Optimising Ship Schedules at a Port

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Prototype System

Port Hedland

Australia’s largest iron ore export port.

Iron ore shipped: 170Mt/year
Tidal variation: up to 6 metres
Ships: 1300 per year
Berths: 8
Tugs: 10
DUKC system in place since 1995.

Background photo: Marj Kibby

Who Will Benefit?

Shipping companies will be able to carry more cargo with the same number of ships, increasing profits. Environmental impact of shipping will be reduced by loading more cargo on each ship. Ports will be able to provide better schedules to clients, and port staff will free up the time they currently spend on manual scheduling.

Implementing a prototype system was implemented using NICTA’s MiniZinc and G12 software to optimise schedules and OMC’s Dynamic Under-Keel Clearance (DUKC®) software for draft calculation.

Calculating Drafts

To calculate the allowable draft for each ship at each point in time, we use OMC’s Dynamic Under-Keel Clearance (DUKC®) software, which is used in 20 ports worldwide to calculate safe sailing times and drafts.

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User Feedback

The prototype software successfully calculated optimal schedules to maximise cargo for a set of ships, but user testing found that schedules were unrealistic due to not considering availability of tugs. Tugs are needed to bring ships into or out of a port. Future versions of our system will include tugs. The schedule below is infeasible if tugs are not considered.

Without tugs:

With tugs:

Asymmetric Setup Times

Separation time between ships varies depending on the order in which ships sail. If ship B sails first, A must wait. If A sails first, B can sail immediately.

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