

2024-05-14 | Turin

Maximizing Mission Success in a Dynamic Scenario with Multiple Constraints, Powered by Opus Evo

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Systecon Group

Statement

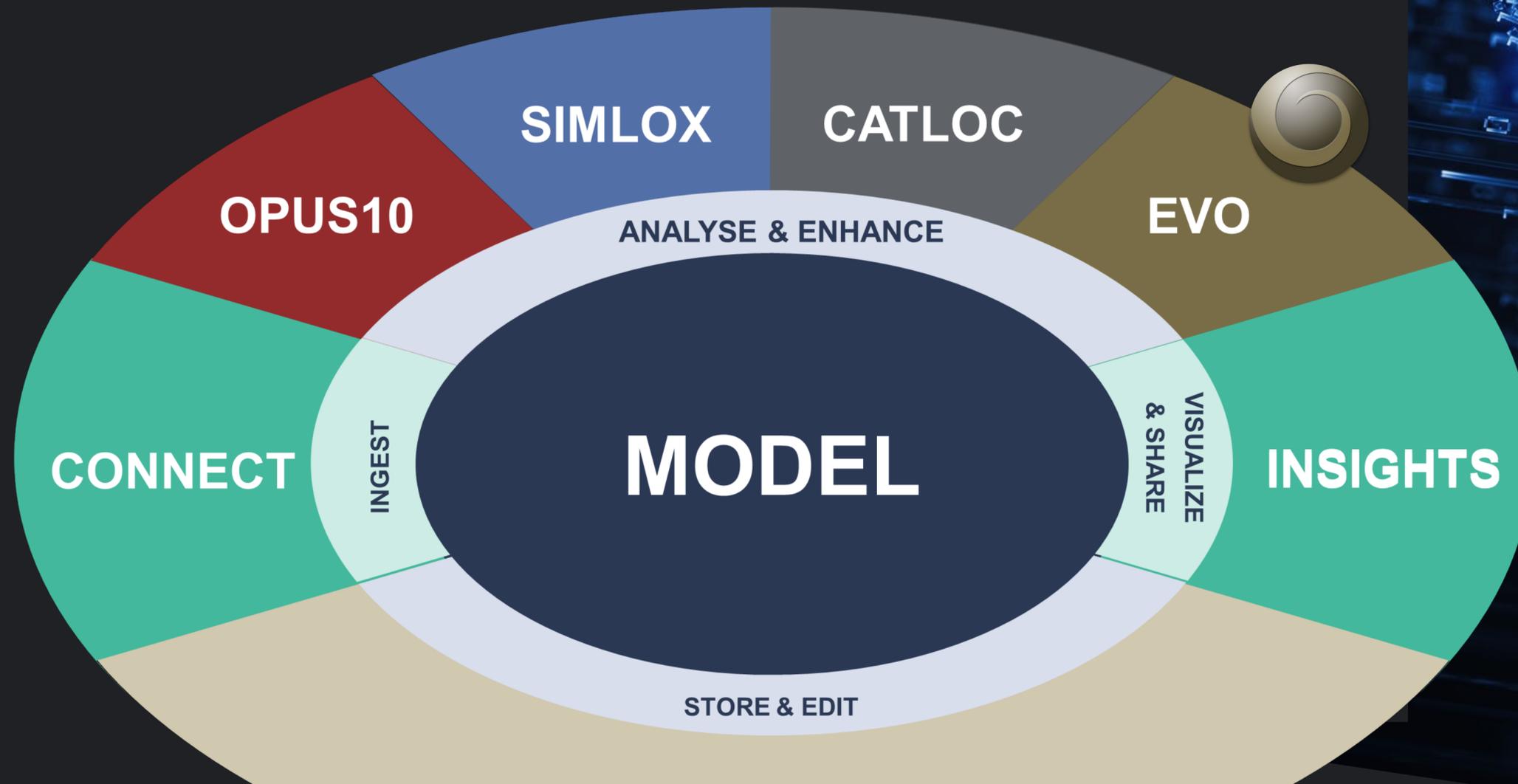
Use OPUS Evo for short-term tactical optimization,
if you want to:

1. Improve expected mission capability
2. Spend less money
3. Save analyst's time

Or... all of the above!!

Opus Evo

- Unlocks new spectrum of capabilities
 - Evolutionary Algorithms + Evaluator (Simulation / Analysis)
- Strong complement to the other Opus Suite software
 - Using the same Opus Suite model and data set
 - Incorporate dynamic aspects - non steady state



OPUS10 vs SIMLOX vs EVO



C/E Optimization – Strategic scenario (long-term)
Analytical approach – “calculation using formulas”
Extremely fast – can handle almost any problem size
Gives you optimized spares suggestions



Simulation of dynamic scenario
Can handle any time variations
Evaluate and present results for a single suggestion
Manual iterative approach to improve the solution



Optimization of dynamic scenario (short-term)
NOT steady-state, handles time variations and logical states
Uses SIMLOX/OPUS10 to evaluate each suggestion
Automatic approach to find optimal solutions

A Real-World Use Case

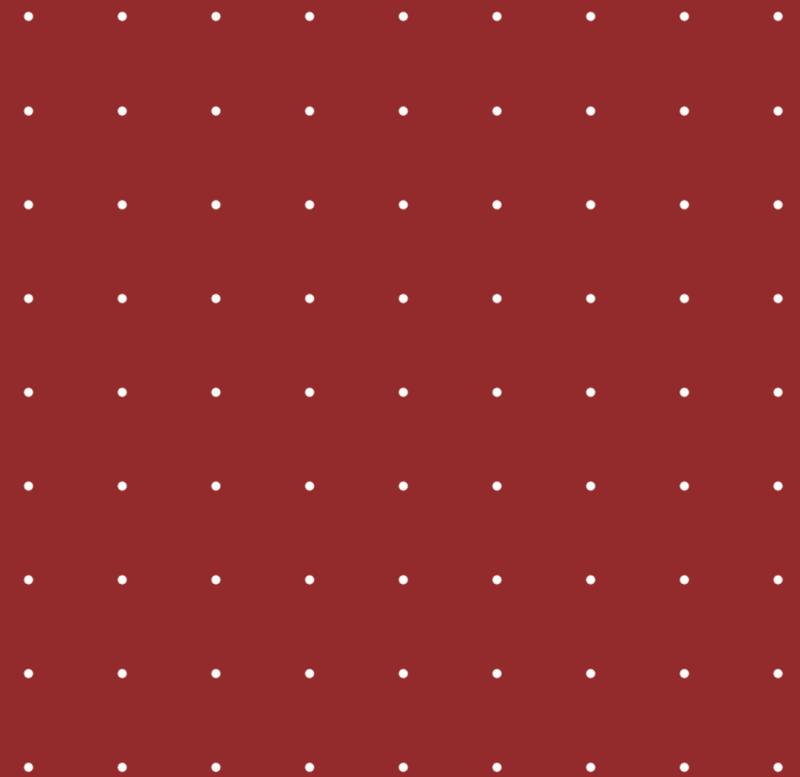
- US Air Force
- Short notice 20 days deployment
 - 24 fighter jets
 - Limited resupply support

Outcome from Opus Evo:

- 50% increase in Mission Capability for deployment
- 38% reduction in the number of spare parts
- 56% cost reduction
 - USAF DSP Model: 33.0 MUSD
 - Opus Evo: 14.5 MUSD



Scenario



Scenario

- Three types of battle tanks (all based upon a common platform), Infantry, Command and Recovery
- 100 items
 - Failure rate (op hours, terrain km, road km, rounds)
 - Price, Weight and Volume

ChatGPT 3.5 ▾

You

Please use the following part number and description list for battle tank components to estimate the Price [USD], Volume [m3] and Weight [kg] for each part number

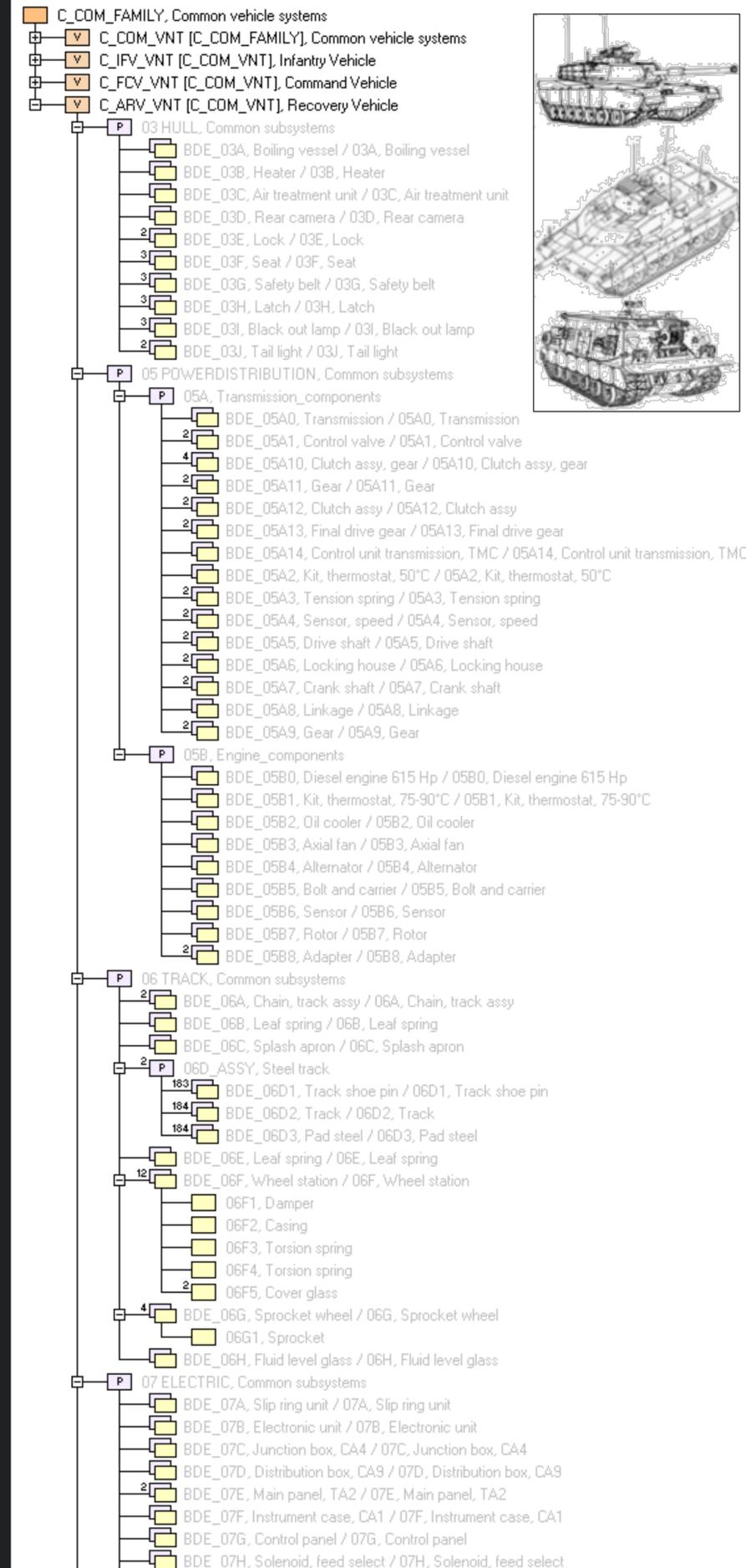
ItemId	Description
03A	Boiling vessel
03B	Heater
03C	Air treatment unit
03D	Rear camera
03E	Lock
03F	Seat

ChatGPT

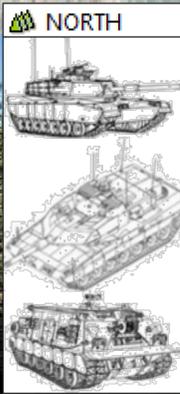
Here's the data set in tab-separated CSV format:

CSV Copy code

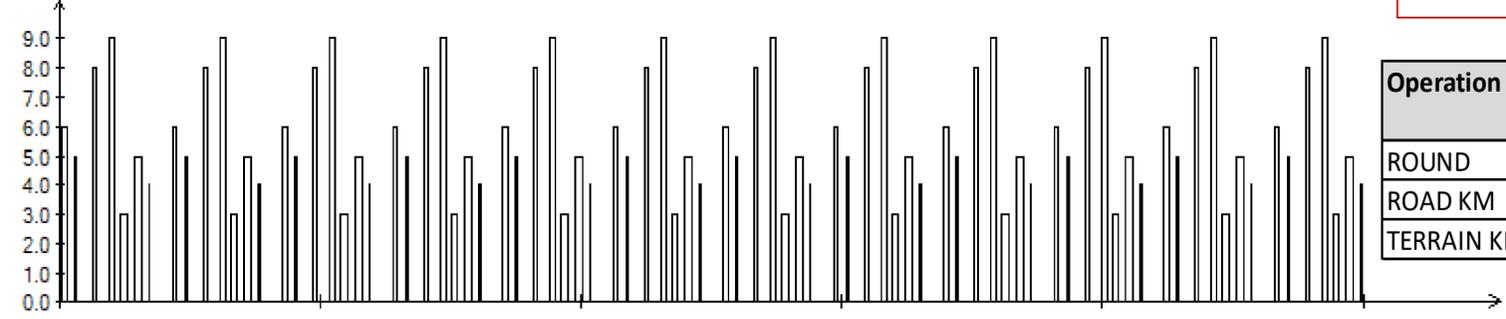
ItemId	Description	Price [USD]	Volume [m3]	Weight [kg]
03A	Boiling vessel	1000	0.1	50
03B	Heater	500	0.05	20
03C	Air treatment unit	3000	0.1	30
03D	Rear camera	1000	0.02	5
03E	Lock	200	0.01	2
03F	Seat	1500	0.05	15
03G	Safety belt	200	0.001	1
03H	Latch	200	0.002	2
03I	Black out lamp	200	0.001	1
03J	Tail light	200	0.001	1



Scenario

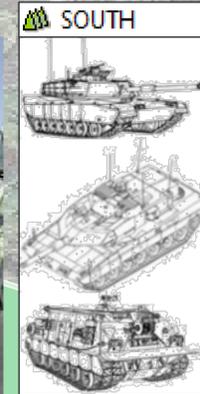


Systems

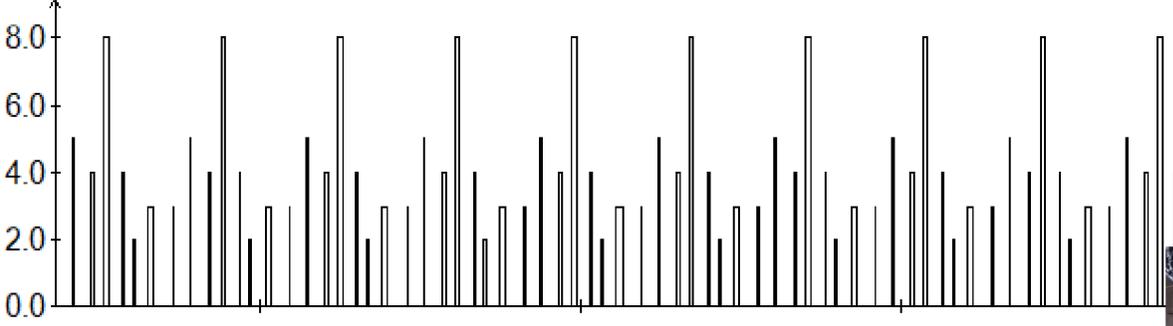


Total System-Hours:
3324.0

Operation ID	Frequency [1/op hour]
ROUND	0.48
ROAD KM	2.39
TERRAIN KM	0.24



Systems



Total System-Hours:
1558.4

Operation ID	Frequency [1/op hour]
ROUND	0.77
ROAD KM	3.14
TERRAIN KM	0.1

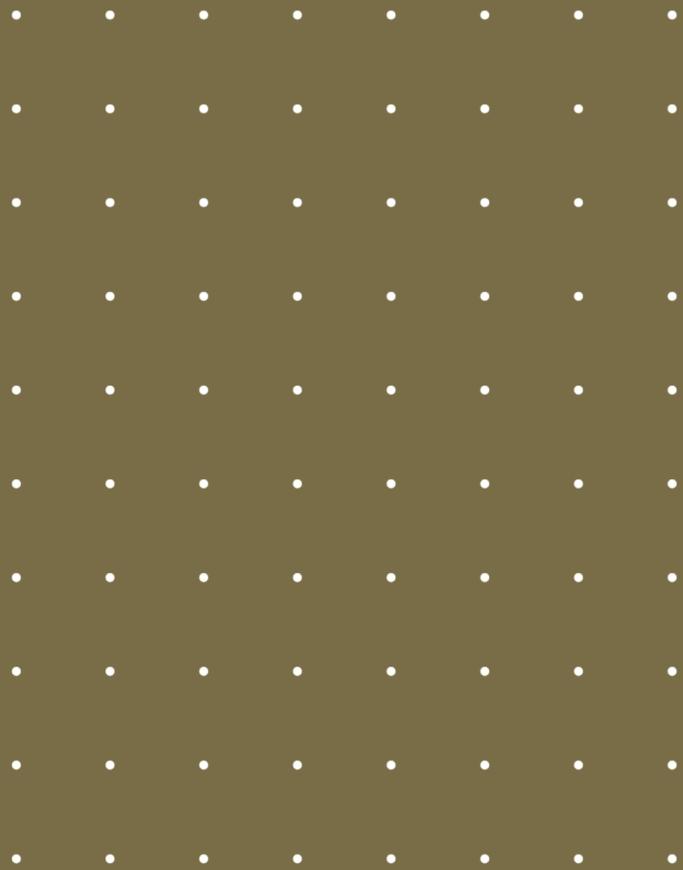


- Endurance period: 90 days
- Assignment for the Opus Suite Analytics Team:
 - A spares package that maximizes mission success

Opus Suite
Conference

TURIN

Day 1



DAY 1

Military Command



Please provide us with the optimal spares package, maximizing missions success. The maximum budget is 5 MUSD and the maximum weight is 20 tonnes



Opus Suite Analytics Team



Ok we will get back to you within 24 hours with the requested spares package

Setup of Opus Evo run

SIMLOX - [EvaluateMe.sxi <Model Table View>]

File Edit View Data Tools Window Help

Product Breakdown

- ROOT, Fictive root
 - C_COM_FAMILY, Common vehicle systems
 - C_COM_VNT [C_COM_FAMILY], Common vehicle systems
 - 03 HULL, Common subsystems
 - BDE_03A, Boiling vessel / 03A, Boiling vessel
 - BDE_03B, Heater / 03B, Heater
 - BDE_03C, Air treatment unit / 03C, Air treatment unit
 - BDE_03D, Rear camera / 03D, Rear camera
 - BDE_03E, Lock / 03E, Lock
 - BDE_03F, Seat / 03F, Seat
 - BDE_03G, Safety belt / 03G, Safety belt
 - BDE_03H, Latch / 03H, Latch
 - BDE_03I, Black out lamp / 03I, Black out lamp
 - BDE_03J, Tail light / 03J, Tail light
 - 05 POWERDISTRIBUTION, Common subsystems
 - 05A, Transmission_components
 - BDE_05A0, Transmission / 05A0, Transmission
 - BDE_05A1, Control valve / 05A1, Control valve
 - BDE_05A10, Clutch assy, gear / 05A10, Clutch assy, gear
 - BDE_05A11, Gear / 05A11, Gear
 - BDE_05A12, Clutch assy / 05A12, Clutch assy
 - BDE_05A13, Final drive gear / 05A13, Final drive gear
 - BDE_05A14, Control unit transmission, TMC / 05A14, Control unit transmission, TMC
 - BDE_05A2, Kit, thermostat, 50°C / 05A2, Kit, thermostat, 50°C
 - BDE_05A3, Tension spring / 05A3, Tension spring
 - BDE_05A4, Sensor, speed / 05A4, Sensor, speed
 - BDE_05A5, Drive shaft / 05A5, Drive shaft
 - BDE_05A6, Locking house / 05A6, Locking house
 - BDE_05A7, Crank shaft / 05A7, Crank shaft
 - BDE_05A8, Linkage / 05A8, Linkage
 - BDE_05A9, Gear / 05A9, Gear
 - 05B, Engine_components
 - BDE_05B0, Diesel engine 615 Hp / 05B0, Diesel engine 615 Hp
 - BDE_05B1, Kit, thermostat, 75-90°C / 05B1, Kit, thermostat, 75-90°C
 - BDE_05B2, Oil cooler / 05B2, Oil cooler
 - BDE_05B3, Axial fan / 05B3, Axial fan
 - BDE_05B4, Alternator / 05B4, Alternator
 - BDE_05B5, Bolt and carrier / 05B5, Bolt and carrier
 - BDE_05B6, Sensor / 05B6, Sensor
 - BDE_05B7, Rotor / 05B7, Rotor
 - BDE_05B8, Adapter / 05B8, Adapter
 - 06 TRACK, Common subsystems
 - BDE_06A, Chain, track assy / 06A, Chain, track assy
 - BDE_06B, Leaf spring / 06B, Leaf spring
 - BDE_06C, Splash apron / 06C, Splash apron
 - 06D_ASSY, Steel track
 - BDE_06D1, Track shoe pin / 06D1, Track shoe pin
 - BDE_06D2, Track / 06D2, Track
 - BDE_06D3, Pad steel / 06D3, Pad steel
 - BDE_06E, Leaf spring / 06E, Leaf spring

Support organization

Quantity System ID

10 C_ARV

10 C_FCV

10 C_IFV

DEPOT NORTH

5 C_ARV

5 C_FCV

5 C_IFV

DEPOT SOUTH

5 C_ARV

5 C_FCV

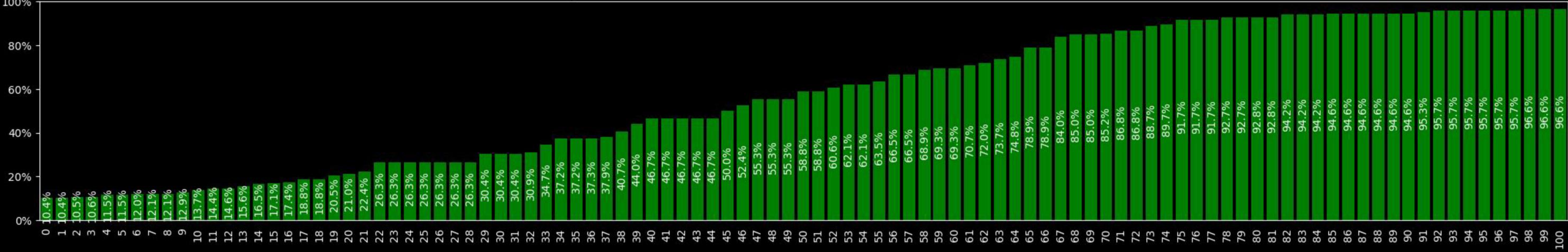
5 C_IFV

BreakdownElement		
BDEID	DESCR	
Breakdown element identifier	Description	
1	BDE_03A	Boiling vessel
2	BDE_03B	Heater
3	BDE_03C	Air treatment unit
4	BDE_03D	Rear camera
5	BDE_03E	Lock
6	BDE_03F	Seat
7	BDE_03G	Safety belt
8	BDE_03H	Latch
9	03 HULL	Common subsystems
10	BDE_03I	Black out lamp
11	BDE_03J	Tail light
12	05A	Transmission_components
13	BDE_05A0	Transmission
14	BDE_05A1	Control valve
15	BDE_05A10	Clutch assy, gear
16	BDE_05A11	Gear
17	BDE_05A12	Clutch assy

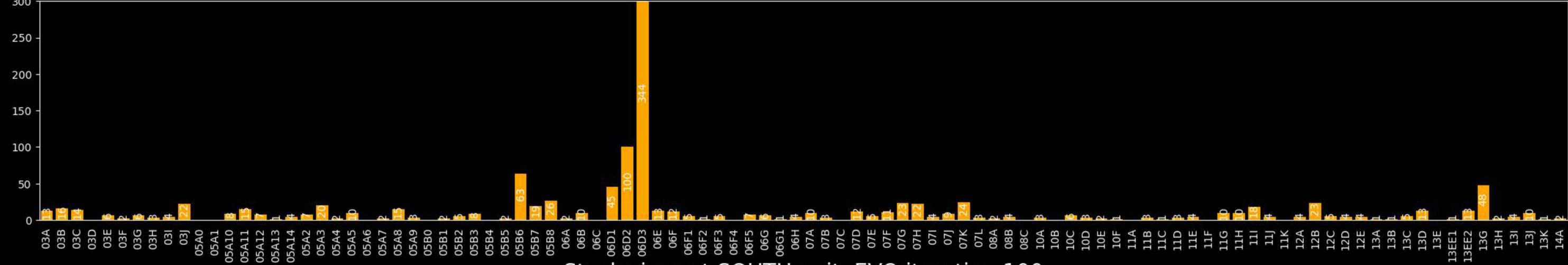


Running EVO with {Total Cost & Weight Constraints} ...

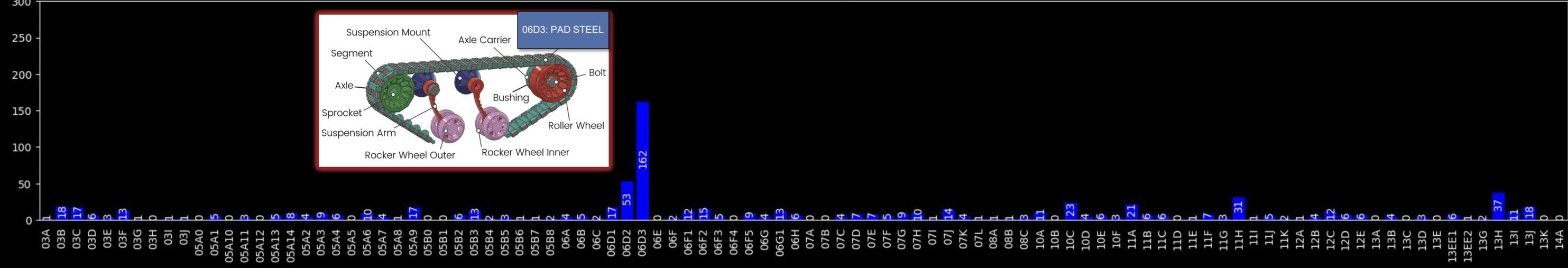
Planned operation achievement for EVO iterations 0, 1, ..., 100



Stock sizes at NORTH unit, EVO iteration 100



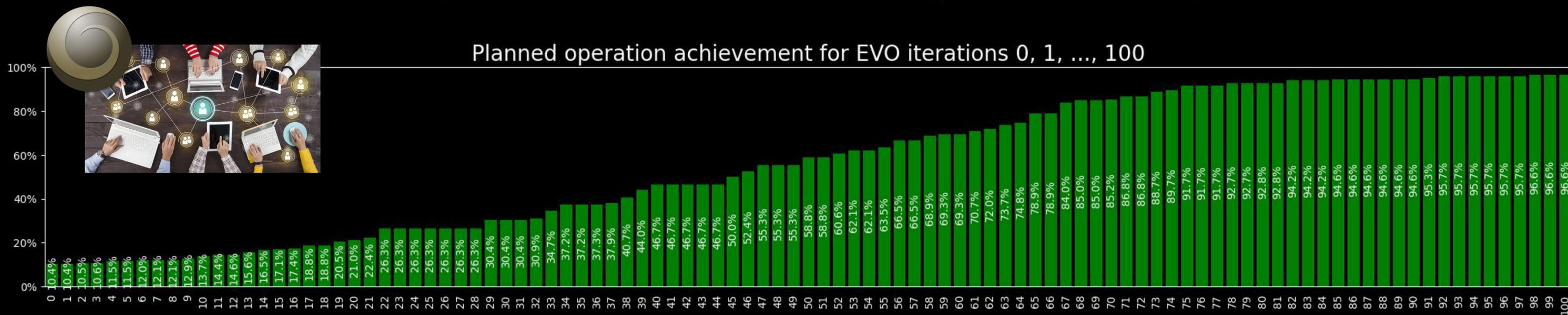
Stock sizes at SOUTH unit, EVO iteration 100



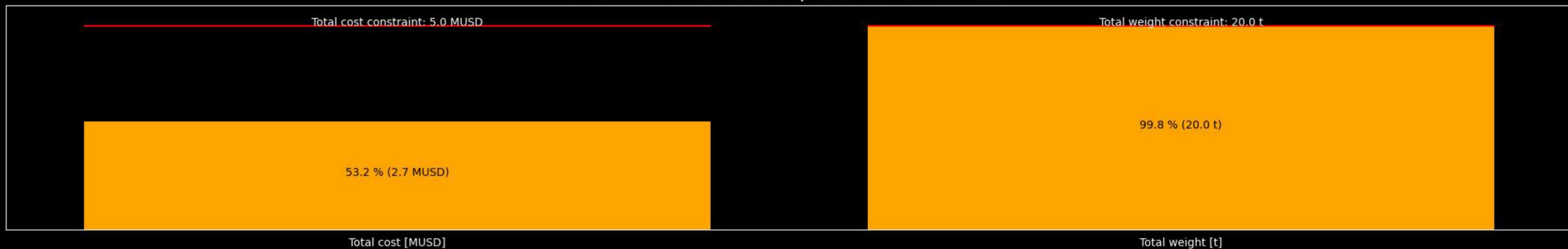


The maximum budget is 5 MUSD and the maximum weight is 20 tonnes

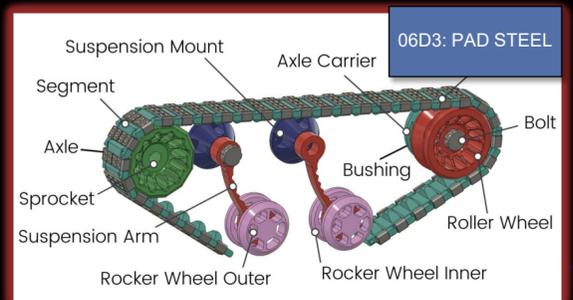
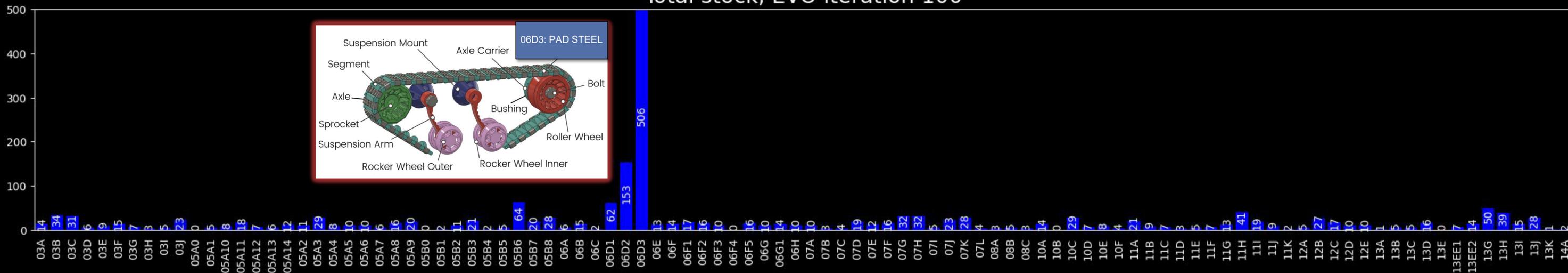
Running EVO with {Total Cost & Weight Constraints} ...



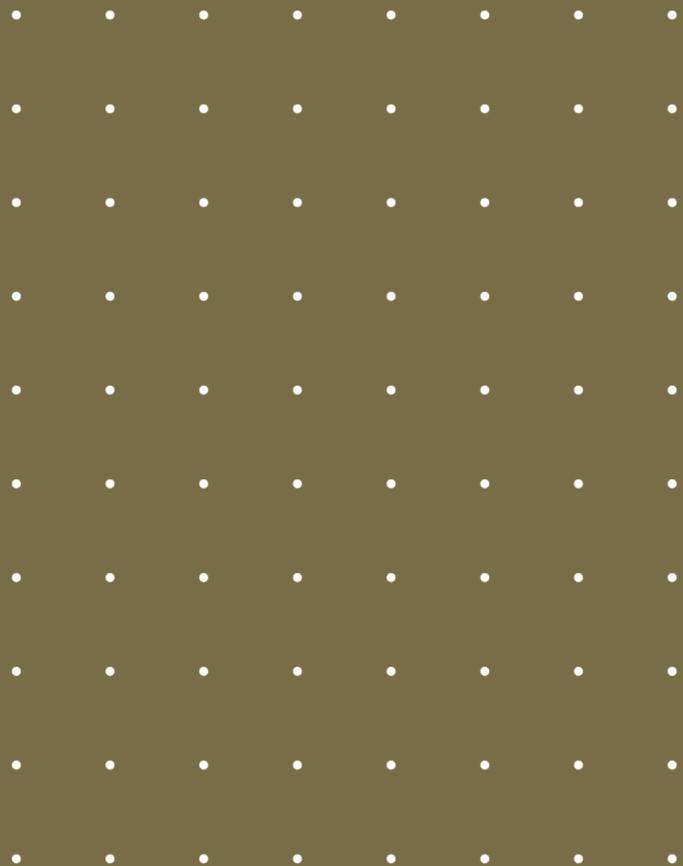
Constraint validation, EVO iteration 100



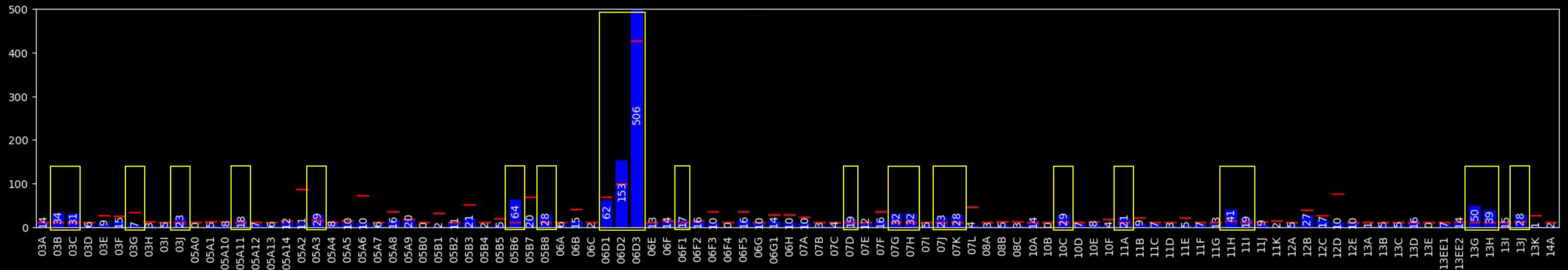
Total stock, EVO iteration 100



Day 2



Available stock limits exceeded!



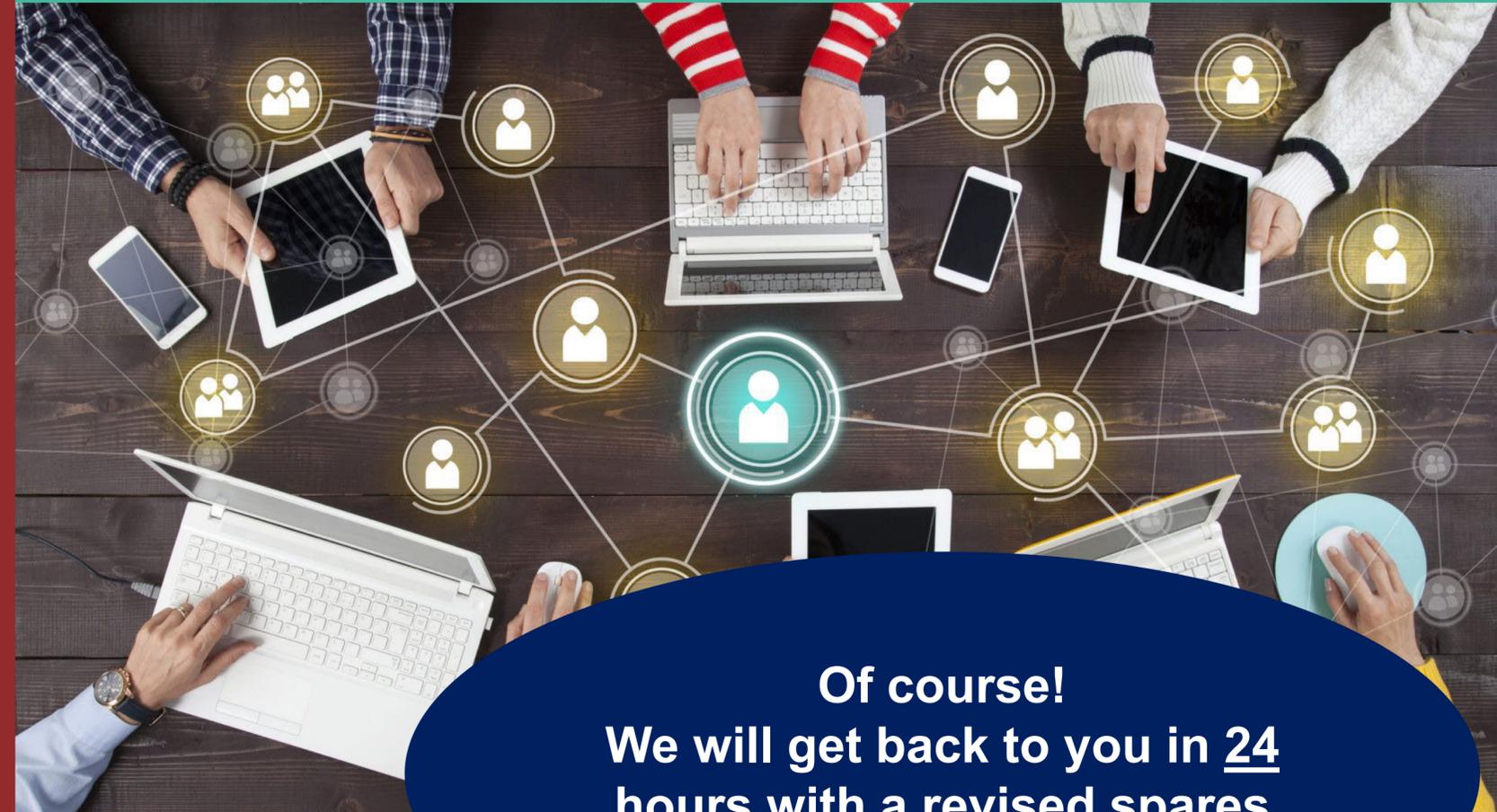
DAY 2

Military Command

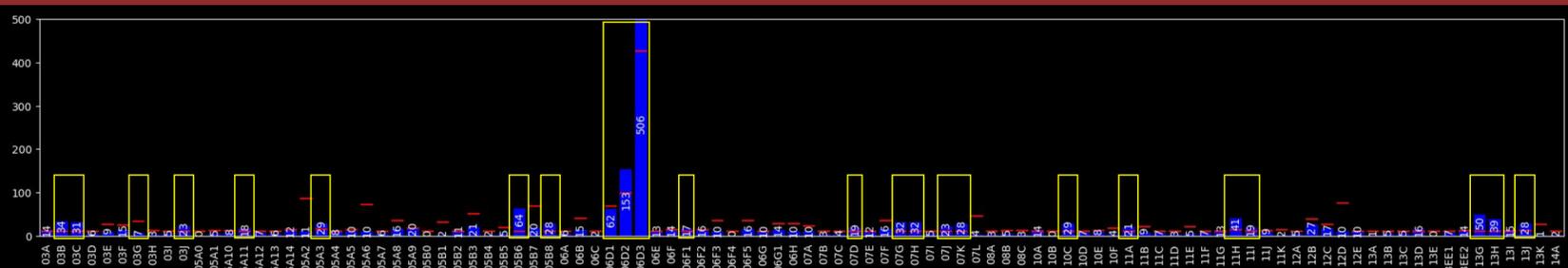


Thanks for the suggested spares package, unfortunately it exceeds the existing stock for some items, can you please redo the analysis

Opus Suite Analytics Team

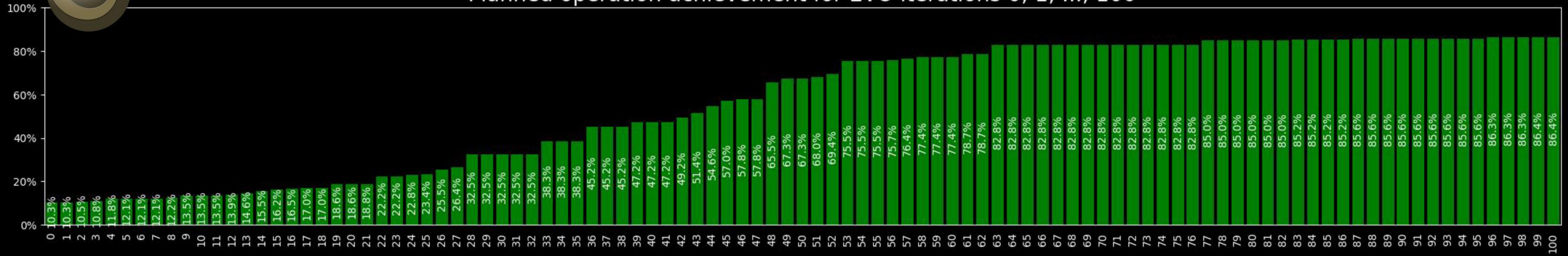


Of course!
We will get back to you in 24 hours with a revised spares package.

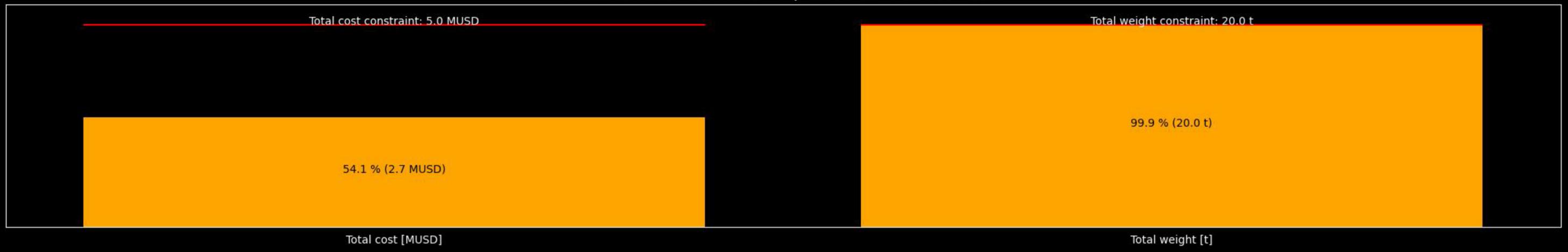


Running EVO with {Total Cost, Weight and Stock Constraints} ...

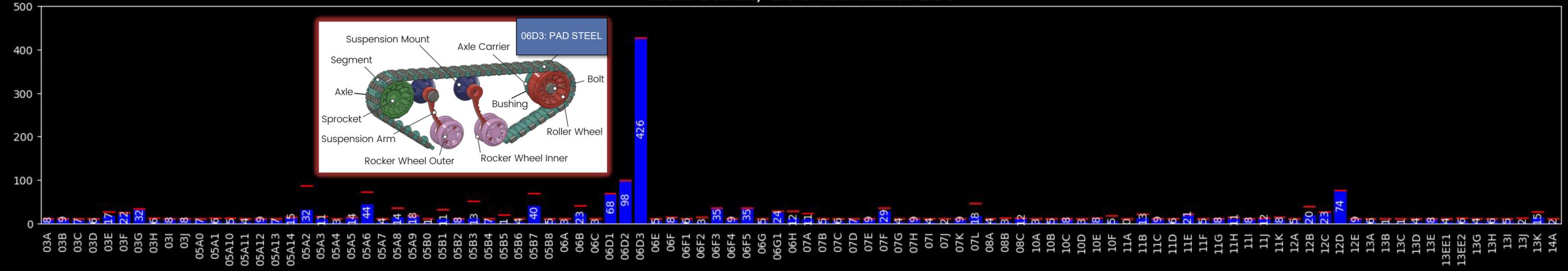
Planned operation achievement for EVO iterations 0, 1, ..., 100



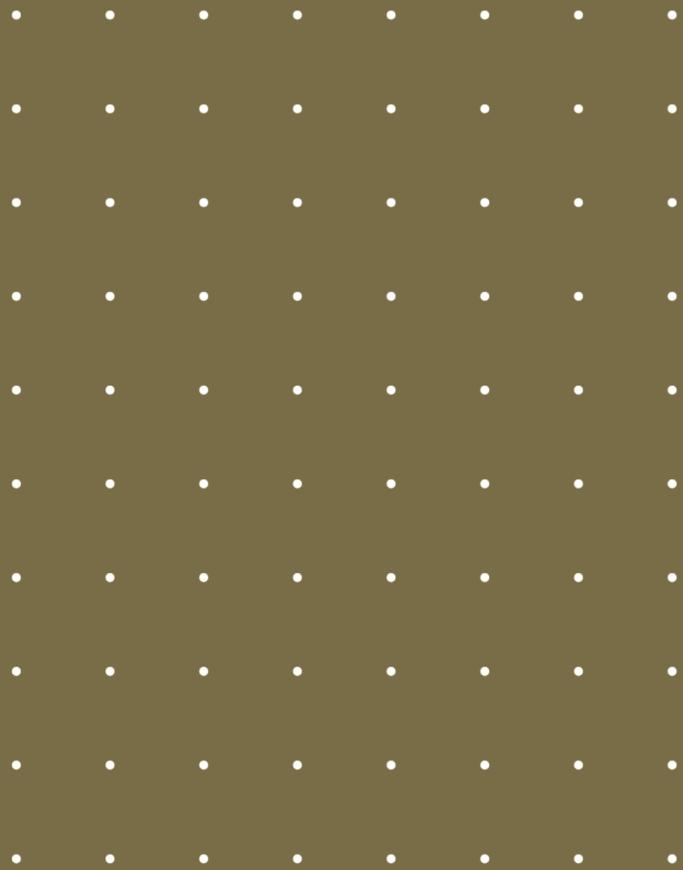
Constraint validation, EVO iteration 100



Total stock, EVO iteration 100



Day 3



DAY 3

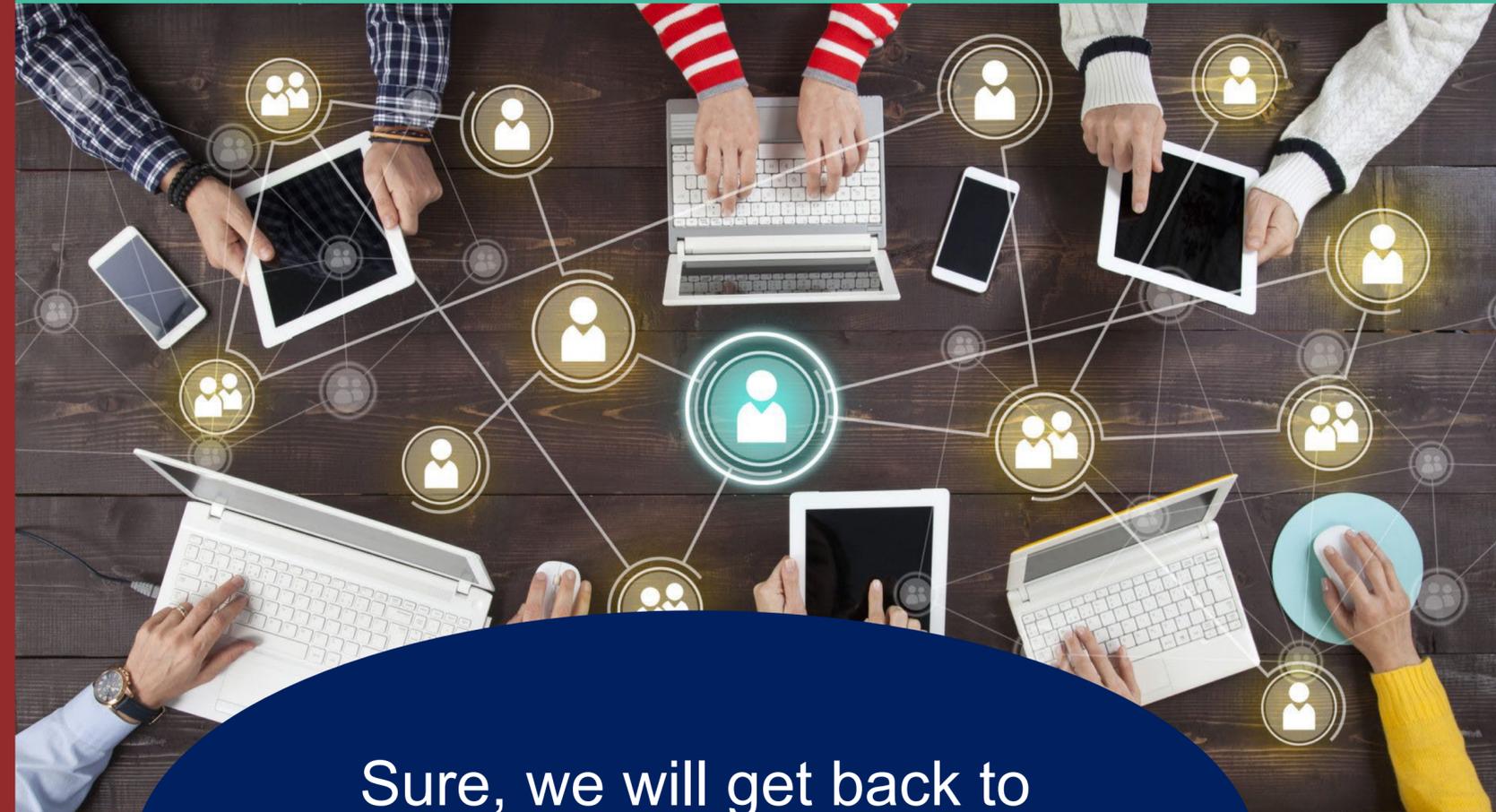
Military Command



Thanks for the suggested spares package, can you please update the analysis since there are also container volume constraints, **10 m³** for the NORTH unit and **5 m³** for the SOUTH unit

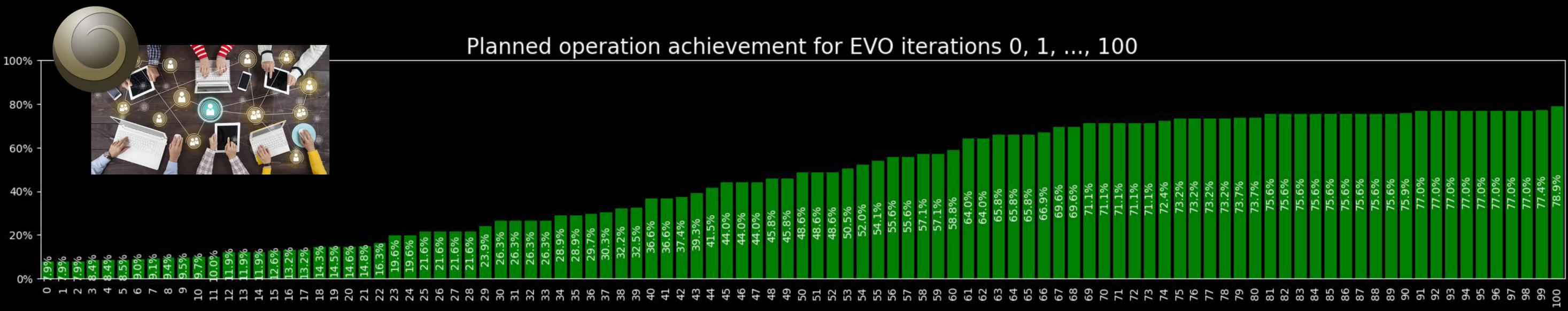


Opus Suite Analytics Team

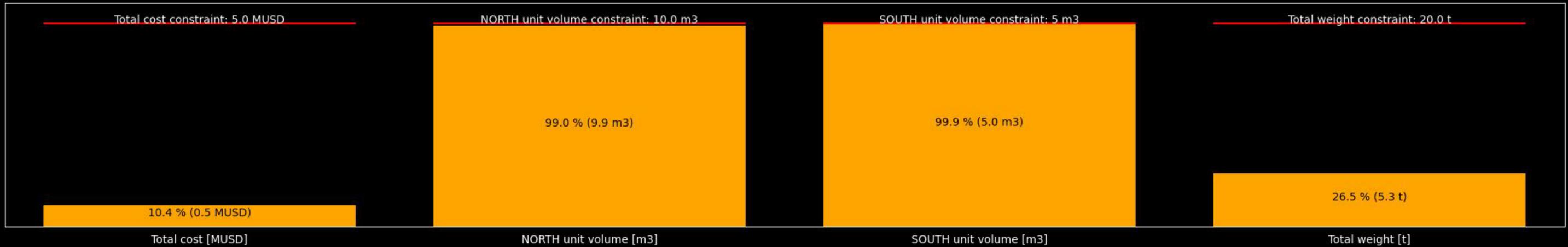


Sure, we will get back to you within **24 hours** with a revised spares package

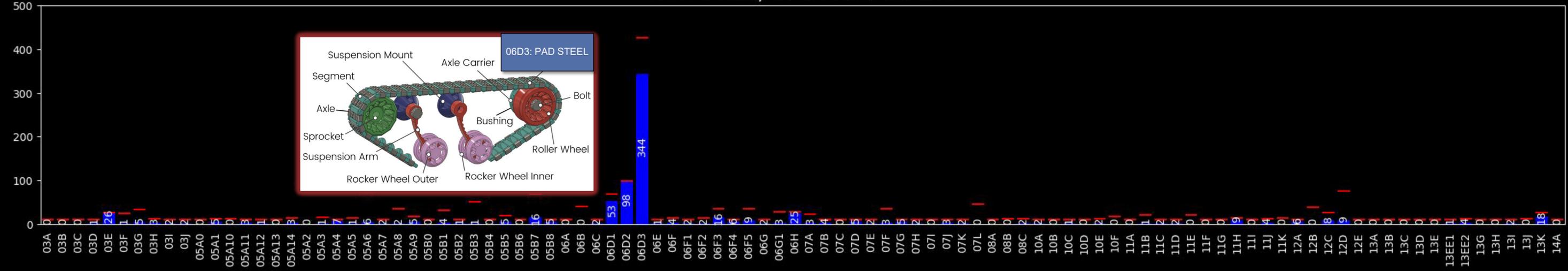
Running EVO with {Total Cost, Weight and Stock Constraints} and {Local Volume Constraints}...



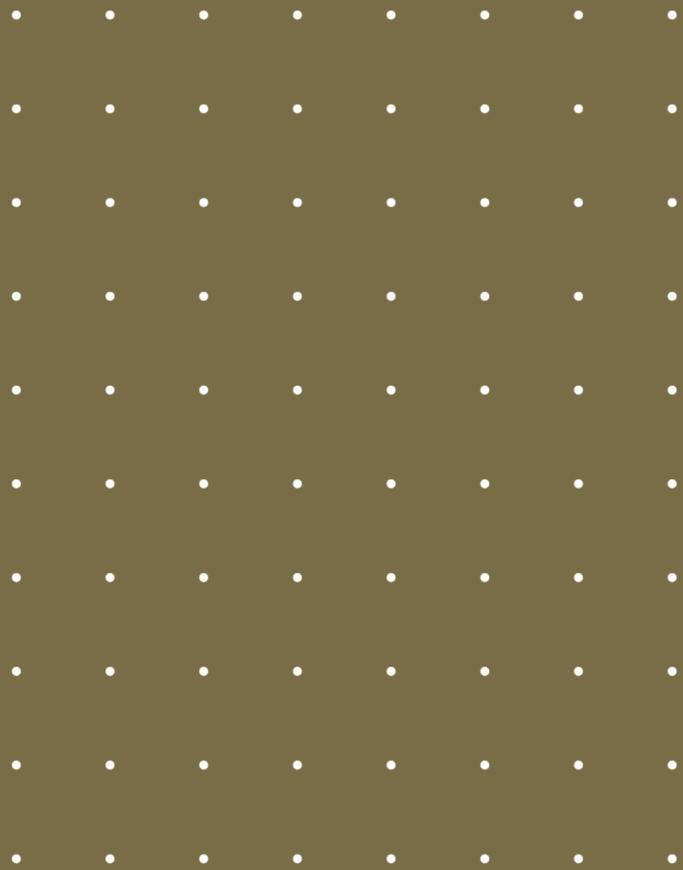
Constraint validation, EVO iteration 100



Total stock, EVO iteration 100

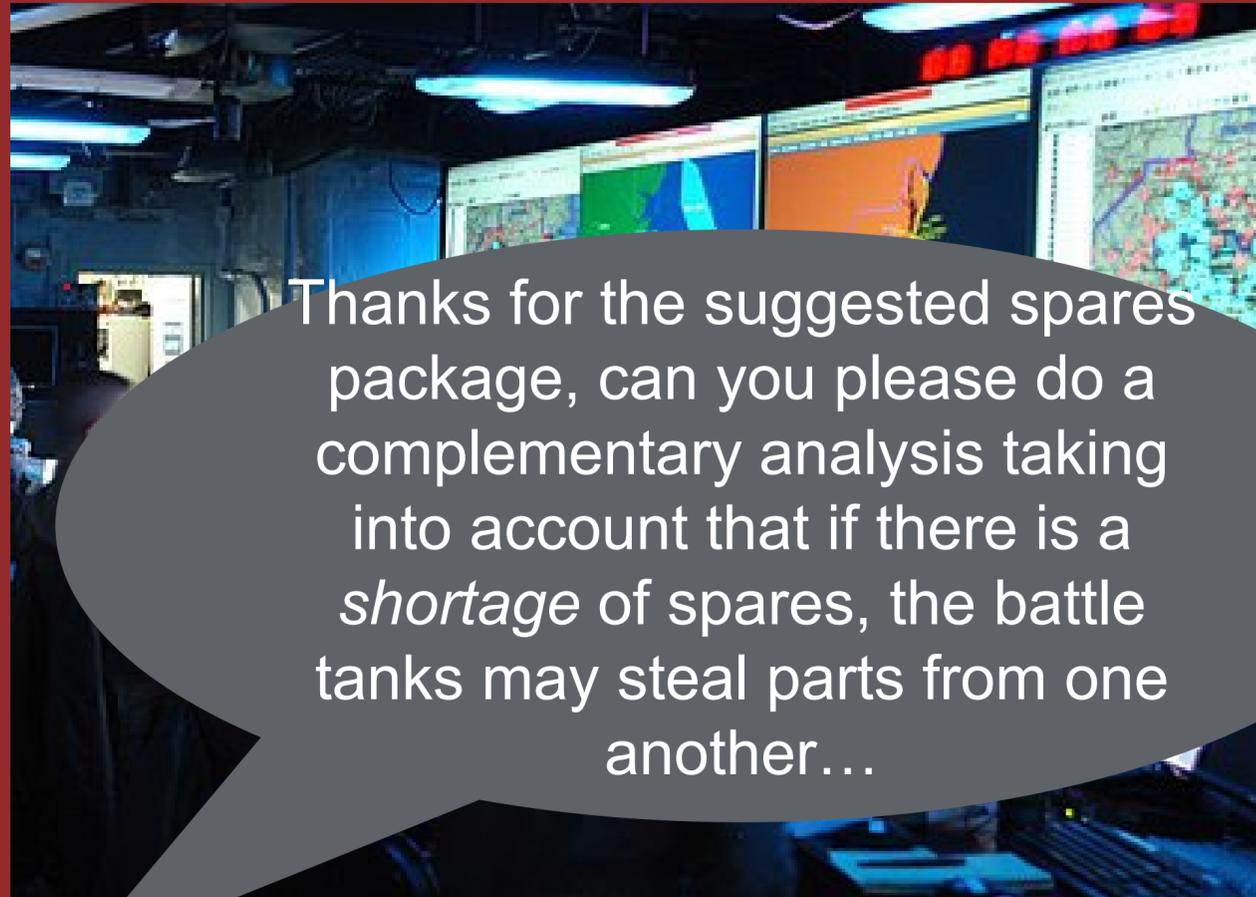


Day 4



DAY 4

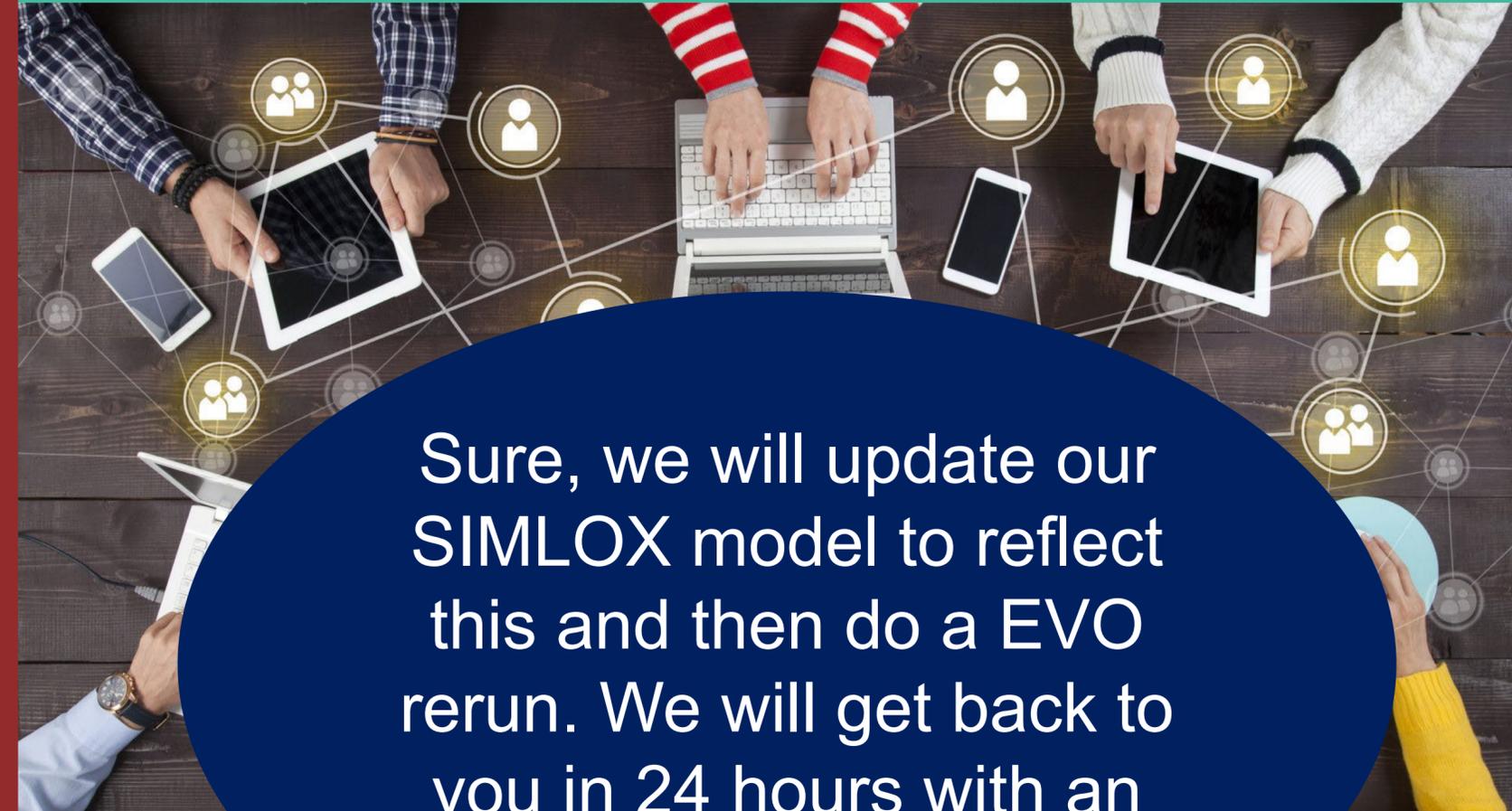
Military Command



Thanks for the suggested spares package, can you please do a complementary analysis taking into account that if there is a *shortage* of spares, the battle tanks may steal parts from one another...



Opus Suite Analytics Team



Sure, we will update our SIMLOX model to reflect this and then do a EVO rerun. We will get back to you in 24 hours with an efficient spares package

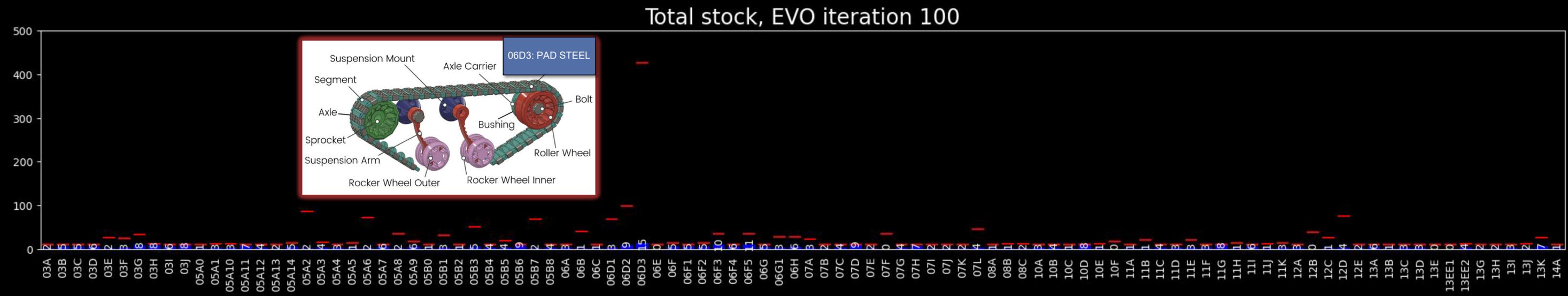
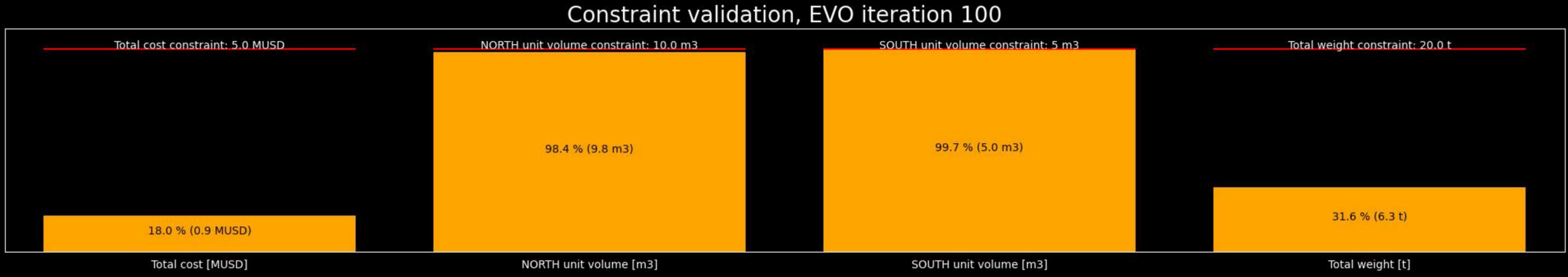
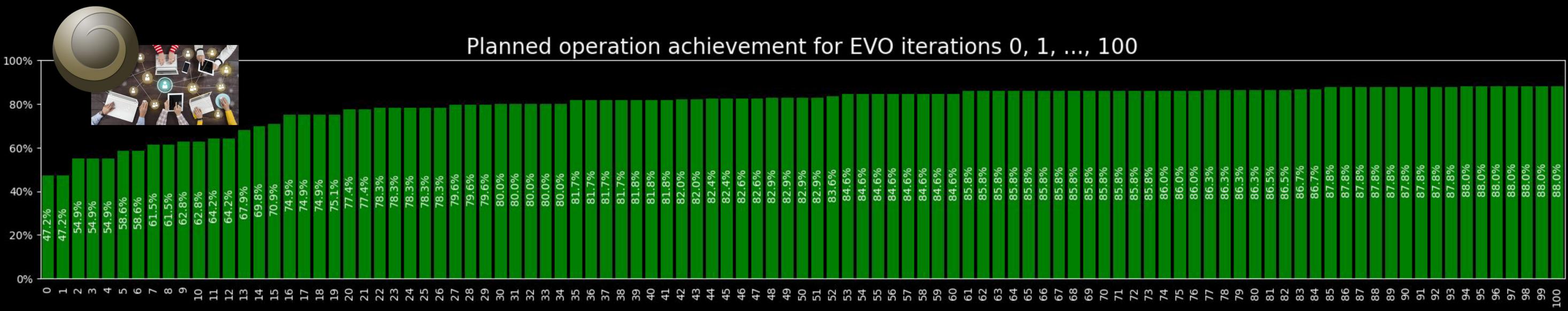
Adjusting the SIMLOX model used by Opus Evo ...

The screenshot displays the SIMLOX software interface for 'EvaluateMe_Robbing_NREPS=3.sxi'. It is divided into three main sections:

- Product Breakdown:** A hierarchical tree view on the left showing components like 'C_COM_FAMILY', '03 HULL', and '05 POWERDISTRIBUTION'.
- Support organization:** A central area showing two depots: 'DEPOT NORTH' and 'DEPOT SOUTH'. Each depot lists quantities for system IDs C_ARV, C_FCV, and C_IFV.
- Control Table:** A table at the bottom with various simulation parameters. The 'ENROB' parameter (Enable robbing) is highlighted with a red box and set to 'Y'.

PVID	BDSID	BDMID	QTYPM	TID	RTID
Product or product variant identifier	Breakdown sub identifier	Breakdown mother identifier	Quantity per mother element	Replacement task identifier	Robbing victim replacement task identifier
1	C_COM_VNT	BDE_03A	<1>	REPLACE_03A	REPLACE_03A
2	C_COM_VNT	BDE_03B	<1>	REPLACE_03B	REPLACE_03B
3	C_COM_VNT	BDE_03C	<1>	REPLACE_03C	REPLACE_03C
4	C_COM_VNT	BDE_03D	<1>	REPLACE_03D	REPLACE_03D
5	C_COM_VNT	BDE_03E	2	REPLACE_03E	REPLACE_03E
6	C_COM_VNT	BDE_03F	3	REPLACE_03F	REPLACE_03F
7	C_COM_VNT	BDE_03G	3	REPLACE_03G	REPLACE_03G
8	C_COM_VNT	BDE_03H	3	REPLACE_03H	REPLACE_03H
9	C_COM_VNT	03 HULL	<1>		
10	C_COM_VNT	BDE_03I	3	REPLACE_03I	REPLACE_03I
11	C_COM_VNT	BDE_03J	2	REPLACE_03J	REPLACE_03J
12	C_COM_VNT	05A	<1>		
13	C_COM_VNT	BDE_05A0	<1>	REPLACE_05A0	REPLACE_05A0
14	C_COM_VNT	BDE_05A1	2	REPLACE_05A1	REPLACE_05A1
15	C_COM_VNT	BDE_05A10	4	REPLACE_05A10	REPLACE_05A10
16	C_COM_VNT	BDE_05A11	2	REPLACE_05A11	REPLACE_05A11
17	C_COM_VNT	BDE_05A12	2	REPLACE_05A12	REPLACE_05A12
18	C_COM_VNT	BDE_05A13	2	REPLACE_05A13	REPLACE_05A13
19	C_COM_VNT	BDE_05A14	<1>	REPLACE_05A14	REPLACE_05A14
20	C_COM_VNT	BDE_05A2	<1>	REPLACE_05A2	REPLACE_05A2
21	C_COM_VNT	BDE_05A3	2	REPLACE_05A3	REPLACE_05A3
22	C_COM_VNT	BDE_05A4	2	REPLACE_05A4	REPLACE_05A4
23	C_COM_VNT	BDE_05A5	2	REPLACE_05A5	REPLACE_05A5
24	C_COM_VNT	BDE_05A6	2	REPLACE_05A6	REPLACE_05A6
25	C_COM_VNT	BDE_05A7	2	REPLACE_05A7	REPLACE_05A7
26	C_COM_VNT	BDE_05A8	2	REPLACE_05A8	REPLACE_05A8
27	C_COM_VNT	BDE_05A9	2	REPLACE_05A9	REPLACE_05A9
28	C_COM_VNT	05B	<1>		
29	C_COM_VNT	BDE_05B0	<1>	REPLACE_05B0	REPLACE_05B0
30	C_COM_VNT	BDE_05B1	<1>	REPLACE_05B1	REPLACE_05B1
31	C_COM_VNT	BDE_05B2	<1>	REPLACE_05B2	REPLACE_05B2
32	C_COM_VNT	BDE_05B3	<1>	REPLACE_05B3	REPLACE_05B3
33	C_COM_VNT	BDE_05B4	<1>	REPLACE_05B4	REPLACE_05B4
34	C_COM_VNT	BDE_05B5	<1>	REPLACE_05B5	REPLACE_05B5
35	C_COM_VNT	BDE_05B6	<1>	REPLACE_05B6	REPLACE_05B6
36	C_COM_VNT	BDE_05B7	<1>	REPLACE_05B7	REPLACE_05B7
37	C_COM_VNT	BDE_05B8	2	REPLACE_05B8	REPLACE_05B8
38	C_COM_VNT	05 POWERDISTRIBUTION	<1>		
39	C_COM_VNT	BDE_06A	2	REPLACE_06A	REPLACE_06A
40	C_COM_VNT	BDE_06B	2	REPLACE_06B	REPLACE_06B

Running EVO with {Total Cost, Weight and Stock Constraints} and {Local Volume Constraints}...



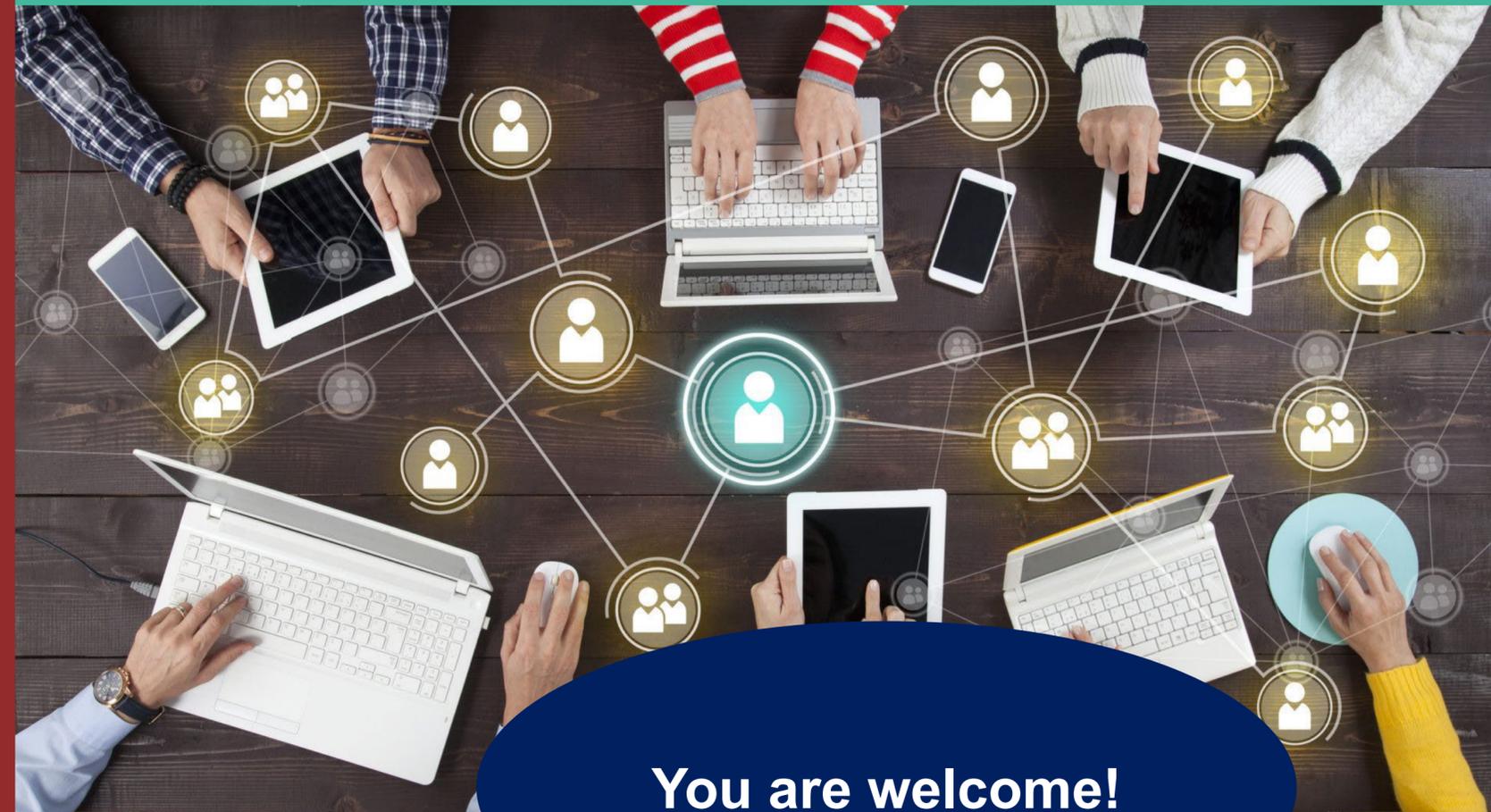
Ready to go ...

Military Command



Thanks for giving us the best possible conditions for a successful deployment!

Opus Suite Analytics Team



You are welcome!

A Real-World Use Case

- US Air Force
- Short notice 20 days deployment
 - 24 fighter jets
 - Limited resupply support

Outcome from Opus Evo:

- 50% increase in Mission Capability for deployment
- 38% reduction in the number of spare parts
- 56% cost reduction
 - USAF DSP Model: 33.0 MUSD
 - Opus Evo: 14.5 MUSD



Thank you.

