Data Impacts on System Readiness and Cost

ICEAA 2019 Professional Development & Training Workshop

May 14-17, 2019

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Agenda

- Problem
- Operations & Sustainment Costs
- Estimating Methodologies
- Operational Performance
- Parameters that affect cost and readiness
- Data impacts
- Challenges
- What is happening Now?

System Readiness Problem

SECDEF Mattis set a goal to achieve a minimum of 80 percent mission capability rates for the Pentagon's F-35, F-22, F-16 and F-18 inventories — a number well above the mission capability rates those aircraft now achieve. In addition, Mattis wants to see reduced operating and maintenance costs on the platforms, starting in FY19.

The Navy has lost more than 27,000 days of ship and submarine availability due to maintenance delays since 2012.

The Navy has spent $1.5 billion "to support attack submarines that provide no operational capability—those sitting idle no longer certified to conduct normal operations—while waiting to enter the shipyards."

90% of the Army's unit equipment moves by strategic sealift. The readiness of the surge sealift and combat logistics fleets has trended downwards since 2012 and maintenance periods are running longer than planned.

MISSION-CAPABLE RATES

Across the Air Force, roughly seven in 10 planes are ready to perform their designated missions at any given time. Mission-capable rates in fiscal 2017 ranged from 49 percent for the F-22A Raptor to 91.2 percent for the MQ-1B Predator unmanned aircraft.
The chart shows the rates for some of the service's most well-known airframes, and how they compare to previous years' rates.

Aircraft	Active inventory (2017)	2017	2016	Change	2015	2014
A-10	283	73.76%	74.09%	-0.33%	76.80%	75.10%
AC-130U	16	82.80%	81.18%	1.62%	83.40%	83.10%
B-1B	62	52.79%	51.62%	1.17%	47.00%	47.70%
B-2A	20	53.83%	51.11%	2.72%	55.90%	56.90%
B-52H	75	71.82%	73.92%	-2.10%	72.20%	73.50%
C-5M	48	60.25%	67.89%	-7.64%	69.00%	66.40%
C-17A	222	83.69%	85.12%	-1.43%	85.10%	85.60%
C-130H	188	73.14%	73.04%	0.10%	73.80%	72.70%
C-130J	110	76.96%	78.72%	-1.76%	79.80%	80.90%
CV-22B	50	66.61%	60.04%	6.57%	55.80%	59.30%
E-3B	11	69.19%	69.16%	0.03%	74.00%	76.50%
E-3C	3	67.39%	75.89%	-8.50%	78.70%	76.60%
E-3G	17	74.91%	79.28%	-4.37%	82.90%	83.40%
E-8C	16	63.88%	73.31%	-9.43%	76.40%	72.10%
F-15C	212	71.24%	71.22%	0.02%	70.70%	73.20%
F-15D	23	70.37%	59.89%	10.48%	64.20%	72.90%
F-15E	218	75.26%	72.94%	2.32%	71.30%	76.20%
F-16C	786	70.22%	73.08%	-2.86%	73.70%	74.40%
F-16D	155	65.96%	69.06%	-3.10%	70.70%	71.80%
F-22A	187	49.01%	60.18%	-11.17%	67.40%	72.70%
F-35A	119	54.67%	64.57%	-9.90%	67.90%	N/A
HH-60G	97	68.93%	67.28%	1.65%	76.90%	73.50%
KC-135R	344	73.19%	74.10%	-0.91%	75.40%	75.70%
KC-135T	54	75.25%	75.72%	-0.47%	76.10%	77.10%
MC-130H	17	68.53%	66.12%	2.41%	75.80%	69.60%
MC-130J	37	84.35%	86.72%	-2.37%	89.50%	88.30%
MQ-1B	121	91.16%	91.63%	-0.47%	92.10%	91.30%
MQ-9A	218	89.58%	88.48%	1.10%	88.40%	86.10%
RQ-4B	33	74.28%	78.10%	-3.82%	79.20%	82.90%
T-1A	178	55.94%	62.14%	-6.20%	67.30%	72.00%
T-6A	444	76.07%	66.71%	9.36%	60.90%	67.10%
T-38A	53	74.58%	80.06%	-5.48%	79.80%	81.60%
T-38C	443	59.74%	60.78%	-1.04%	62.70%	59.60%
U-2	27	75.20%	78.61%	-3.41%	78.50%	77.00%
UH-1N	63	83.57%	80.44%	3.13%	82.90%	83.20%
Total (listed)	**4950**					
Total (entire fleet)	**5349**					
Average (entire fleet)		**71.30%**	**72.10%**	**-0.80%**	**73.10%**	**73.70%**

Source: Air Force

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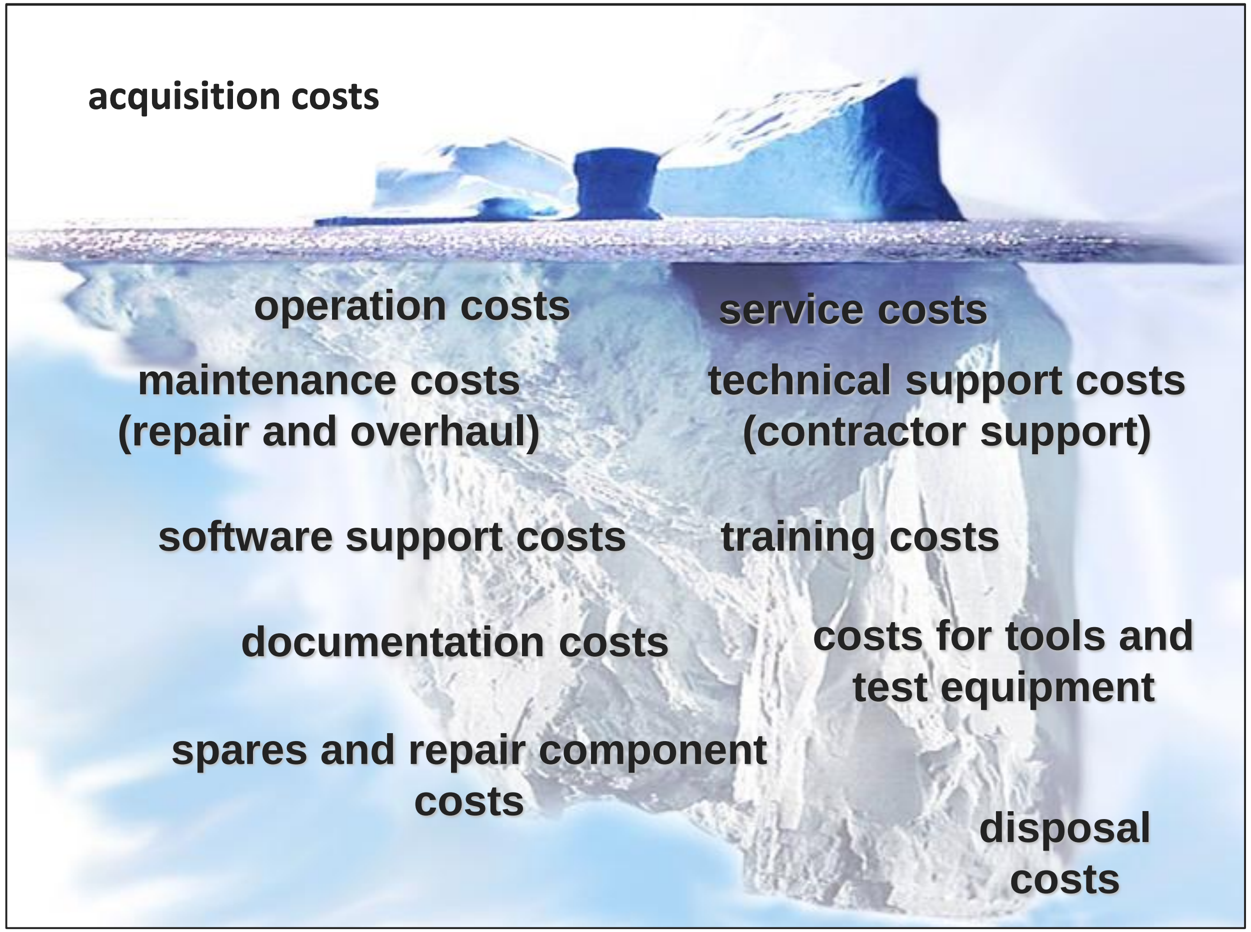
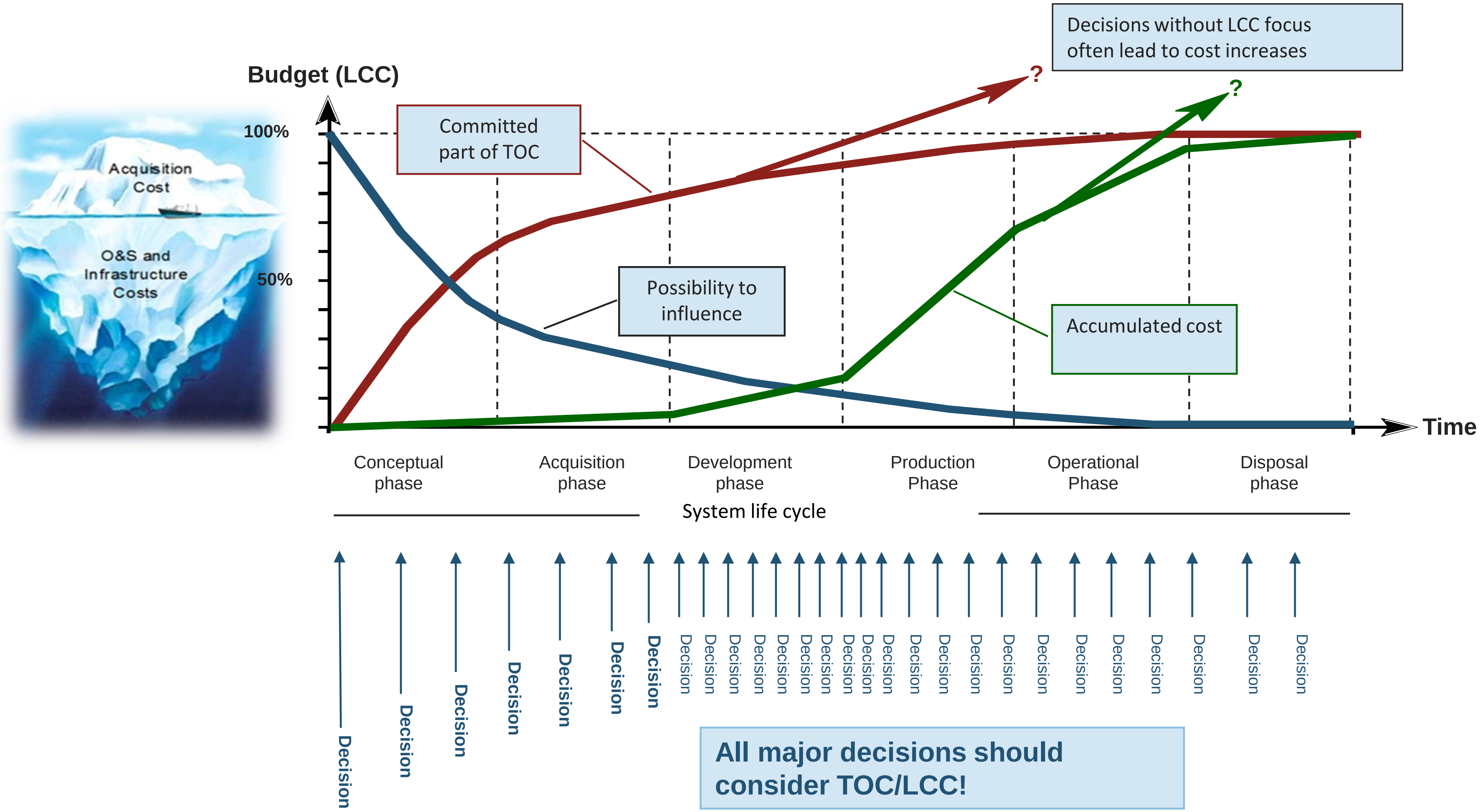
The Classic Iceberg



Operations & Sustainment Costs



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Approaches to Cost Estimation and Analysis

EARLY PHASES OF THE PROCUREMENT CYCLE

- Analogy Approach
  Top-down cost estimation that forecasts the cost of a new system based on the historical cost of one or several similar systems. Selected "complexity factors" are often used to adjust the estimate.

- Parametric Approach
  Top-down cost estimation where linear regression models are typically used to forecast the cost of a new system based on a multitude of selected cost driving variables.

ALL PHASES OF THE SYSTEM LIFE CYCLE

- Engineering Approach
  Bottom-up cost estimation starting from a low level of definable cost elements within the cost breakdown structure and building up to estimate the total cost of a new system.
  - "It is the most detailed of all the techniques and the most costly to implement."
  - *However*, " it provided some key advantages":
    - [It] is highlighting the critical aspects in the design and its logistical organization, which makes it a tool for project management and systems engineering.
    - It provides a structured way of weighing significant technical and cost inputs.
    - It shows the economical consequences of the technical system properties over time, which provides the means of evaluating the cost implication of a proposed system solution
    - [It]allows the user to determine the cost efficiency of the system.
    - Cost drivers can be identified and more detailed analysis on costs can be started.

Source: NATO RTO Tech report TR-SAS-076

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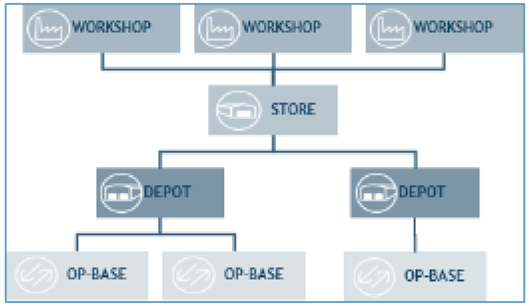
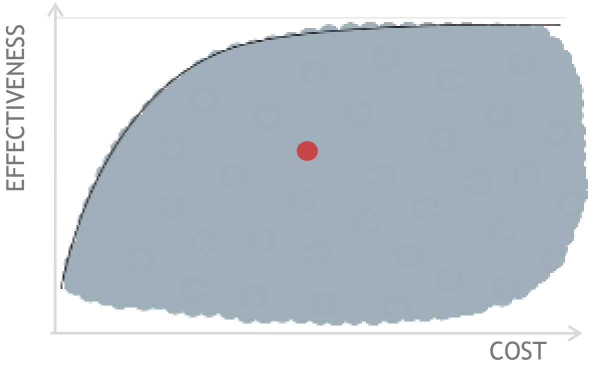
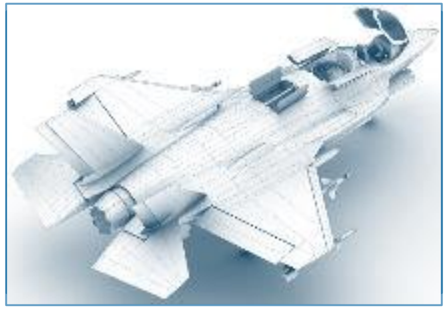
Optimization, Simulation and Cost Analysis for Affordable Effectiveness and Readiness

SUPPORT SOLUTION

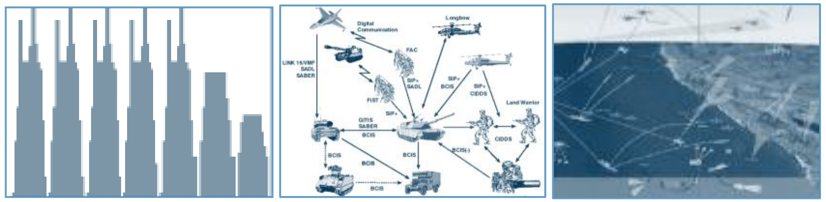




TECHNICAL SYSTEM

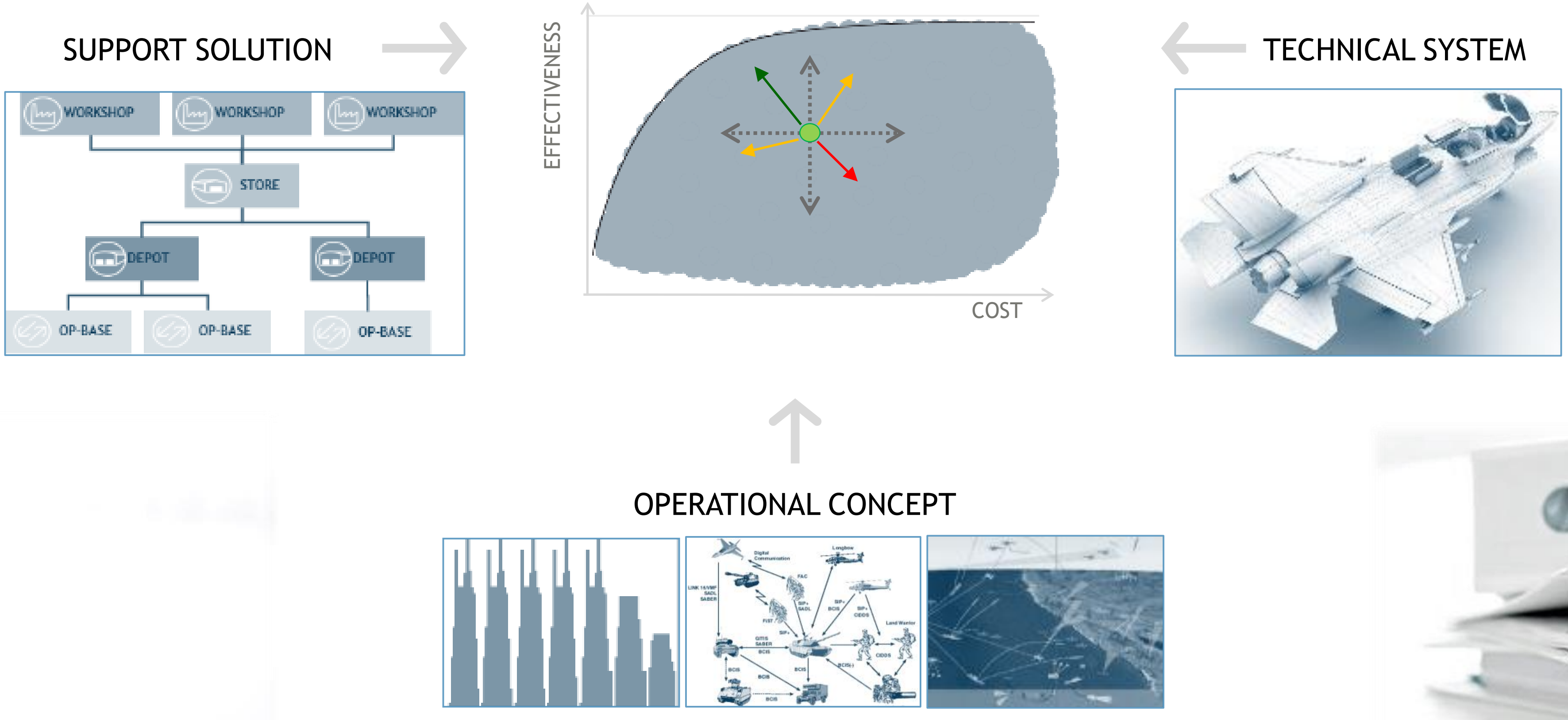


OPERATIONAL CONCEPT



Consequence Analysis – Understand how decisions impact cost effectiveness during life cycle

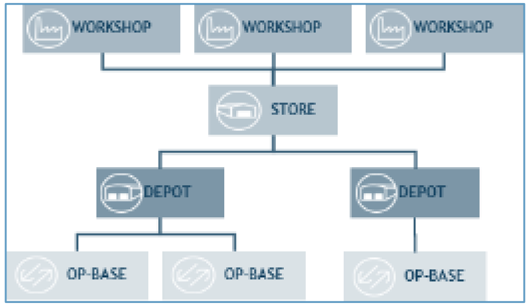
- Identify cost-effective decisions/alternatives/solutions
  - ensure good design
  - optimal balance between performance and cost

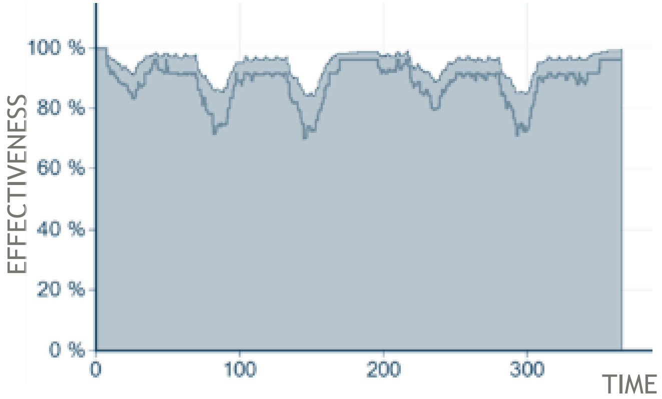


Consequence Analysis – Simulate how decisions impact readiness and sustainability over time

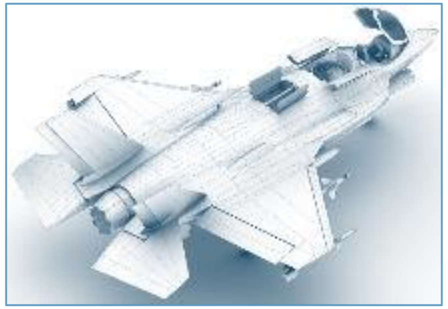
- Evaluate different scenarios, uncertainty and the impact of time-dynamic factors
  - simulate effectiveness, resource utilization and drivers of unavailability
  - Establish flexible, robust and sustainable solutions

SUPPORT SOLUTION

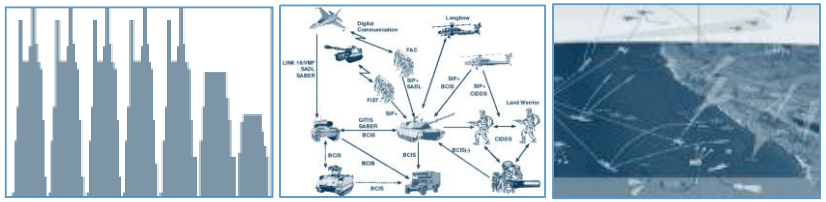




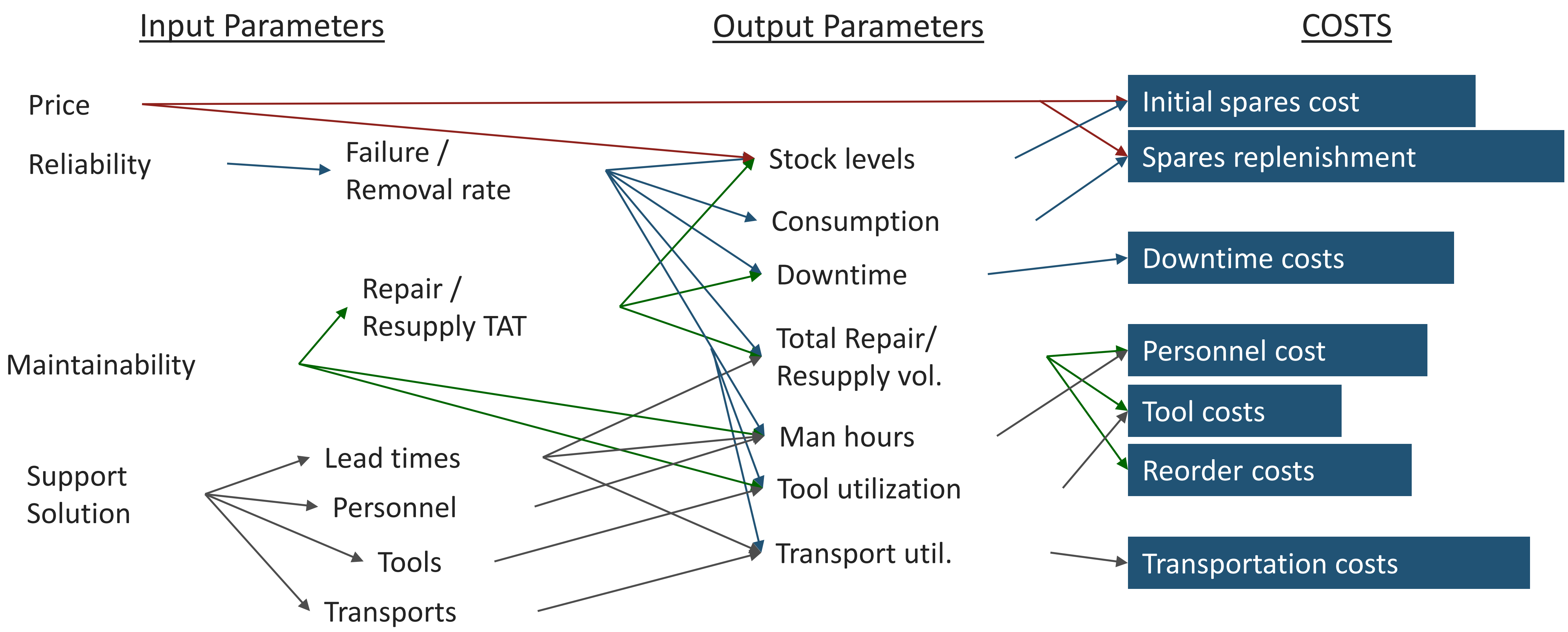
TECHNICAL SYSTEM



OPERATIONAL CONCEPT



Parameters that affect cost



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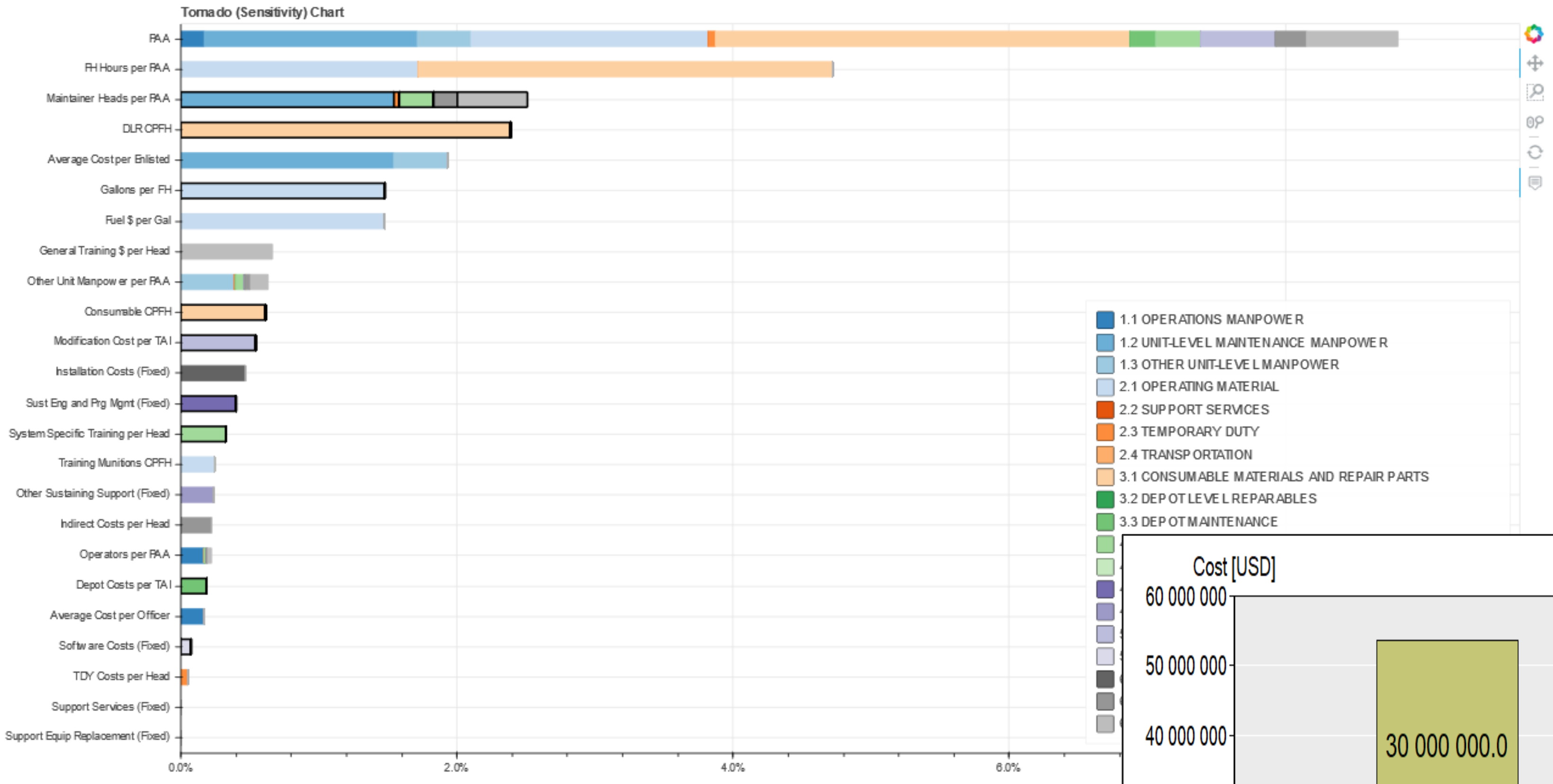
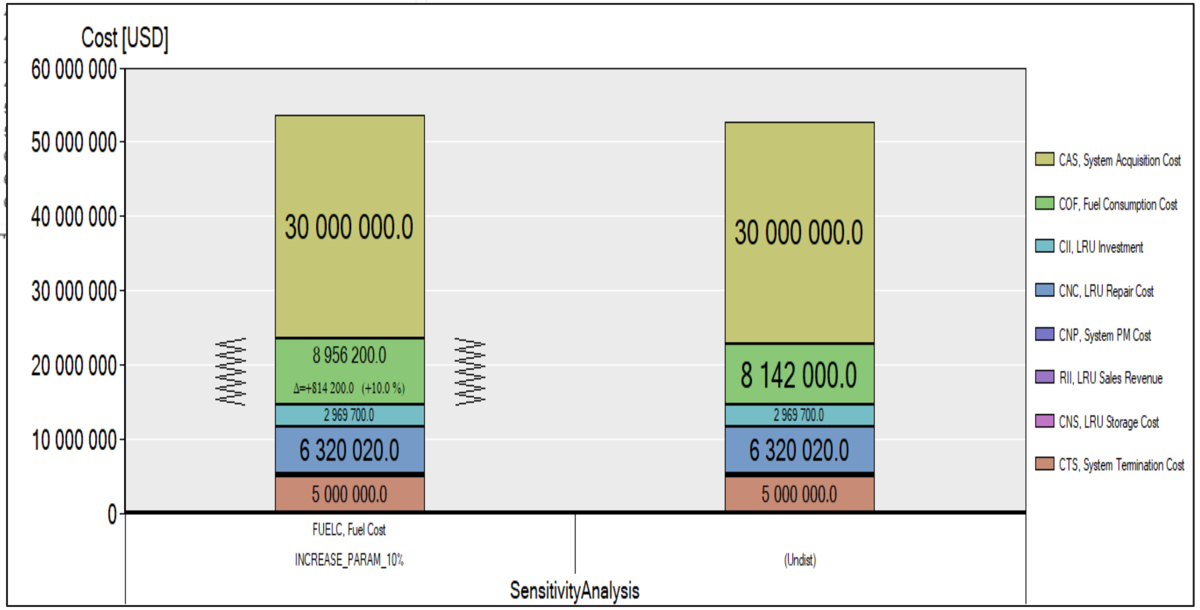
Parameters that influence readiness





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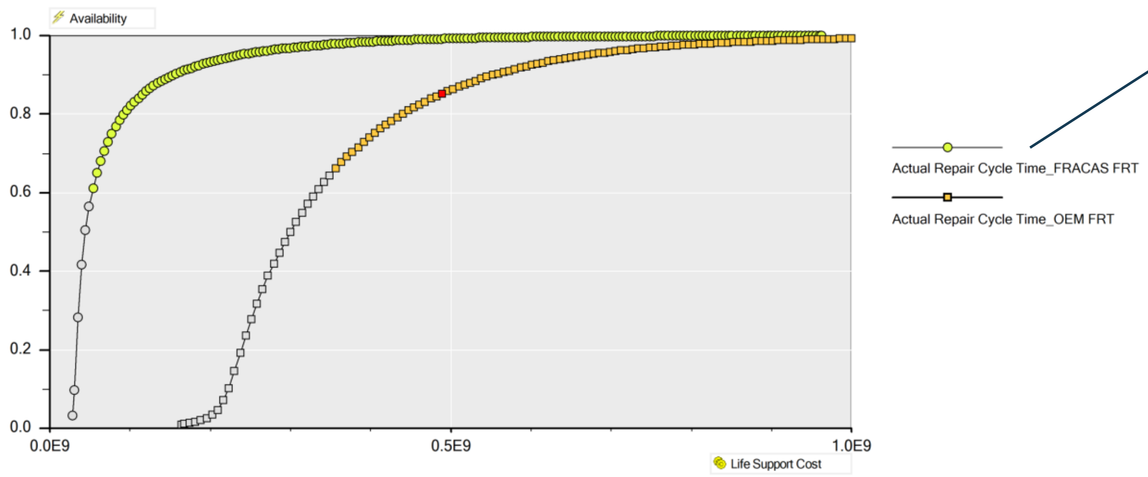
Sources of data

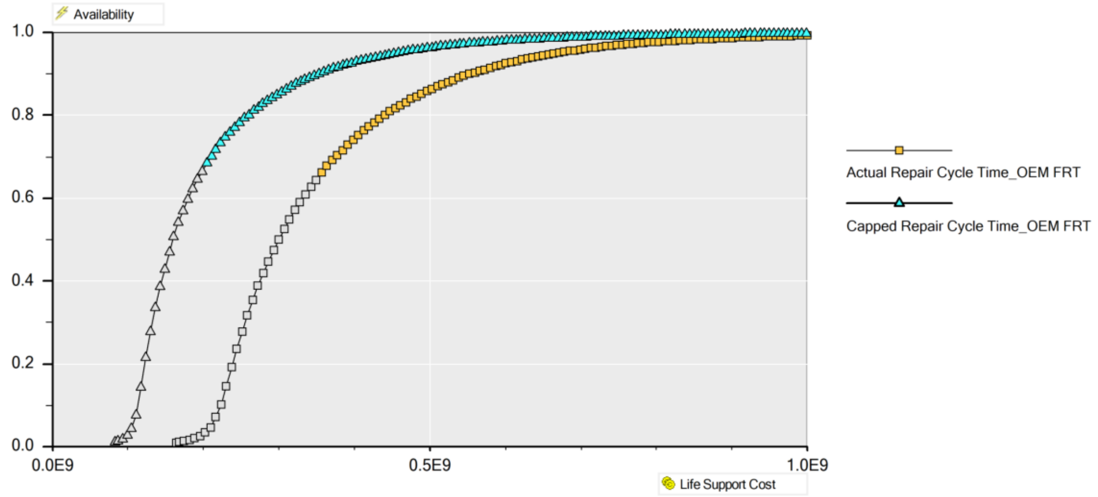
CADE
COST ASSESSMENT DATA ENTERPRISE

LOCKHEED MARTIN
BAE SYSTEMS
BOEING
NORTHROP GRUMMAN
Raytheon
GENERAL ATOMICS
Rolls-Royce

Impact data can have on readiness results



Comparing differing failure rates using actual repair cycle times



Comparing differing repair cycle times using the same failure rates

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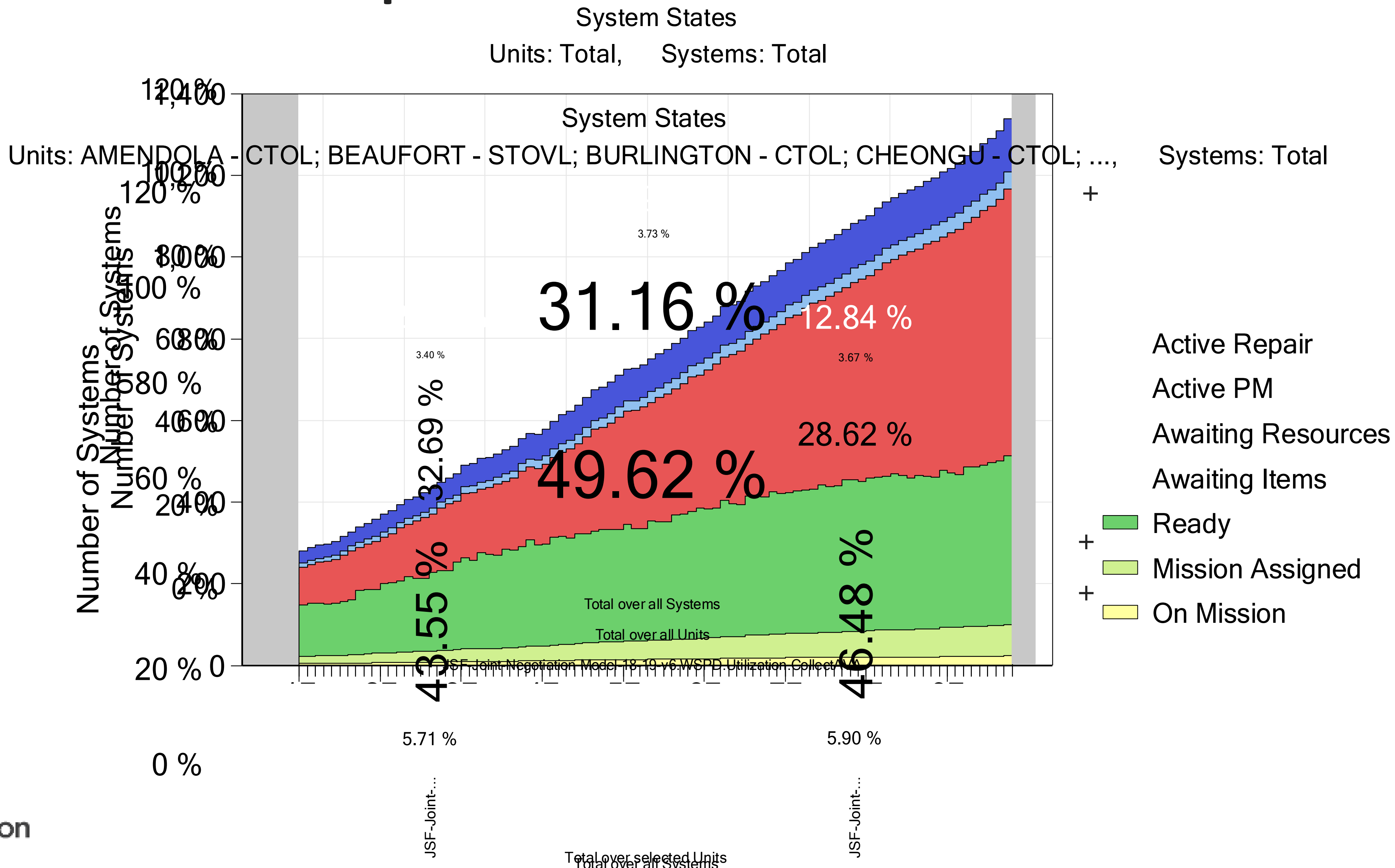
Fleet Readiness Impact – Actual DRCT



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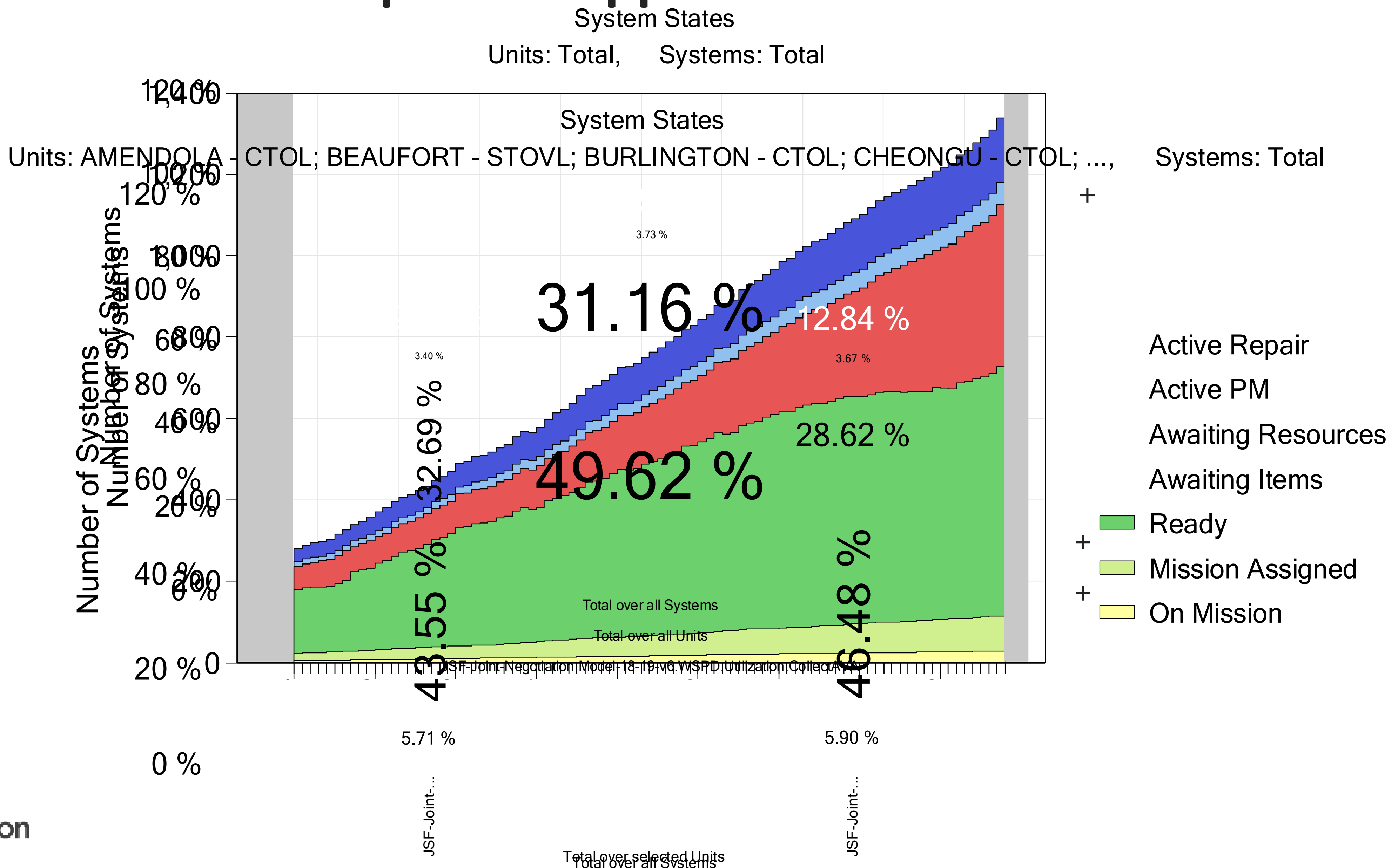
Fleet Readiness Impact – Capped DRCT



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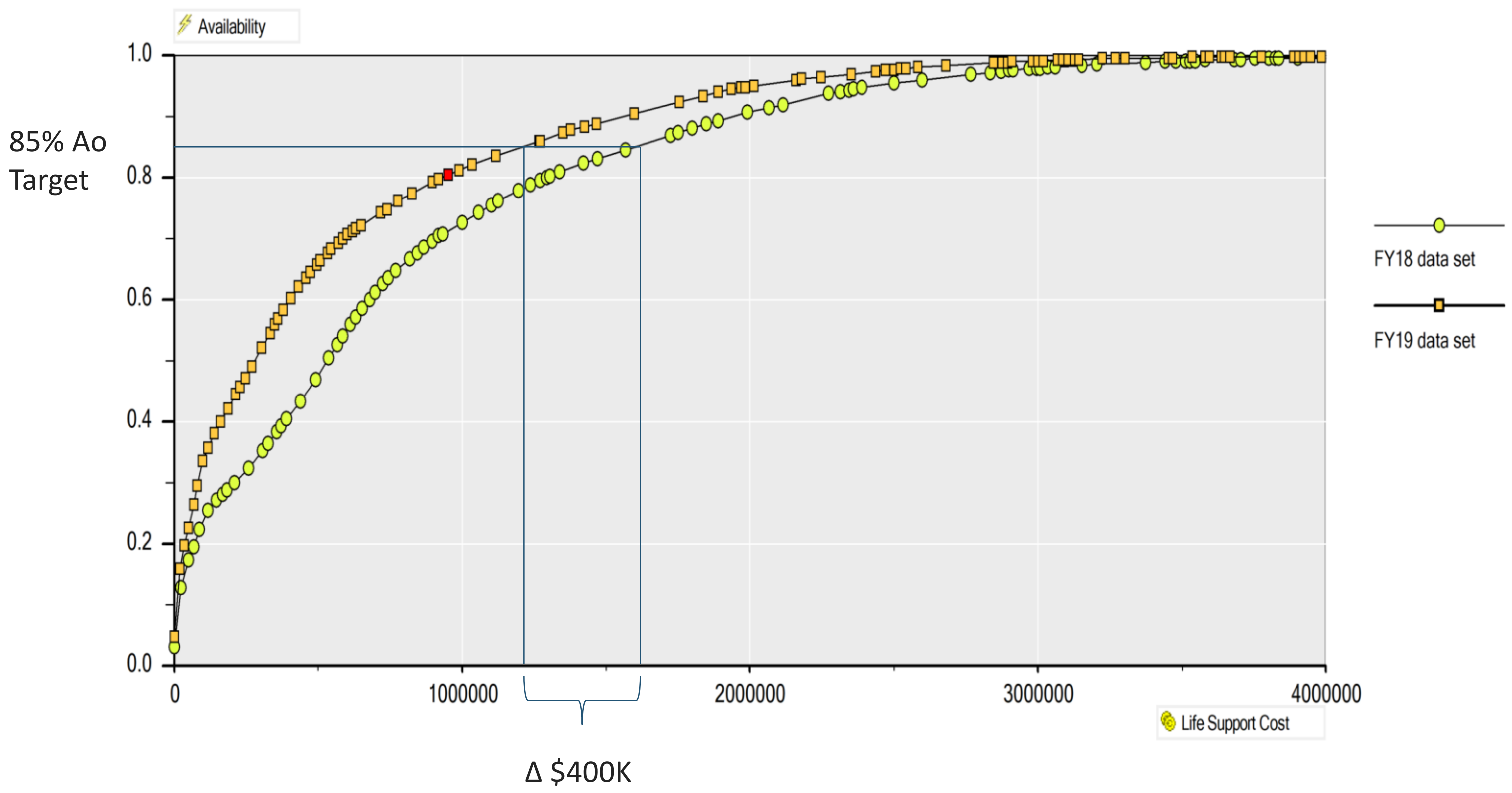
Impact data can have on readiness results (cont.)



Recall the parameters that can influence readiness

- Differences in data sets can include:
  - Lead times
  - Repair times
  - FRTs
  - Prices
- Other data points that will influence curves:
  - Storage costs
  - Transportation times/policies
  - Resources

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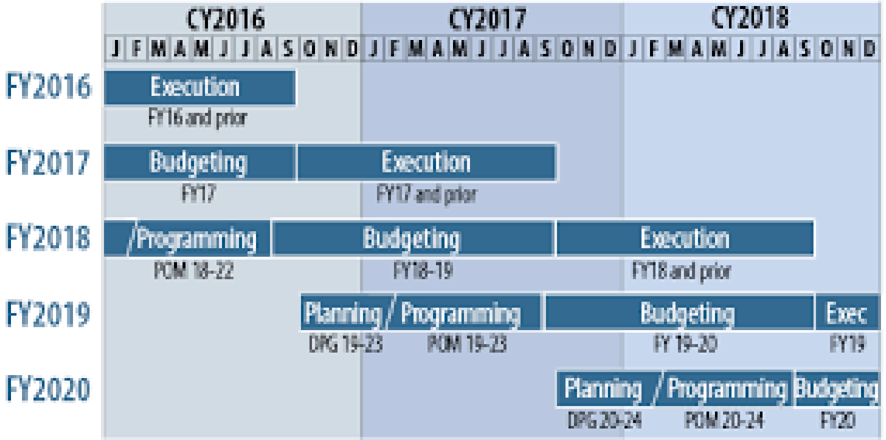
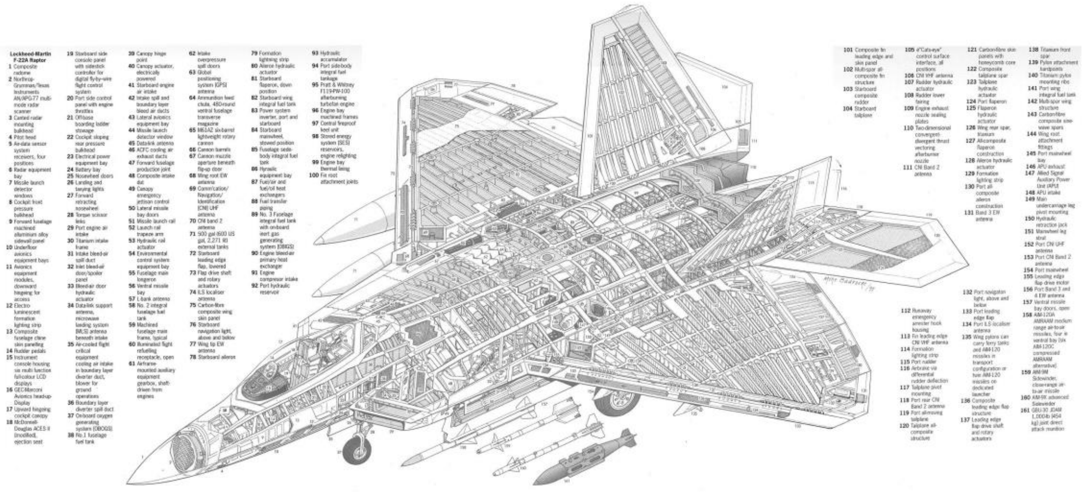
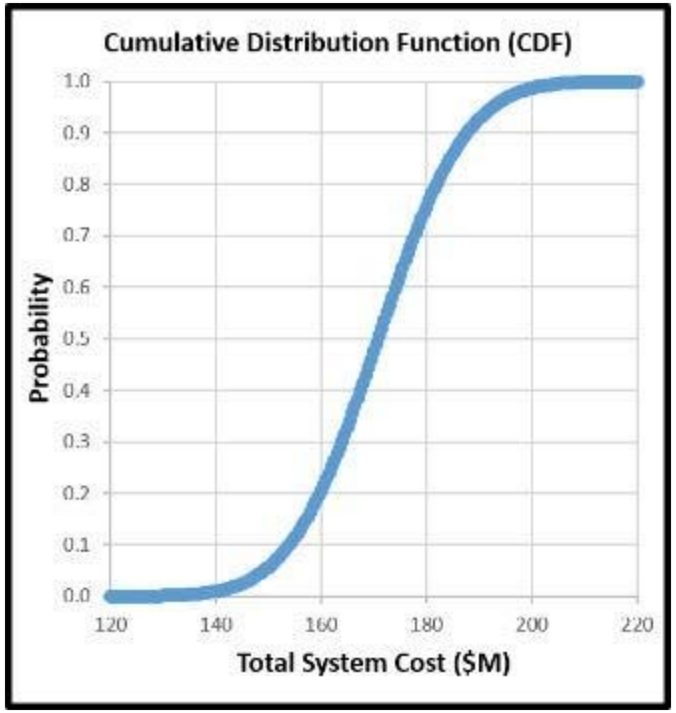
Challenges


CY2016
CY2017
CY2018
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
FY2016
Execution
FY16 and prior
FY2017
Budgeting
FY17
Execution
FY17 and prior
FY2018
Programming
POM 18-22
Budgeting
FY18-19
Execution
FY18 and prior
FY2019
Planning / Programming
DPG 19-23
POM 19-23
Budgeting
FY 19-20
Exec
FY19
FY2020
Planning
DPG 20-24
Programming
POM 20-24
Budgeting
FY20




Puget Sound Naval Shipyard
Letterkenny Army Depot
Ogden Air Logistics Complex
Portsmouth Naval Shipyard
Barstow Production Plant
Tobyhanna Army Depot
Fleet Readiness Center Southwest
Norfolk Naval Shipyard
Oklahoma City Air Logistics Complex
Fleet Readiness Center East
Pearl Harbor Naval Shipyard
Red River Army Depot
Anniston Army Depot
Fleet Readiness Center Southeast
Corpus Christi Army Depot
Albany Production Plant
Warner Robins Air Logistics Complex
ARMY NAVY AIR FORCE MARINE CORPS


Cumulative Distribution Function (CDF)
Probability
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
120
140
160
180
200
220
Total System Cost ($M)

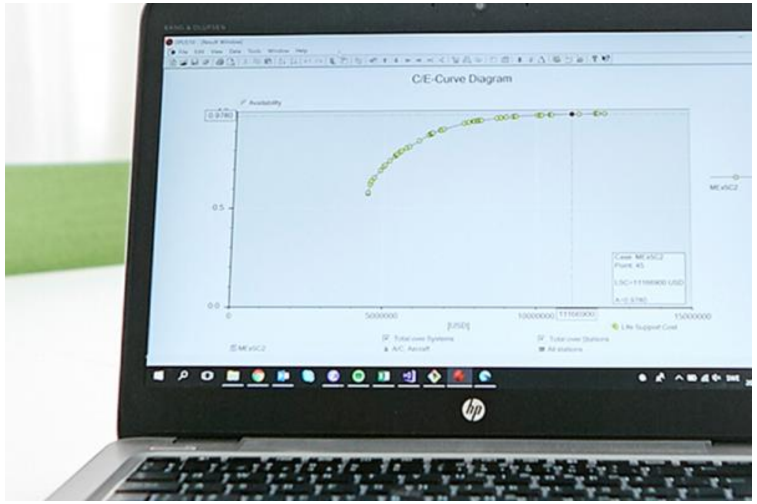
What is happening now?

- Continued emphasis on data analytics and readiness
  - “U.S. Fleet Forces Command Creating Analytics Office to Assess Fleet, Industrial Readiness”

- Investments in logistics information systems
  - Lockheed Martin is pouring $180 million of its own money into ALIS to bring things back on track
  - Air Force has its in-house Kessel Run software team working on speeding up a few of ALIS’s functions

- Increasing usage of modeling and predictive analytics tools
  - Recent Army and Navy predictive analytics and model based product support solicitations

- Bigger push for inclusion of modeling data CDRLs in contracts



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Questions & Discussions

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