



Dredge Fleet Scheduling Optimization

Dredging Innovations Group (DIG)

U.S. ARMY CORPS OF ENGINEERS

BUILDING STRONG®

Problem

Each year the US Army Corps of Engineers (USACE) invests hundreds of millions of dollars in maintenance dredging of its vast portfolio of inland and coastal navigation projects. Individual dredging projects are carried out by the fleet of Corps-owned dredges and that of the US dredging industry. Because of scheduling constraints imposed by federal budget cycles, dredge fleet availability, and environmental permitting, significant additional costs are frequently incurred as project managers push, often in competition with one another, towards mission execution. It is anticipated that significant additional efficiencies and cost savings could be realized overall were dredging jobs aggregated across Corps Districts and Divisions and dredging fleet scheduling optimization conducted at the system-level.



Study Description

This project formulates the Corps' annual Operations and Maintenance (O&M) dredging program as a joint job assignment and scheduling problem. The optimal scheduling of the dredge fleet and overall costs will be dependent upon the constraints imposed by environmental restrictions concerning when dredging can take place and by the costs and production rates of the available dredging fleet. Once formulated and solved through constraint programming with commercial optimization software (ILOG CPLEX), sensitivity analysis can be conducted to determine the overall impacts of relaxing (or tightening) the problem constraints. For the overall dredge fleet scheduling problem, this means that the costs imposed by new and/or proposed environmental restrictions can be rigorously quantified and compared to the overall dredge budget. Likewise, the overall savings and additional efficiencies that could be realized by having additional dredges in the US fleet or from increased productivity rates for individual dredges can be

objectively evaluated and used for decision support purposes and long-term dredge fleet planning. This capability allows the Corps to answer calls for increased justification for its claim that environmental restrictions are a key driver of increasing mission execution costs.

Products

The job assignment-scheduling model created by this effort enables quantitative analysis and evaluations of environmental work restrictions and the costs they impose on the Corps' O&M dredging program. The model also enables evaluation of next-generation dredge fleet composition and allows environmental scientists to pinpoint which specific work restrictions are having the greatest disruptive effect and are therefore most in need of further research. The formulation can also be used to identify groups of navigation projects that lend themselves to joint contracting mechanisms and the optimal sequencing with which government requests for bids should be issued. The model conceptual basis is documented in a peer-reviewed journal article, and significant findings will be published in one or more ERDC technical reports.



Summary

This project attempts to capture the "ripple effect" disruptions of environmental restrictions on overall dredge fleet availability and provide the Corps with a roadmap for targeted R&D concerning particular species, an improved understanding of dredge fleet scheduling dynamics, and optimal next-generation fleet capabilities. With dredging costs continuing to rise across the board, and with an uncertain fiscal outlook for O&M at the federal level, it is imperative for the sustainability of the Corps' Navigation mission that the full impact of environmental work restrictions be properly understood and that all possible opportunities for increased efficiency in dredge program execution be explored.

Addressing complex dredging challenges and building institutional capacity for long-term mission sustainability.



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