Scheduling combat logistic force replenishments at sea for the US Navy

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Abstract: The Replenishment at Sea Planner (RASP) is used by U.S. Navy to plan voyages by its Combat Logistics Force (CLF) ships to minimize the delivery cost of fuel and goods during peacetime and maximize deliveries in conflict. CLF shuttle supply ships deploy from providers (tankers or ports) to rendezvous with underway U.S. combatants and those of coalition partners. The overwhelming commodity transferred is fuel, ship-to-ship by hoses, while other important packaged goods and spare parts are highlined, or helicoptered between ships. The U.S. Navy is organized in large areas of responsibility called numbered fleets, and within each of these a scheduler must promulgate a daily forecast of CLF shuttle operations. The operational planning horizon extends out several weeks, or as far into the future as we can forecast demand. We solve RASP with integer linear optimization and a purpose-built heuristic. RASP plans Replenishment-at-Sea (RAS) events with four-hour (Navy watch) time fidelity. For six years, RASP has served two purposes: (1) it helps schedulers generate a daily schedule and animates it using Google Earth, and (2) it automates reports and command-to-ship messages that are essential to keep this complex logistics system operating.

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