

Modeling & Analysis of Grocery Picking Bots

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MOSIMTEC™

North America based business focused on modeling & simulation consulting



multiple geographies

2011 Established

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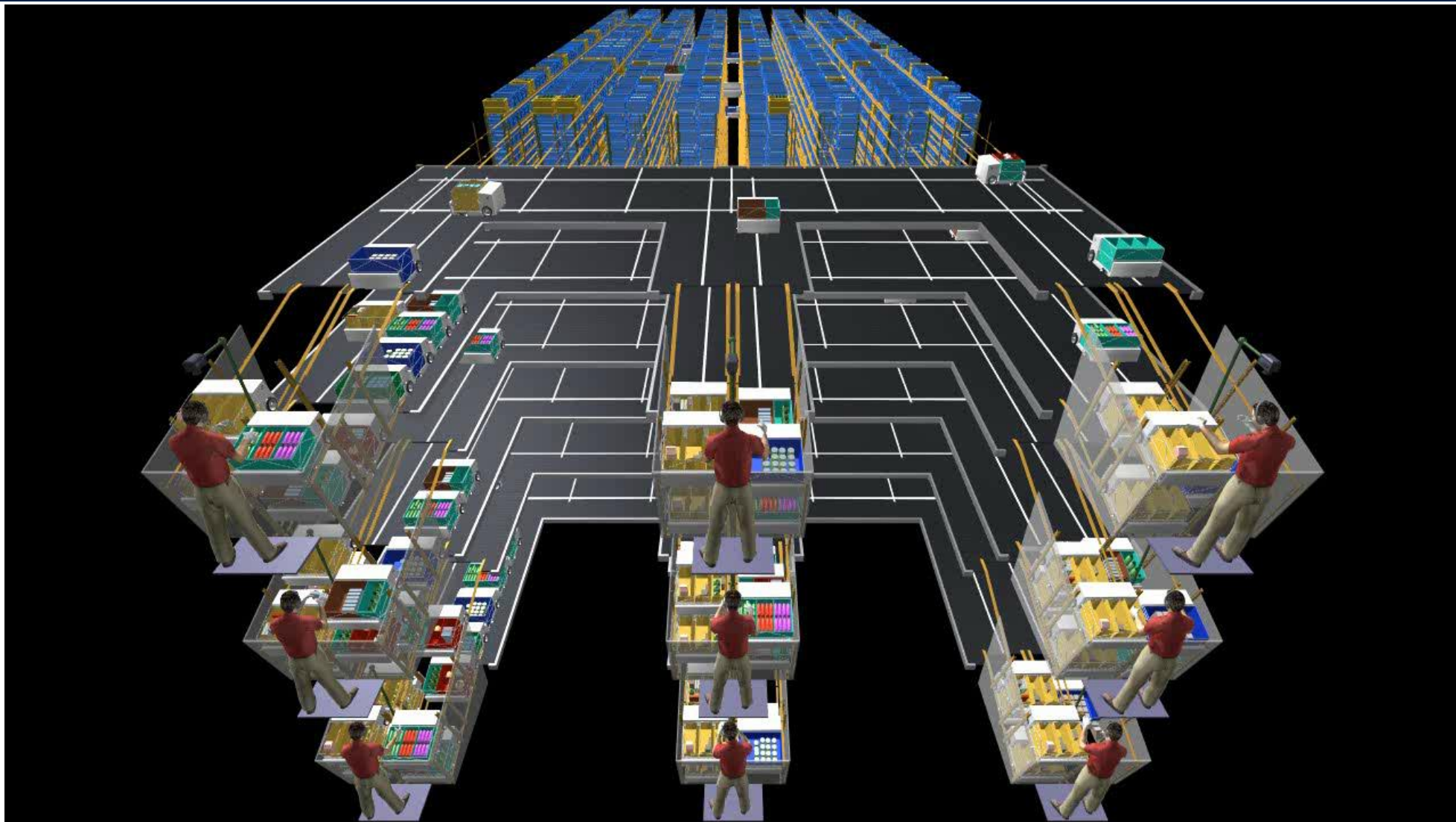
government mining transportation supply-chain chemicals oil & gas healthcare manufacturing aerospace consumer food service

Automating the Supermarket



- 1994: First conception of a supermarket with fully automated center store and self-service fresh market

AlphaBot Animation



Phase 1 Overview

- Walmart to use model results make a go / no-go decision on investing in AlphaBot
- 7 weeks from kick-off to results delivery
- Tool to cover a variety of store sizes and customer demand profiles
- Control logic did not exist yet, but having control logic in the model would be key to correctly estimating the performance of this yet to be built system

Inputs

ORDER DEMAND INPUTS

LINES PER ORDER	
Percentage	Value
0.10	6
0.10	9
0.10	13
0.10	14
0.10	...
0.10	...
0.10	...
0.10	...
0.10	...
0.10	...

EACHES PER LINE	
Percentage	Value
0.8000	1
0.1000	2
0.0200	3
...	4
...	5
...	6

BOT INPUTS

BOT INPUTS	
Number of Bots	85
Length of Bot (mm)	670
Width of Bot (mm)	600
Rack Put/Pull Time (seconds)	8

BOT SPEEDS

Type	Target Speed (m/s)		Acceleration / Deceleration (m/s ²)	
	Vertical	Horizontal	Vertical	Horizontal
Towers	1		3	
Decks		4		3
Aisles		6		2

BOT SPEED DE-RATING

Bot speed de-rating due to congestion on transit deck.	
Number of Bots / m ²	De-Rating Factor
0	1
0.1	0.865
0.2	0.63
0.3	0.395

SYSTEM CONFIGURATION INPUTS

WORKSTATION INPUTS

Number of Workstation Tiers	2	count
Workstations per Tier	4	count
oTote Holster Capacity	3	count
oTote Positioning Move (last out, next in)	3	seconds

RACK INPUTS

Number Aisles	6	count
Space Between Aisle Centers	1900	mm
Aisle Pitch	610	mm
Number Levels	15	count
Height per Level	375	mm
Number Slots Horizontal	120	count
Width per Slot	437	mm

600 mm per tote
300 mm on tote
400 mm on tote

DemoScenario.xlsx - Excel

File Home Insert Page Layout Formulas Data Review View Developer Add-ins Help Inquire MOSIMTEC Formatting Simulation Tell me what you want to do

Clipboard Font Alignment Number Styles Cells Editing

E10

A B C D E F G H I J K L M N O P Q R S T U V W

ORDER DEMAND INPUTS

LINES PER ORDER

Percentage	Value
0.10	6
0.10	9
0.10	13
0.10	15
0.10	19
0.10	21
0.10	24
0.10	30
0.10	34
0.10	44

EACHES PER LINE

Percentage	Value
0.8000	1
0.1200	2
0.0200	3
0.0150	4
0.0045	5
0.0036	6
0.0006	7
0.0010	8
0.0001	9
0.0020	12

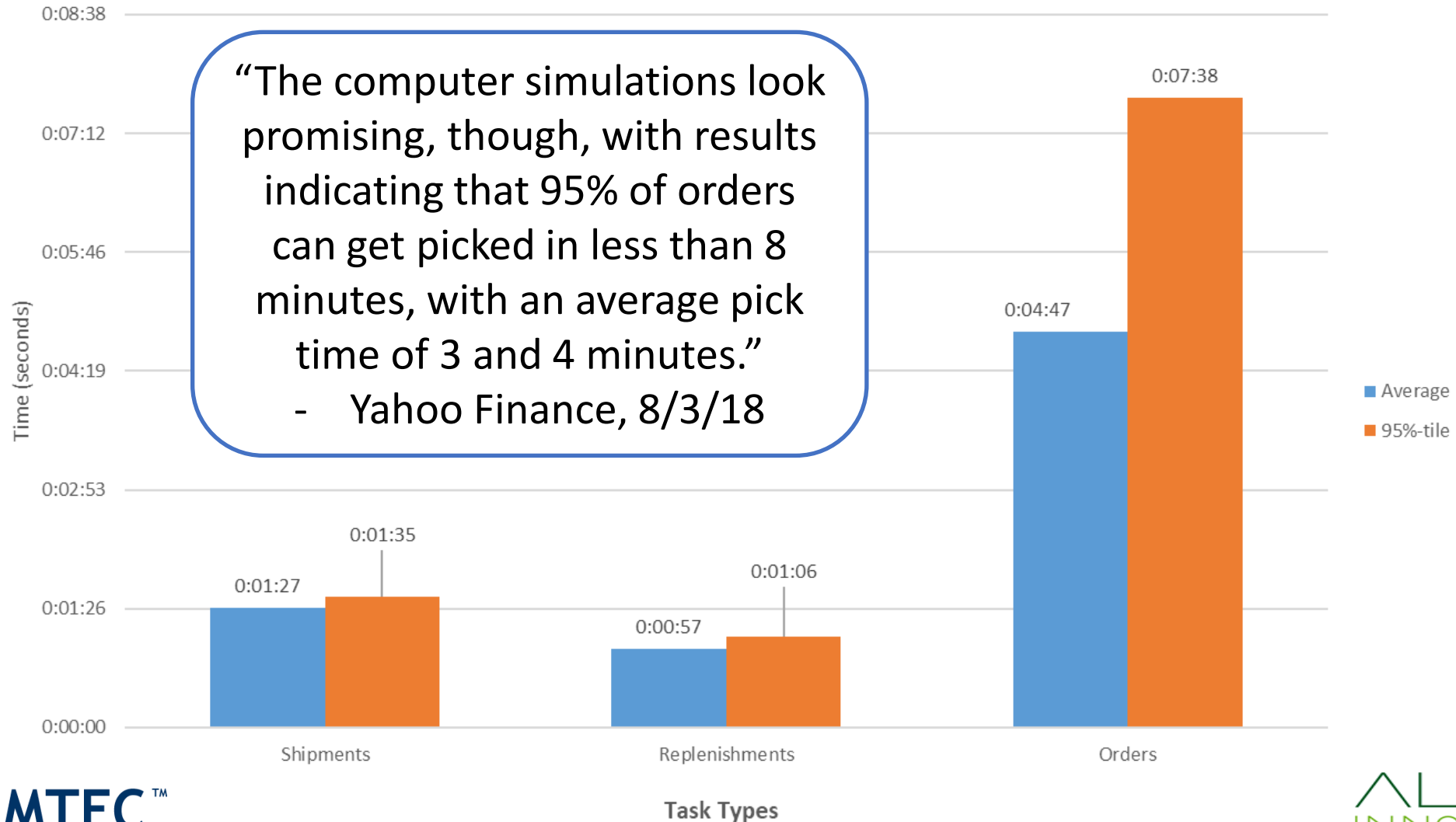
MOVE DEMAND

	Peak Volume	Coefficient
Replenish Totes per Hour	664	0.01
Orders per Hour	78	1.00
Order Pickups per Hour	210	0.01

ORDER TOTE CAPACITIES

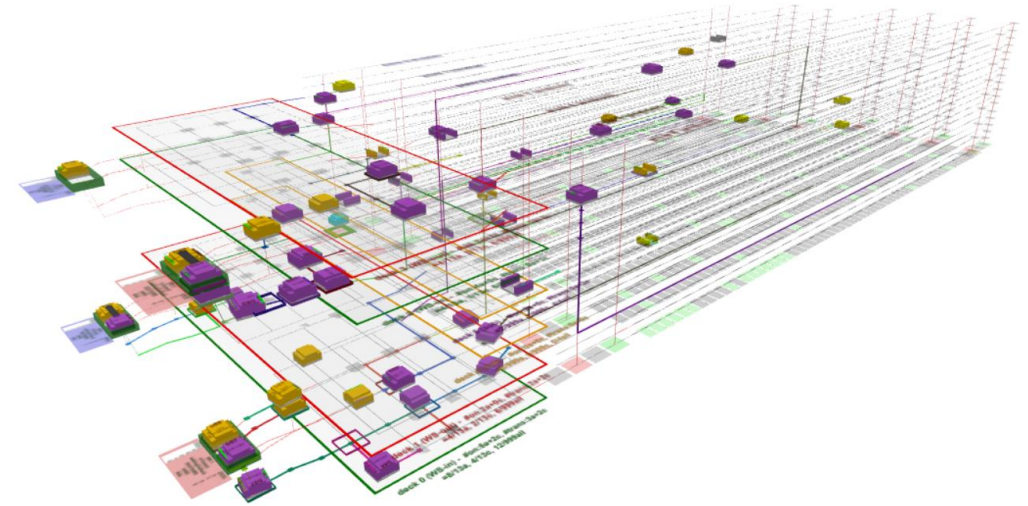
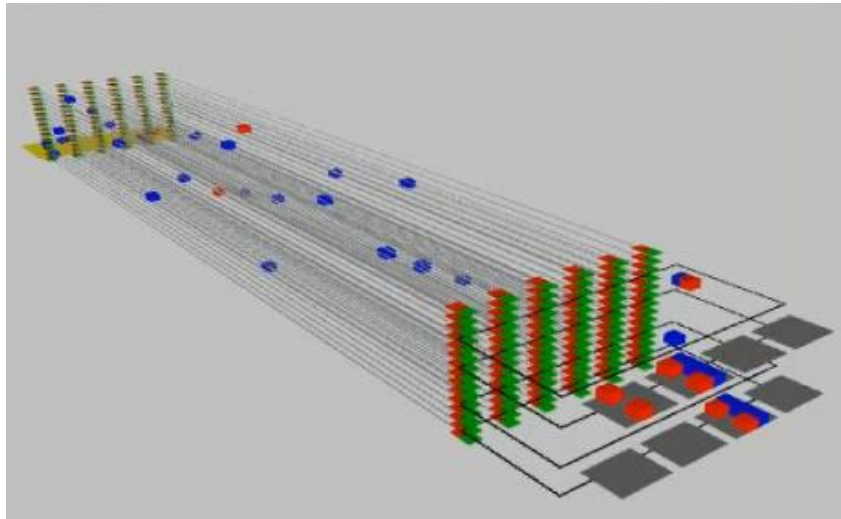
Percentage	Value
0.1	2
0.1	4
0.1	6
0.1	8
0.1	10

Turnaround Time Results

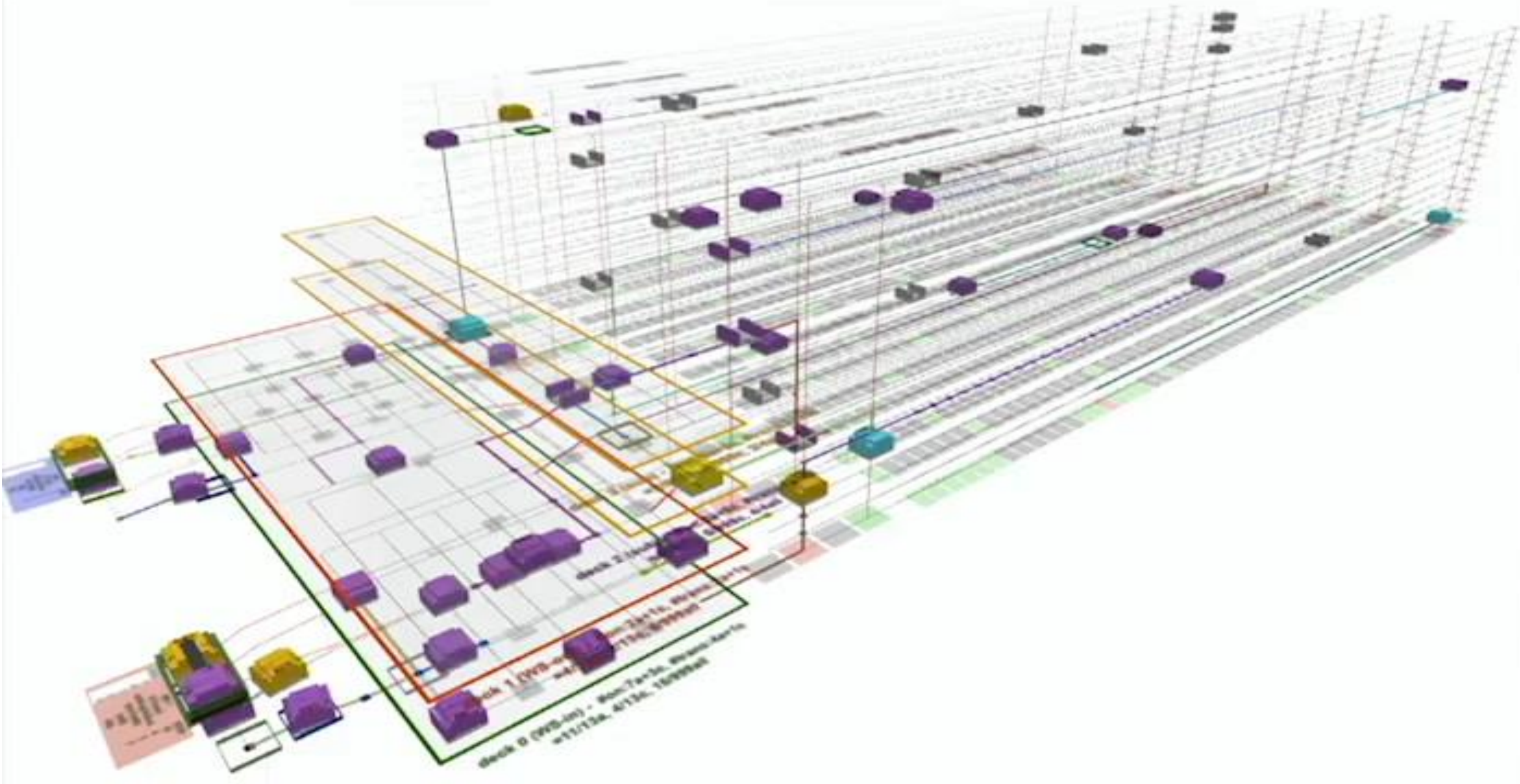


MODEL PHASE 2

Model Evolution

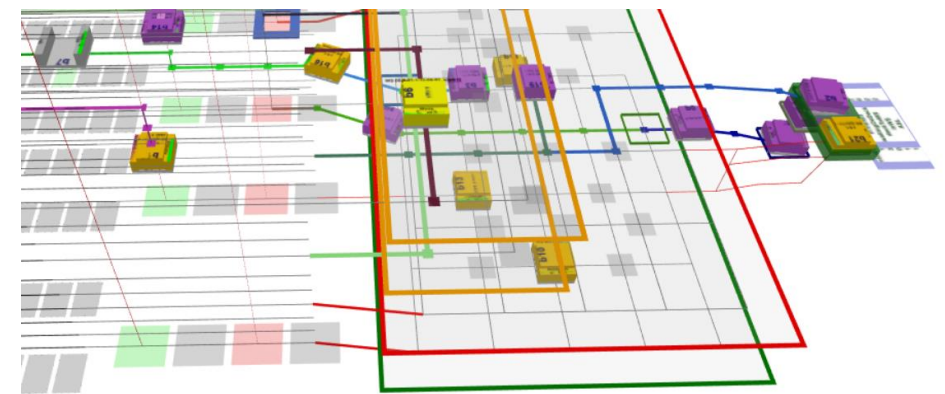
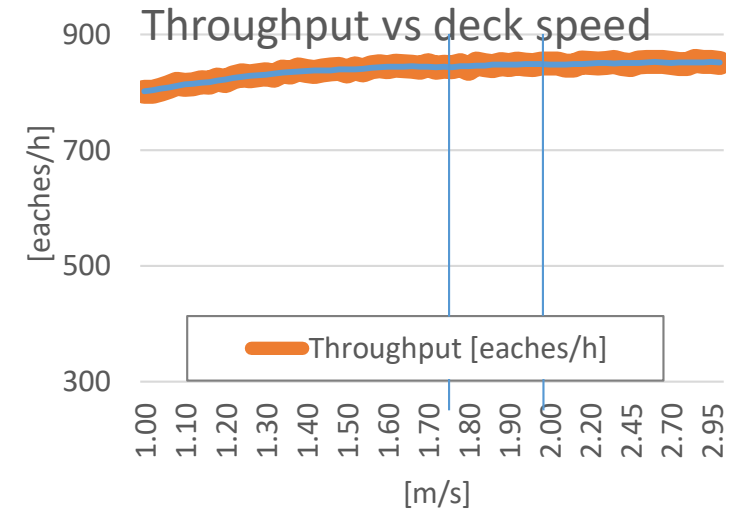


- Increased level of detail step by step
 - Bot paths, reservations, collision avoidance, movement profiles
 - Temperature separation
 - Inventory tracking, bot sequencing



Utilizing Simulation Model

- Layout design
- Design decisions in system development
 - Focusing development efforts / sensitivity analyses
 - Sizing capacity of the supercapacitor energy storage device
 - Radiused turns not critical for deck throughput



Novastore Will Soon Be Possible



Relevant Links

- Introducing Alphabot videos & background
 - <https://www.alertinnovation.com/>
- Novastore Video
 - <https://www.alertinnovation.com/novastore>
- Yahoo finance article:
 - <https://finance.yahoo.com/news/exclusive-walmart-unveils-grocery-picking-robots-test-store-064113990.html>
- MOSIMTEC Simulation Consulting
 - www.MOSIMTEC.com
- Alphabot Phase 1 Case Study
 - <https://mosimte.com/insights/alphabot/>