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DATAWorks 2022: Taming the Beast: Making Questions About the Supply System Tractable by Quantifying Risk

Vincent Lillard, Project Leader

Kyle Remley
Joseph Fabritius

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Executive Summary

The DOD sustainment system is responsible for managing the supply of millions of different spare parts, most of which are infrequently and inconsistently requisitioned, and many of which have procurement lead times measured in years. The DOD must generally buy items in anticipation of need, yet it simply cannot afford to buy even one copy of every unique part it might be called upon to deliver.

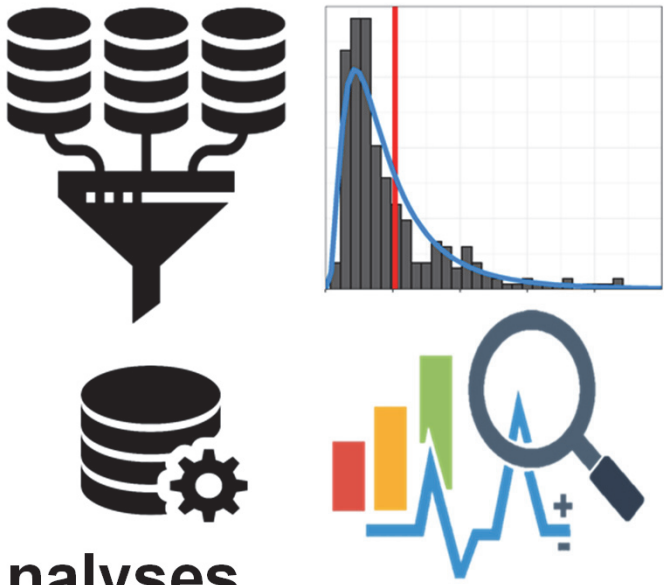
Deciding which items to purchase necessarily involves taking risks, both military and financial. However, the huge scale of the supply system makes these risks difficult to quantify. We have developed methods that use raw supply data in new ways to support this decision-making process.

First, we have created a method to identify areas of potential overinvestment that could safely be reallocated to areas at risk of underinvestment. Second, we have used raw requisition data to create an item priority list for individual weapon systems in terms of importance to mission success. Together, these methods allow DOD decision-makers to make better-informed decisions about where to take risks and where to invest scarce resources.

Taming the Beast: Making Questions about the Supply System Tractable by Quantifying Risk

Kyle E. Remley

Joseph M. Fabritius II



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Modeling and Simulation
Han G. Yi & Andrew C. Flack

Aggregate raw data

Calculate key performance metrics

Make assumptions and set scope of study

Conduct study exploring link between $ and readiness

Analyze and interpret results

Handling Raw Sustainment Data
Megan L. Gelsinger

Cross-Cutting Data Analyses
Joseph M. Fabritius II & Kyle E. Remley

Part I: Identifying Overstocked and Understocked Items

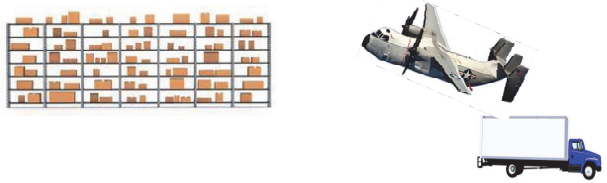
Working Capital funds are used to replenish wholesale stock in the Sustainment hierarchy

Operations
Units perform missions

Local supply and maintenance
Replace or repair stock at local location, e.g. base or ship, as able

$$$

Wholesale
Stock delivery to local sites



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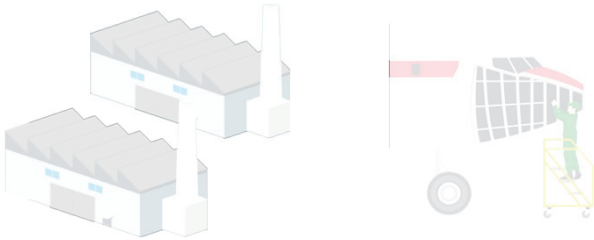
Depot-level maintenance
Extensive repair, scheduled upgrade, or maintenance performed off-site



DOD has billions of dollars tied up in overstocked items and low demand items. *How did we get here?*

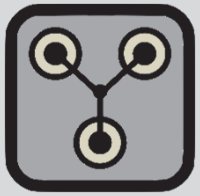
Understocked items that experience backorders damage fleet readiness and deny DOD the opportunity to better allocate funds.

Overstocked items represent a significant risk to the DOD by tying up billions of dollars that could be more effectively invested elsewhere.

We need a consistent way to compare different items' stock posture

$$lead\ times\ of\ stock = \frac{total\ stock}{demand\ rate \times lead\ time}$$

On Shelf



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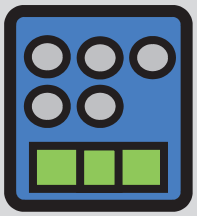
small demand
short restock time

High Lead Times of Stock

On Shelf



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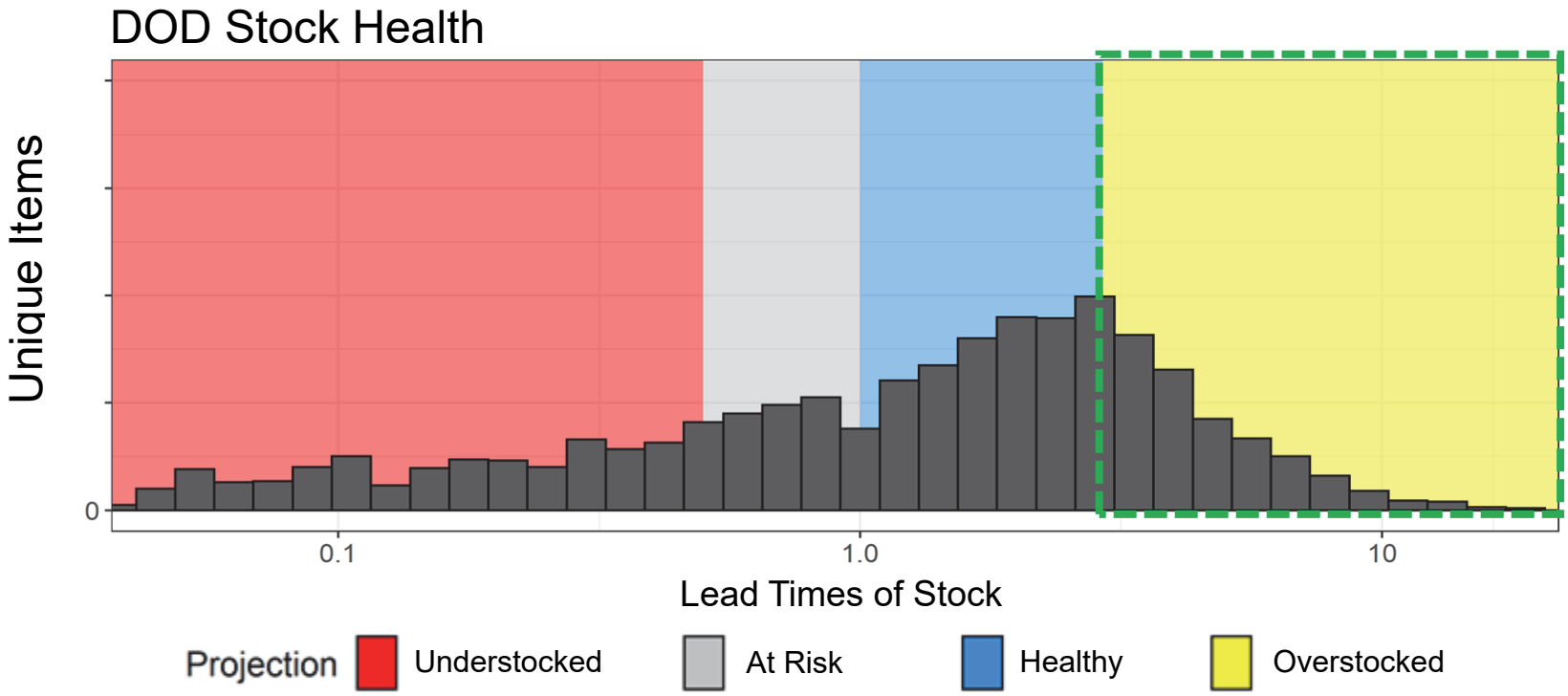
large demand
long restock time

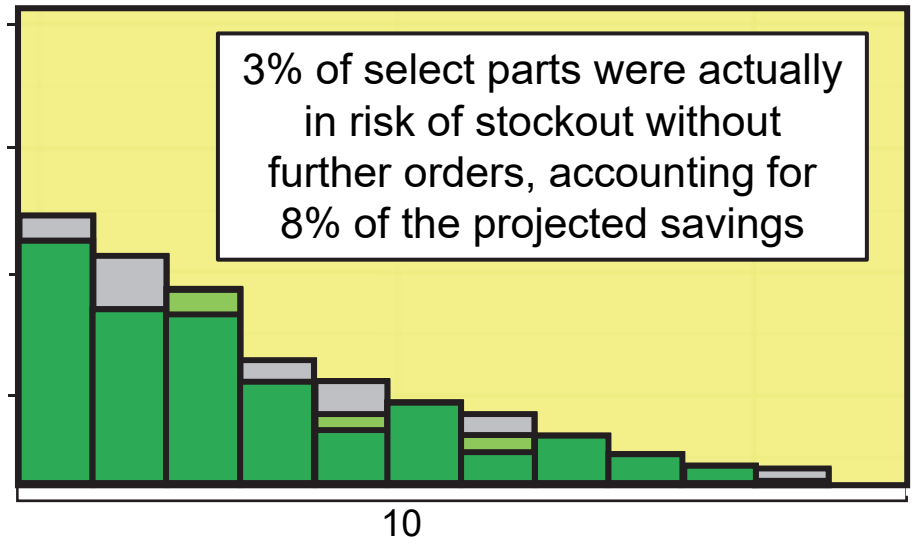
Low Lead Times of Stock

We need a consistent way to compare different items' stock posture *across the fleet*

$$\textbf{\textit{lead times of stock}} = \frac{\textbf{\textit{total stock}}}{\textbf{\textit{demand rate}} \times \textbf{\textit{lead time}}}$$



To validate our method, we can use predictions at a date in the past, and compare it to *real* outcomes



Look at all items in surplus (c. 2019-10-01) → Identify items considered safe surplus → Check prediction against future stock posture

The method had ***97%*** part accuracy, ***92%*** financial success

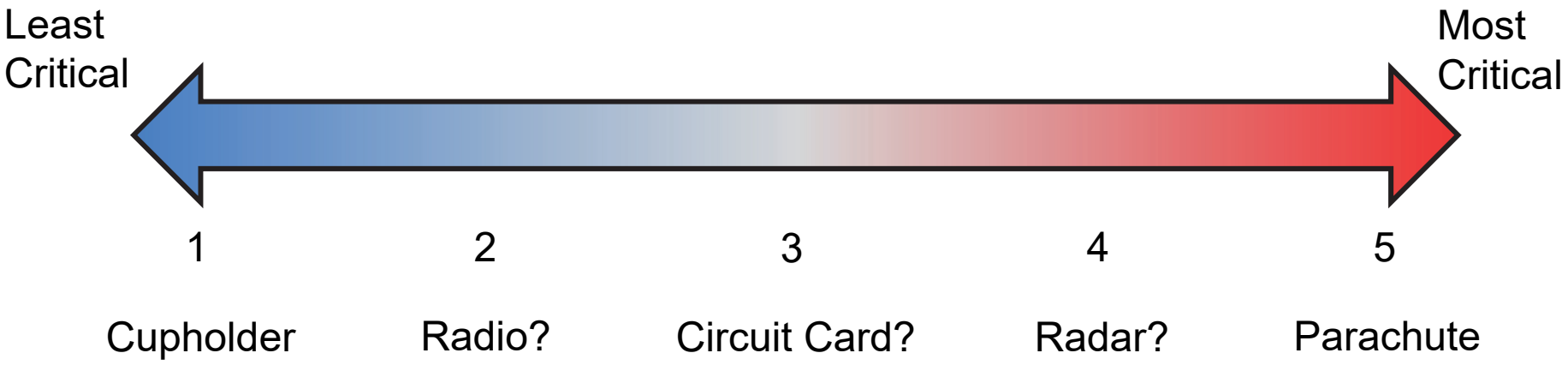
Summary

Part II: Quantifying Mission Criticality of Items

Not all items are created equal

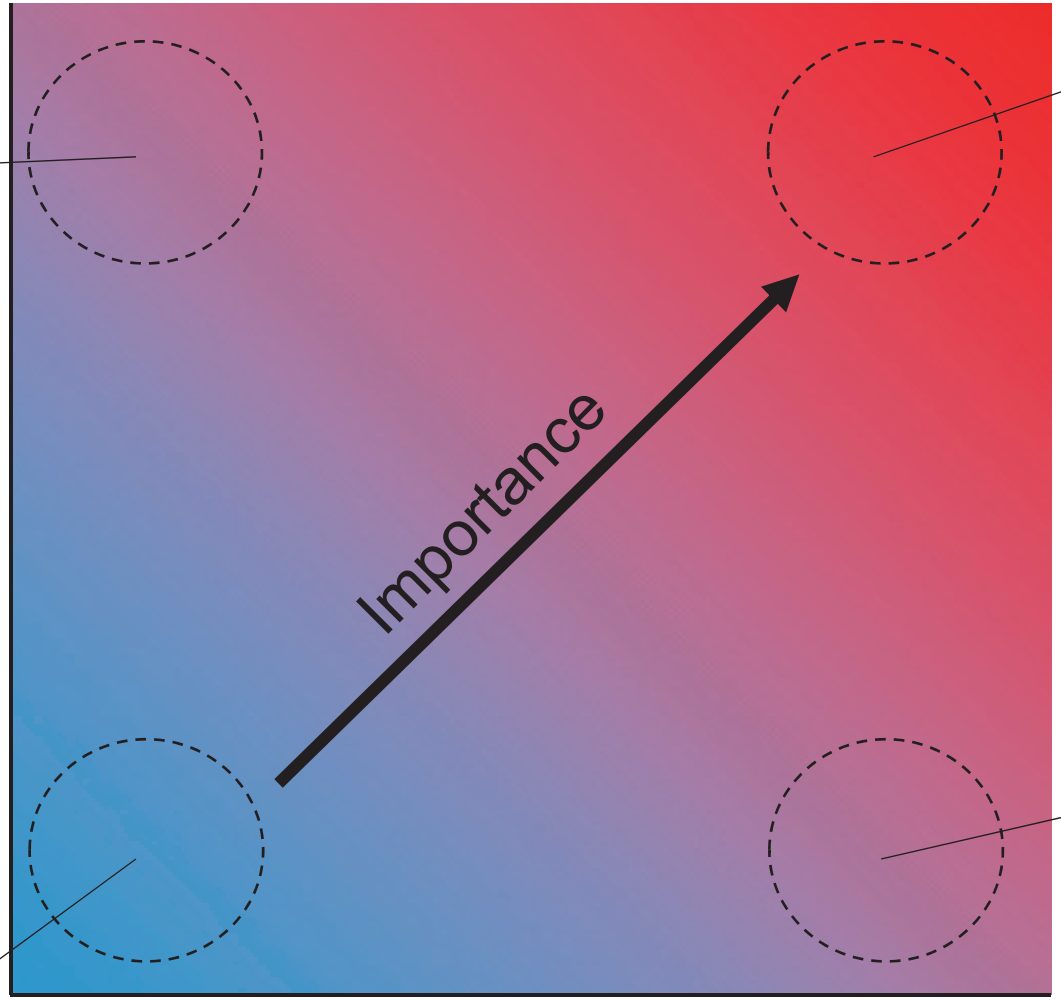
DOD has Item Mission Essentiality Codes (IMECs) that give a qualitative measure of an item's importance to a mission

- Decided by committee (soldiers, sailors, engineers)
- Nonstandard selection criteria



Consistent, systematically chosen IMECs can help item managers optimally purchase items to support readiness

We determine item importance using historical demands and the readiness impact (criticality) of items



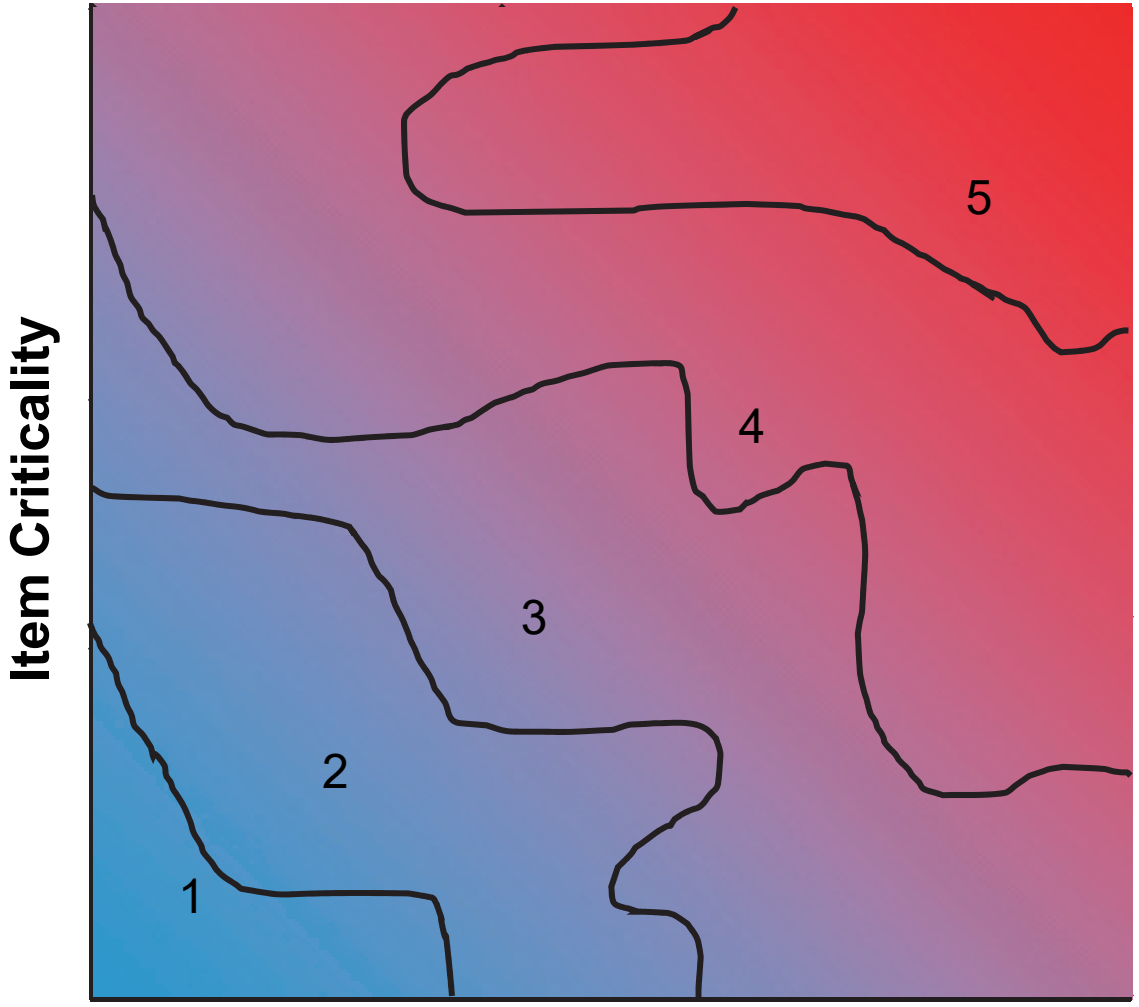
Demands that stop you from doing missions are less important; you don't need them often

The most important items are demanded frequently and stop you from doing missions

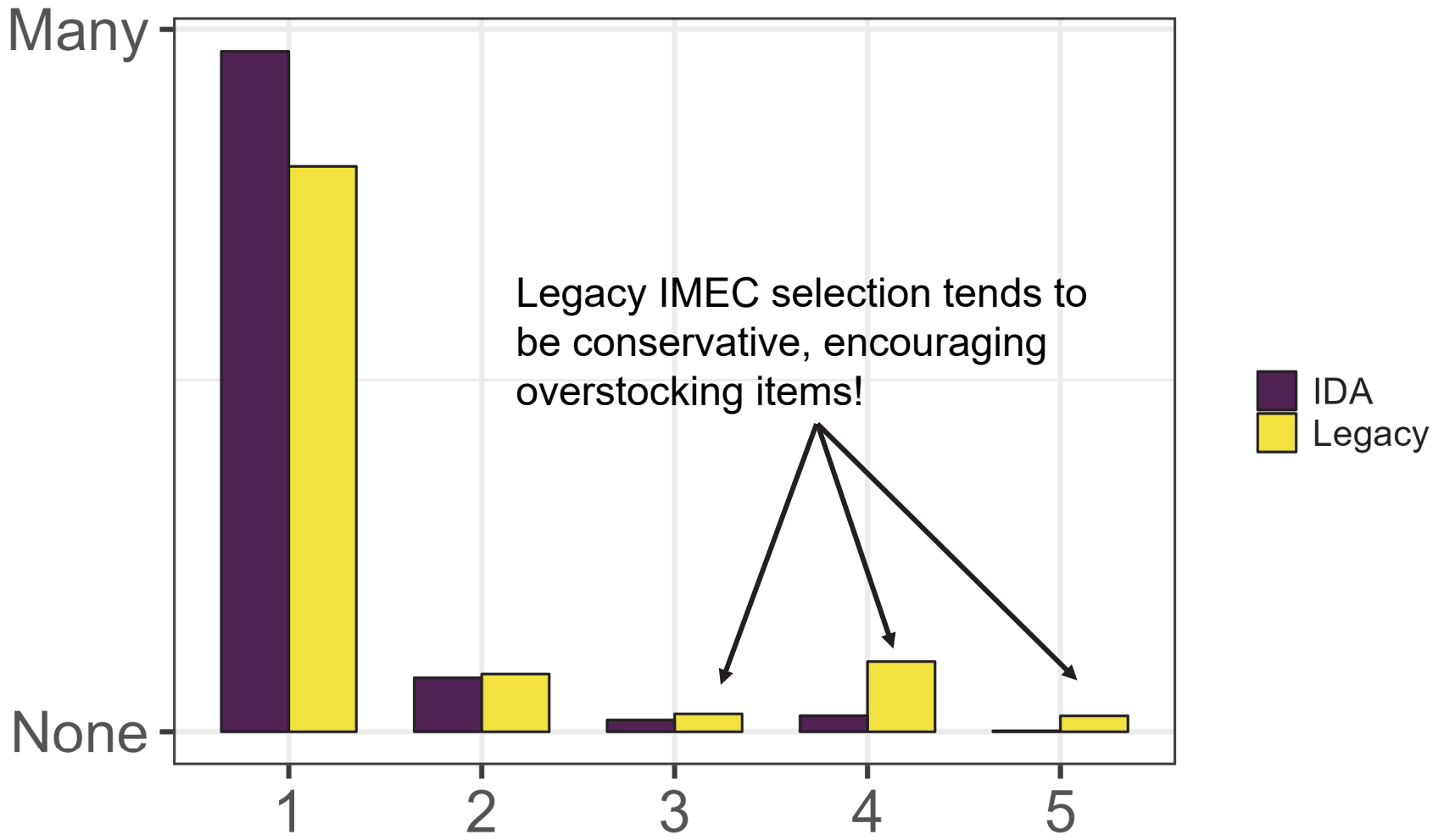
Items needed frequently are less important if they don't stop you from doing missions

Items that you don't need that much and don't stop you from doing missions are least important

Tying importance to IMEC is inherently subjective, but a single standard is enforced across all items

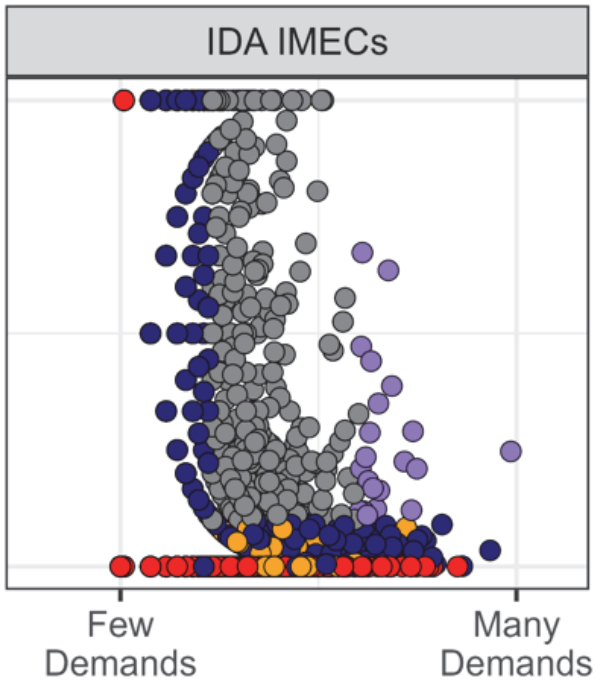


We selected IMECs that correlate more closely with item importance



Fewer priority items clarifies which ones are *really* important!

Our analysis allows DOD item managers to weigh purchasing decisions with readiness and financial information



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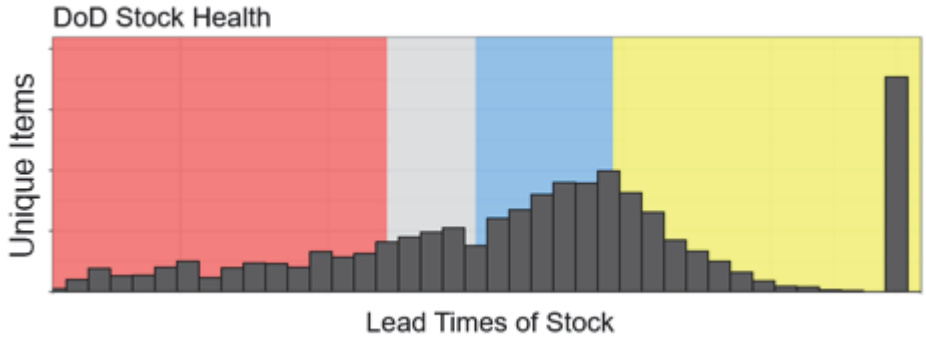

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Item Purchase List	
Parachute	High Importance
Circuit Card	Medium Importance
Cupholder	Low Importance
Radio	Overstocked
Radar	Overstocked

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Lillard, Vincent

14. ABSTRACT
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