

SYSTEMS ENGINEERING APPROACH FOR CONCEPTUAL DESIGN OF FRIGATE

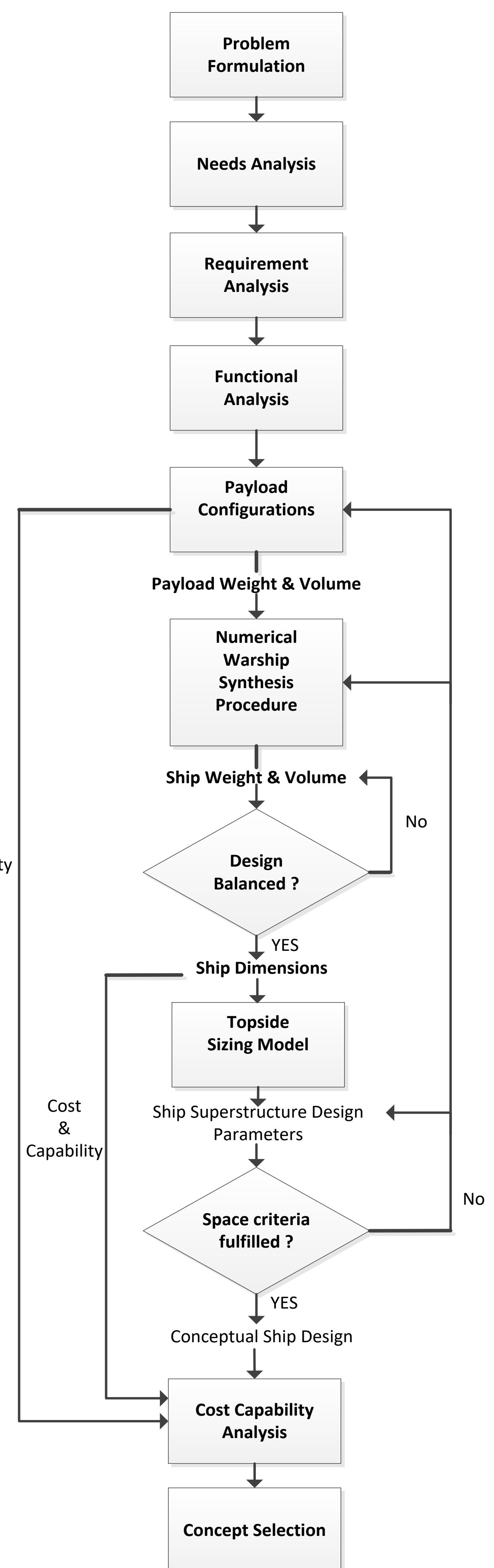
Lua Kwong Yang
September 2015

Thesis Advisor : Professor Fotis Papoulias
Second Reader : Professor Clifford Whitcomb

The objective of this thesis is to apply systems engineering approach to design a frigate with topside considerations and eventually use Naval Postgraduate School (NPS) Capability Engineering in selecting a cost-effective conceptual frigate design that meets all the Measures of Effectiveness (MOEs). Firstly, this thesis uses University College London (UCL) Numerical Warship Design Procedure to derive a balanced frigate design.

The Topside Sizing Model (TSM) is introduced and added to the Numerical Warship Design Procedure to find feasible and satisfactory conceptual frigate designs. This thesis also provides guidance to ship topside designers in the methodology of integrating weapon and platform systems onboard a surface ship. A spiral model for Topside Design is also introduced and applied in the ship design process.

Lastly, this thesis uses NPS Capability Engineering for its cost-effectiveness model to examine several design alternatives and trade-offs in the capability of the frigate versus its cost of procurement. Factorial analysis was performed to determine the impact of the various defense attributes on the performance of the overall defense. The Design of Experiments (DOE) result suggests that the kill probability of the Surface to Air Missile (SAM) and Radar Cross Section (RCS) have the most significant impact in defending and protecting the fleet in surviving the swarm attack. An assessment of all the 41 alternatives with calculated costs, different combination of payload upgrades, and system effectiveness is analyzed. A cost-effectiveness plot is generated to provide the stakeholders the available options that meet all the MOEs. The configuration with detection range of surveillance radar and the Area Terminal Type Defense (ATTD) being upgraded fulfills all the MOEs with the least cost.



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