Theory of Constraints

NDTA – USTRANSCOM FALL MEETING 2018

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Breakthrough thinking in action

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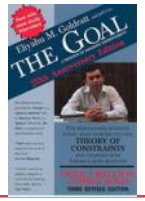
Agenda

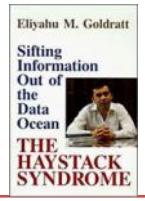
- Introduction to Theory of Constraints (TOC)
- 5 Focusing Steps
- Principles of Flow
- Case Studies

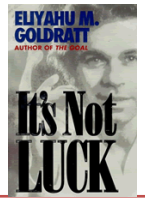
Theory Of Constraints

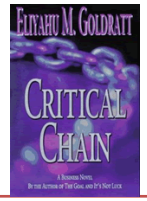
- Invented by Dr. Eliyahu Goldratt
- Aims to continually achieve more of the goal of a system
- Derived from the hard sciences (physics)

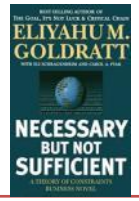
OPT

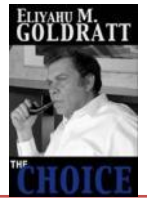












1970's 1980's 1990's 2000's 2010's

Production & MRO

Supply Chains Distribution

Sales Marketing

Projects & Heavy MRO

Strategy & Tactics

Holistic

Retail

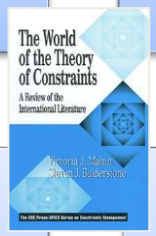
Typical Results from TOC Implementations

Manufacturing

- DDP 99% (44% ↑)
- 25-70% Capacity exposed
- Inventory 49%↓
- Lead Time 65%↓

Supply Chain

- Inventory 20-50%↓
- Shortages 50+%↓
- Turn 2x↑ or more



Fonte: The World of Theory of Constraints, Vicky Mabin & Steven Balderstone, St. Lucie Press.

MRO

- 20-33% Throughput↑
- 20-50% TAT ↓
- On time Perf. 90+%

Engineering, Projects

- DDP 95%+
- 20-50% Capacity exposed
- Lead Time 30+%↓

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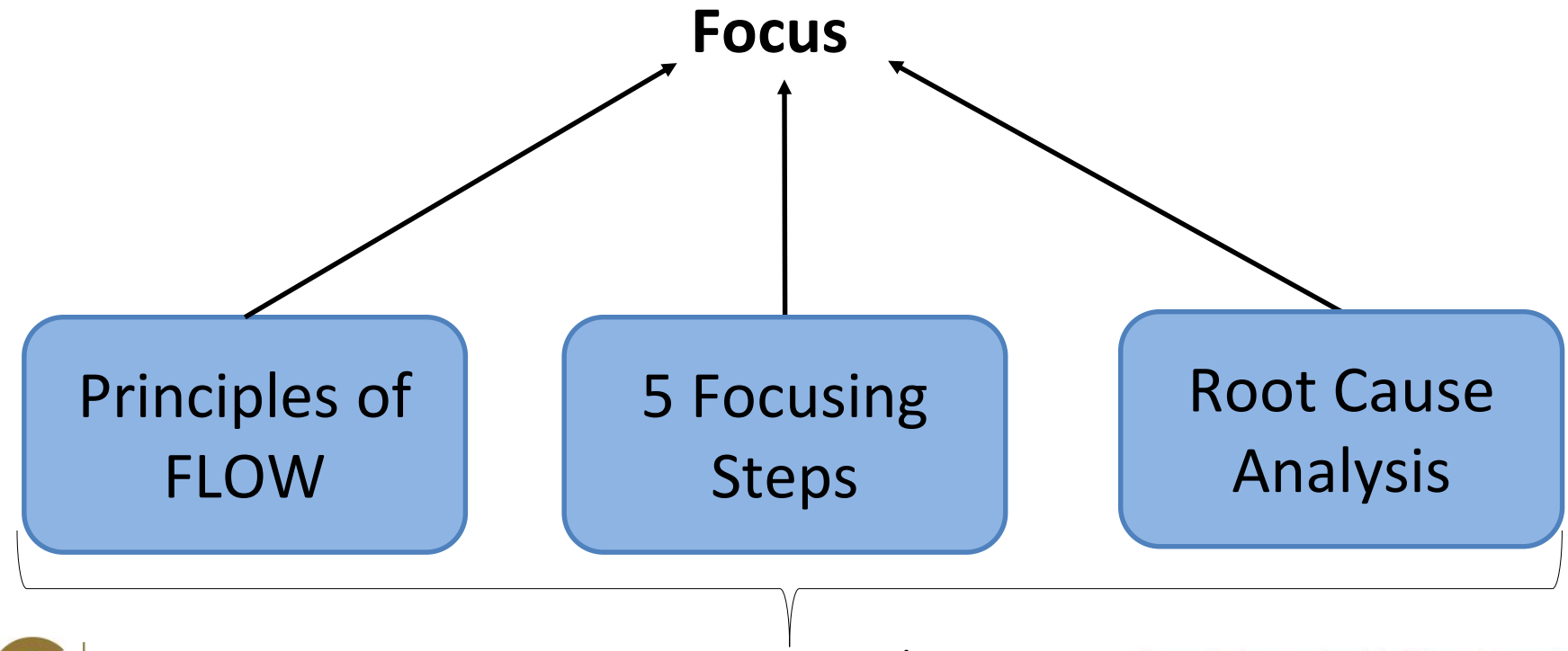
TOC = FOCUS

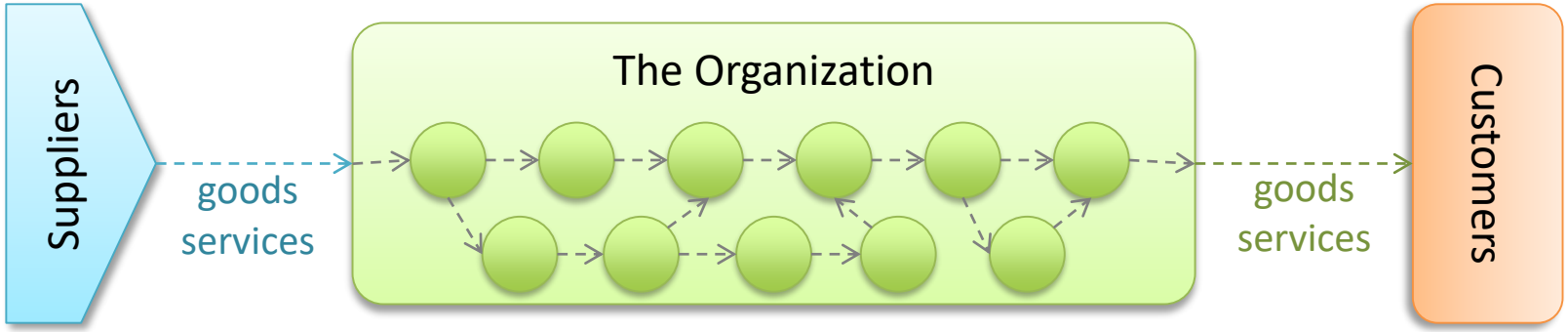
"If I'll need to choose one word to explain what TOC is all about it will be FOCUS."

Dr. Eli Goldratt



Every Organization is a System…

…. With Dependencies & Variability



What limits the system's performance relative to its goal?

Constraint

The factor that limits a system's performance relative to its goal.

5 FOCUSING STEPS

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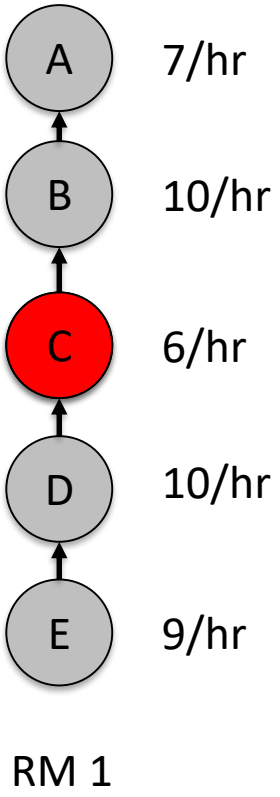
Identify the constraint

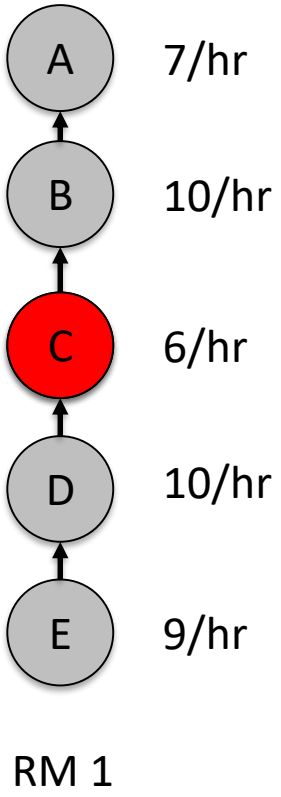
- **What is output of this factory?**
- **Which machine determines the output?**



Exploit the constraint?

- **What happens if the machine C breaks down?**
- **What happens if some other machine breaks down?**
- **Where should we test for quality?**
- **What happens if machine C produces only Red widgets?**

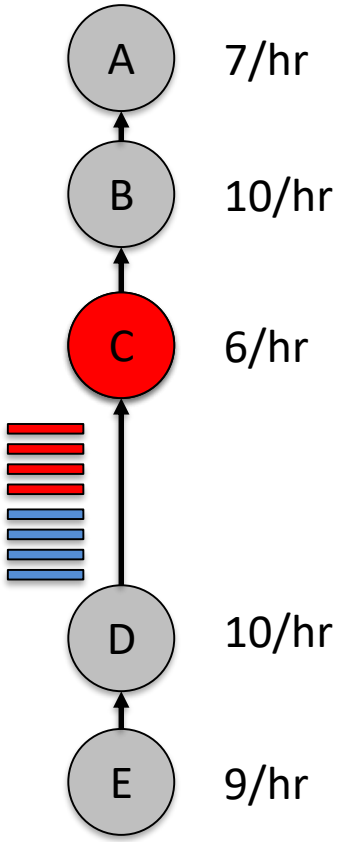
Demand is 24 Red and 24 Blue



Exploit the constraint?

- **How do we protect the constraint from disruptions?**
- **What else can we do to protect output at the constraint?**
- **What if demand is not fixed at 24 red and 24 blue? What if it is dynamic?**

Demand is 24 Red and24 Blue



RM 1

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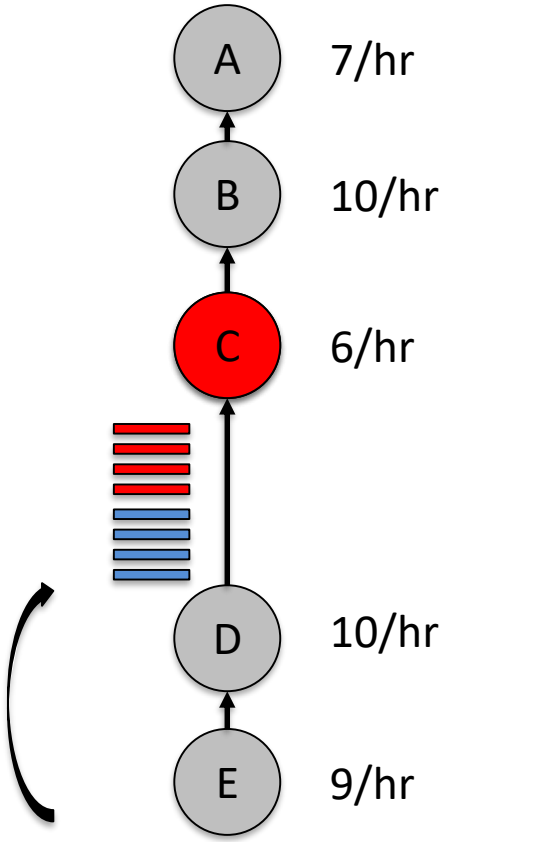
Subordinate to the Constraint

- **What if E tries to produce 9/hr?**
- **What if D and B are measured to efficiency?**
- **How do we stop all other machines from "over" production?**



RM 1

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TOC's 5 Focusing Steps

1. Identify the constraint
2. Exploit the constraint
3. Subordinate everything else to the constraint
4. Elevate the constraint
5. Go back to Step 1 (don't allow Inertia to set in)

PRINCIPLES OF FLOW

TOC for Operations

*Improving **FLOW** is the Primary Goal of Operations*

Dr. Goldratt

TOC acknowledges that UNCERTAINTIES & VARIABILITY are intrinsic in all operations

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	○
P	16	△
Q	17	□
R	18	○
S	19	△
T	20	□
U	21	○
V	22	△
W	23	□
X	24	○
Y	25	△
Z	26	□

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	○
P	16	△
Q	17	□
R	18	○
S	19	△
T	20	□
U	21	○
V	22	△
W	23	□
X	24	○
Y	25	△
Z	26	□

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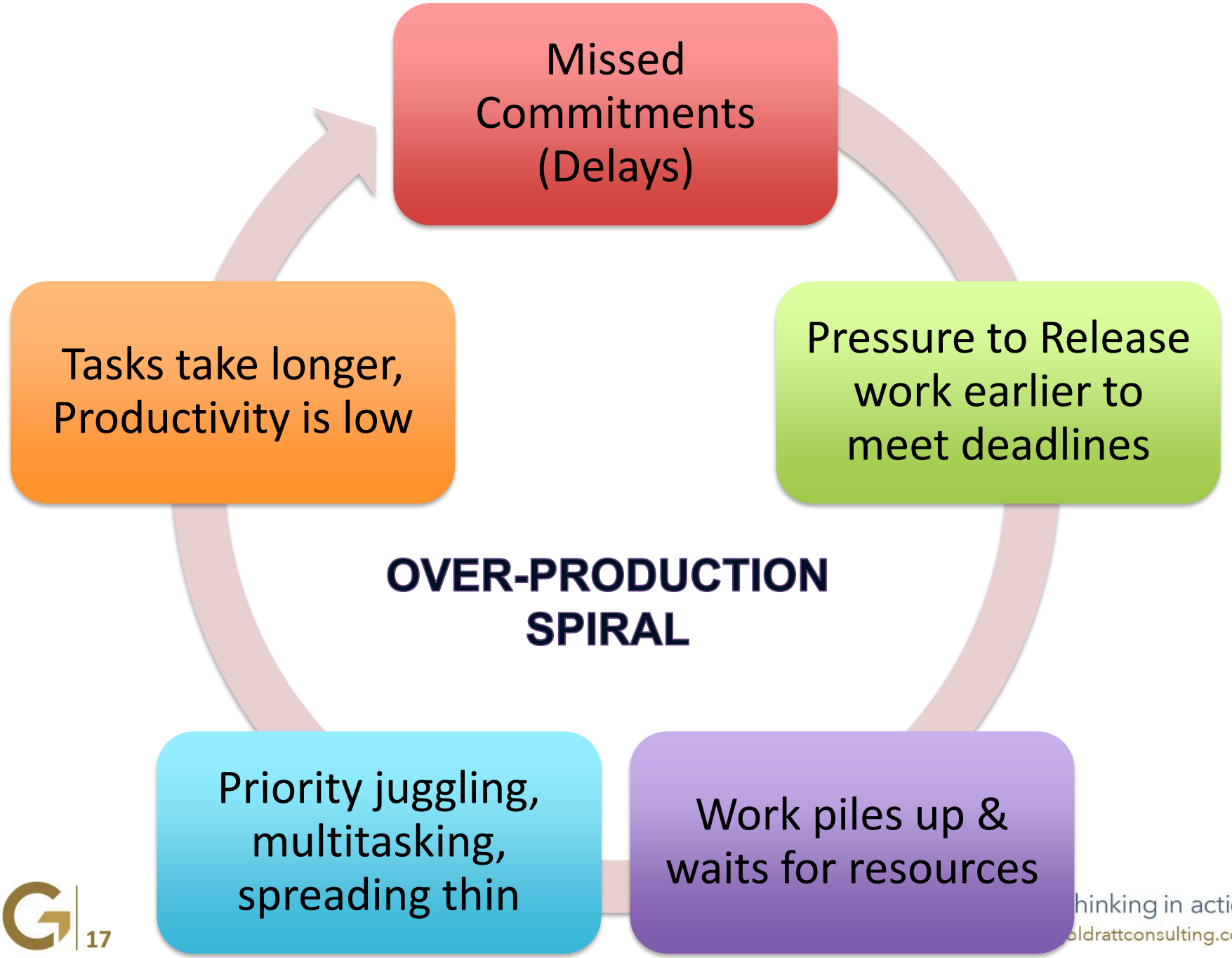

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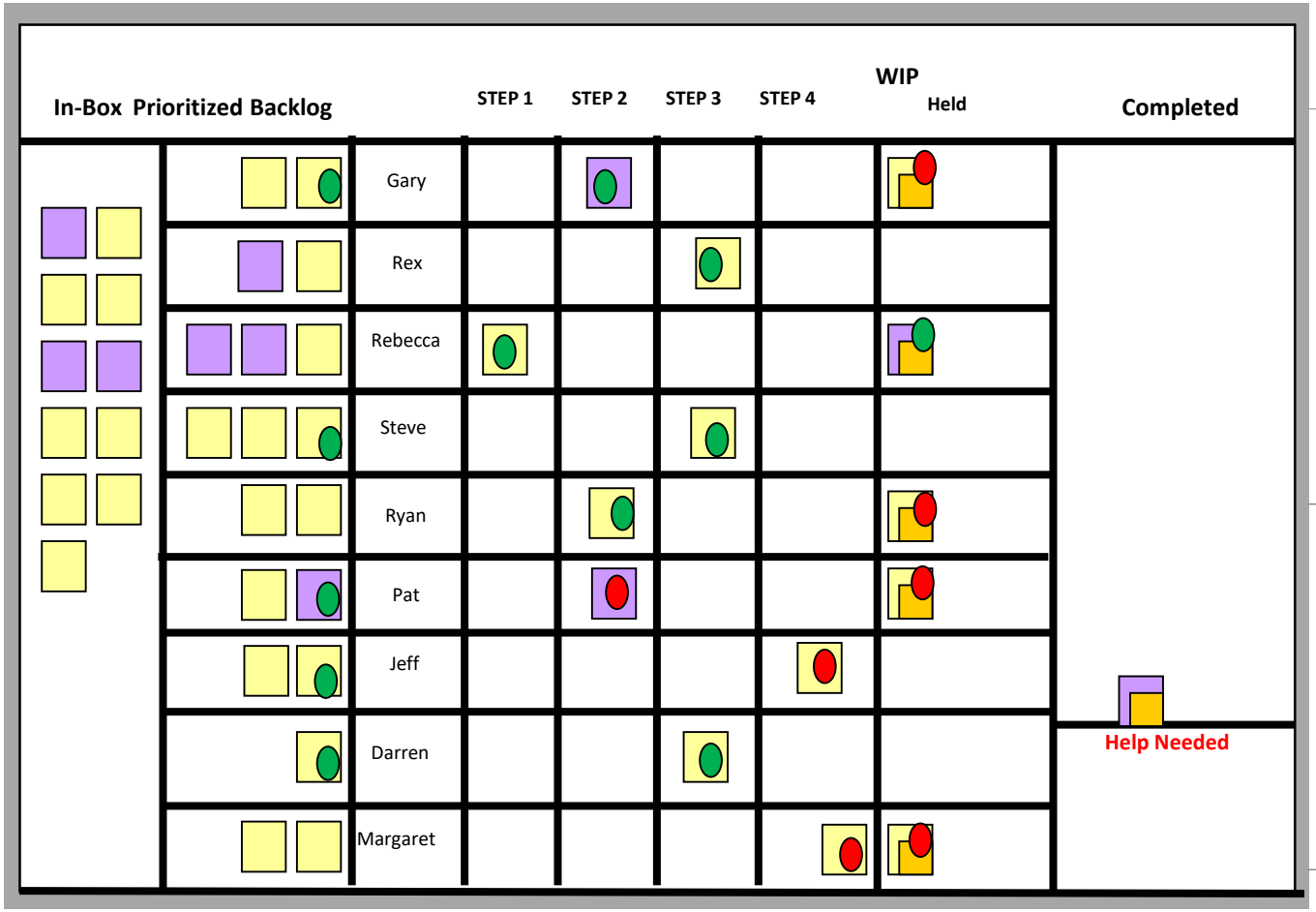
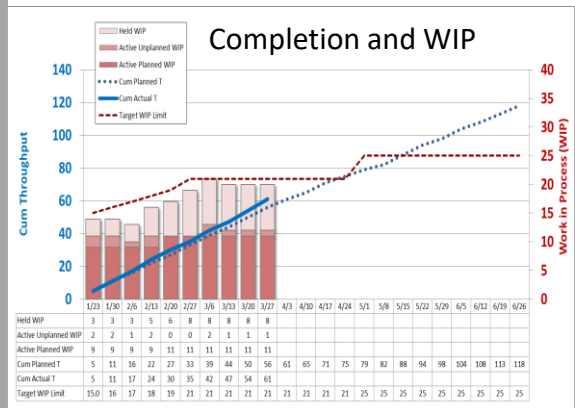
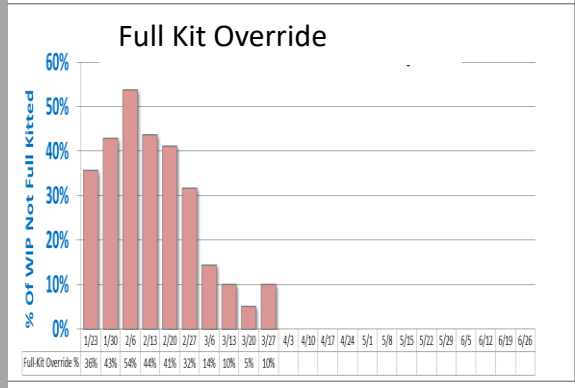
WIP Control







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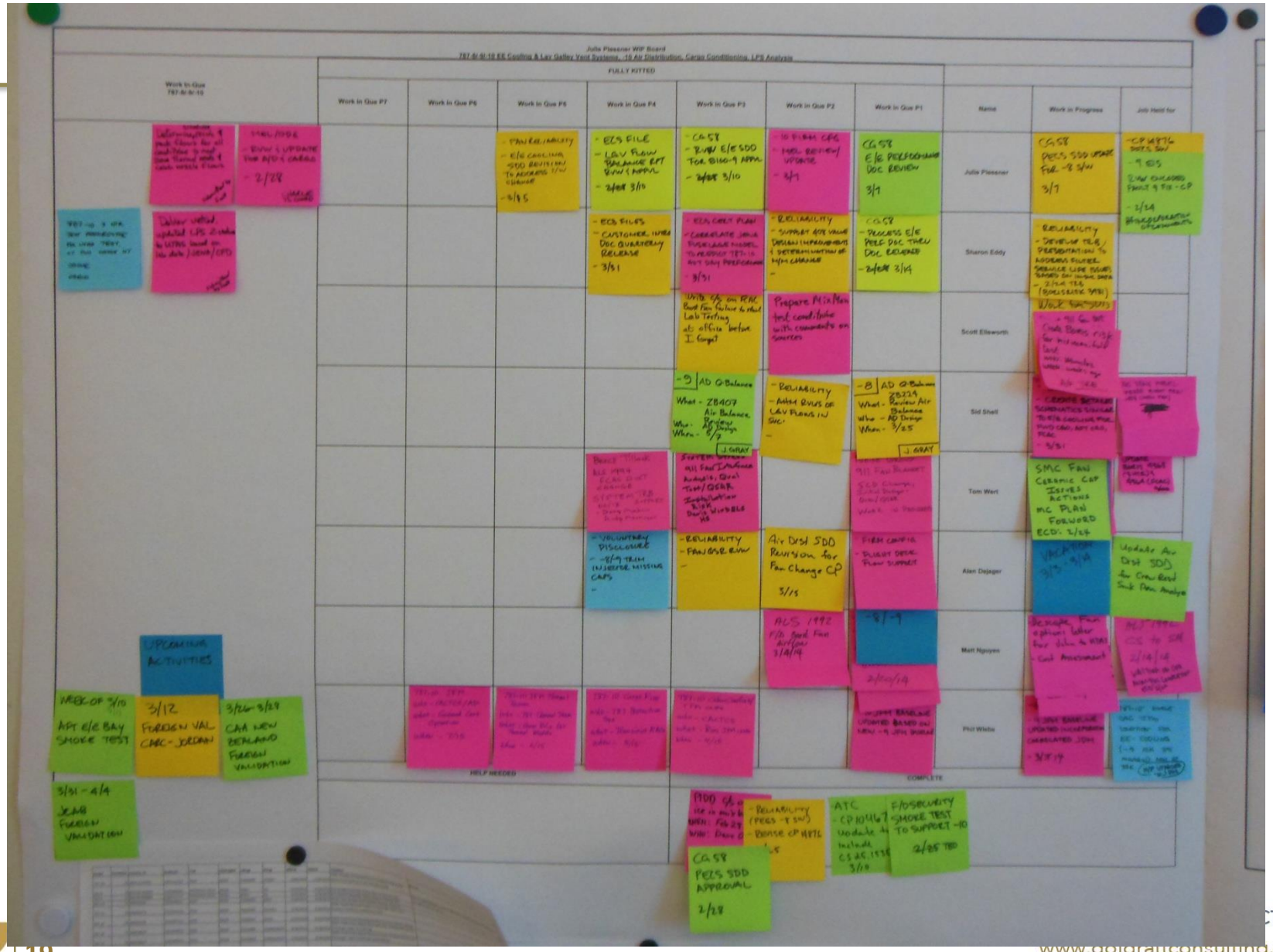
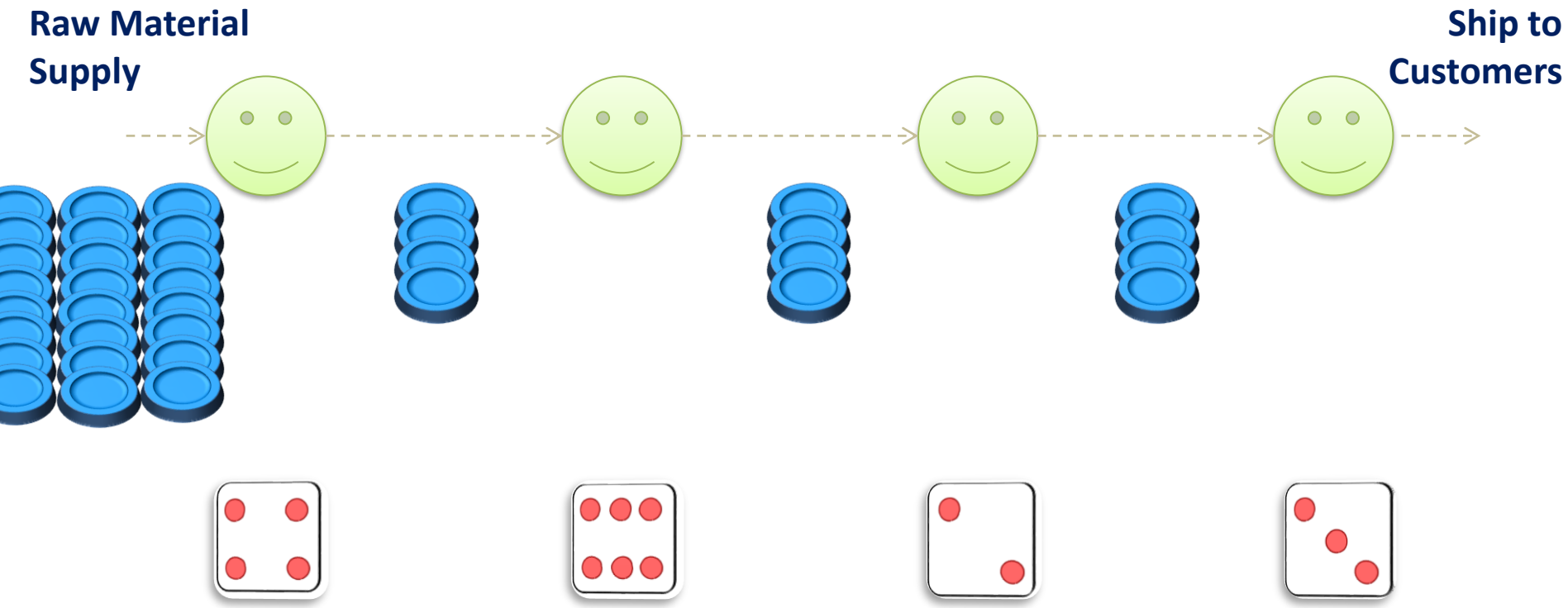

Julia Plessner WIP Board
787-8/-9/-10 EE Cooling & Lav Galley Vent Systems, -10 Air Distribution, Cargo Conditioning, LFS Analysis
FULLY KITTED
Work In Que P7
Work In Que P6
Work In Que P5
Work In Que P4
Work In Que P3
Work In Que P2
Work In Que P1
Name
Work in Progress
Julia Plessner
Sharon Eddy
Scott Ellsworth
Sid Shell
Tom Wert
Alan Dejager
Matt Nguyen
Phil Wiebe
HELP NEEDED
COMPLETE
UPCOMING ACTIVITIES
WEEK OF 3/10
APT E/E BAY SMOKE TEST
3/12
FOREIGN VAL CMC - JORDAN
3/26-3/28
CAA NEW ZEALAND FOREIGN VALIDATION
3/31 - 4/4
JCAB FOREIGN VALIDATION

Setup



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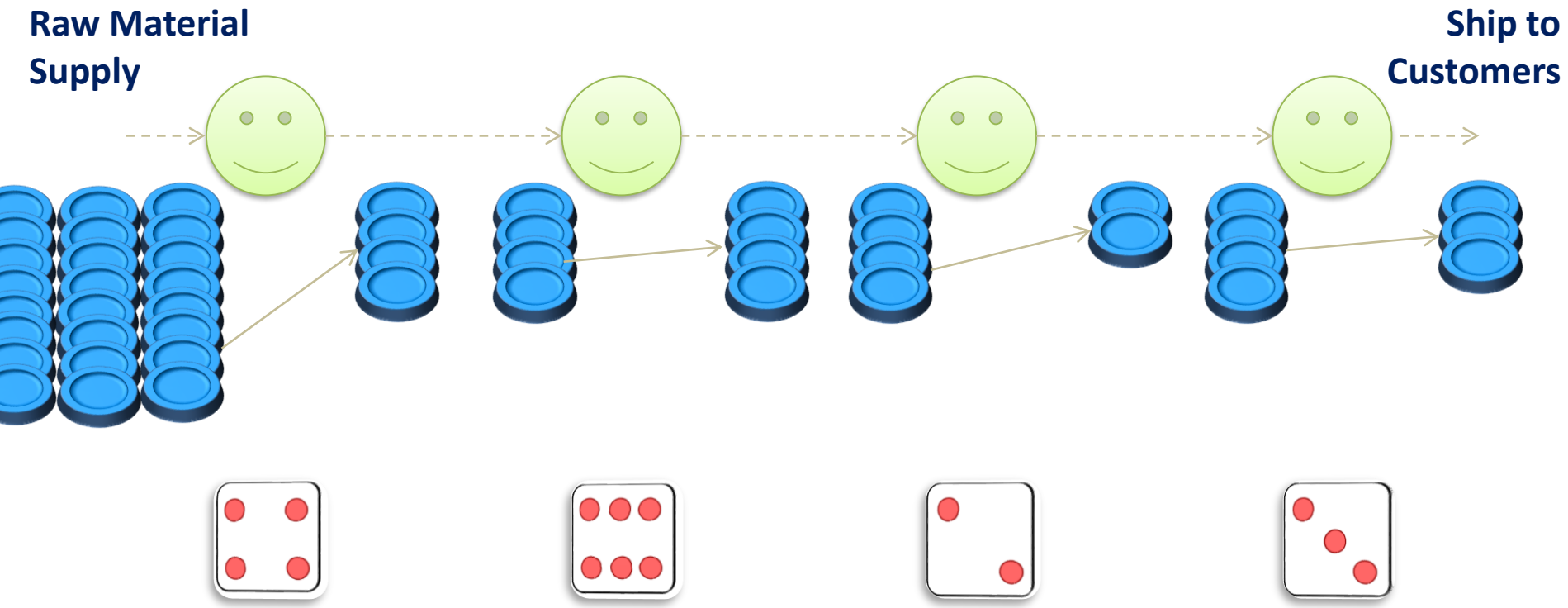
First Day Simulation



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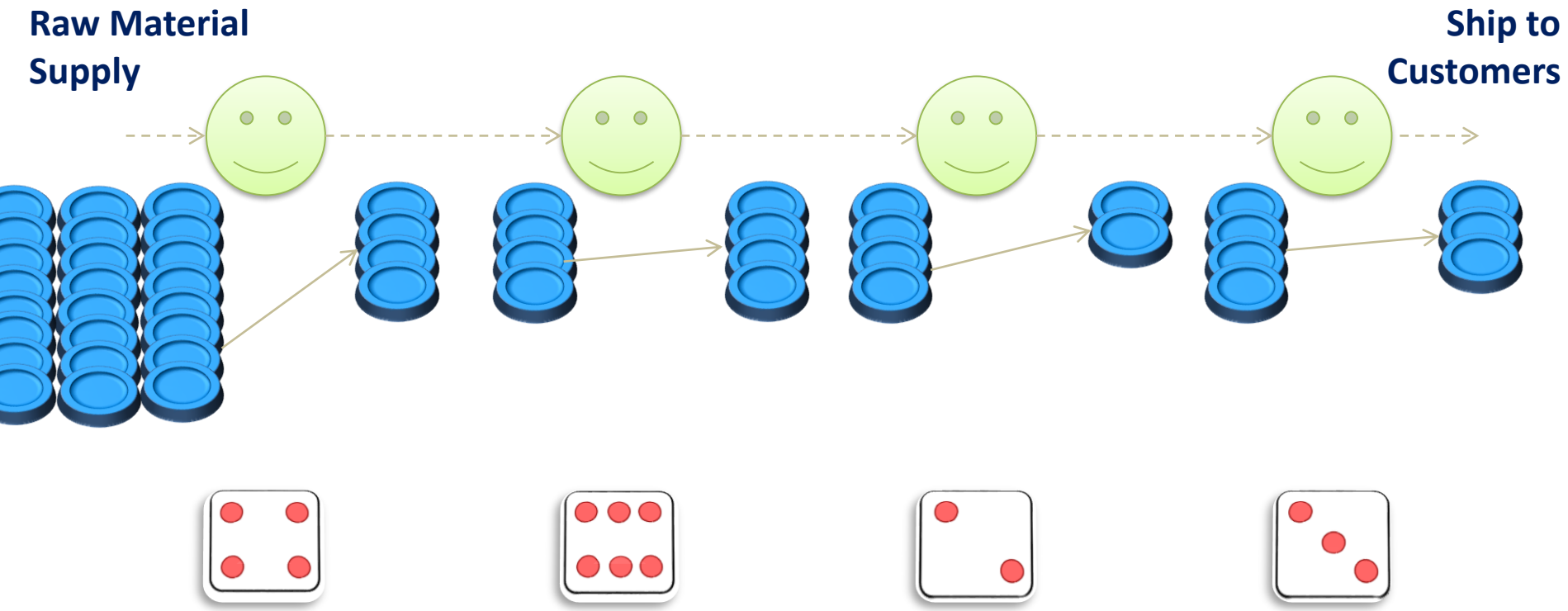
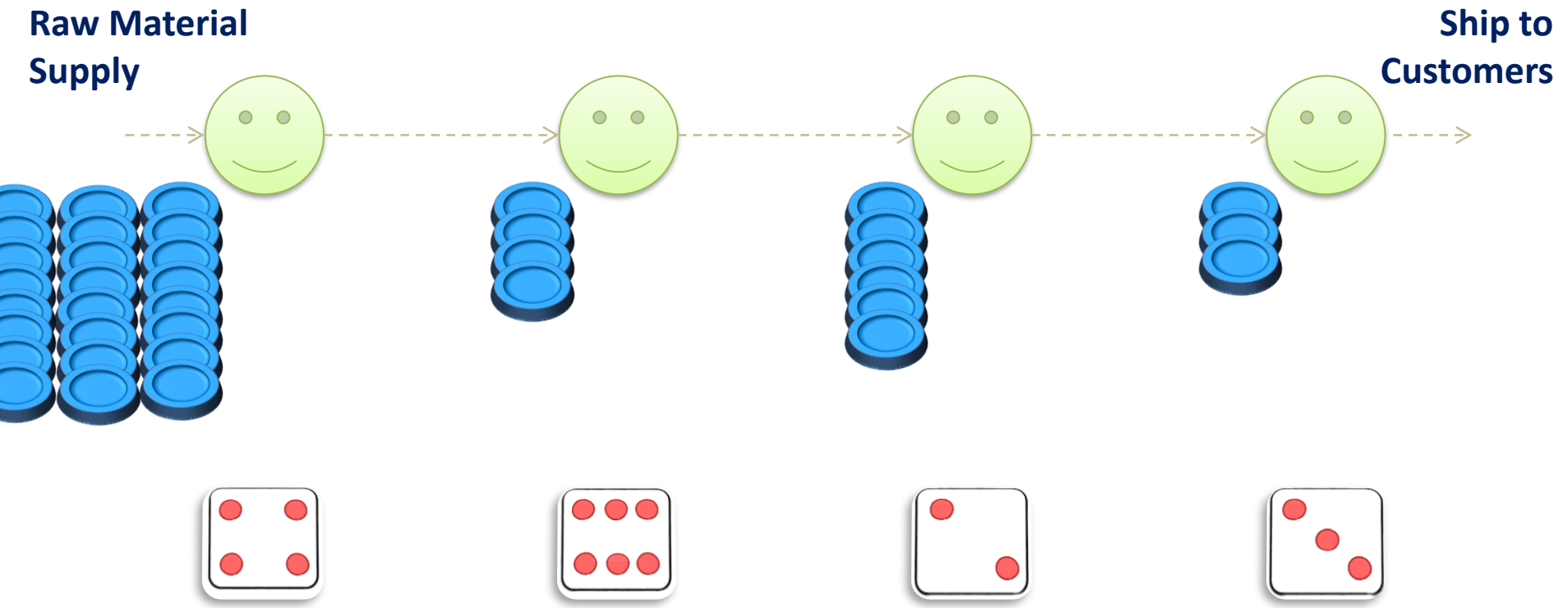
What Day One Looks Like “Real Time”



Beginning of Day 2



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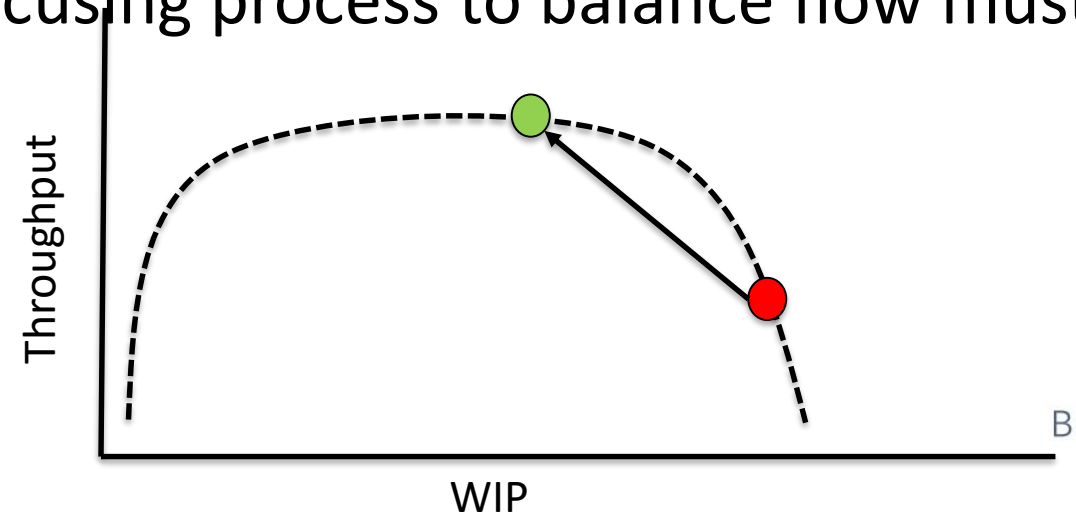
TOC's Principles of Flow

- Improving FLOW is a primary objective of operations.
- This primary objective should be translated into a practical mechanism that guides the operation when NOT to produce → (i.e. how to maintain Low WIP)
- Local efficiencies must be abolished
- A focusing process to balance flow must be in place



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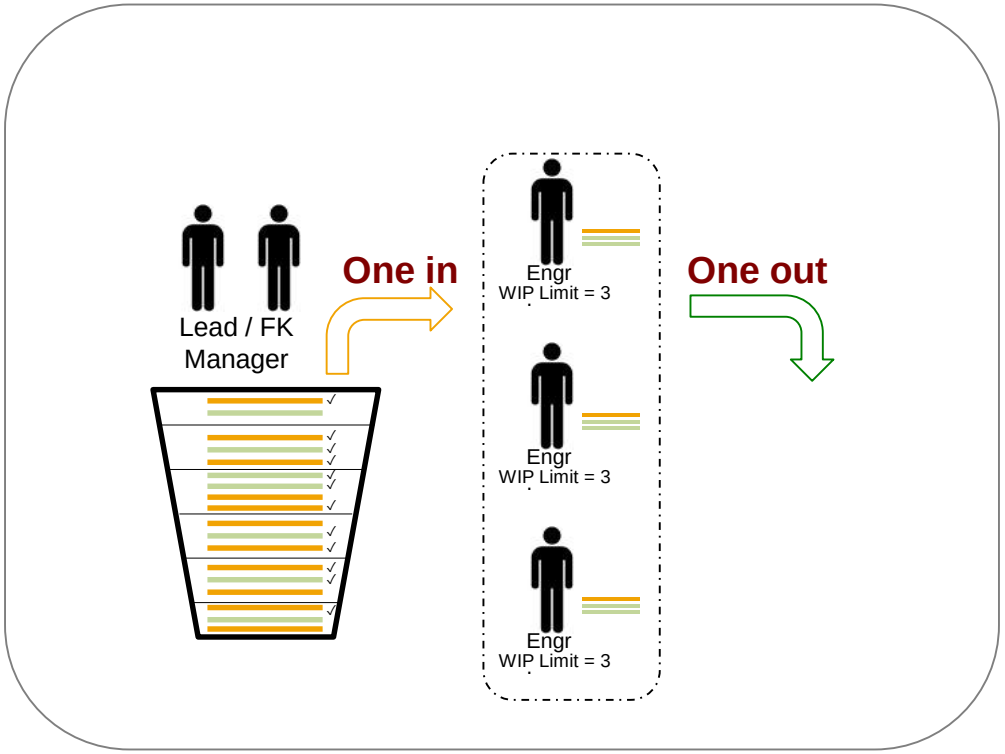
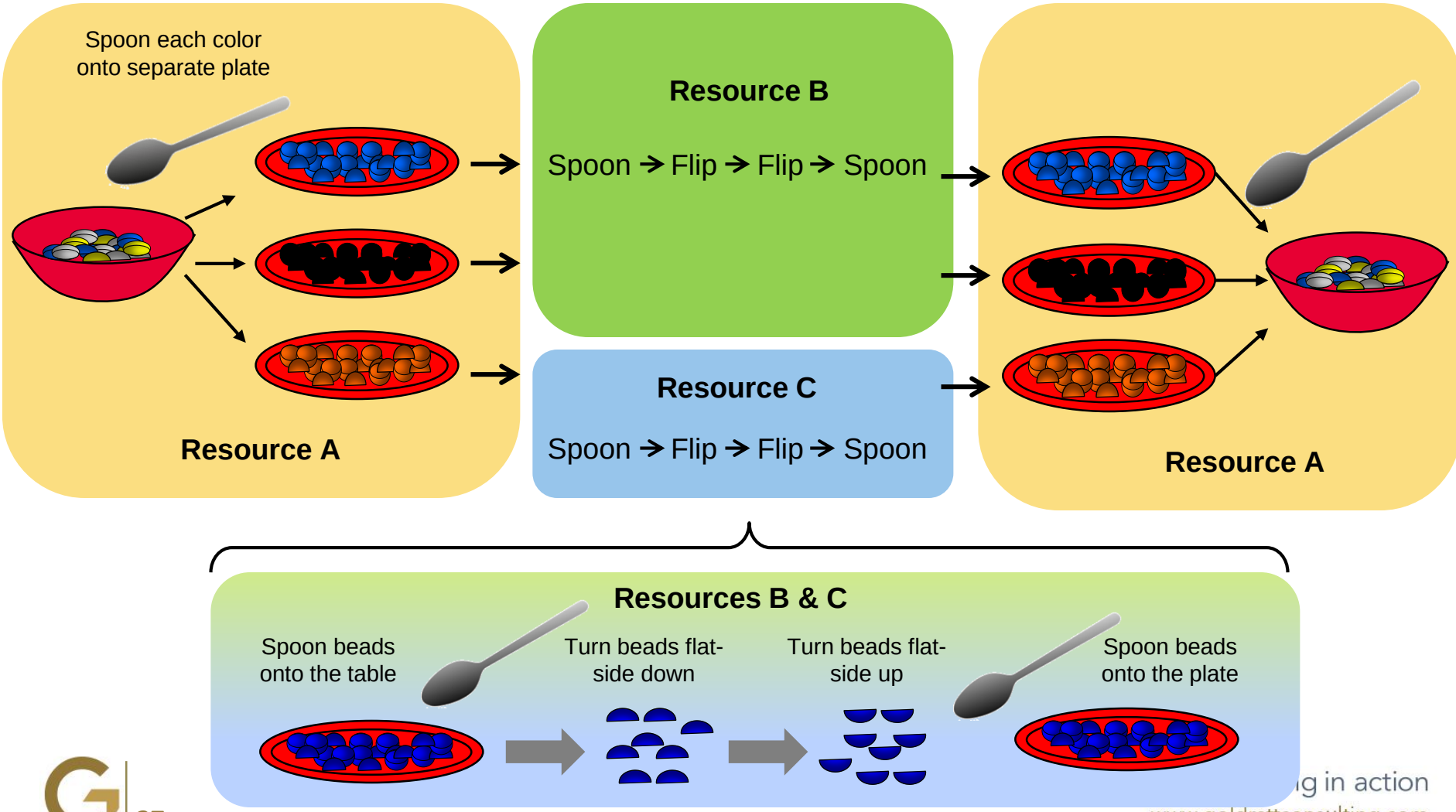
Backup

WIP Control


Lead / FK
Manager
One in
Engr
WIP Limit = 3
Engr
WIP Limit = 3
Engr
WIP Limit = 3
One out

Bead Simulation



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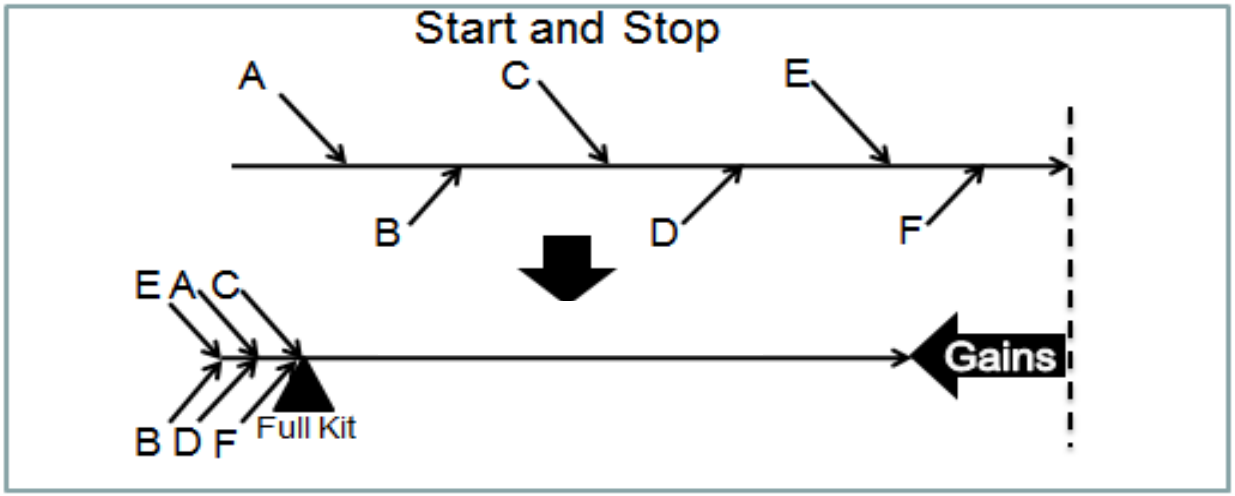
Full Kit

- Ensure full preparation of parts, work package, tech. documents, troubleshooting history etc. for the scheduled aircraft



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Case Study – Delta Air Lines

Challenging Basic Assumptions

The earlier we start, the sooner we will finish

The better the worker/ work center efficiency, the higher the throughput