

Warner Robins Air Logistics Complex

Using a High-Level Template to Increase Model Development Speed



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Overview



- Overview of WR-ALC
- Art of the Possible
- Modeling each “Gate”
- Utilization concerns
- Hold – Delay – Queue
- Restrict area start / end
- How fast is the template to use
- KPI dashboard

WR-ALC – Warner Robins - Air Logistics Complex, KPI – Key Performance Indicator



Overview of WR-ALC



■ Robins Air Force Base, GA

- Warner Robins Air Logistics Complex (WR-ALC) is one of many tenant units on Robins AFB
- WR-ALC is part of the Air Force Sustainment Center (AFSC)
- Repairs and overhaul's the United States Air Forces' largest aircraft
- Due to the nature of depot level repair and overhaul WR-ALC operates much like a manufacturing company



C-5	feet	meter
Length	247	75
Wingspan	228	70



C-17	feet	meter
Length	174	53
Wingspan	170	52



C-130	feet	meter
Length	96	29
Wingspan	130	40



F-15	feet	meter
Length	64	19.5
Wingspan	43	13

WR-ALC – Warner Robins - Air Logistics Complex, AFSC – Air Force Sustainment Center

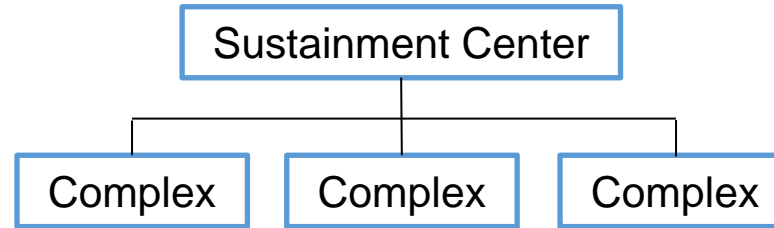


Air Force Sustainment Center

“The way we do business”



- Art of the Possible AFSC Handbook, AFSCH60-101, Dec 2021 is publicly available.



- With hundreds of different processes, high level descriptions are necessary to streamline management decision making.
- In the Art of the Possible (AoP) management system, this is called a “gated process” or “gated machine.”

Available Time (Days)	Required Output	Takt (Days)	Gate 1 (Pre-dock)	Gate 2 (Inspect Dock)	Gate 3 (Structures)	Gate 4 (System Ops)	Gate 5 (Post Dock)	TOTALS	
365	64	5.7	2	3	10	3	5	23	WIP
	Req'd Flowtime (Days):		11	17	57	17	29	131	Cal Days

AoP – Art of the Possible, AFSC – Air Force Sustainment Center ,Takt – Pace: time to produce one item, WIP – Work in Process



Air Force Sustainment Center “The way we do business”



- When process flowtime and WIP levels are set and variation is introduced in the gated process, it is difficult to predict how the process will perform.
- Solution
 - A standardized template was designed in AnyLogic
 - This template enables engineers to easily model their gated machines rather than create them from scratch.



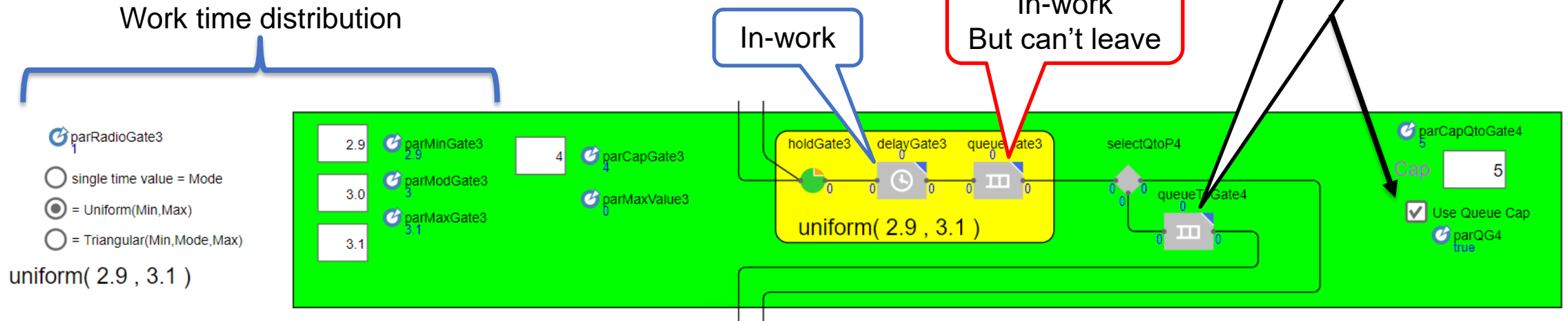
WIP – Work in Process



Modeling Each Gate



- Effects of Variation & Dependencies
 - In-work utilization
 - How queues fill
 - Actual time in the system
 - Actual throughput of each gate (milestone)



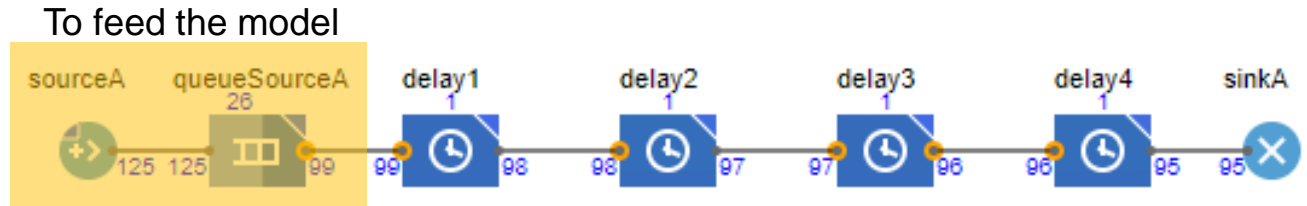


The Biggest Problem



In-work Utilization

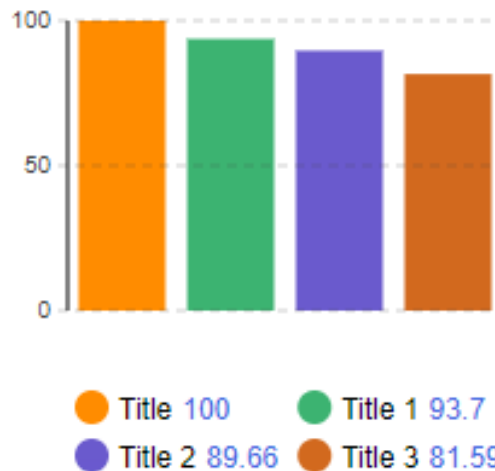
- When the delay time is finished, It keeps counting the utilization



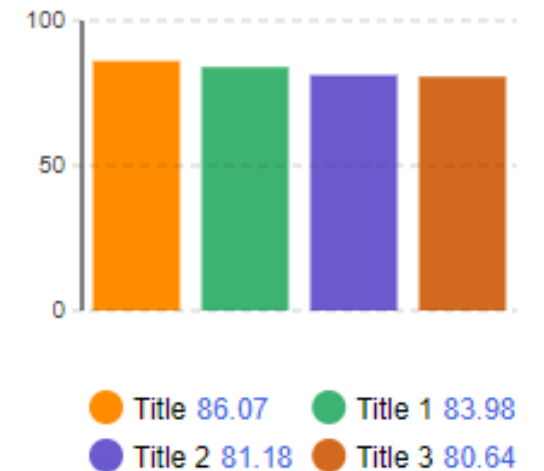
- Finished items should go into a queue

Station	Not real	Real	Difference
Delay 1	100	86.1	13.9
Delay 2	93.7	84.0	9.7
Delay 3	89.7	81.2	8.5
Delay 4	81.6	80.7	0.9

Not Real

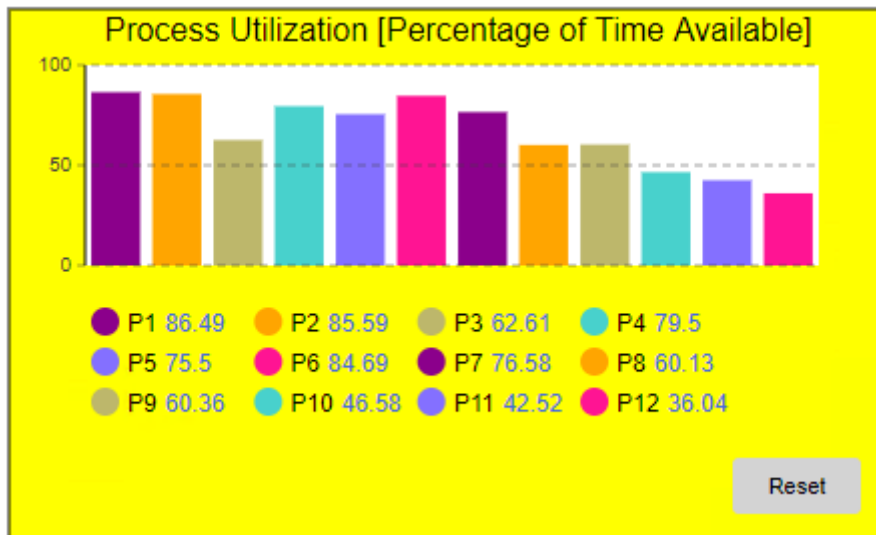
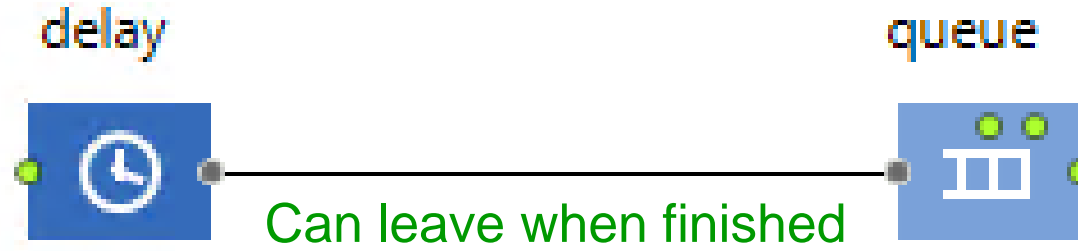


Real Utilization





Getting the Real Process Utilization



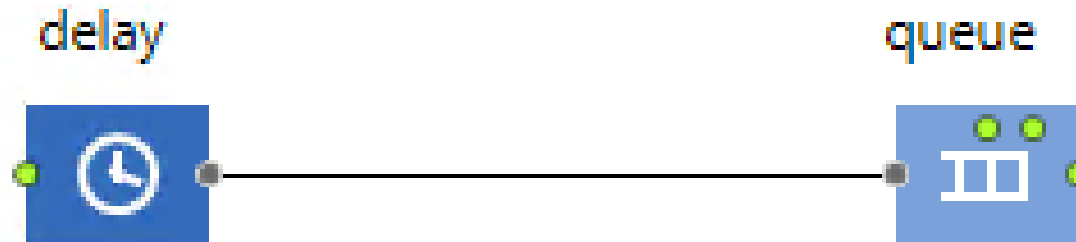
```
delay.statsUtilization.mean() * 100
```




Getting the Real Process Utilization



- I want to know about my excess capacity



Delay block

- Utilization = $\text{size}() / \text{capacity}$
- If the delay is finished but the agent can't leave, then the utilization increases
 - This is not processing utilization

Queue block

- Accepts agents that are finished
- If the next step is blocked
 - Holds the finished agent
 - It shows bottlenecks in the entire process



Control Capacity with a HOLD Block



- Hold, On enter
`holdGate1.block();`



- Queue, On exit
`holdGate1.unblock();`

- Delay, On enter

```
// Let another one in if PROCESS is not full  
if( (delayGate1.size() + queueGate1.size() ) < delayGate1.capacity )  
{  
    holdGate1.unblock();  
}
```

- Delay, **On at exit**

```
if( (delayGate1.size() + queueGate1.size() ) < delayGate1.capacity )  
{  
    holdGate1.unblock();  
}
```

Total capacity is based on this



Control Capacity the Easy Way



- No enter and exit coding needed

Set your max capacity

Capacity

Max cap

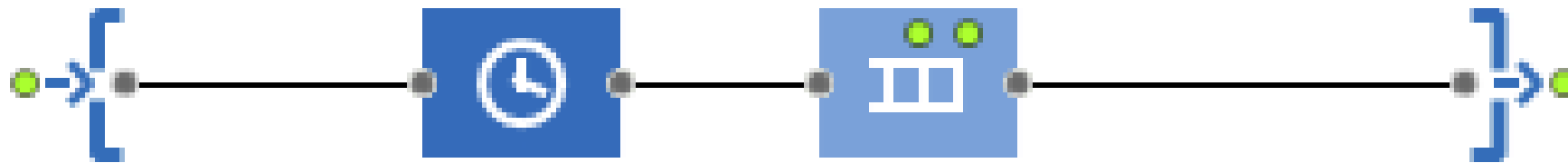
Choose start object

restrictedAreaStart2

delayGate2

queueGate2

restrictedAreaEnd2



How much to allow in

How many can you work at the same time



Template KPI Dashboard



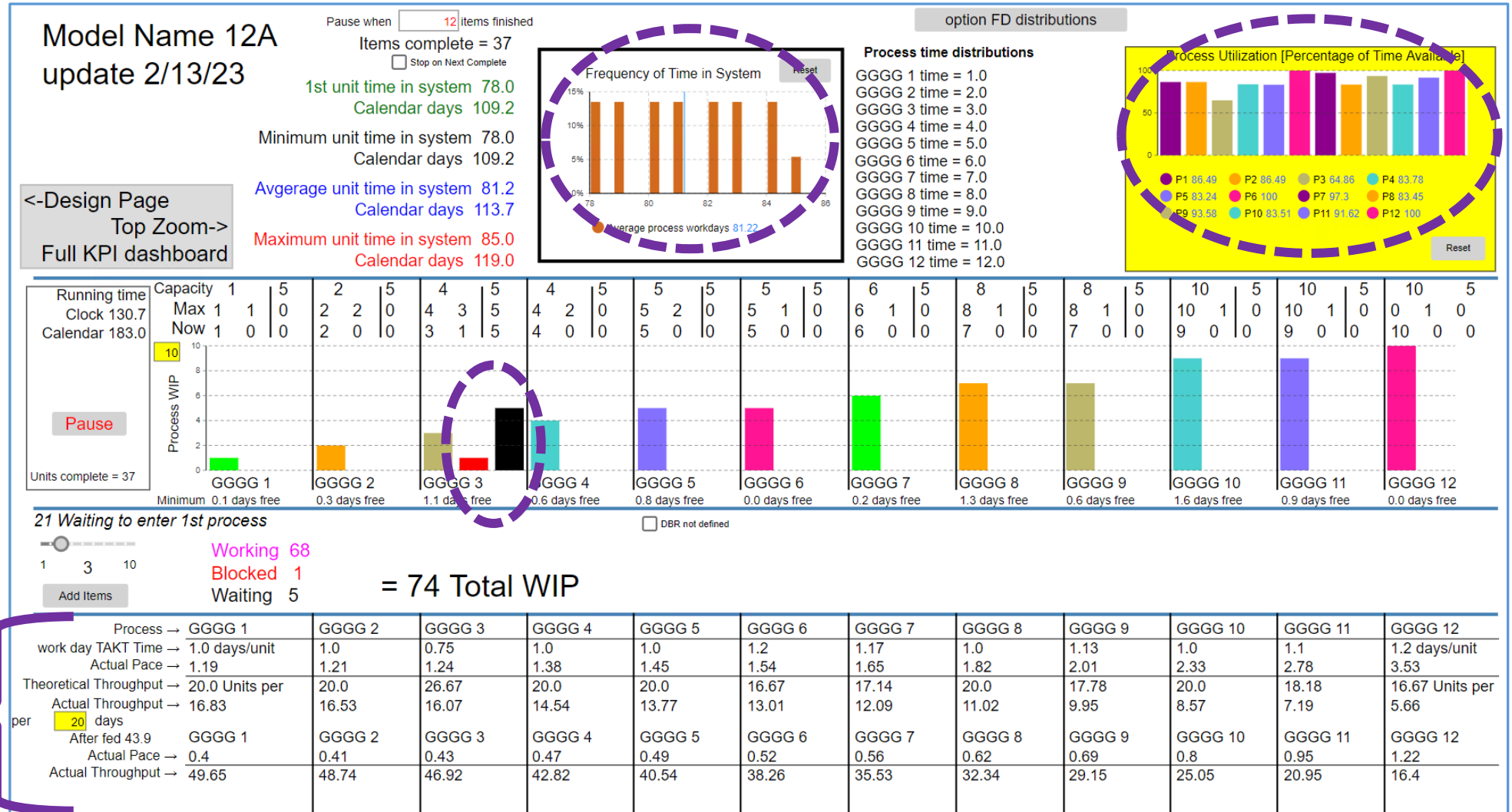
Questions answered

Actual time in the system

In-work utilization

How queues fill

Actual throughput of each Gate





Modeling Steps



■ Six steps for model design

Timeframe

■ Modeling work already done by the template

1. Design the logic
2. Create visual output to understand what the model is doing
3. Validate and verify the model design

Weeks

■ AoP already knows process data for the gated machine

4. Collect and verify process data

A week

■ Method to fill in the template

5. Input data into the model

2 hours

■ 10% of the remaining time

6. Fine tune the model with newly found dependencies

Another week



Method to Fill In the Template



- **Modeler and Process Engineer meet**
 - Both are familiar with gated process structures
 - Both are familiar with the process to be modeled
- **Modeler explains the template**
 - 30 minutes
- **Both people step through the template and gate design**
 - 1.5 hours
 - 90% of the model design is complete
- **Discover things to add to the model later**
 - Find where dependencies and resource constraints need to be added
 - Flow or worktime change based on aircraft model



C-5 Gated
Repair Process



C-130 Gated
Repair Process

C-130 Fuel Bladder
Inspection & Repair



We Deliver Better Airpower....Period!!!