Massachusetts Institute of Technology
DEPARTMENT OF OCEAN ENGINEERING

2.611 SHIP POWER and PROPULSION

Problem Set #2, Waterjet Problems, Due: October 5, 2006

1. In the following equation for Total Propulsive Efficiency in a waterjet, what does K_in and K_out physically represent. What is the designer using to derive values for K_in and K_out?

$$\eta_D = \left[\frac{(1-t)}{(1-w)}\right] \cdot \eta_p \cdot \left[\frac{2 \cdot \mu (1-\mu)}{1 + K_{out} - \mu^2 \cdot (1 - K_{in})}\right]$$

As a designer, how would you optimize overall efficiency in a waterjet? Hint: The above equation makes some assumptions that may not always be true and substitutes for Vj/Va.

Bonus: What is the optimum value for Vj/Va?

2. Two waterjet propulsion systems are proposed for a surface effect ship having a net thrust of 225,000 lbf at 70 knots. Determine the total propulsive efficiency, pump pressure rise, the mass flow rate, and the total horsepower delivered to the pumps, for the two designs with the following characteristics:

	Ram	Flush
V_J/V_A	2.0	2.0
h	12 ft	12 ft
C_D	0.4	0.15
K_{in}	0.8	0.2
K_{out}	0.7	0.2
η_{pump}	0.9	0.9

** For this problem you can assume w and t are equal, or use reasonable values for each.