Threat-Adaptive Interdiction of Taiwan's Crude Oil Supply

Project summary | MA289-27-1 Independent Study | Cadet Dennis Pezan | Advisor: LTC Matthew Webb

THE PITCH

Taiwan imports nearly all of its crude oil by sea, and every barrel passes through a handful of straits. I am turning those shipping routes into a network model, and using LTC Webb's reinforcement-learning interdiction agent to ask two things: if China put its full effort into cutting Taiwan's oil supply, where would it act, and can an AI trained on one kind of network reason about a very different one?

WHY IT MATTERS

Energy is widely identified as Taiwan's sharpest vulnerability in a blockade or quarantine. The chokepoints are not hypothetical: the Strait of Hormuz, which carried 61% of Taiwan's crude in 2025, has been largely closed since February 2026. Most open analysis comes from wargames; this project brings an optimization model to the question.

SCOPE

- **In:** crude oil only; the four regions that supply it (Persian Gulf, U.S. Gulf Coast, Oman, West Africa); the straits and canals it must pass; Taiwan's three refinery ports; one month of supply.
- **Out:** LNG and coal, escorts and counter-attacks, and anything classified. A proof of concept from open sources, not a targeting tool.

WHAT I AM LOOKING TO FIND

1. **Where China acts.** With its full effort (a fixed budget of 100), does China go after distant chokepoints such as Hormuz and Malacca, or Taiwan's own approaches? And how does that change if some actions cost more or less than assumed?
2. **Quarantine versus blockade.** How does the answer change between a lower-cost coast-guard quarantine and a higher-cost naval blockade?
3. **Transfer.** Does an agent trained on the Ukrainian rail network still find sound strategies on a maritime network without retraining?

Early checks of the network (not yet model results): no single action hurts Taiwan, since it reroutes or buys more U.S. crude, but combinations do. A full blockade of the west coast, where all three crude ports sit, takes China's whole budget and still leaves Taiwan about 23% of its oil on average.

PREVIOUS WORK IT BUILDS ON

- **Network interdiction:** the classic optimization models of Wood (1993) and Cormican, Morton and Wood (1998), surveyed in Smith and Song (2020).
- **LTC Webb's reinforcement-learning approach:** Webb and Caplice (2025), which trains an agent to find attacker strategies (defeat, isolate, canalize, divert) on the Ukrainian rail network.
- **Taiwan blockade analysis:** CSIS's quarantine scenarios and its 2025 "Lights Out?" blockade wargames, which identify energy shipping as the critical factor.

DONE THIS SEMESTER

- Built the network: 61 points and 83 shipping lanes. Each lane has one possible action (cyber, quarantine, blockade and others), a cost out of 100 and a chance of success anchored on real events.
- Sourced the limits from EIA and IMF PortWatch data: supplier maximums, strait and canal capacities, refinery capacity at the ports. Hormuz can be slowed, not closed.
- Loaded it into LTC Webb's environment, where it runs episode by episode, and checked the results against an independent calculation.

NEXT STEPS AND GOALS

Next: baseline calculations, then the agent on an Army cloud environment with LTC Webb, then tests of how the answer changes with action costs. Whether each action works is random (its chance of success); the network, costs and Taiwan's best rerouting are fixed. Goals: a defensible open-source model of Taiwan's crude supply; where China's full effort does the most damage; whether the agent transfers from rail to sea; and a poster. Future work: a traveling salesman (TSP) formulation, possibly with k-nearest neighbors.