



INSTITUTE FOR DEFENSE ANALYSES

Tools for Building End-to-End Readiness Models with OPUS/SIMLOX

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About This Publication

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Executive Summary

Bottom-up emulations of real sustainment systems that explicitly model spares, personnel, operations, and maintenance are a powerful way to tie funding decisions to their impact on readiness, but they are not widely used. The simulations require extensive data to properly model the complex and variable processes involved in a sustainment system, and the raw data used to populate the simulation are often scattered across multiple organizations.

The Navy has encountered challenges in keeping the desired number of F/A-18 Super Hornets in mission-capable states. IDA was asked to build an end-to-end model of the Super Hornet sustainment system using the OPUS/SIMLOX suite of tools to investigate the strategic levers that drive readiness. IDA built an R package (“honeybee”) that aggregates and interprets Navy sustainment data using statistical techniques to create component-level metrics. IDA built a second R package (“stinger”) that uses these metrics to automatically generate the input tables necessary to run OPUS/SIMLOX; the effect of both of these packages is that IDA has lowered the barrier for entry into building these large end-to-end sustainment models. We present a

summary of these tools and techniques to the OPUS user community in this briefing.



Tools for Building End-to-End Readiness Models with OPUS/SIMLOX

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April 16, 2020

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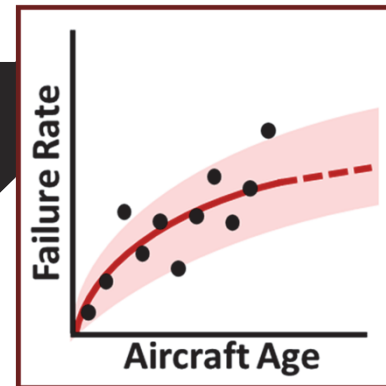
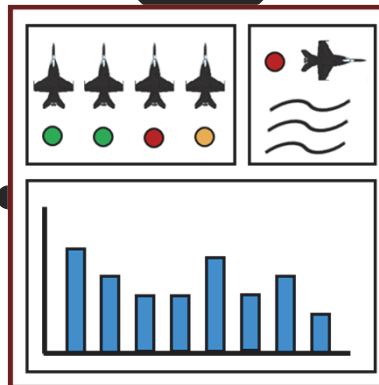
End-to-End Simulation/Forecasting Model

Bottom-up emulation of real sustainment system that explicitly models spares, manpower, operations, and maintenance to understand the impact of decisions on readiness

- + Tie \$ spent to readiness outcomes
- Heavy lift to build initial model



Data-Driven Decisions



Correlative Studies

Identify factors that drive performance through statistical approaches like machine learning
+ Search historical data to reveal hidden trends that may potentially predict future performance
- Abstract equations do not tie results to actionable recommendations (e.g., specific spares purchases)

Data Visualization/Dashboards

Make statuses available to user community via dashboards

- + Provides accessible ground truth
- Does not connect decisions to outcomes

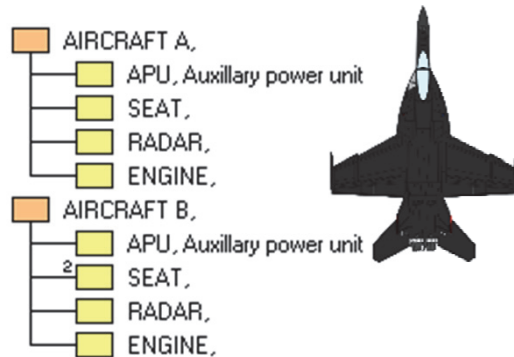
The number of mission-capable F/A-18 Super Hornets has remained relatively steady in the last few years, despite adding new aircraft to the fleet and increasing funding for readiness.

The goal of IDA's study is to build a readiness model to identify the major strategic levers that drive Super Hornet readiness.

All data in this presentation are notional
and for demonstration purposes.

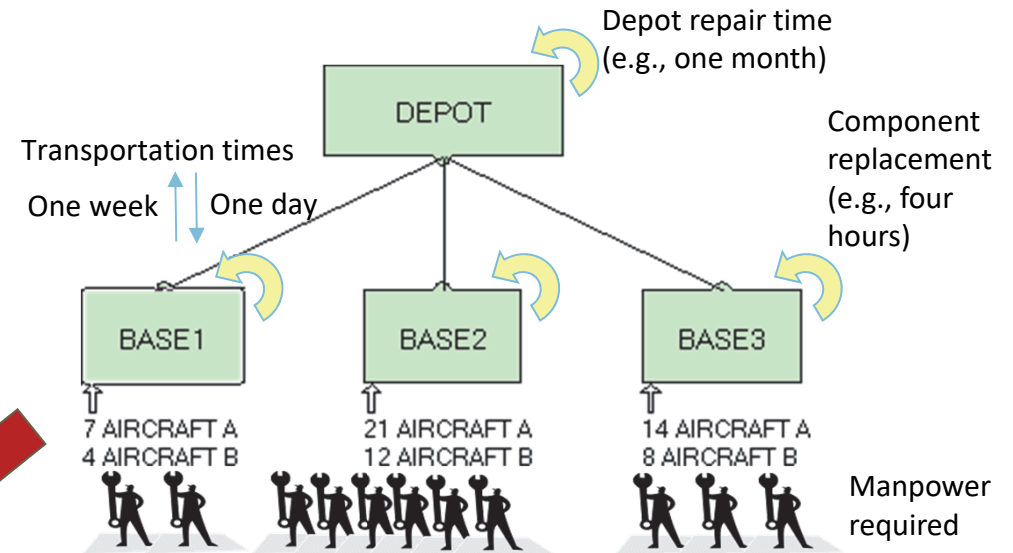
SIMLOX Requires Detailed Information from Different Sources

Technical system data:

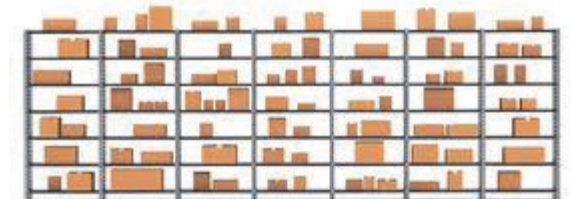


Failure rates
 Repair costs
 Purchase costs
 Common parts
 Time to repair
 Condemnation rates
 Preventative maintenance
 Dependencies on support equipment

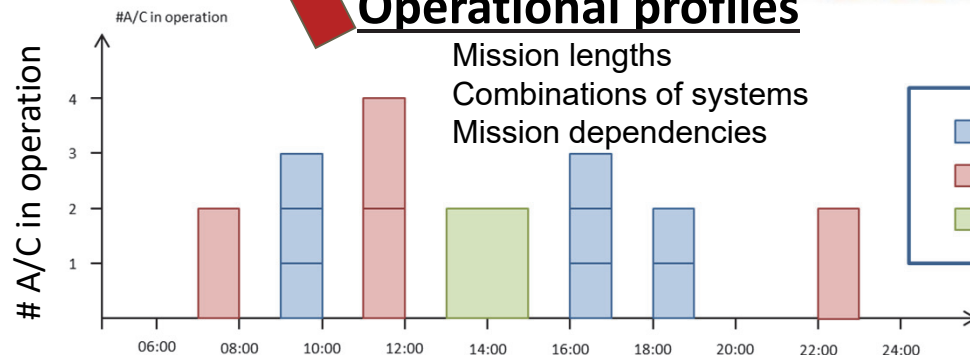
Sustainment and ops organization:



Stock inventories and reorder policies

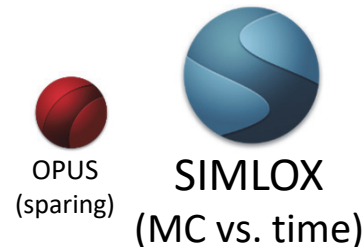


Operational profiles



Fleet dynamics:

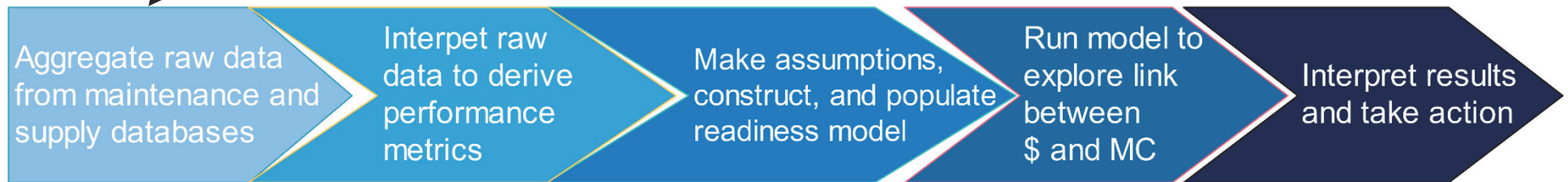
Modification/depot plans
 New A/C delivery schedule
 Transfers/trading
 Deployments



How to connect raw data to readiness decision making

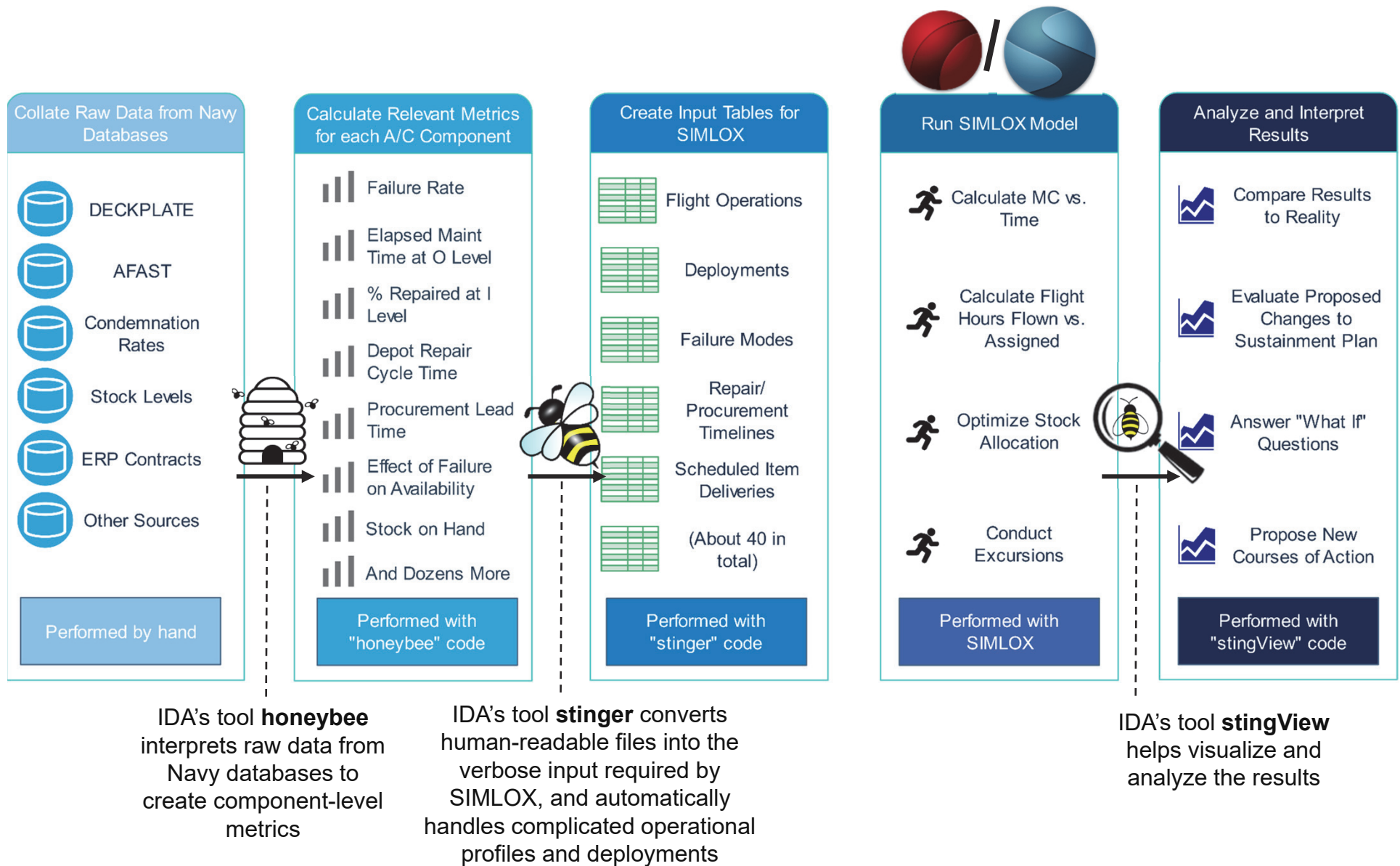
Stovepiped databases and institutional disconnects can make this time consuming

You have to understand in detail how the model will use the information you give it (“model-isms”)

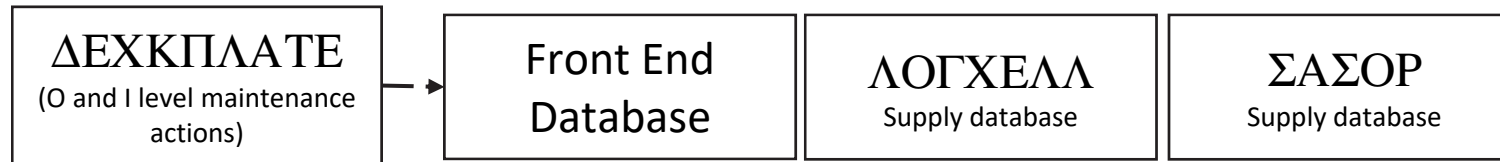


Existing metrics should only be used if you understand the math/logic behind them, and ideally you should be able to check the raw data yourself

How to connect raw data to readiness decision making

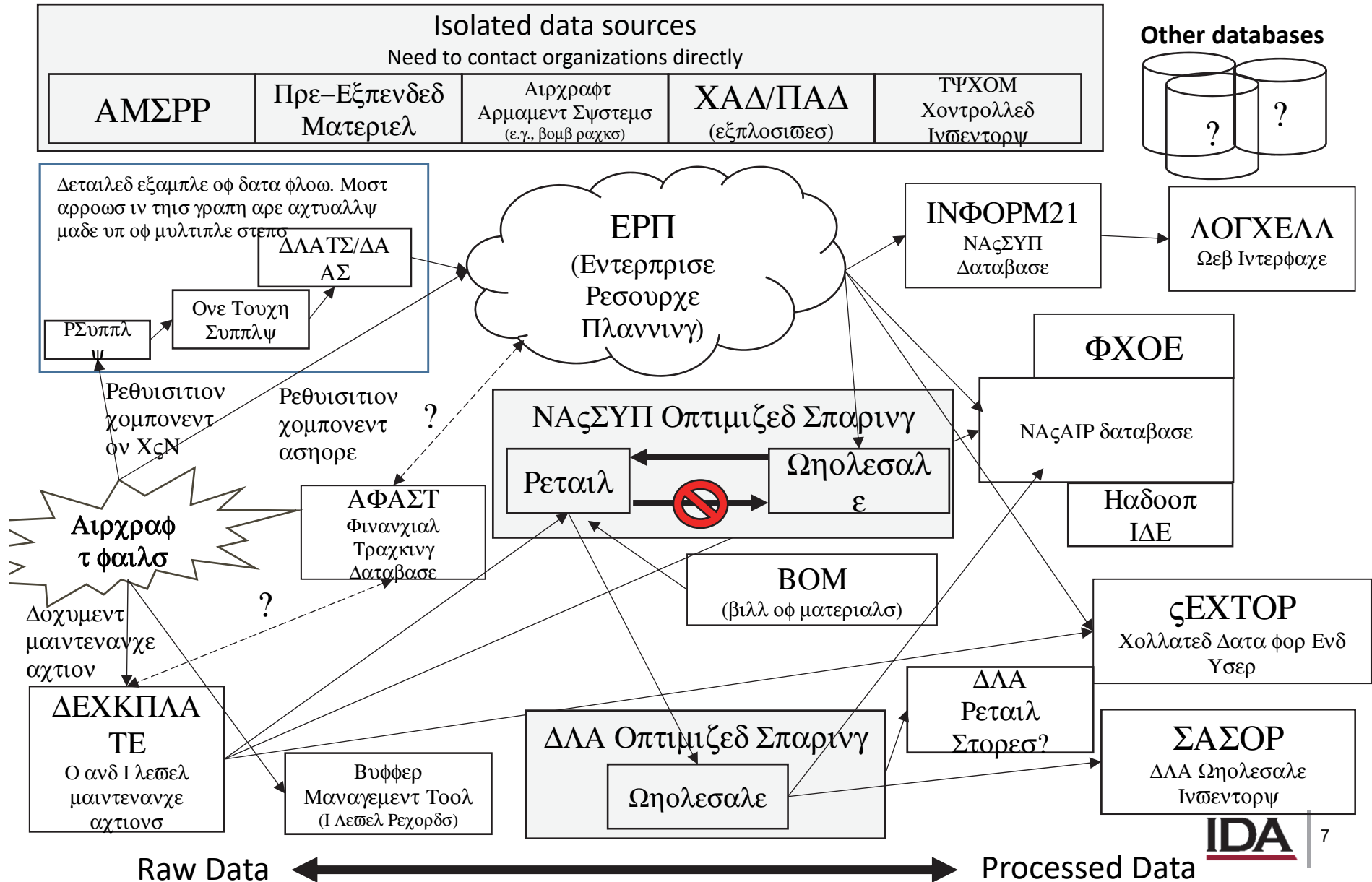


Initial discussions with Navy implied that four major databases should provide all the parts and maintenance data needed to populate a SIMLOX model

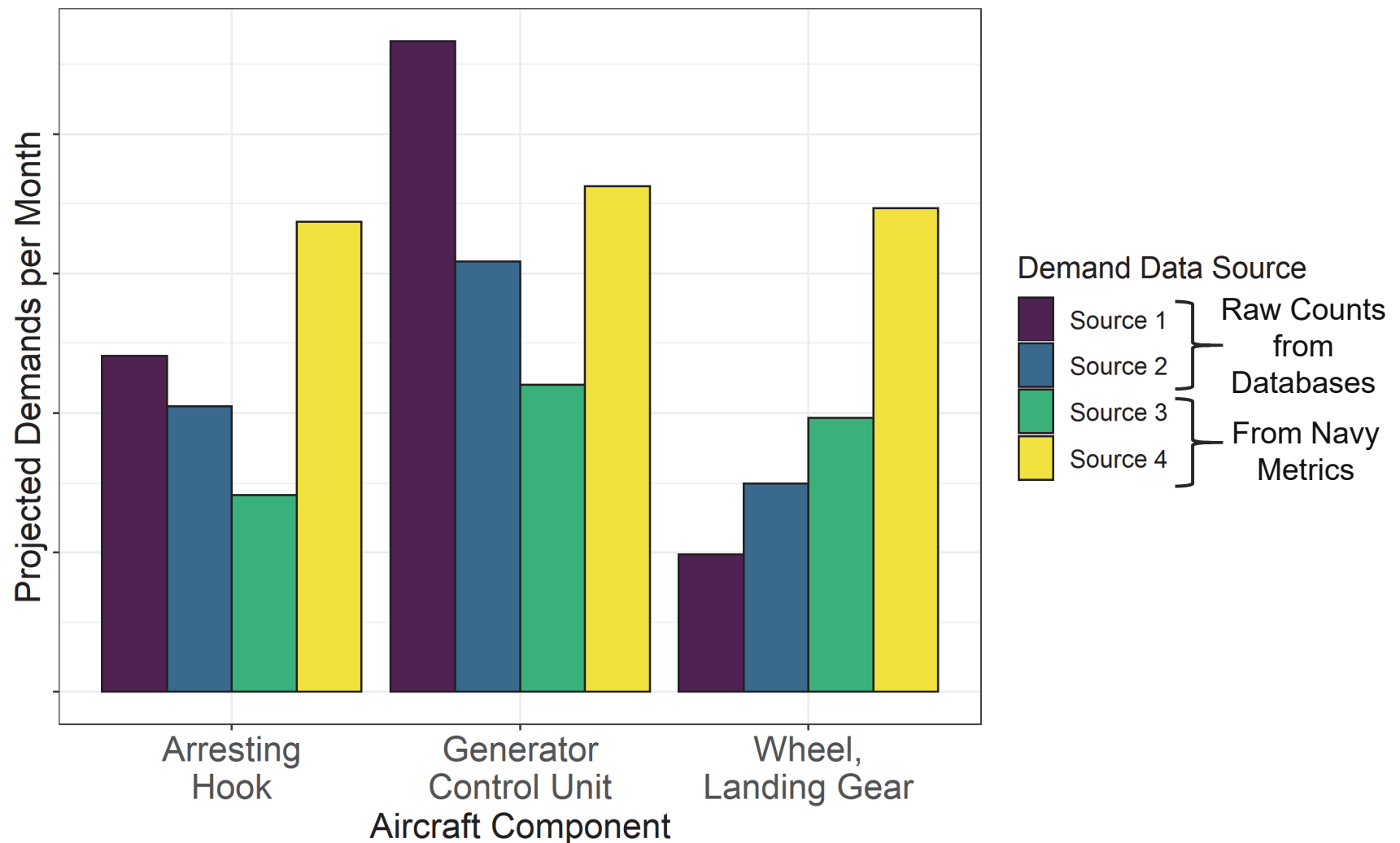


This is reality: many databases, with overlap and ambiguous data

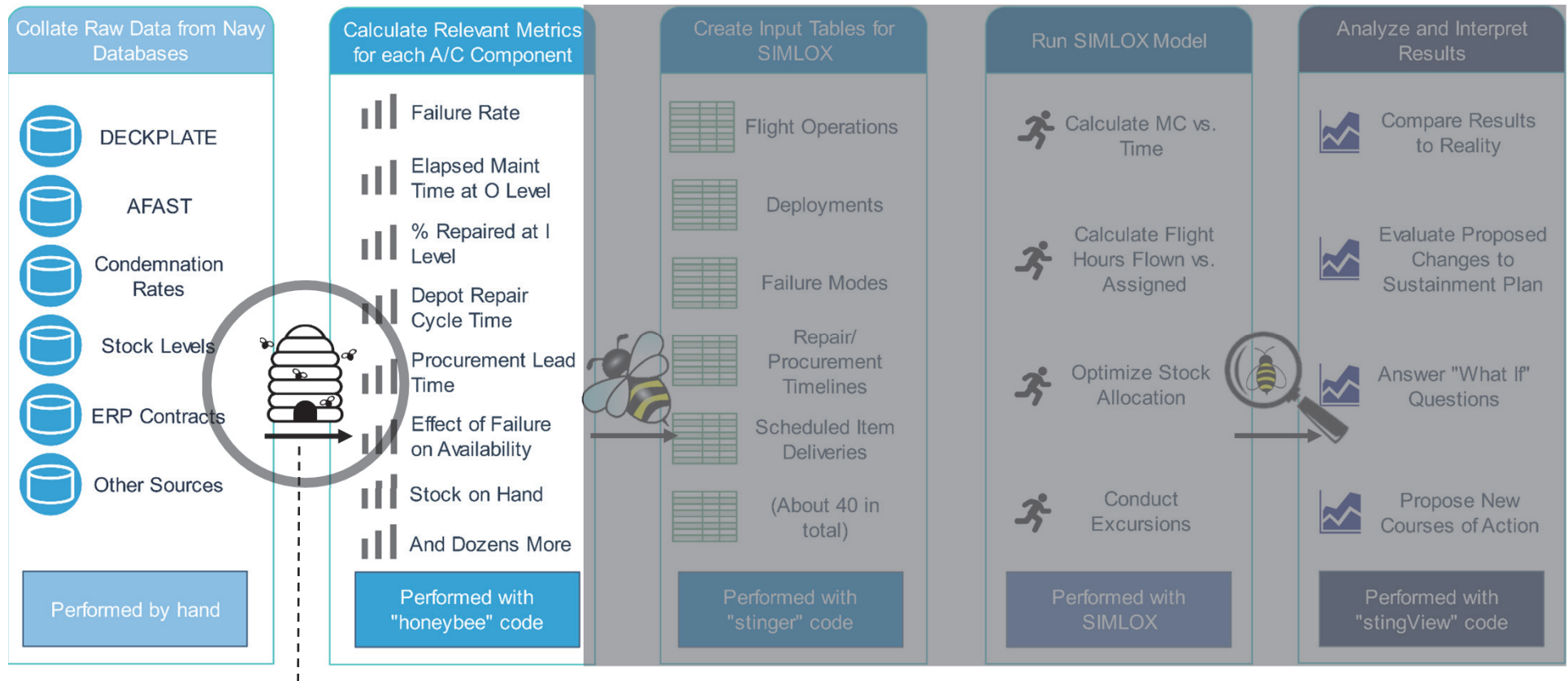
Within the Naval Aviation Enterprise, managers get a view that is limited by the tool they are using



Different data sources and different rules for interpreting the data lead to divergent demand predictions



How to connect raw data to readiness decision making



IDA's tool **honeybee** interprets raw data from Navy databases to create component-level metrics

honeybee inputs

AFAST	DECKPLATE	BOM	priceData	Commodity Curve
uniqueName	uniqueName	uniqueName	uniqueName	minWindow
COG	TEC	TEC	New Price	maxWindow
TEC	JCN	Level 1 uniqueName	Repair Price	repairProportion
JCN	MCN	Level 2 uniqueName	Wholesale Stock	Retail Stock
MCN	BUNO	Level 3 uniqueName		uniqueName
BUNO	WUC5	Level 4 uniqueName		Station
JCN Date	EMT	Level 5 uniqueName	uniqueName	SOH
ProjectCode	WhenDiscovered	Level 6 uniqueName	Station	Allocation
ActionOrg	Manhours	Condemnation Rate	SOH	Contract Data
Status	ActionTakenCode	Dictionary	Station Mapping	NIIN
ExtendedPriceChar	ReceivedDateTime		realStation	PR Date
Qty	MaintenanceLevel	uniqueName	simloxStation	PO Date
	ReceivedEOC	Condemnation Rate	stockClass	Repair or Procurement
		uniqueName		Delivery Date
		NIIN		Latest Delivery Date
		NIINHOF		Items Outstanding
		COG		Sched Delivery Date
		LRC		
		LRC First Letter		

AFAST
uniqueName
COG
TEC
JCN
MCN
BUNO
JCN Date
ProjectCode
ActionOrg
Status
ExtendedPriceChar
Qty

BOM*
uniqueName
TEC
Level 1 uniqueName
Level 2 uniqueName
Level 3 uniqueName
Level 4 uniqueName
Level 5 uniqueName
Level 6 uniqueName

Condemnation Rate
uniqueName
Condemnation Rate

Station Mapping
realStation
simloxStation
stockClass

Wholesale Stock
uniqueName
Station
SOH

DECKPLATE
uniqueName
TEC
JCN
MCN
BUNO
WUC5
EMT
WhenDiscovered
Manhours
ActionTakenCode
ReceivedDateTime
MaintenanceLevel
ReceivedEOC

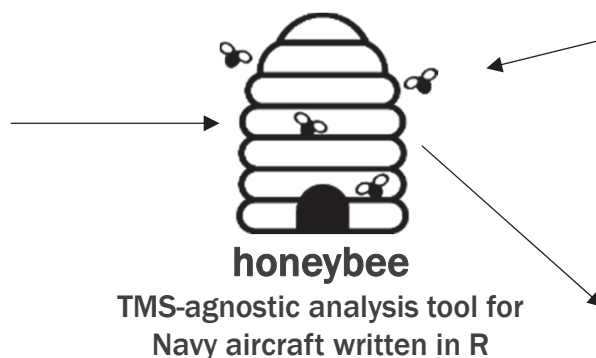
priceData
uniqueName
New Price
Repair Price

Contract Data
NIIN
PR Date
PO Date
Repair or Procurement
Delivery Date
Latest Delivery Date
Items Outstanding
Sched Delivery Date

Commodity Curve
minWindow
maxWindow
repairProportion

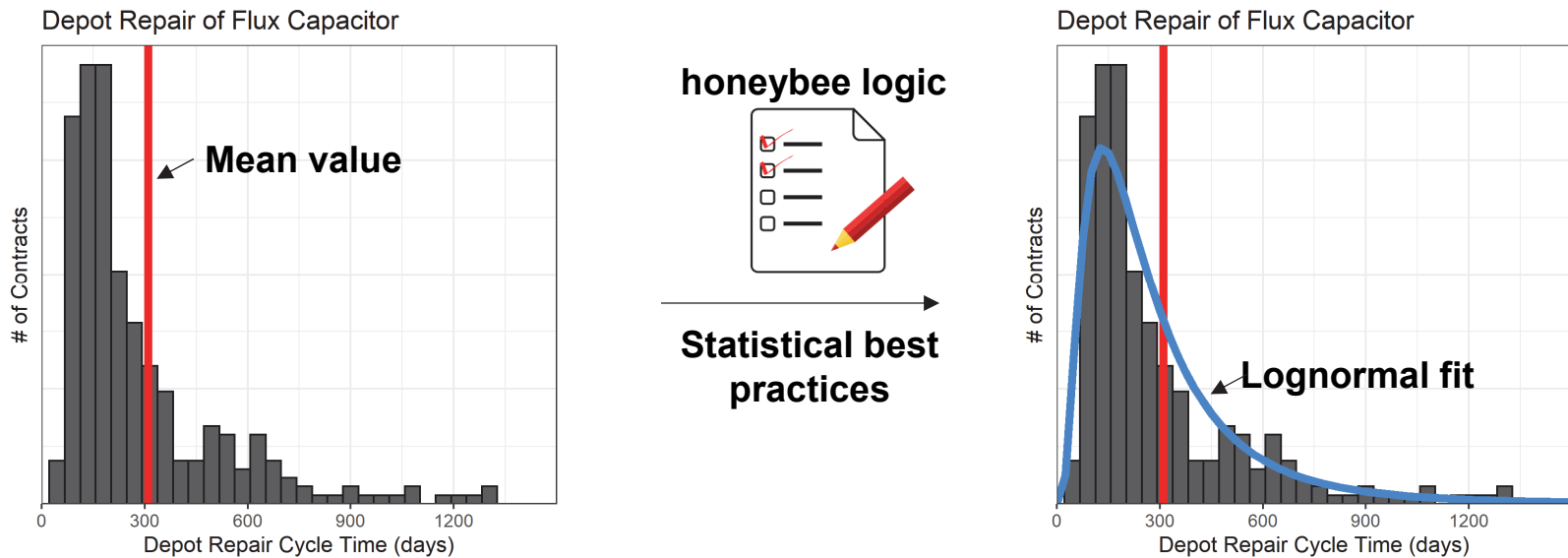
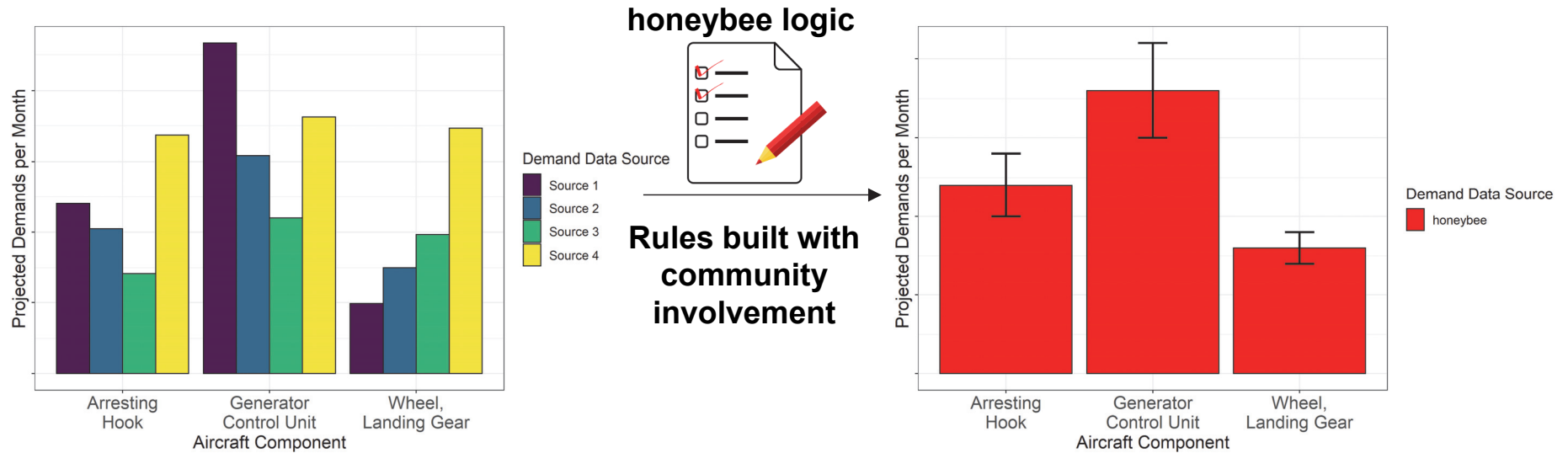
Retail Stock
uniqueName
Station
SOH
Allocation

User-defined settings and filters
Date range
Aircraft types (honeybee is TMS-agnostic)
What counts as a failure?
Which requisition codes indicate NMCS?
Which Action Taken Codes indicate a repair?
What do we do about missing I level repair times?
Etc.

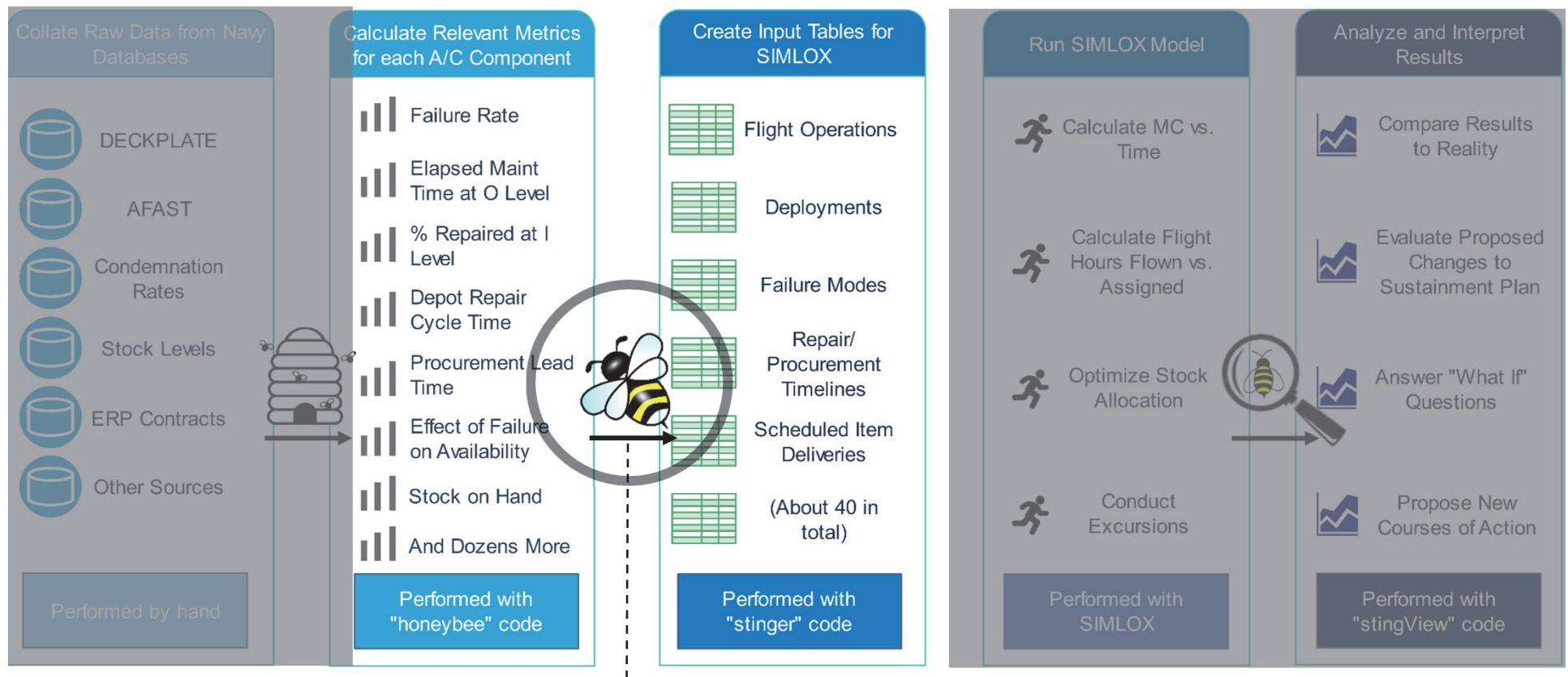


Calculate Relevant Metrics for each A/C Component
Failure Rate
Elapsed Maint Time at O Level
% Repaired at I Level
Depot Repair Cycle Time
Procurement Lead Time
Effect of Failure on Availability
Stock on Hand
And Dozens More
Performed with "honeybee" code

We need an adjudicated, trusted data source to overcome the balkanization of current databases



How to connect raw data to readiness decision making



IDA's tool **stinger** converts human-readable files into the verbose input required by SIMLOX, and automatically handles complicated operational profiles and deployments

One file is used to populate many SIMLOX input tables

“Unit Data” stinger input file

A	B	C	D	E	F	G	H
Unit Name	Land Base	CVW Name	System Type	Quantity	Land-Based Profile	Deployed Profile	Deployable
1	VAQ-130	NAS Whidbey	CVW-3	F18G	5 CVW-3 Land Profile - Growler	CVW-3 Deployed Profile	TRUE
2	VAQ-131	NAS Whidbey	CVW-8	F18G	5 CVW-8 Land Profile - Growler	CVW-8 Deployed Profile	TRUE
3	VAQ-133	NAS Whidbey	CVW-9	F18G	5 CVW-9 Land Profile - Growler	CVW-9 Deployed Profile	TRUE
4	VAQ-136	NAS Whidbey	CVW-2	F18G	5 CVW-2 Land Profile - Growler	CVW-2 Deployed Profile	TRUE
5	VAQ-137	NAS Whidbey	CVW-1	F18G	5 CVW-1 Land Profile - Growler	CVW-1 Deployed Profile	TRUE
6	VAQ-139	NAS Whidbey	CVW-17	F18G	5 CVW-17 Land Profile - Growler	CVW-17 Deployed Profile	TRUE
7	VAQ-140	NAS Whidbey	CVW-7	F18G	5 CVW-7 Land Profile - Growler	CVW-7 Deployed Profile	TRUE
8	VAQ-141	Iwakuni	CVW-5	F18G	5 CVW-5 Land Profile - Growler	CVW-5 Deployed Profile	TRUE
9	VAQ-142	NAS Whidbey	CVW-11	F18G	5 CVW-11 Land Profile - Growler	CVW-11 Deployed Profile	TRUE
10	XVAQ-1	NAS Whidbey	XVAQ-1	F18G	5 XVAQ-1 Land Profile	None	FALSE
11	XVAQ-2	NAS Whidbey	XVAQ-2	F18G	5 XVAQ-2 Land Profile	None	FALSE
12	XVAQ-3	NAS Whidbey	XVAQ-3	F18G	5 XVAQ-3 Land Profile	None	FALSE
13	XVAQ-4	NAS Whidbey	XVAQ-4	F18G	5 XVAQ-4 Land Profile	None	FALSE
14	XVAQ-5	NAS Whidbey	XVAQ-5	F18G	5 XVAQ-5 Land Profile	None	FALSE
15	FRS-West-G	FRS West	FRS-West	F18G	86 FRS Land Profile - Growler	None	FALSE
16	VFA-2	NAS Lemoore	CVW-2	F18F	12 CVW-2 Land Profile - Rhino	CVW-2 Deployed Profile	TRUE
17	VFA-11	NAS Oceana	CVW-1	F18F	12 CVW-1 Land Profile - Rhino	CVW-1 Deployed Profile	TRUE
18	VFA-14	NAS Lemoore	CVW-9	F18F	12 CVW-9 Land Profile - Rhino	CVW-9 Deployed Profile	TRUE
19	VFA-22	NAS Lemoore	CVW-17	F18F	12 CVW-17 Land Profile - Rhino	CVW-17 Deployed Profile	TRUE
20	VFA-25	NAS Lemoore	CVW-7	F18F	10 CVW-7 Land Profile - Rhino	CVW-7 Deployed Profile	TRUE
21	VFA-27	Iwakuni	CVW-5	F18F	12 CVW-5 Land Profile - Rhino	CVW-5 Deployed Profile	TRUE
22	VFA-31	NAS Oceana	CVW-11	F18F	12 CVW-11 Land Profile - Rhino	CVW-11 Deployed Profile	TRUE
23	VFA-32	NAS Oceana	CVW-3	F18F	12 CVW-3 Land Profile - Rhino	CVW-3 Deployed Profile	TRUE
24	VFA-34	NAS Lemoore	CVW-17	F18F	10 CVW-17 Land Profile - Rhino	CVW-17 Deployed Profile	TRUE
25	VFA-37	NAS Oceana	CVW-8	F18F	12 CVW-8 Land Profile - Rhino	CVW-8 Deployed Profile	TRUE
26	VFA-41	NAS Lemoore	CVW-9	F18F	12 CVW-9 Land Profile - Rhino	CVW-9 Deployed Profile	TRUE
27	VFA-81	NAS Oceana	CVW-1	F18F	10 CVW-1 Land Profile - Rhino	CVW-1 Deployed Profile	TRUE
28	VFA-83	NAS Oceana	CVW-7	F18F	10 CVW-7 Land Profile - Rhino	CVW-7 Deployed Profile	TRUE
29	VFA-86	NAS Lemoore	CVW-3	F18F	10 CVW-3 Land Profile - Rhino	CVW-3 Deployed Profile	TRUE
30	VFA-87	NAS Oceana	CVW-8	F18F	10 CVW-8 Land Profile - Rhino	CVW-8 Deployed Profile	TRUE
31	VFA-94	NAS Lemoore	CVW-17	F18F	10 CVW-17 Land Profile - Rhino	CVW-17 Deployed Profile	TRUE
32	VFA-97	NAS Lemoore	CVW-9	F18F	10 CVW-9 Land Profile - Rhino	CVW-9 Deployed Profile	TRUE
33	VFA-102	Iwakuni	CVW-5	F18F	12 CVW-5 Land Profile - Rhino	CVW-5 Deployed Profile	TRUE
34	VFA-103	NAS Oceana	CVW-7	F18F	12 CVW-7 Land Profile - Rhino	CVW-7 Deployed Profile	TRUE
35	VFA-105	NAS Oceana	CVW-3	F18F	12 CVW-3 Land Profile - Rhino	CVW-3 Deployed Profile	TRUE
36	VFA-113	NAS Lemoore	CVW-17	F18F	12 CVW-17 Land Profile - Rhino	CVW-17 Deployed Profile	TRUE
37	VFA-115	Iwakuni	CVW-5	F18F	10 CVW-5 Land Profile - Rhino	CVW-5 Deployed Profile	TRUE
38	VFA-131	NAS Oceana	CVW-3	F18F	10 CVW-3 Land Profile - Rhino	CVW-3 Deployed Profile	TRUE
39	VFA-136	NAS Lemoore	CVW-1	F18F	10 CVW-1 Land Profile - Rhino	CVW-1 Deployed Profile	TRUE
40	VFA-137	NAS Lemoore	CVW-2	F18F	12 CVW-2 Land Profile - Rhino	CVW-2 Deployed Profile	TRUE
41	VFA-143	NAS Oceana	CVW-7	F18F	12 CVW-7 Land Profile - Rhino	CVW-7 Deployed Profile	TRUE
42	VFA-146	NAS Lemoore	CVW-11	F18F	10 CVW-11 Land Profile - Rhino	CVW-11 Deployed Profile	TRUE
43	VFA-151	NAS Lemoore	CVW-9	F18F	10 CVW-9 Land Profile - Rhino	CVW-9 Deployed Profile	TRUE
44	VFA-154	NAS Lemoore	CVW-11	F18F	12 CVW-11 Land Profile - Rhino	CVW-11 Deployed Profile	TRUE
45	VFA-192	NAS Lemoore	CVW-2	F18F	10 CVW-2 Land Profile - Rhino	CVW-2 Deployed Profile	TRUE
46	VFA-195	Iwakuni	CVW-5	F18F	10 CVW-5 Land Profile - Rhino	CVW-5 Deployed Profile	TRUE
47	VFA-211	NAS Oceana	CVW-1	F18F	12 CVW-1 Land Profile - Rhino	CVW-1 Deployed Profile	TRUE
48	VFA-213	NAS Oceana	CVW-8	F18F	12 CVW-8 Land Profile - Rhino	CVW-8 Deployed Profile	TRUE
49	FRS-East	FRS East	FRS East	F18F	11 FRS Land Profile - Rhino	None	FALSE
50	FRS-East	FRS East	FRS East	F18F	5 FRS Land Profile - Rhino	None	FALSE
51	FRS-West	FRS West	FRS West	F18F	12 FRS Land Profile - Rhino	None	FALSE
52	FRS-West	FRS West	FRS West	F18F	5 FRS Land Profile - Rhino	None	FALSE
53	TOP GUN	TOPGUN	TOPGUN	F18F	4 TG Land Profile	None	FALSE
54	TOP GUN	TOPGUN	TOPGUN	F18F	2 TG Land Profile	None	FALSE
55	VX-E	TEST COM	VX-E	F18F	17 TC Land Profile	None	FALSE
56	VX-F	TEST COM	VX-F	F18F	8 TC Land Profile	None	FALSE
57							
58							



Here we define each squadron with its composition, location, profiles, etc.

SID	USTID	QTYPS	UTIL	PRIOF	PLID	NOTE
System identifier	Unit or station identifier	Quantity	Utilization	Priority	Prelife	User Note

UNID	DESCR	STID	MAXPM	MAXPMP	NOTE
Unit identifier	Unit or station identifier	Priority	Additional mission out-put	User Note	er

UGID	USTID	PRI	XTIME	NOTE
Unit group identifier	Unit or station identifier	Priority	Additional mission out-put	User Note

USTID	PRID	NOTE
Unit or station identifier	Profile identifier	User Note

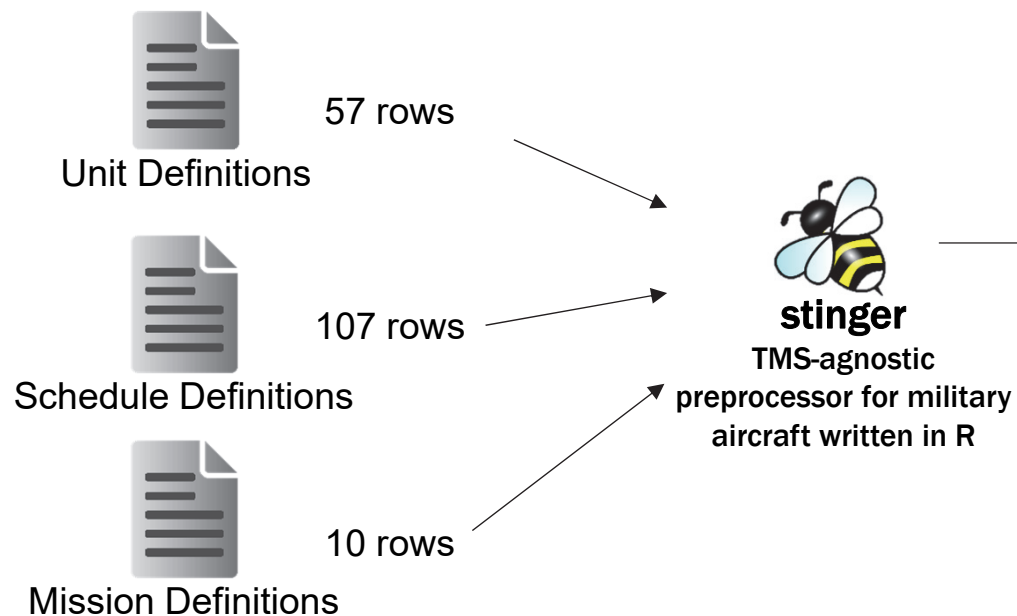
1	VAQ-130	2	CVW-8	CVW-8 LAND PROFILE - GROWLER
2	VAQ-131	3	CVW-9	CVW-9 LAND PROFILE - GROWLER
3	VAQ-133	4	CVW-1	CVW-1 LAND PROFILE - GROWLER
4	VAQ-136	5	CVW-17	CVW-17 LAND PROFILE - GROWLER
5	VAQ-137	6	CVW-5	CVW-5 LAND PROFILE - GROWLER
6	VAQ-139	7	CVW-11	CVW-11 LAND PROFILE - GROWLER
7	VAQ-140	8	CVW-7	CVW-7 LAND PROFILE - GROWLER
8	VAQ-141	9	CVW-3	CVW-3 LAND PROFILE - GROWLER
9	VAQ-142	10	CVW-2	CVW-2 LAND PROFILE - GROWLER
10	XVAQ-1	11	CVW-1	CVW-1 LAND PROFILE - RHINO
11	XVAQ-2	12	CVW-7	CVW-7 LAND PROFILE - RHINO
12	XVAQ-3	13	CVW-8	CVW-8 LAND PROFILE - RHINO
13	XVAQ-4	14	CVW-9	CVW-9 LAND PROFILE - RHINO
14	XVAQ-5	15	CVW-17	CVW-17 LAND PROFILE - RHINO
15	FRS-WEST-1	16	CVW-1	CVW-1 LAND PROFILE - RHINO
16	VFA-2	17	CVW-7	CVW-7 LAND PROFILE - RHINO
17	VFA-11	18	CVW-3	CVW-3 LAND PROFILE - RHINO
18	VFA-14	19	CVW-8	CVW-8 LAND PROFILE - RHINO
19	VFA-22	20	CVW-9	CVW-9 LAND PROFILE - RHINO
20	VFA-25	21	CVW-1	CVW-1 LAND PROFILE - RHINO
21	VFA-27	22	CVW-7	CVW-7 LAND PROFILE - RHINO
22	VFA-31	23	CVW-3	CVW-3 LAND PROFILE - RHINO
23	VFA-32	24	CVW-8	CVW-8 LAND PROFILE - RHINO
24	VFA-34	25	CVW-9	CVW-9 LAND PROFILE - RHINO
25	VFA-37	26	CVW-17	CVW-17 LAND PROFILE - RHINO
26	VFA-41	27	CVW-1	CVW-1 LAND PROFILE - RHINO
27	VFA-81	28	CVW-7	CVW-7 LAND PROFILE - RHINO
28	VFA-83	29	CVW-3	CVW-3 LAND PROFILE - RHINO
29	VFA-86	30	CVW-8	CVW-8 LAND PROFILE - RHINO
30	VFA-87	31	CVW-9	CVW-9 LAND PROFILE - RHINO
31	VFA-94	32	CVW-17	CVW-17 LAND PROFILE - RHINO
32	VFA-97	33	CVW-1	CVW-1 LAND PROFILE - RHINO
33	VFA-102	34	CVW-7	CVW-7 LAND PROFILE - RHINO
34	VFA-103	35	CVW-3	CVW-3 LAND PROFILE - RHINO
35	VFA-105	36	CVW-8	CVW-8 LAND PROFILE - RHINO
36	VFA-113	37	CVW-9	CVW-9 LAND PROFILE - RHINO
37	VFA-115	38	CVW-17	CVW-17 LAND PROFILE - RHINO
38	VFA-131	39	CVW-1	CVW-1 LAND PROFILE - RHINO
39	VFA-136	40	CVW-7	CVW-7 LAND PROFILE - RHINO
40	VFA-143	41	CVW-8	CVW-8 LAND PROFILE - RHINO
41	VFA-146	42	CVW-9	CVW-9 LAND PROFILE - RHINO
42	VFA-151	43	CVW-17	CVW-17 LAND PROFILE - RHINO
43	VFA-154	44	CVW-1	CVW-1 LAND PROFILE - RHINO
44	VFA-192	45	CVW-7	CVW-7 LAND PROFILE - RHINO

stinger outputs – 40 OPUS/SIMLOX tables

OPUS/SIMLOX Table Name		
Control	OperationProfile	Station
ControlParameters	Operations	StationStructure
CMLocation	PMActivation	StockAllocation
CMReplacement	PMFailureMode	StockExist
FailureMode	PMLocation	SystemDeployment
Item	PMReplacement	SystemTransfer
ItemReorder	Prelife	System
ItemRepair	PrelifeData	TaskResource
ItemTransfer	PrelifeDataAge	Tasks
Lateral Support	Problem Description	TimeDistributions
MaterielPM	Resource	TransportPolicyProfile
MaterielPosition	ResourceAllocation	Unit
MaterielStructure	ResourceStation	
MissionType	ResourceTransfer	

stinger creates all of the tables our model requires

stinger simplifies creating a complex model



SIMLOX Table	# of rows
MissionType	10
OperationProfile	50,049
Operations	97
System	3
SystemDeployment	100
SystemTransfer	1,461
Unit	96
Total	51,813

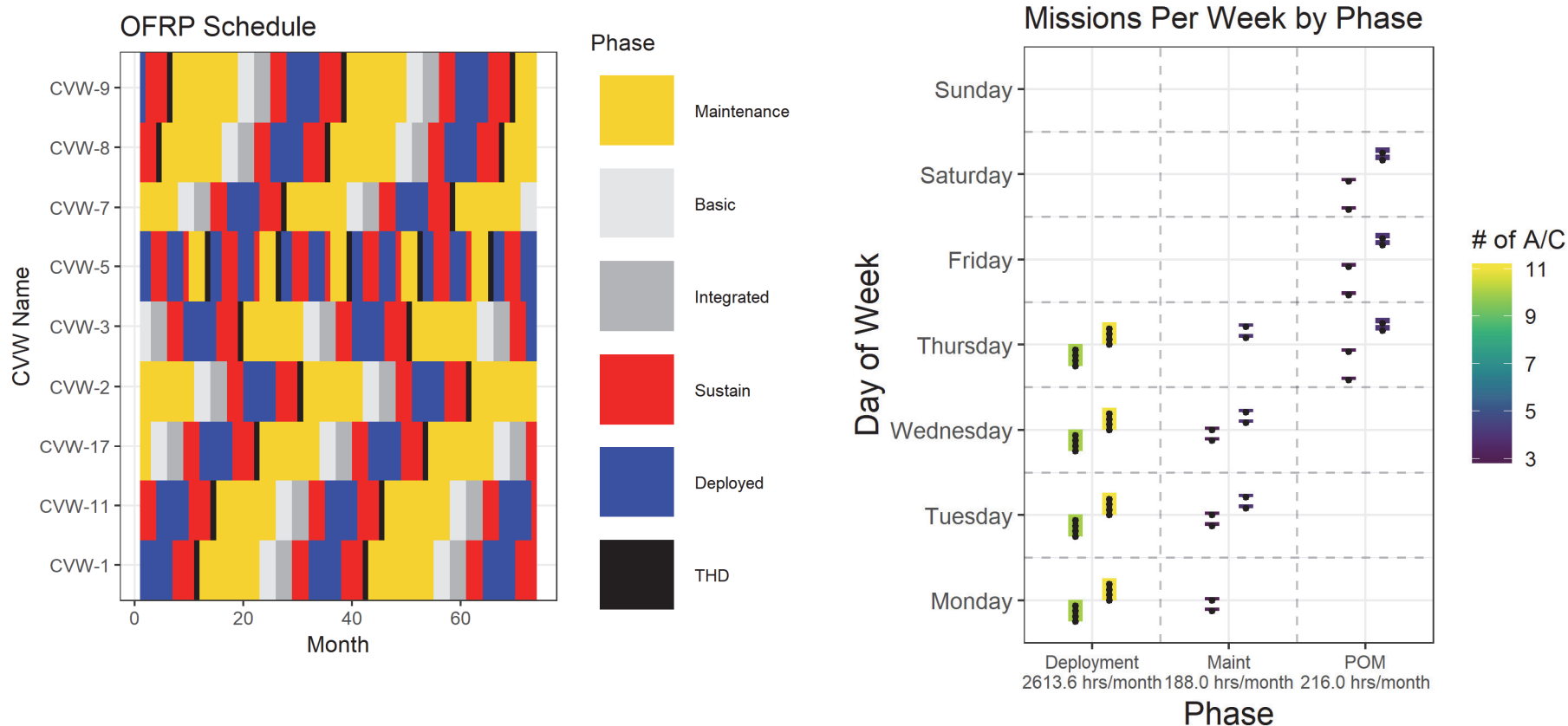


SIMLOX Table	# of rows
CMLocation	9,198
CMReplacement	3,945
FailureMode	4,897
Item	771
ItemReorder	771
ItemRepair	771
MaterielPosition	1,914
MaterielStructure	3,828
TimeDistributions	1,389
Total	27,484

stinger lowers the barrier to entry to build complex readiness models in SIMLOX

IDA's Super Hornet model includes a detailed representation of real-world fleet operations

- F-18 model implements variable hours to reflect land/sea operations
 - Improves spares projections and captures “real world” cueing problems
 - Models 2+2 deployment schedule

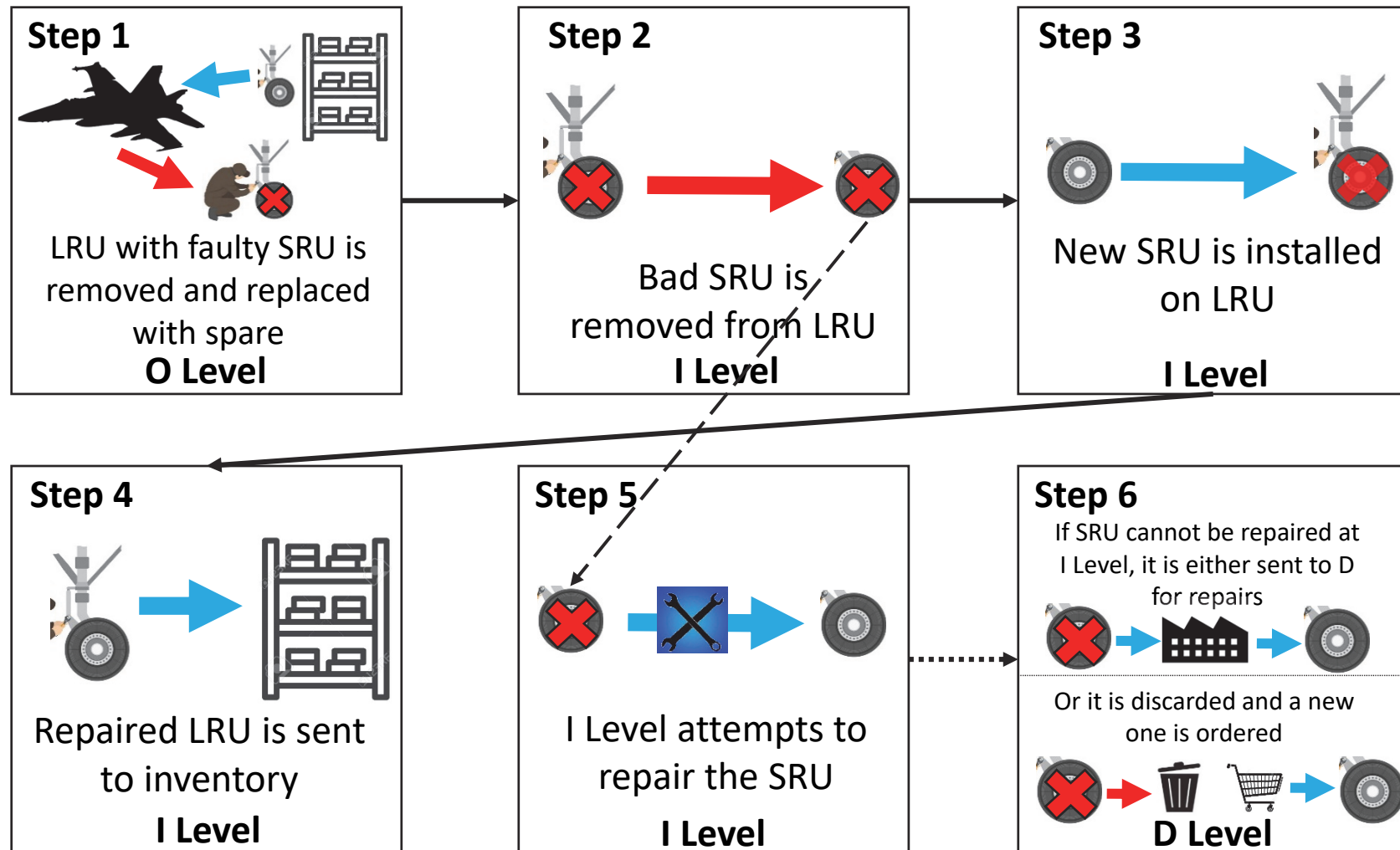


These profiles can easily be adjusted for excursions (e.g., wartime operations)

Deployed units have differences that matter for a sustainment model

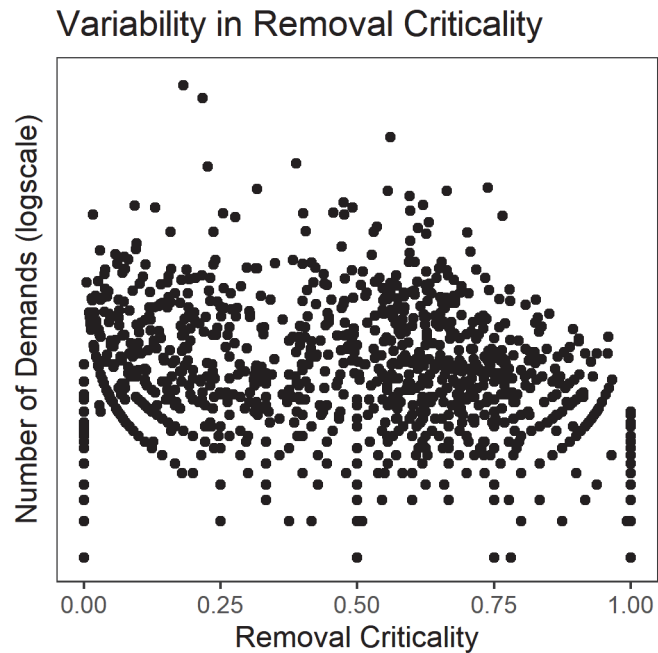
Aspect of deployment	Feature Status
Deployed squadrons have a different item transport profile	Implemented
Squadrons draw from different spares pool when deployed	Implemented
Squadrons *always* begin deployed period with all aircraft operational	Implemented
Squadrons deployed together can “cover” for each other on missions	In Progress
Repair facilities at deployed locations have different capabilities	Planned
Failure rates are different on deployment	Planned

IDA's model closely mimics the Navy's O-I-D sustainment concept

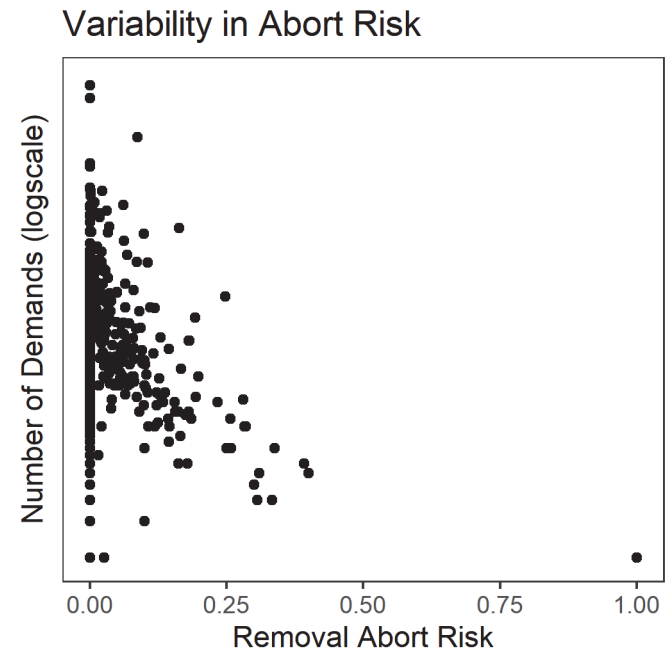


The failure rates and repair times are calculated using Navy data

Not all failures are created equal

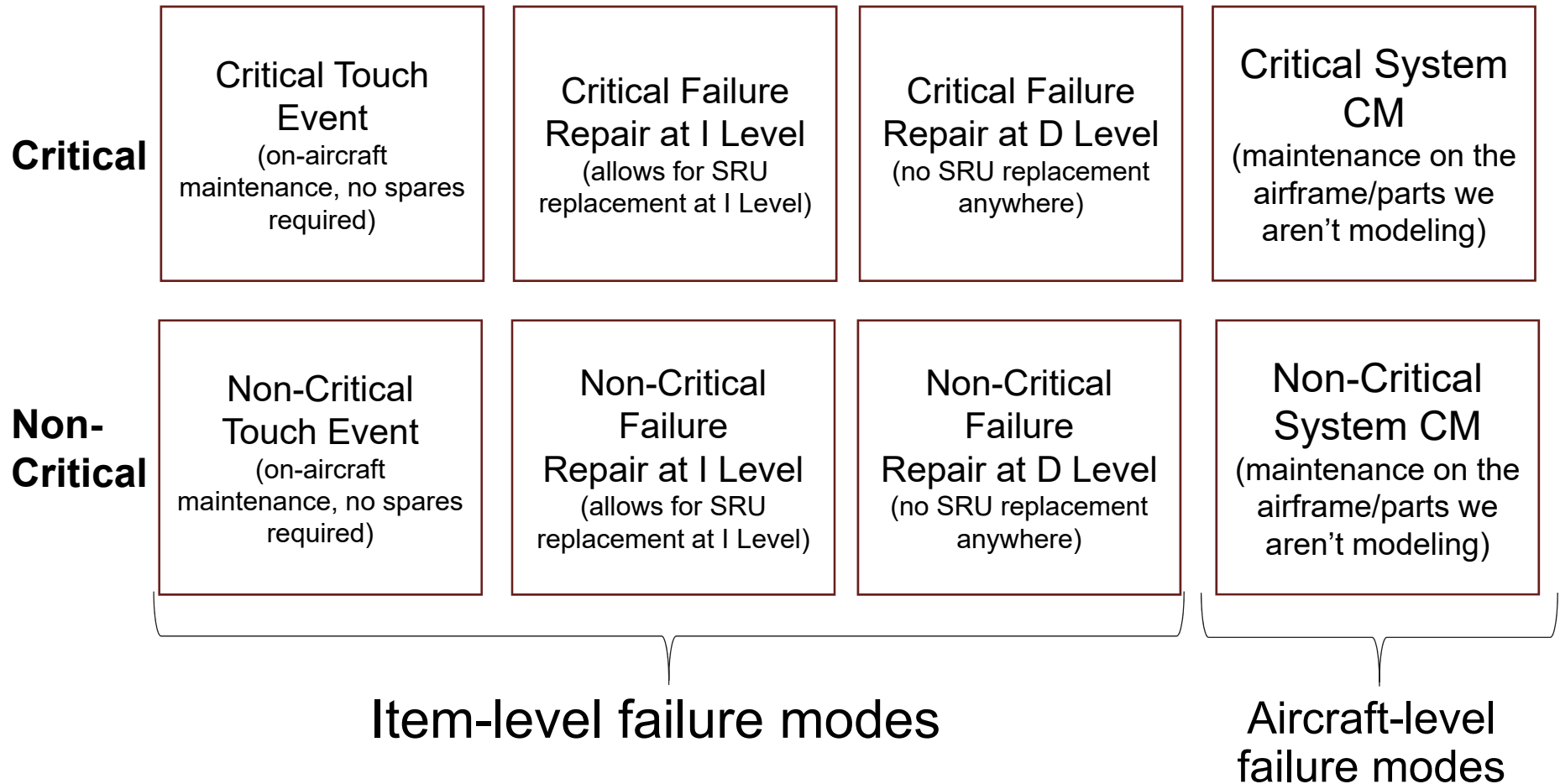


The effect of a given item's failure on readiness is not binary

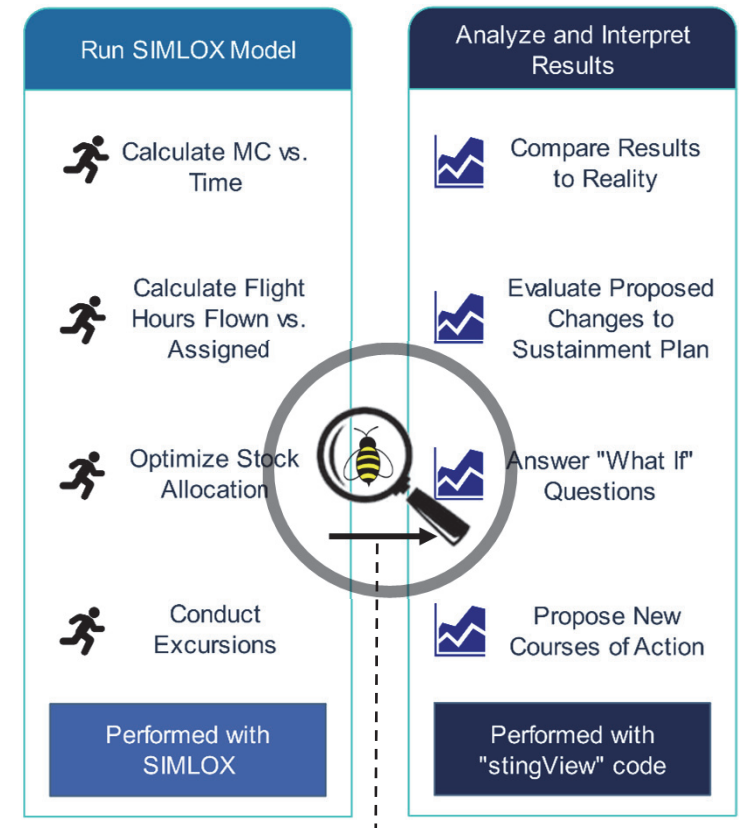
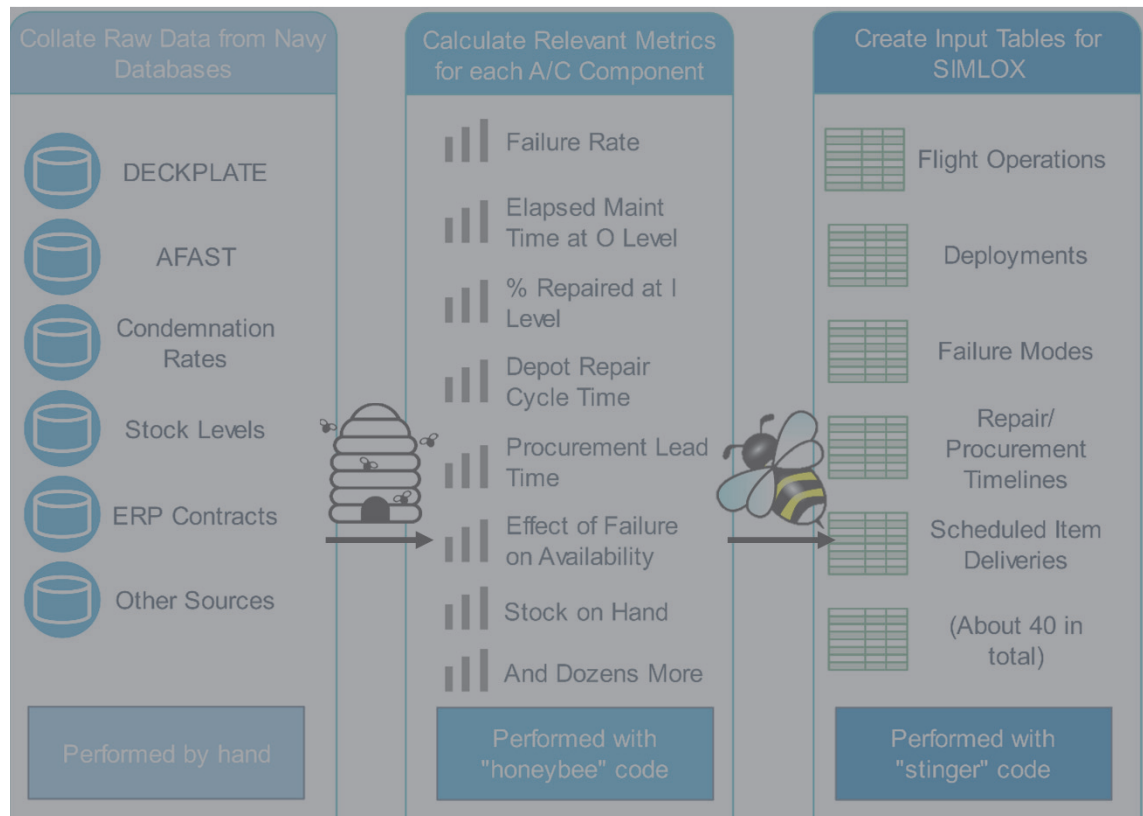


Few items consistently cause mission aborts upon failure

We use up to 6 failure modes per item to capture the different possible outcomes of a failure, as well as modeling aircraft-level failures separately

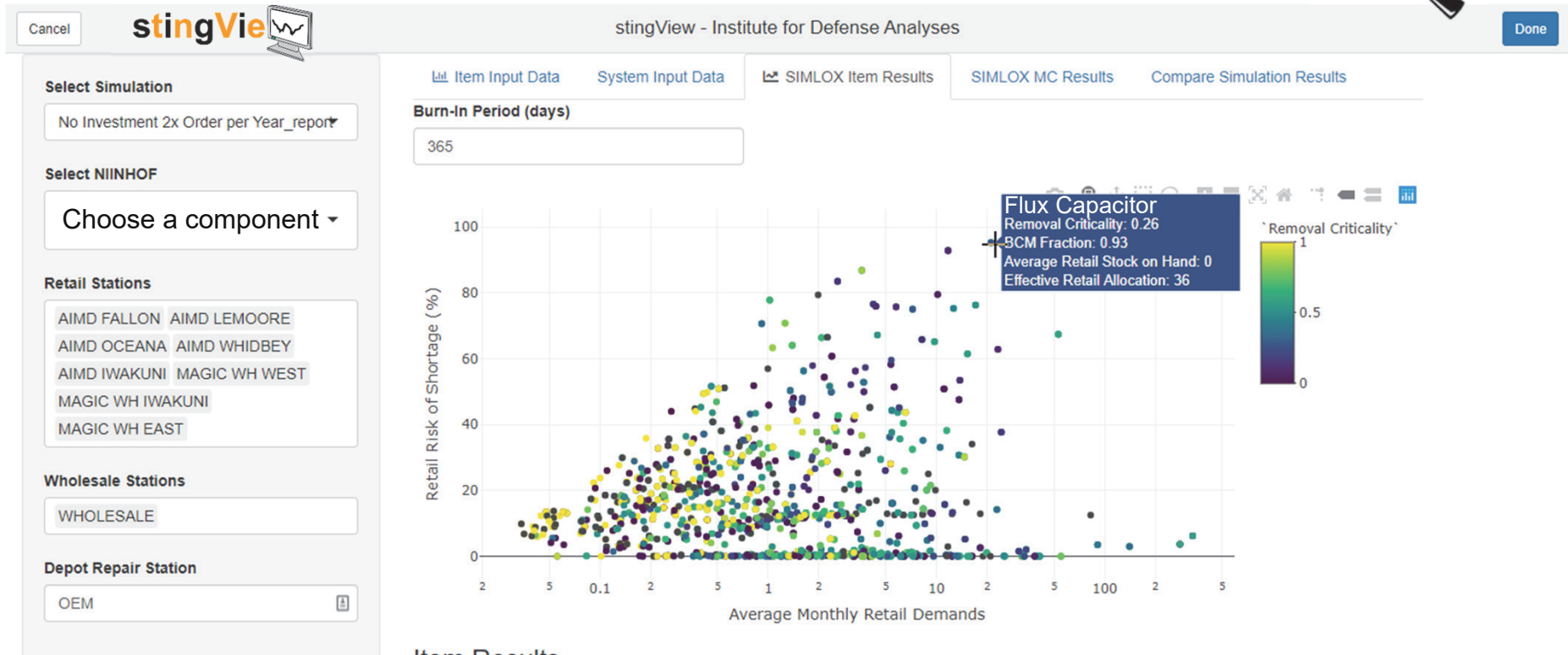


How to connect raw data to readiness decision making



IDA's tool **stingView** helps visualize and analyze the results

stingView provides interactive graphs to examine simulation results



Item Results

Retail Stock:
Average Retail Stock on Hand: 20
Effective Retail Allocation: 20
Average Retail Risk of Shortage: 36.2%
Navy Retail Allocation (not strictly relevant to simulation): 2

Wholesale Stock:
Average Wholesale Stock on Hand: 121.6
Effective Wholesale Allocation: 174.3
Average Wholesale Risk of Shortage: 0%

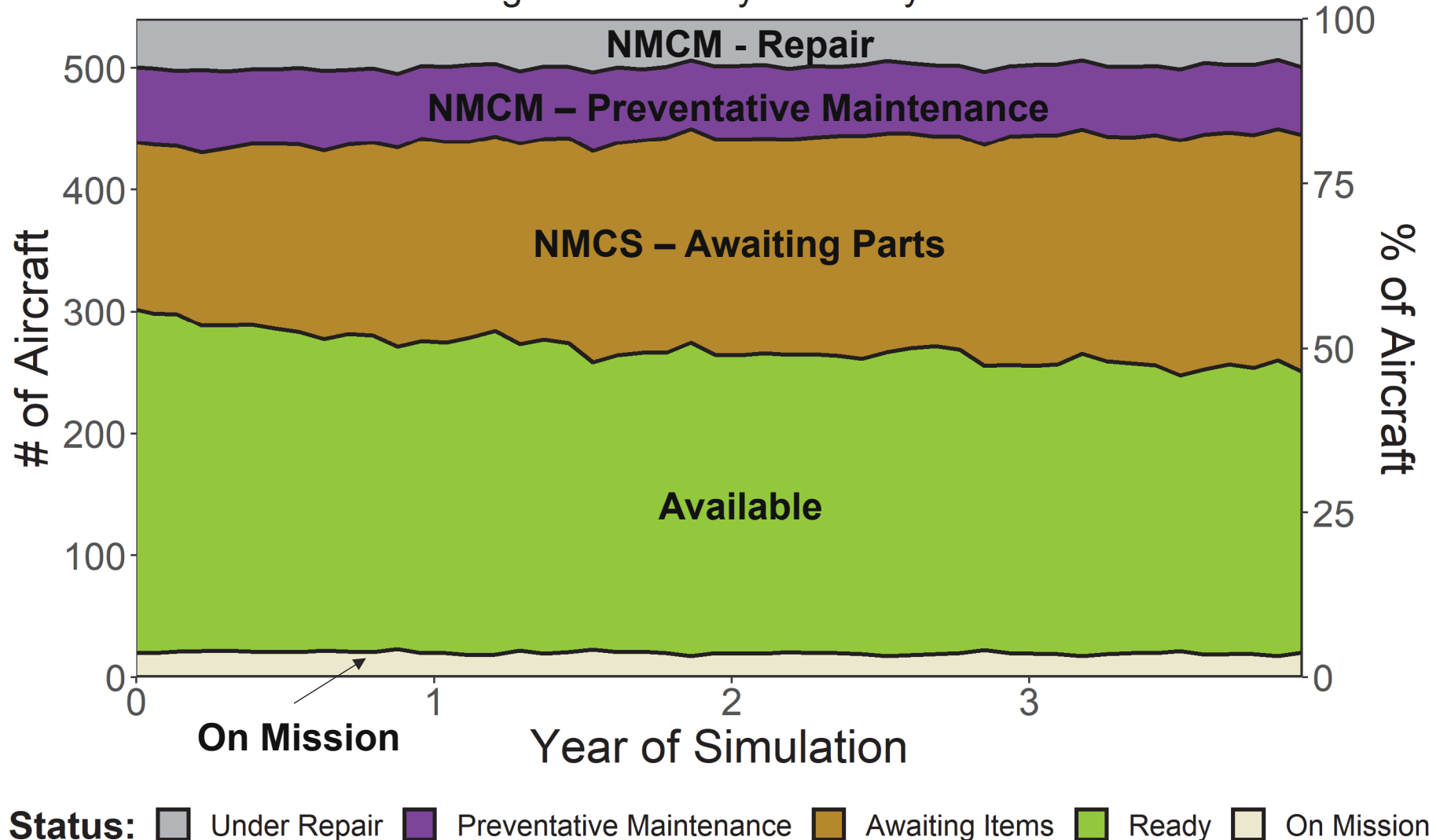
Retail:
Monthly Retail Demands: 5.3
Retail Waiting Time (days): 90.2
Retail Waiting Time Given Shortage (days): 172.9

I Level:
Monthly I Level Repairs: 0

Wholesale:
Monthly Items Consumed/Condemned: 0.1
Monthly Wholesale Demands: 3.7
Monthly Wholesale Repairs: 3.7

We have built a functioning model, down to the part level, that can support funding questions

SIMLOX Results Using Current Navy Inventory + Scheduled Deliveries*

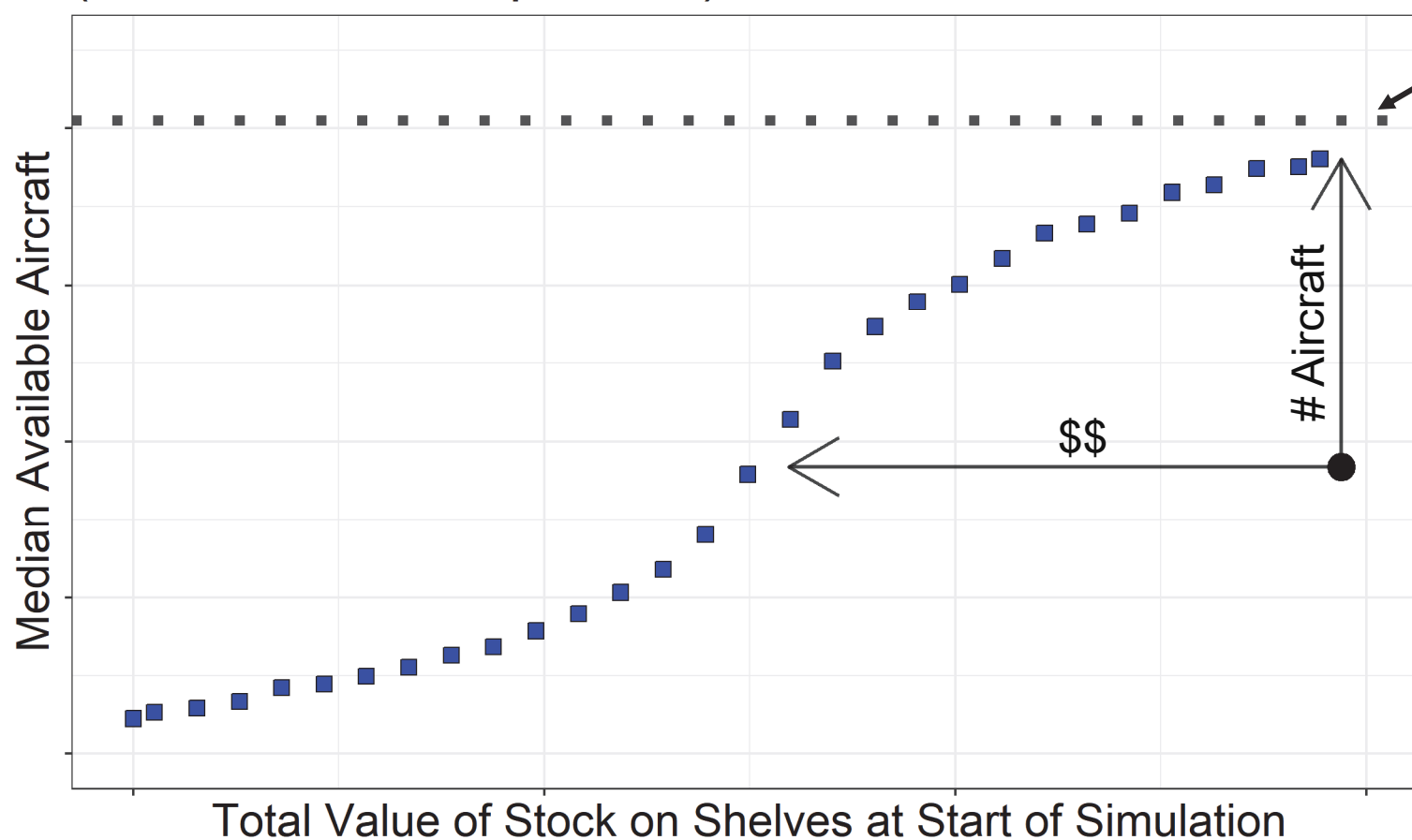


*Includes purchases estimated to arrive before July 2021

The data suggest that the Navy is not buying the right parts (too many of some, too few of others)

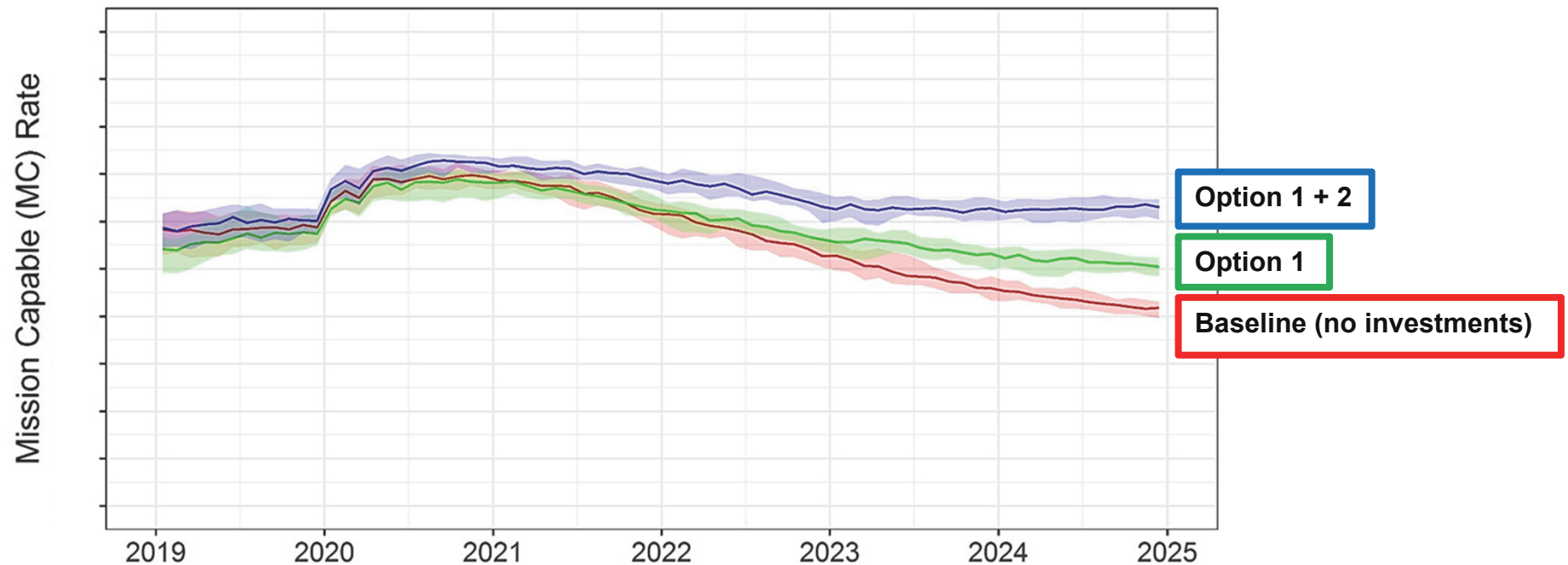
Stock Optimization vs. Current Stock
(~300 aircraft components)

Practical upper bound in model



● Current Navy Stock ■ OPUS Stock Optimization

² ⁶ Example Results from the F-35 SIMLOX Model: Availability projections and options costed



Option	FY20 delta	FY21 delta	FY22 delta	FY23 delta	FY24 delta	Total delta over FYDP	Availability improvement over FYDP
Investment option #1	\$\$	\$\$	\$\$	\$	\$	\$\$\$\$	X%
Investment option #2	\$\$	\$\$	\$\$	\$\$	\$\$\$	\$\$\$\$	XX%

A bottom-up, end-to-end forecasting model is a powerful way to tie dollars spent to sustainment outcomes

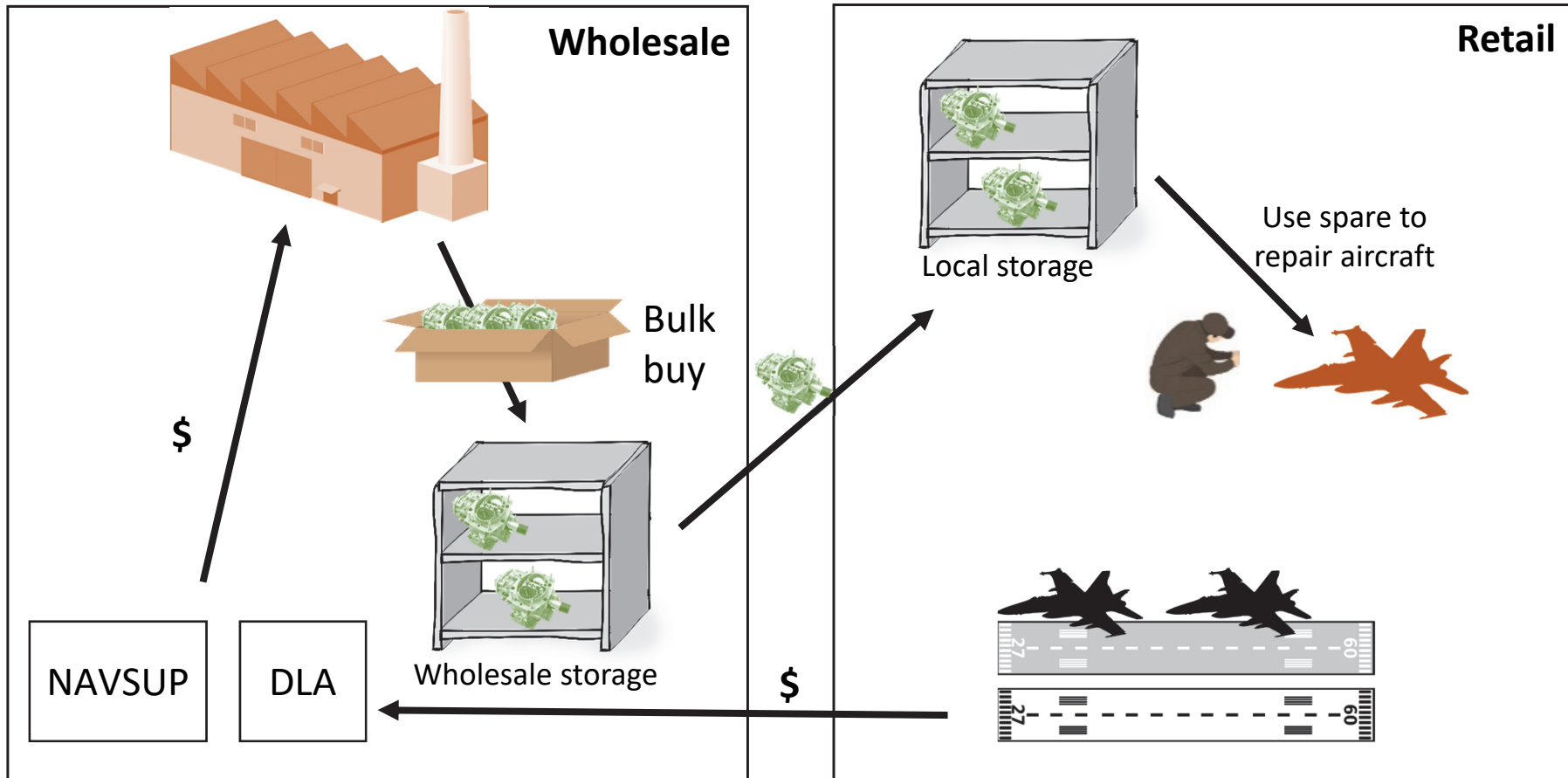
The key role of the analyst is assembling, interpreting, and applying rigorous, reproducible methods when populating the model

Tool development builds consensus within the sustainment community

IDA

The letters 'IDA' are rendered in a bold, dark blue serif font. A solid red horizontal line is positioned directly beneath the text, extending slightly beyond the width of the letters.

Retail and Wholesale



NAVSUP and DLA spend money from their working capital funds to procure new parts and (in NAVSUP's case) repair broken carcasses. They attempt to buy in advance of need based on forecasted demand.

Individual units and bases usually buy spare parts from wholesale with money from their operational funds to keep the retail shelves stocked.

Scrutinize your data

Cancel

stingView - Institute for Defense Analyses

Done

Select Simulation

Next Dollar - F18 Point 1 Value 0 M

Select NIINHOF

Choose a component

Retail Stations

AIMD FALLON AIMD LEMOORE
AIMD OCEANA AIMD WHIDBEY
AIMD IWAKUNI
MAGIC WH WEST
MAGIC WH IWAKUNI
MAGIC WH EAST

Wholesale Stations

WHOLESALE

Depot Repair Station

OEM

Item Input Data System Input Data SIMLOX Item Results SIMLOX MC Results

Compare Simulation Results

NIINHOF/TMS-Level Properties

name	F18F	F18E	F18G	Weighted Total
Num Demands	21	43	18	82
Num Touch Events	39	32	25	96
MFHBR	4125.95	2623.15	3355.7	3168.82
Removal Criticality	0.52	0.47	0.29	0.44
Touch Criticality	0.82	0.81	0.88	0.83

NIINHOF-Level Properties

Item Type: LRU, COG: 7R

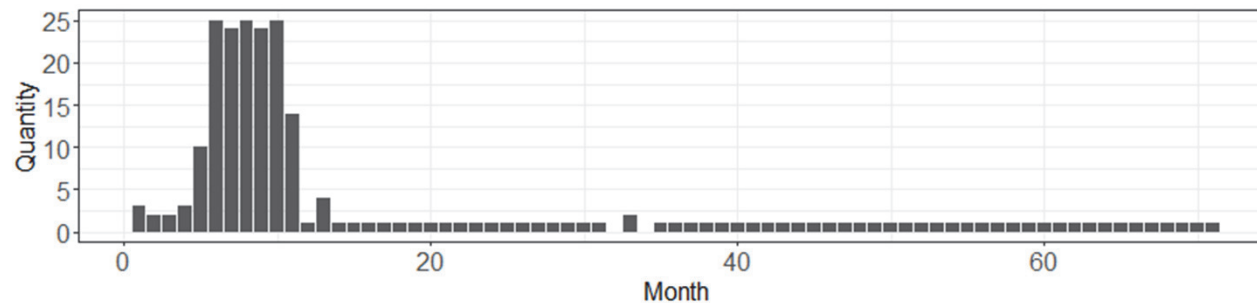
name	value
Condemnation Rate	0.02
bcmFraction	1
DRCT Point Estimate (days)	269.85
PCLT Point Estimate (days)	753.23

These values are inputs to the simulation and provide a handy way to view the properties of individual items

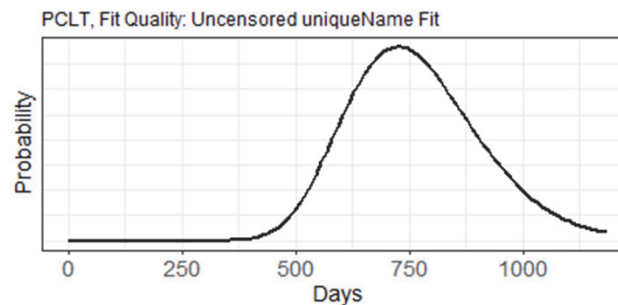
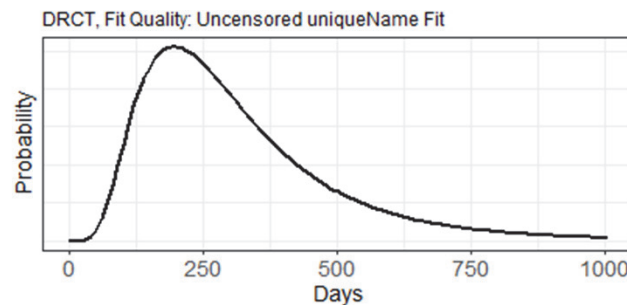
Stock Information

name	value
Retail Stock Levels at t=0	2
Navy Retail Stock Allocation	20
Wholesale Stock Levels at t=0	1
Total Due In	219

Scheduled Deliveries



DRCT and PCLT



The Scheduled Deliveries and DRCT/PCLT (repair and procurement lead time) graphs provide an at-a-glance overview of the supply system

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14. ABSTRACT Bottom-up emulations of real sustainment systems that explicitly model spares, personnel, operations, and maintenance are a powerful way to tie funding decisions to their impact on readiness, but they are not widely used. The simulations require extensive data to properly model the complex and variable processes involved in a sustainment system, and the raw data used to populate the simulation are often scattered across multiple organizations. The Navy has encountered challenges in keeping sustaining the desired number of F/A-18 Super Hornets in mission capable states. IDA was asked to build an end-to-end model of the Super Hornet sustainment system using the OPUS/SIMLOX suite of tools to investigate the strategic levers that drive readiness. IDA built an R package ("honeybee") that aggregates and interprets Navy sustainment data using statistical techniques to create component-level metrics. IDA built a second R package ("stinger") that uses these metrics to automatically generate the input tables necessary to run OPUS/SIMLOX; the effect of both of these packages is that IDA has lowered the barrier for entry for building these large end-to-end sustainment models. We present a summary of these tools and techniques to the OPUS User community in this briefing.					
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