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# Planning for AI Sustainment: A Methodology for Maintenance and Cost Management

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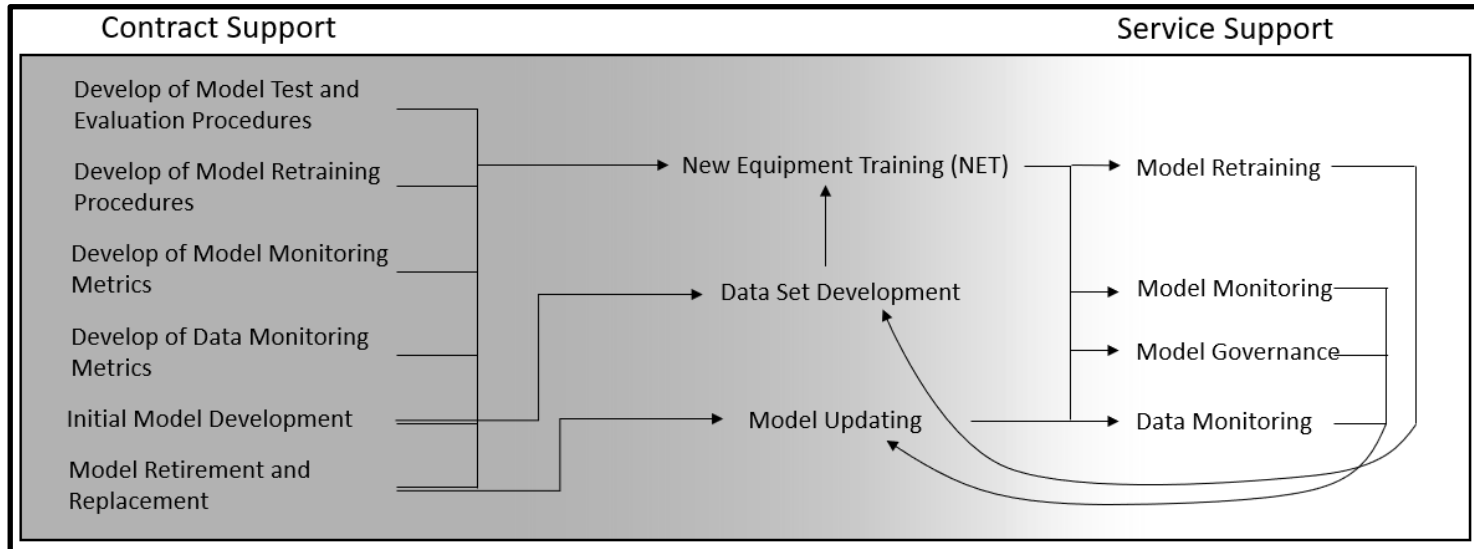
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How can we estimate the sustainment for Department of Defense AI-enabled systems?



**Research Issue:** The machine learning models powering AI-enabled systems require maintenance



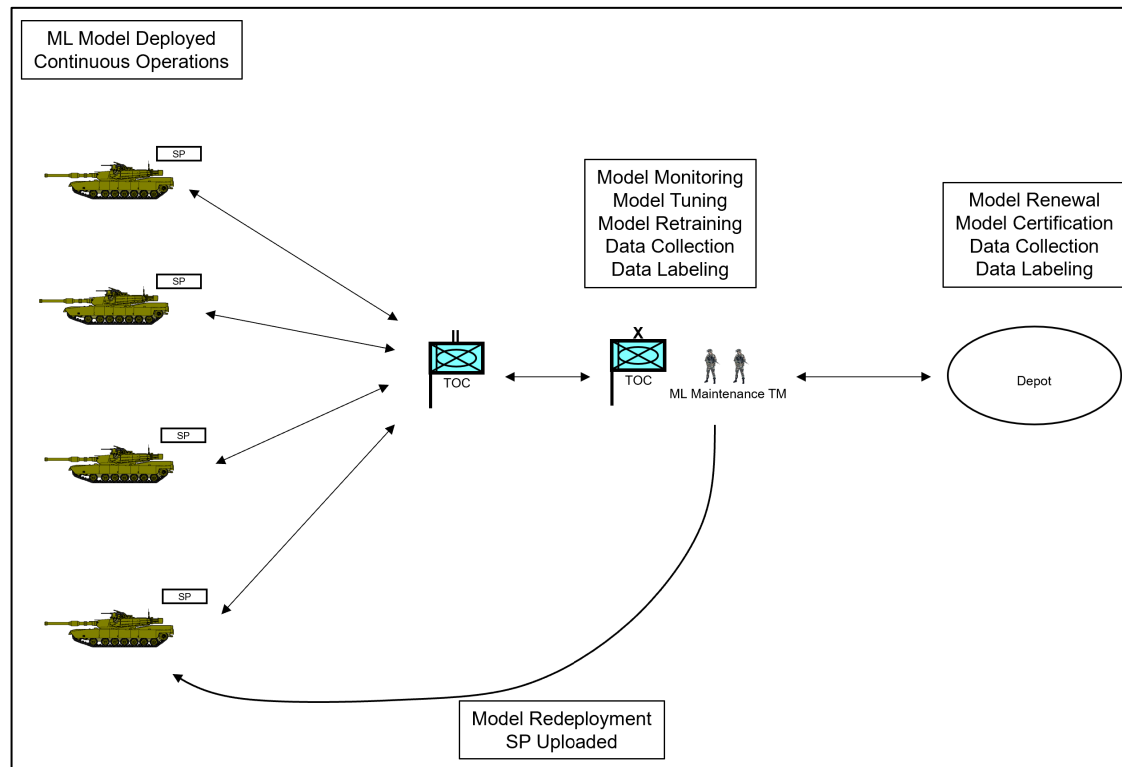
ML model sustainment tasks in a hybrid maintenance plan with associated dependencies between contractor and service maintenance tasks. Source: Cruickshank & Kohtz (2023).

So, how can we estimate this cost for a program that will feature AI-enabled system(s)?

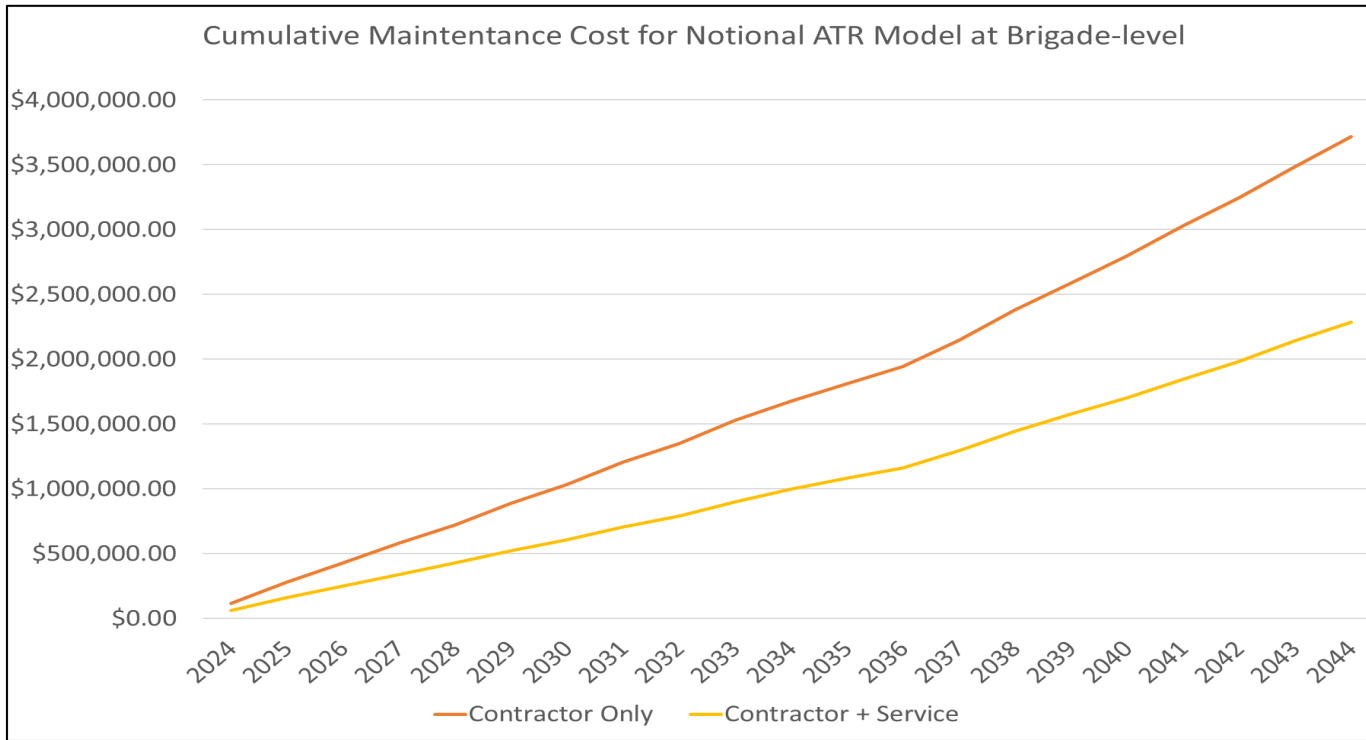
- Develop a function to estimate the cost of ML-model maintenance, which is in addition to a system's hardware and software maintenance

$$\sum_{m=1}^{num\_models} \sum_{i=1}^{num\_tasks} skill\_premium\_per\_time_{m,i} \times \left( \sum_{t=1}^{num\_events} maintenance\_time_{m,i,t} \right)$$

- Explore the cost of maintenance with a realistic use case (touch-time analysis)



ML Maintenance Operations Workflow

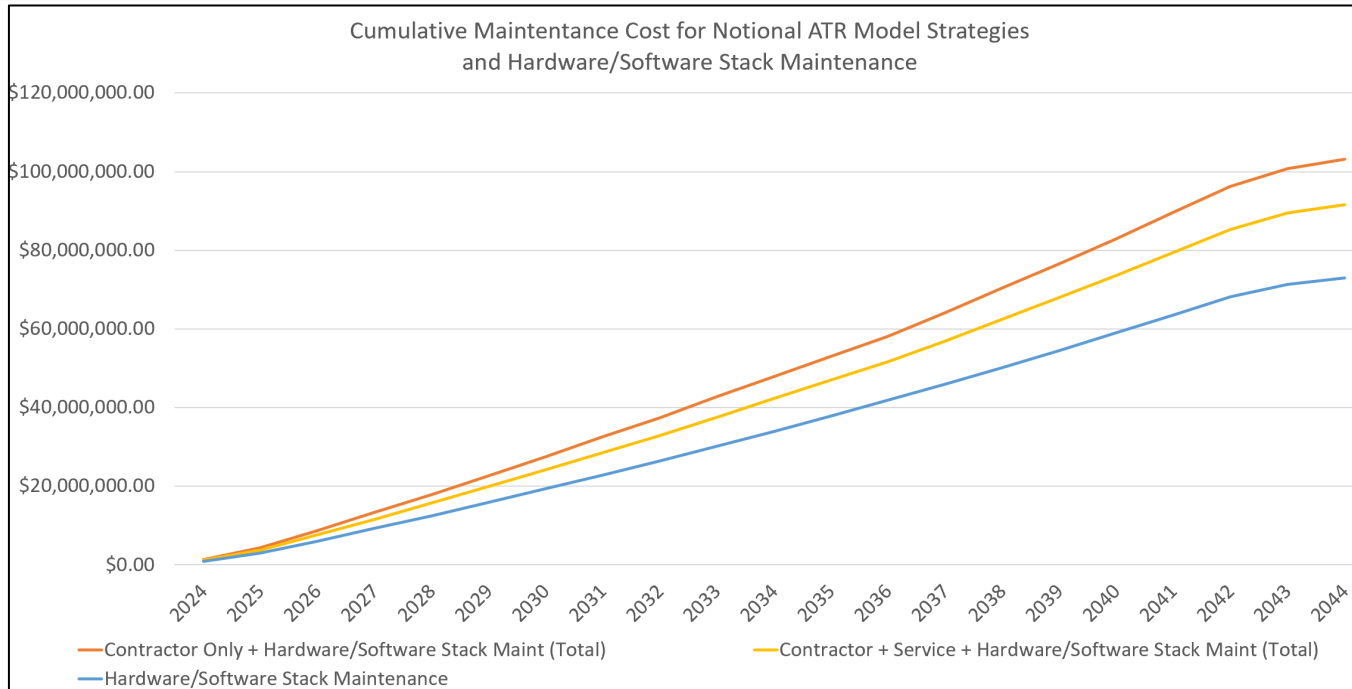


ML Sustainment Costs for a Sensor Payload with ATR Model in One Armored Brigade (20-year lifecycle)

- ML models add significant maintenance costs to a program that wishes to have AI-enabled components
- The main driver of cost for ML maintenance is the touch-time of the systems.
  - Low and mid-skill tasks like model retraining, data collection, and model/data monitoring occur frequently
- A hybrid approach, whereby low and mid-skilled maintenance tasks are performed by the service, provides a substantial cost savings



# Recommendation: Hybrid Sustainment Approach



POR Sustainment Costs for a Sensor with ATR Model to Support Nine Armored Brigade (20-year lifecycle)

- AI-enabled systems increase sustainment costs – potentially 1/3 of total sustainment costs (Contractor Only)
- Programs must conduct a touch time analysis to inform cost estimates and product support strategies
- Services should plan to conduct low and mid-level sustainment tasks
  - Monitor models and data, access collected data, and modify and upload ML models
- Contractors support high-skill maintenance tasks (Model renewal & certification)

AI-enabled system sustainment planning is crucial and a hybrid approach to sustainment can make AI-enabled systems feasible and more affordable.