



Leverage Artificial Intelligence to Learn, Optimize, and Wargame (LAILOW) for Navy Ships

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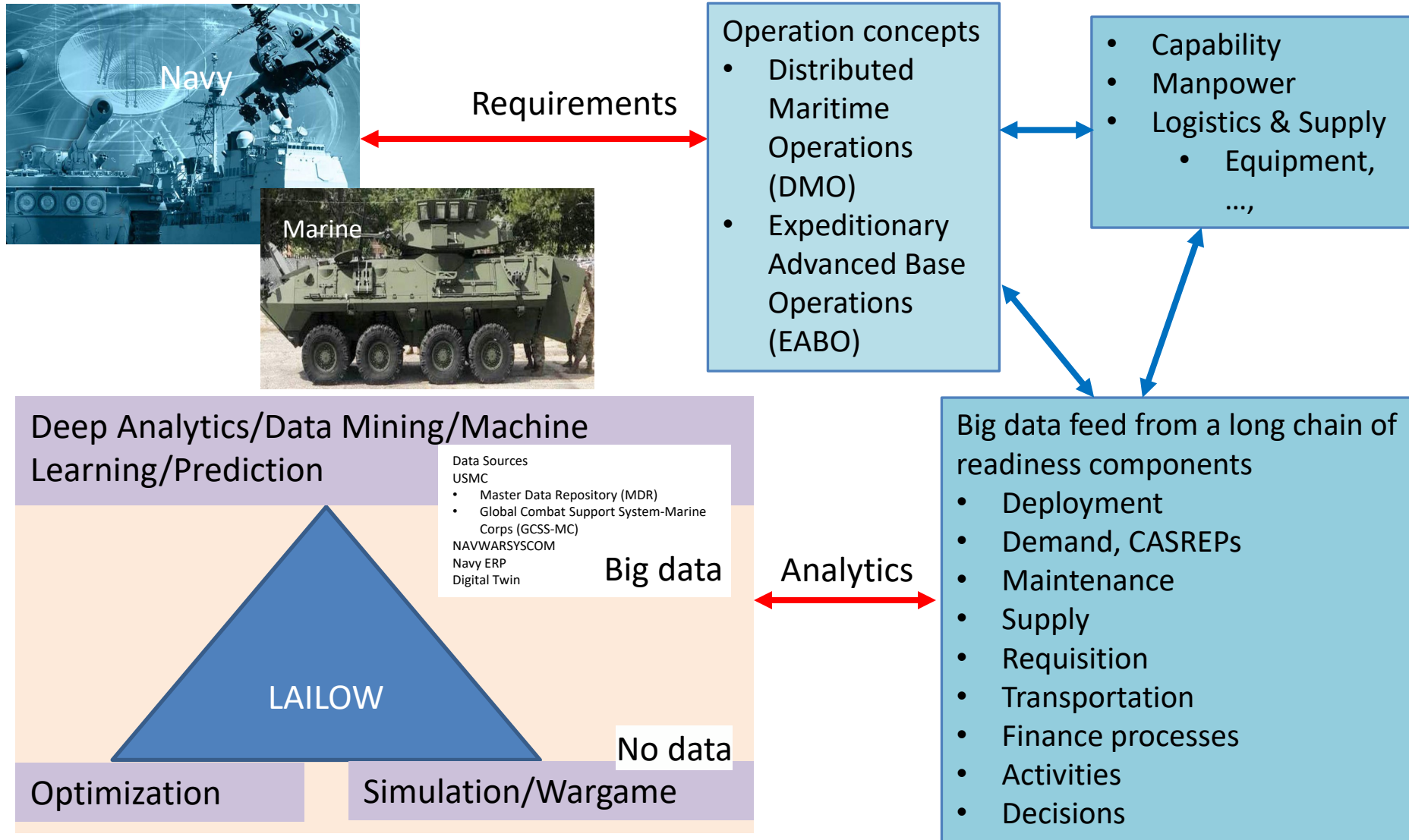
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In the Special Webinar *Developing Artificial
Intelligence in Defense Programs* for the
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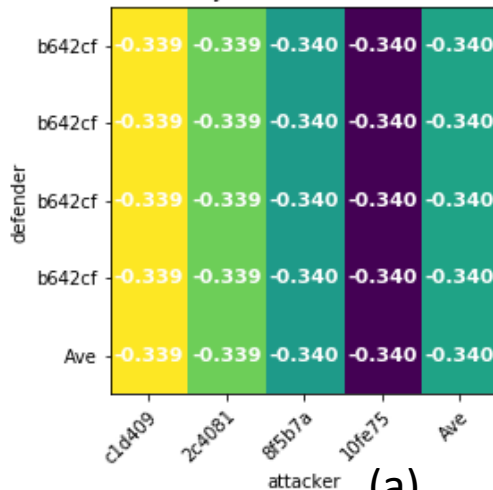


Challenges, Needs, and LAILOW Methods



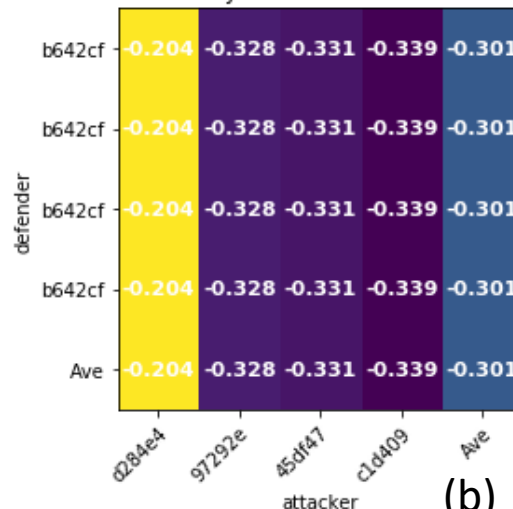
Use Case 1: Coevolution Process

Player: attacker Gen: 0



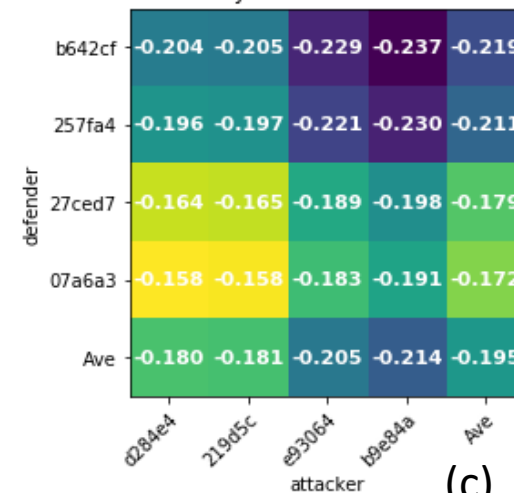
(a)

Player: attacker Gen: 1



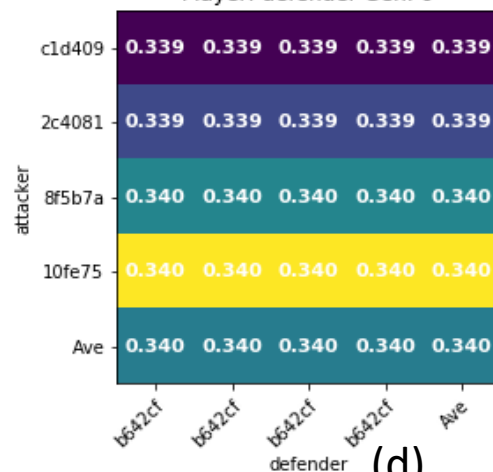
(b)

Player: attacker Gen: 2



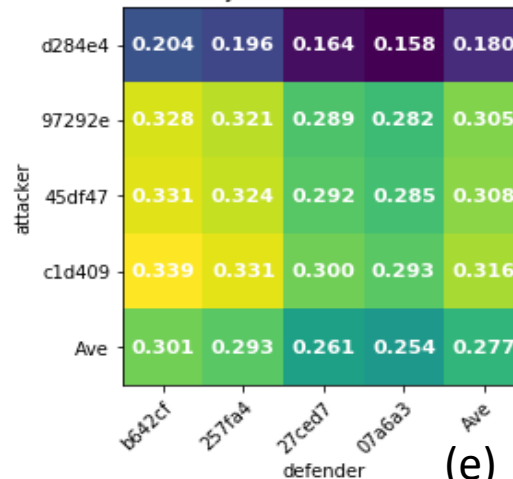
(c)

Player: defender Gen: 0



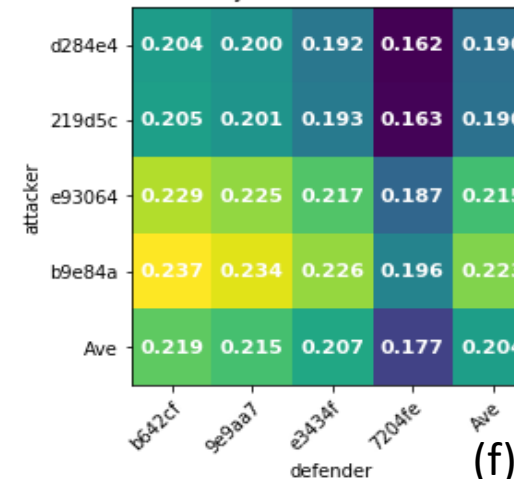
(d)

Player: defender Gen: 1



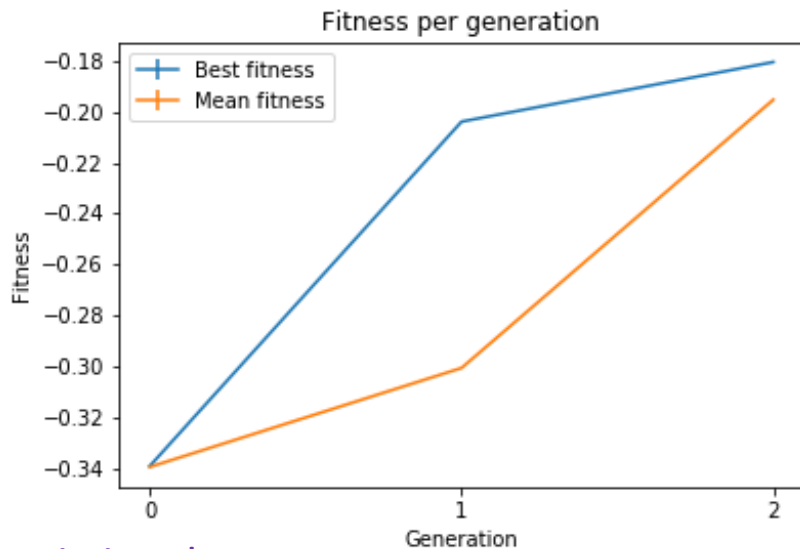
(e)

Player: defender Gen: 2



(f)

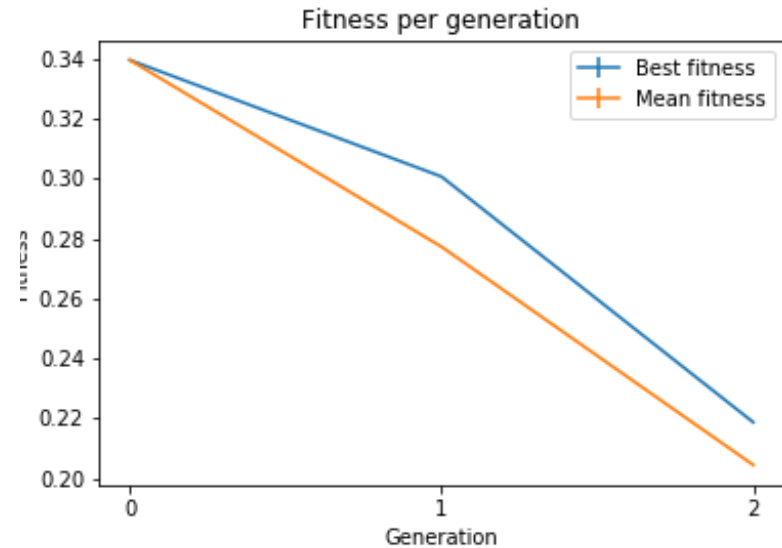
Attackers/Problems



Existing data

(a)

Defender/Solutions



Existing data

(b)

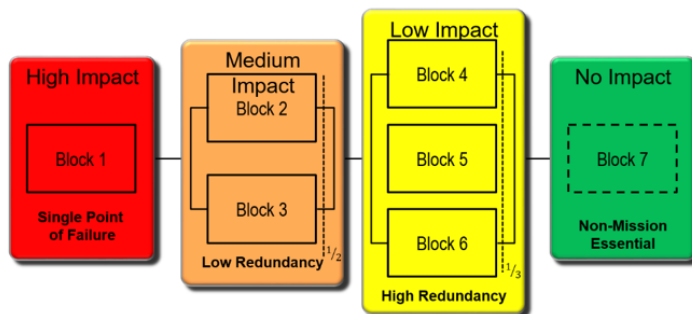
The Wargame can systematically simulate and discover possible new tests or “vulnerabilities” for the complex system and evolve solutions accordingly.



Use Case 2: Predictive Risk Sparing Matrix (PRiSM)



Goal/ Baseline: Determine which parts are likely to fail during operational deployments
“PREDICT” – The Data (AI/ML)



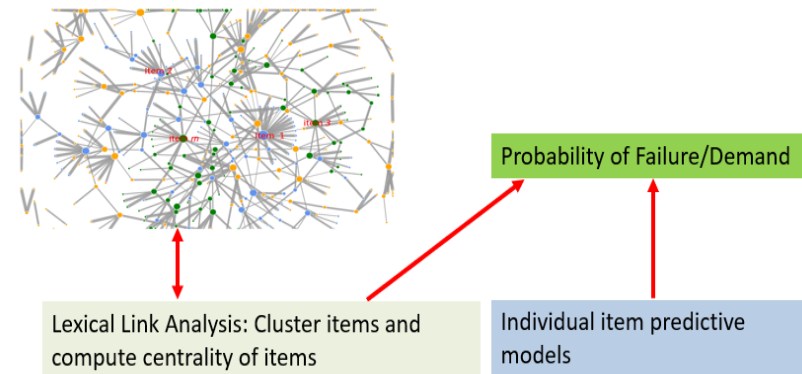
NAVSEA MRBD utilizes PEO C4I approved Reliability Block Diagrams

- ▼ NSWC Corona utilizes Machine Learning analytics with Python, NumPy, Scikit-Learn, Pandas, Tableau, data structures, and algorithm design for data science and advanced programming and techniques

Focus on Predictive Results

Source: Predictive Risk Sparing Matrix (PRiSM), Integrated Product Support/Logistics, Fleet Readiness Directorate (FRD), NAVWARSYSCOM

Applied LAILOW's LLA:

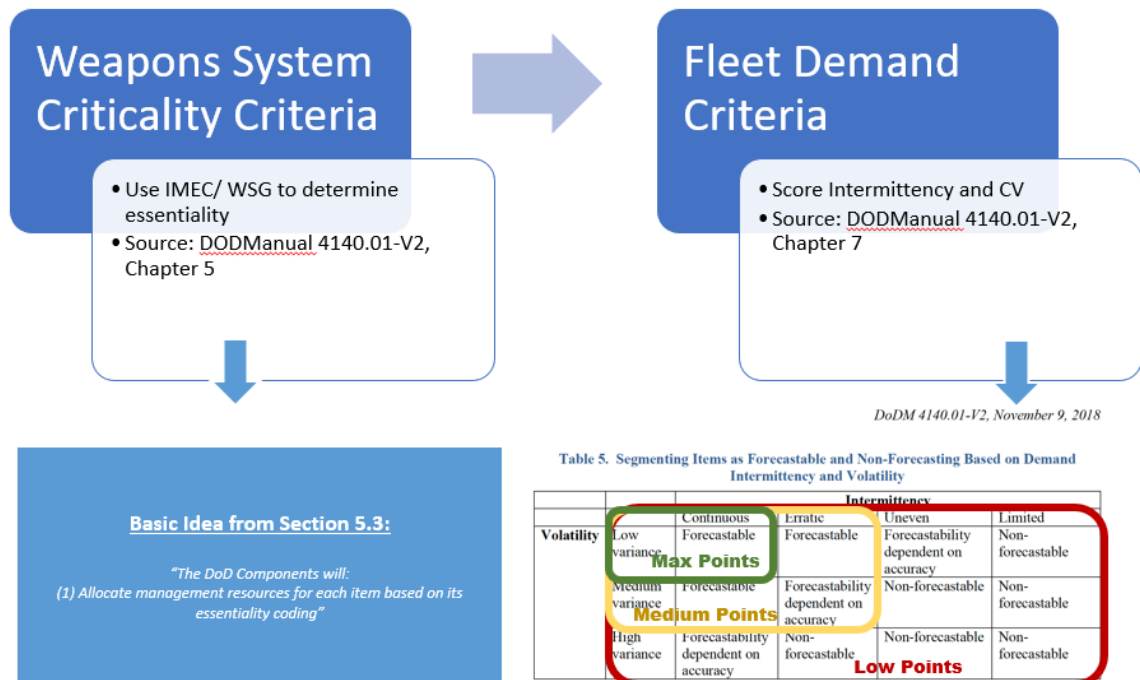


Results: For a test incorporated LLA recently, Theodore Roosevelt Carrier Strike Group (TR CSR) 51 of 64 (~80%) high impact C4I parts that were identified failed and had actually, matched with either LLA or PRiSM, improved from 36 matched from PRiSM alone. PRiSM and LLA are complementary for prediction.

Use Case 3: Deep Analytics for Readiness Impacts of Underfunding Spares Backlogs

- Objective: Prioritize the demanded parts (items) in the Financially Restricted Work Que (FRWQ)
- In the process to see if feasible and helpful to apply LAILOW's lexical link analysis to prioritize the items

Baseline





Conclusions, Recommendations, Acknowledges, and Disclaimer



- **Conclusions**
 - The LAILOW framework provides a holistic predictive and simulation platform to improve readiness
 - Soar-RL results: comparable to other predictive machine learning algorithms, rule-based and explainable, integrated with the coevolutionary algorithm
 - The wargame with the Soar-RL and coevolutionary algorithm integration can systematically
 - Simulate and discover possible new tests or “vulnerabilities” of the value chain
 - Evolve solutions or “resiliency” accordingly
- **Recommendations for Navy Ships**
 - Adopt more deep analytics, machine learning and AI algorithms for big data or no data
 - Focus on the entire spectrum or end-to-end (E2E) logistic planning for
- **Acknowledges**
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- **Disclaimer:** The views presented are those of the authors and do not necessarily represent the views of the U.S. Government, Department of Defense (DoD), or their Components.