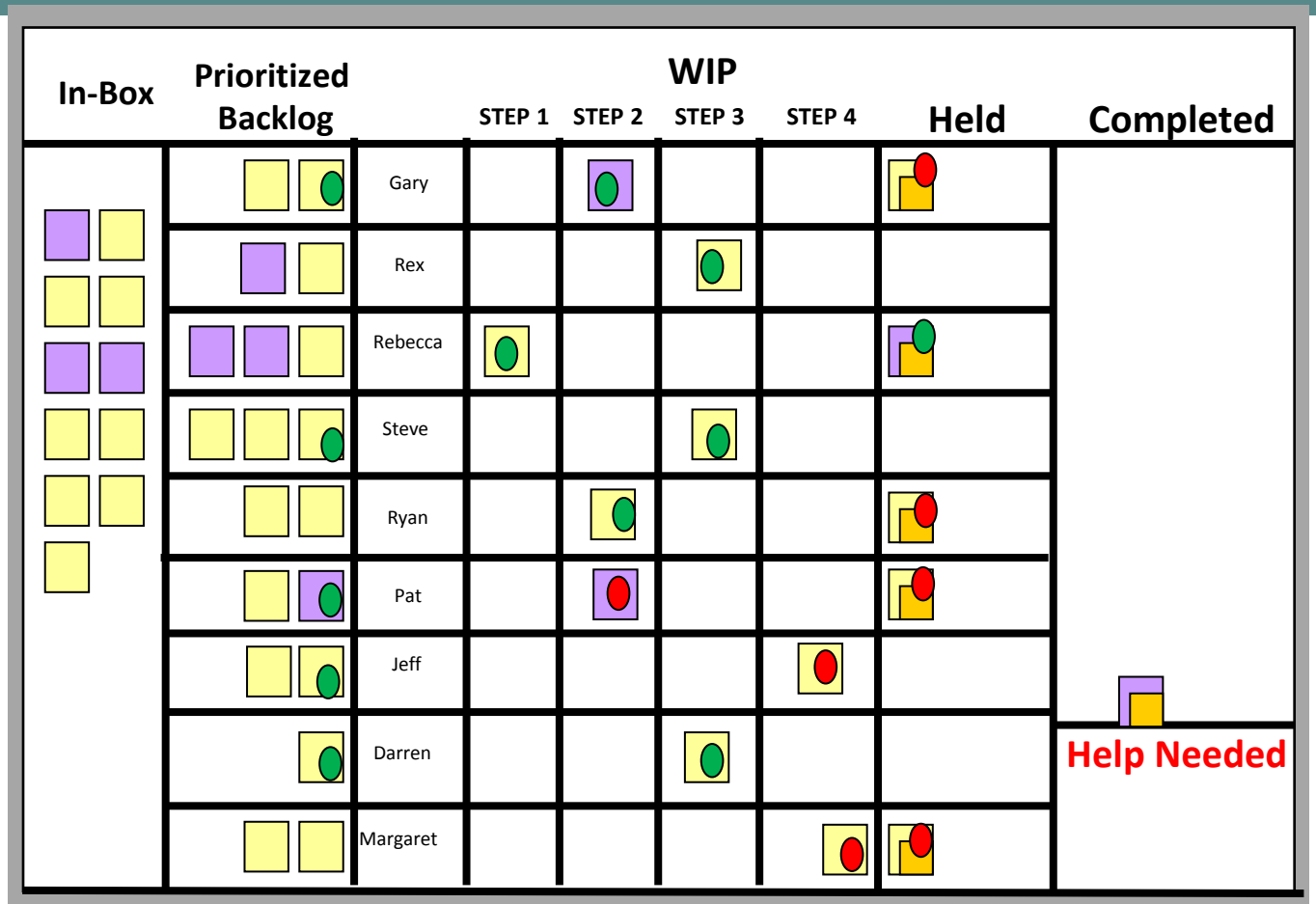
Ensure full preparation of parts, resources, specifications, work package, tech. documents, etc. for the work



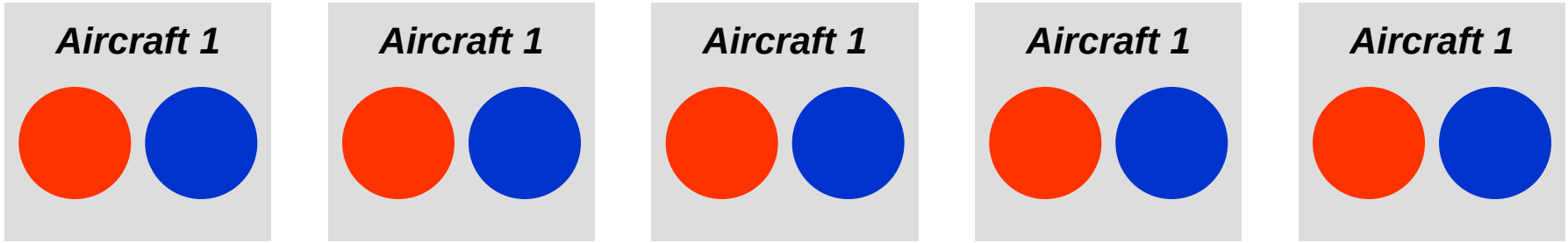
LOW WIP at a Program Level

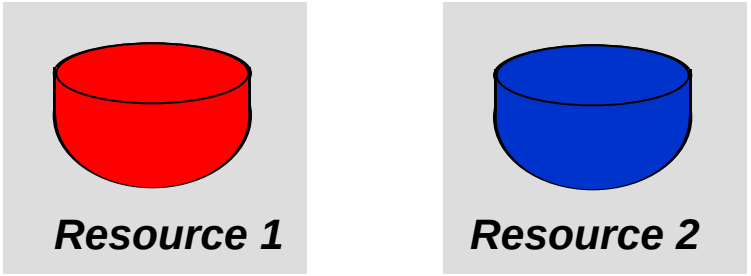


LOW WIP at a Team Level



Exercise





1. Put 21 beads each in the red and blue bowl
2. Each aircraft gets a crew of 9 resources
3. Aircraft that run short of either resource are late
4. Each supervisor is measured to on-time delivery

Typical Supply Chain Problem

Need to protect Sales
Shortages are painful!
More Inventory!!

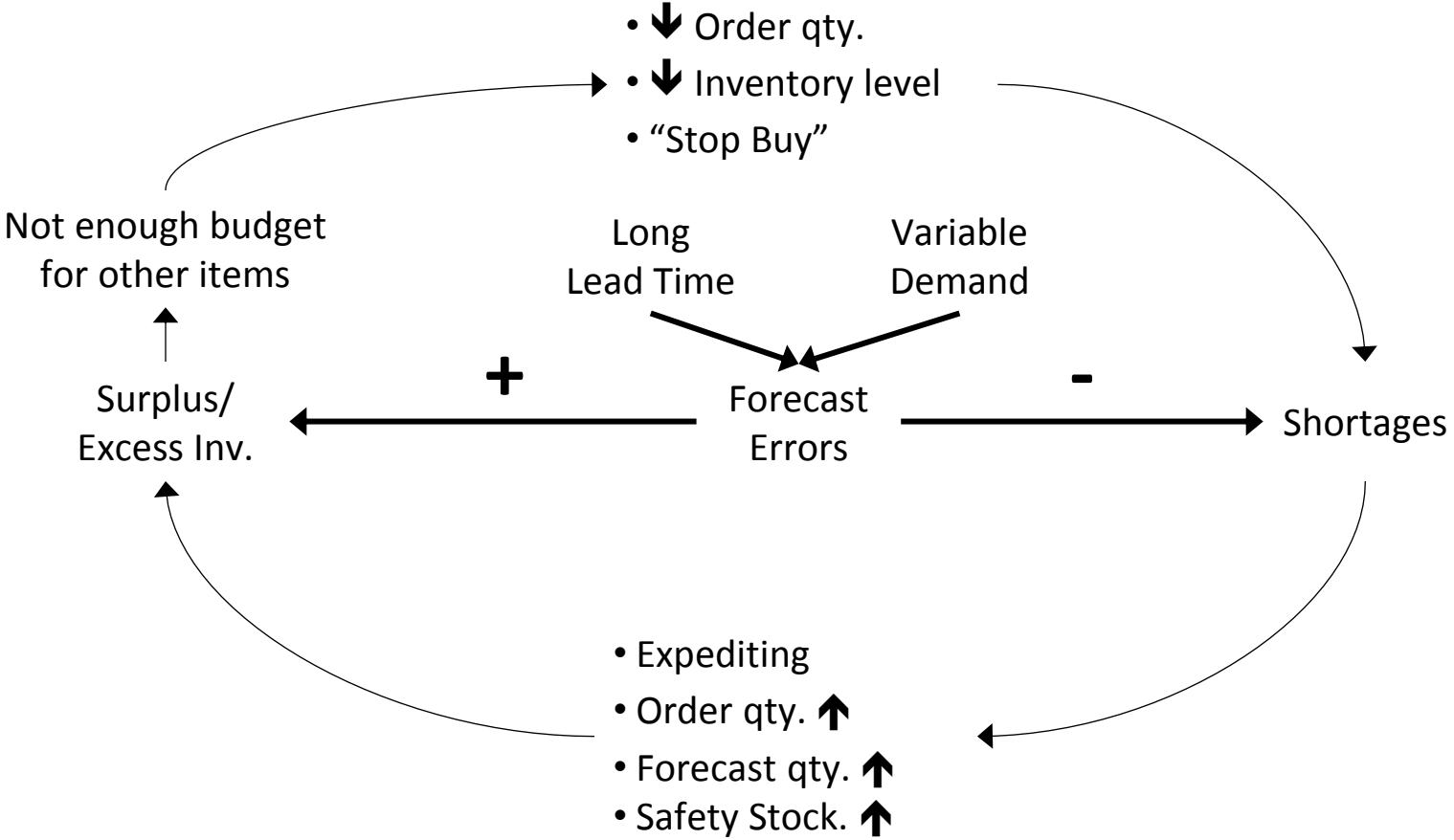
Need to control budget/costs
Surpluses are painful
Less Inventory!!

Both shortages and surpluses are a challenge

Business Objective

How to reduce inventory without impacting operations (maintain / improve parts availability)

Cause & Effect



Typical Initiatives

- Investment in forecasting tools
- Investment in inventory visibility and tracking
- Introduce many metrics

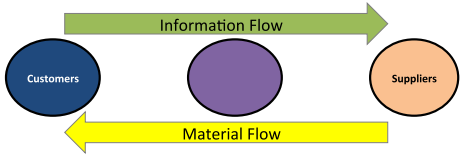
Traditional Approaches vs. TOC

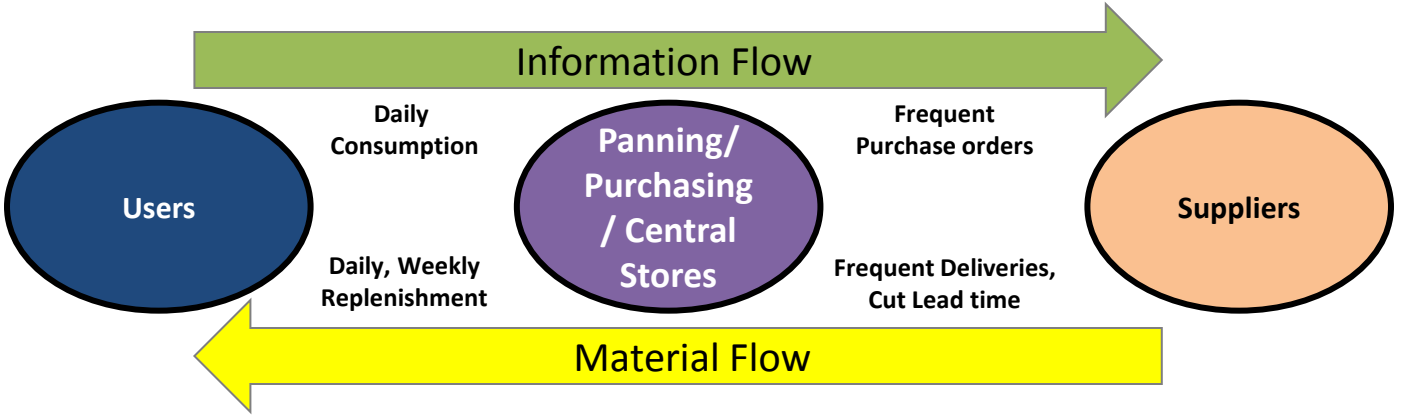
Traditional Approach:

1. Improve Forecast Accuracy
2. PUSH Inventory to Customer

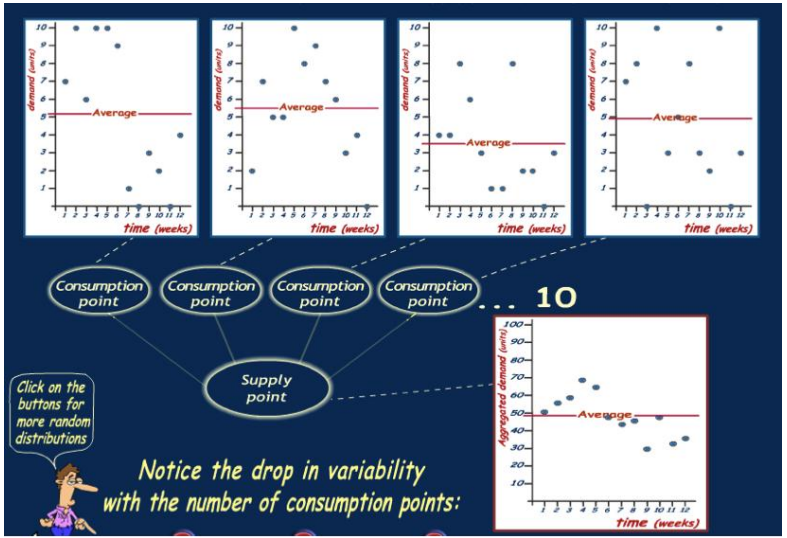
TOC Approach:

1. Improve FLOW
2. PULL based on consumption





1. Inventory Aggregation at Central Warehouse



- Lower inventory (can reallocate $s)
- Better parts availability (inventory in the right place)
- Reduced trans-shipments
- Better tracking of Inventory

2. Daily Ordering & Frequent* Replenishment

* Daily, Weekly, bi-weekly, monthly

Usage Locations

1 wk. stock

1 wk. stock

1 wk. stock

1 wk. stock

Daily Usage Info

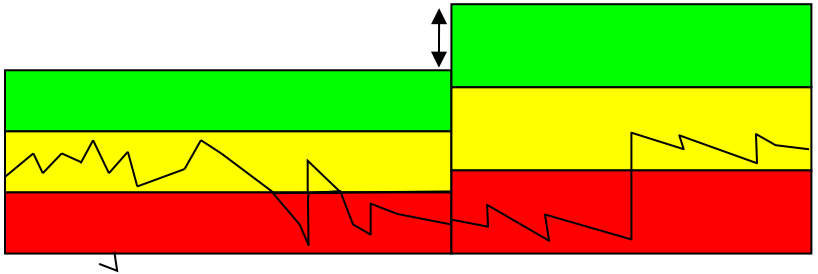
Freq. Replenishment

Central / Regional Warehouse

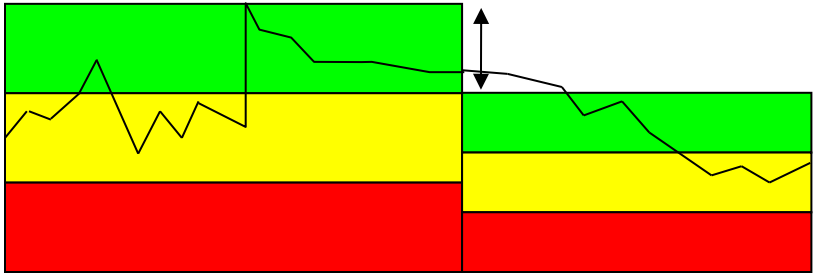
Lead times stock

3. Auto. Inventory Adjustment based on Consumption

1. Increase in usage:
   - Increase buffer zone by 1/3rd
   - One time replenishment of 1/3rd buffer



2. Decrease in usage:
   - Decrease buffer zone by 1/3rd
   - Do not replenish until stock dips to yellow



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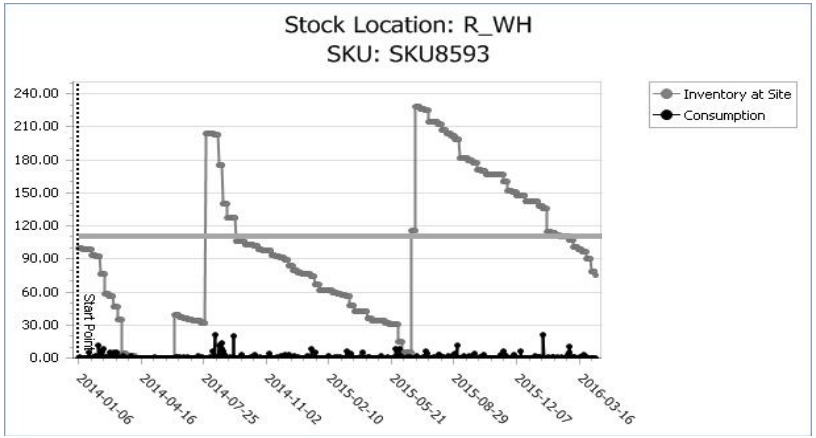
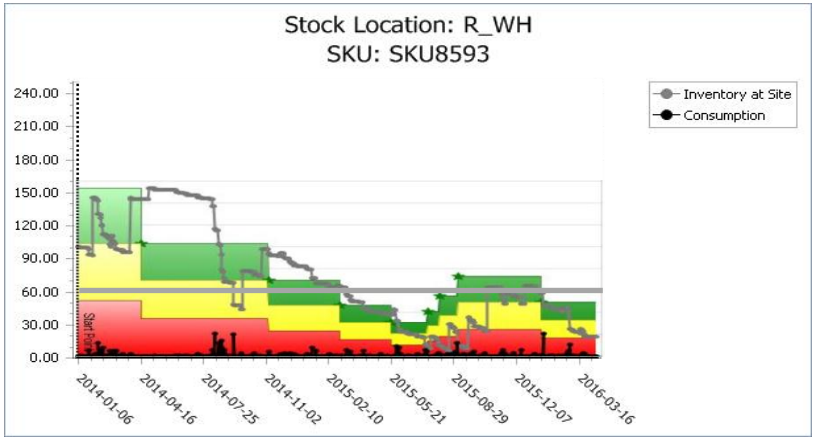
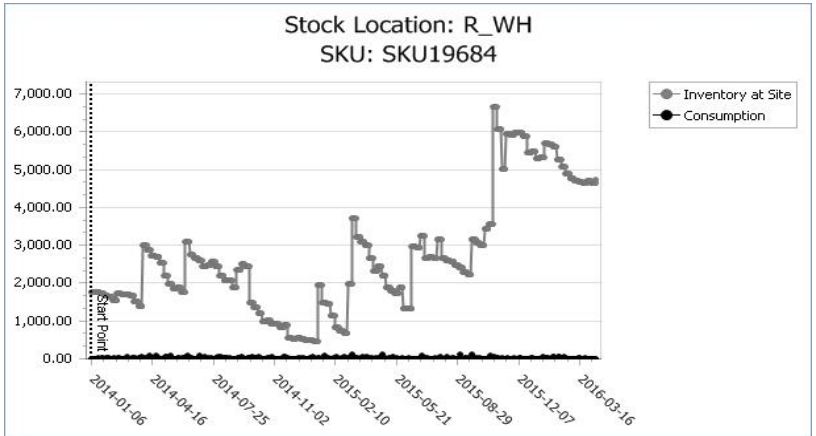
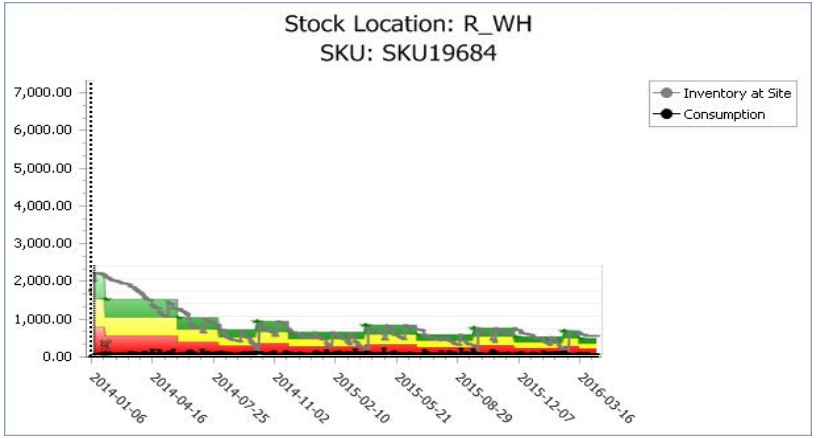
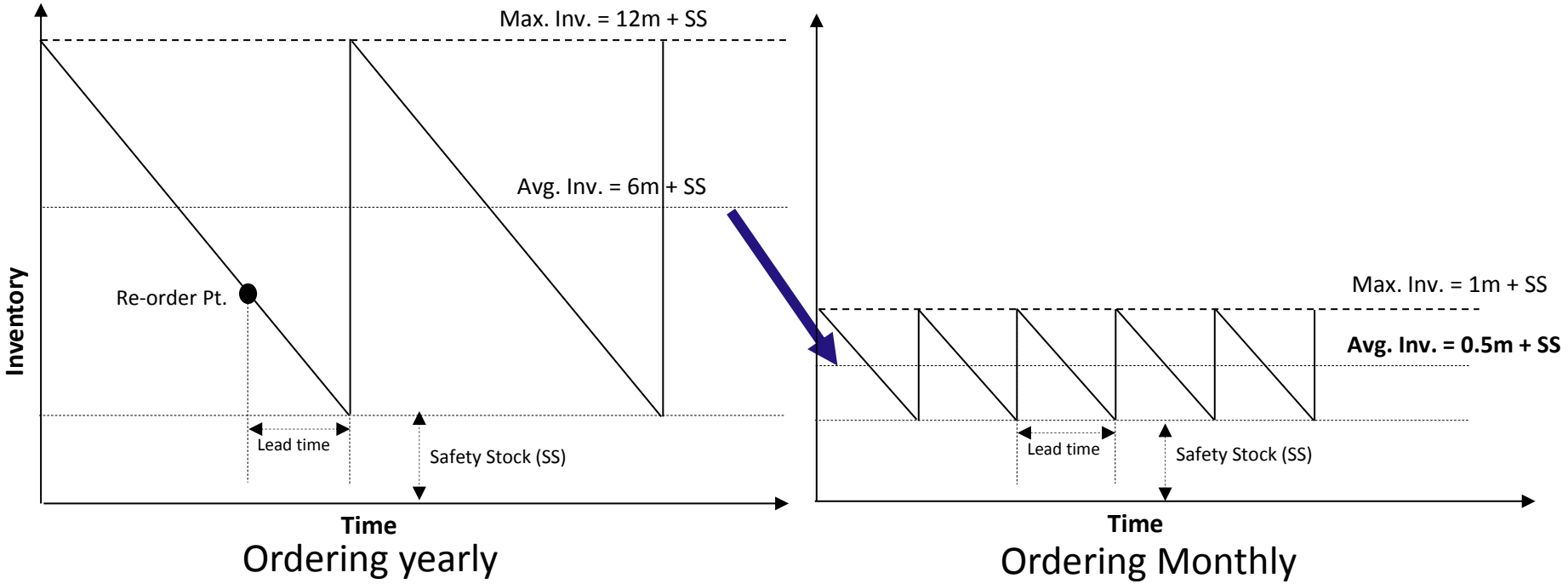






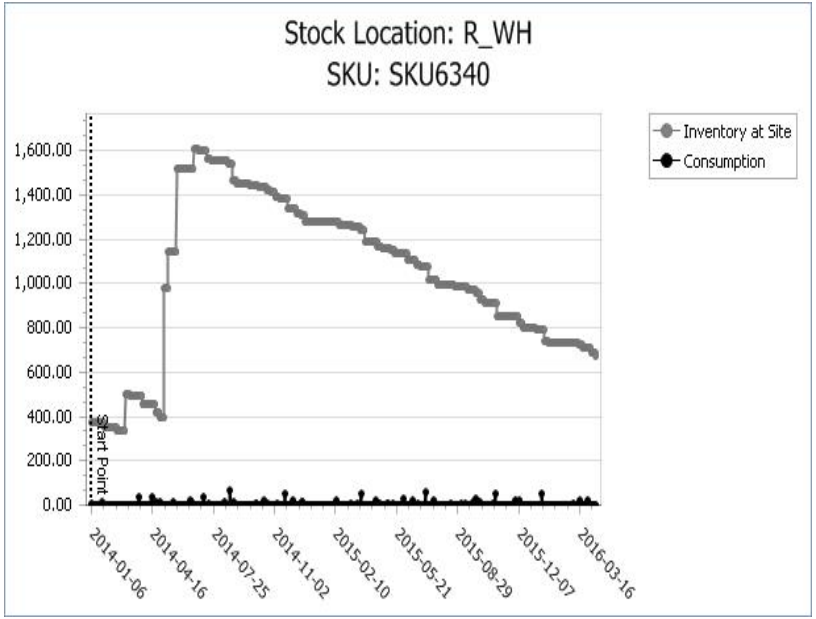


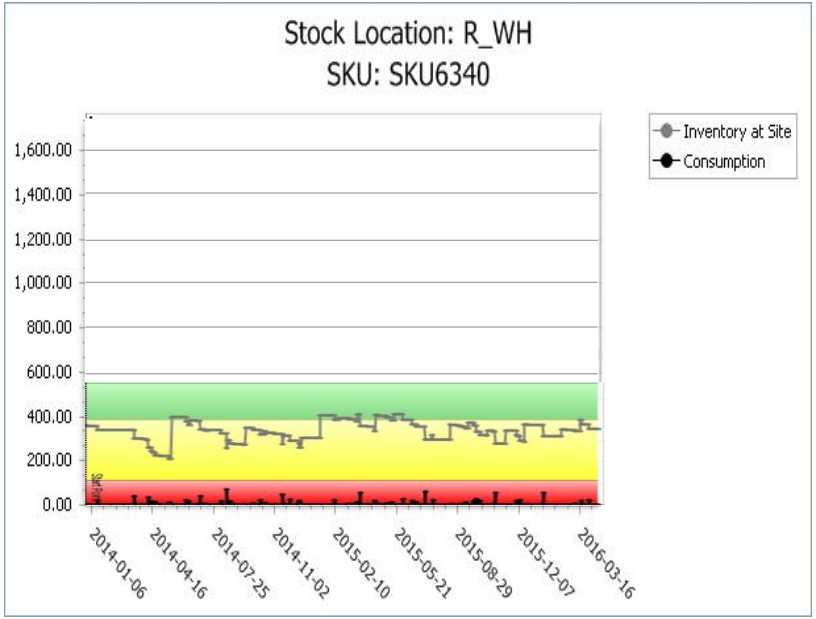
4. Frequent Ordering & Delivery



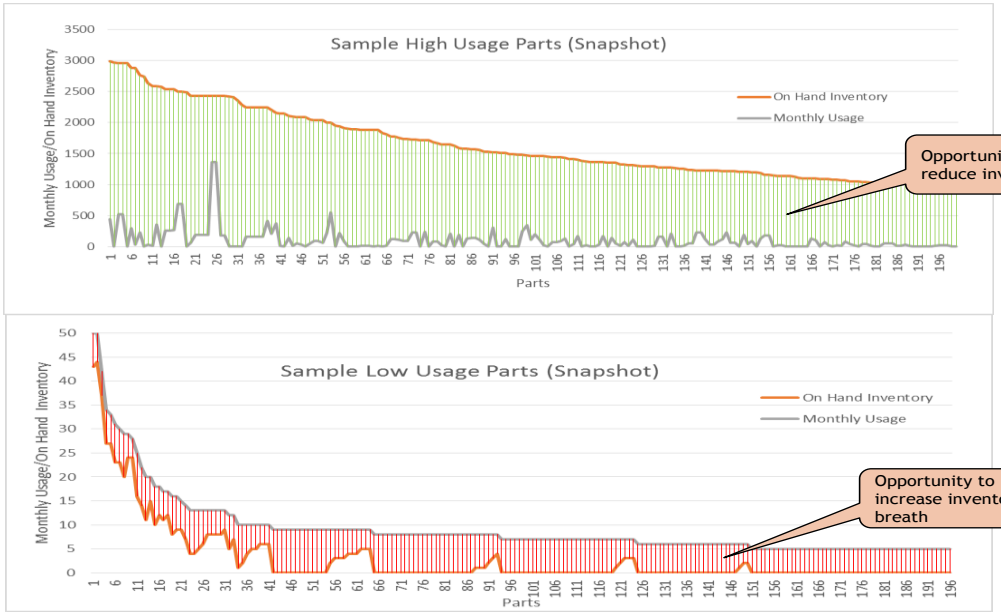
- Lower Inventory
- Less obsolescence, Space

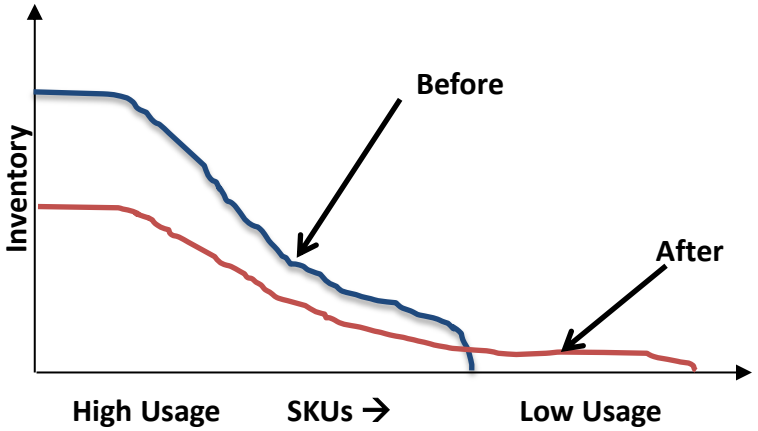
4. Frequent Ordering & Delivery





5. Increase Inventory Breadth





Recap

1. *Aggregate Inventory at Central warehouse*
2. *Order daily usage & replenish frequently*
3. *Automatically adjust inventory levels based on usage*
4. *Order every month from vendors what was used last month*
5. *Increase inventory breadth*

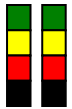
Usage Locations

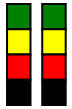

1 wk. stock

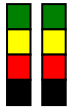

1 wk. stock

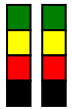

1 wk. stock


1 wk. stock









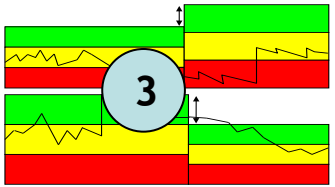
1

Warehouse

Daily Usage Info

2

Freq. Replenishment



Adjust levels automatically based on usage

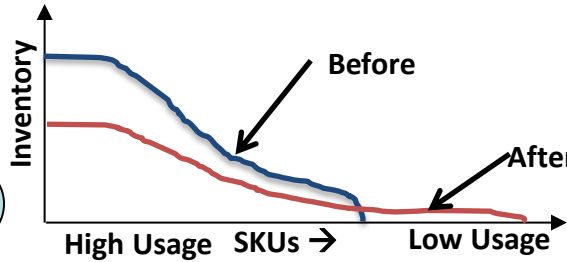
Monthly / wkly POs

4

Monthly / wkly. replenishment

Vendors

5



Thank you

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