Massachusetts Institute of Technology
DEPARTMENT OF MECHANICAL ENGINEERING

2.611 SHIP POWER and PROPULSION
Frigate Propulsion Plant Design Project, PHASE II

For project two you will be working in the same groups as project one. The second part of the design project is to select the **two** most appropriate power plants for final evaluation in Phase 3. You should use the propulsors selected in Phase I (corrected if necessary) to carry out economic evaluations of combinations of propulsors and power plants.

The selection process should be based on minimum life cycle cost. The power plants to be considered should include (but are not limited to) simple gas turbines, inter-cooled recuperative gas turbines (ICR), and medium speed diesels. Reduction gears with controllable reversible pitch propellers (CRP) and electric drive with fixed pitch propellers should be considered for the drive train and propulsor. You should select the two "best" power plants for the ship.

Summary sheet:
A detailed summary is required for all phases of this project. The summary should be placed near the beginning of the report, and should contain all the important numerical values for your selected power plants.

References:
Some handouts with **limited** information will be provided. Students are expected to use all available resources and properly reference them in their reports. Clearly state all assumptions and reasoning for them. There is substantial data about naval propulsion systems floating around 2N spaces. Ask your classmates who have done, and are doing design projects.

Frigate Study

Length	400 ft
Beam	45 ft
Draft	16 ft
Displacement	4100 LT
EHP at sustained speed of 28 kts	23,000 HP
EHP at endurance speed of 20 kts	6,350 HP
Maximum Propeller Diameter (twin screw)	14.5 ft
Propeller Centerline Depth	14.75 ft
Wake fraction, w	0.04
Thrust Deduction Fraction, t	0.095
Relative Rotative Efficiency, η_R	0.995

Operating Profile:

Cruising Range:	7000 nm at endurance speed
Days per year underway	150
Underway time at endurance	97%
Underway time at sustained	3%
Average electrical load	
Underway	1200 kW
Pier-side	400 kW

Cost factors:

Ship life:	28 years
Discount rate:	10%
Fuel cost	$300 per LT
Salvage value	$0
Accounting Method	Life Cycle Cost

Additional Guidance:

This project is meant to be an opportunity to perform a broad but shallow analysis of multiple engineering plant configurations. Take into account size and weight of the engines when compared to the length, beam, and displacement of the ship. Also, provide some estimate for operating and maintaining. Manpower costs over a 28 year life cycle are substantial. The objective of the project is to expose you to the different types of engineering plant configurations and the positive and negative characteristics of each. These include electric drive, CODAG, CODOG, and Integrated Propulsion System plants.