

# UNIVERSITY of PENNSYLVANIA

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To whom it may concern:

**re: Tamara Knutsen**

During the summer of 2000, Tamara worked with us in the GRASP Lab with the NSF Sunfest Research Experience for Undergraduates program. She has proven to be an invaluable asset to our robotic research project.

Tamara worked with us in the redesign of the REEL, a robotic model of the eel we use as a test platform to verify our theories of control for aquatic swimming. Prior to Tamara's participation, we developed two prototype versions of the robot, both of which failed to serve our purposes, due to insufficient flexibility and problems with waterproofing and buoyancy. Over the course of her summer work in the lab, Tamara solved all of the engineering challenges facing the robot design.

Using ProEngineer, she developed solid models for the robot's discrete links, to give the robot the oval cross section required by our hydrodynamic assumptions. She carefully researched our options in sourcing waterproofing methods, including various conformal coatings and potting compounds before making the decision to use an epoxy resin that has solved our problems. Due to her efforts, the robot now has a modular design that allows for easy replacement of malfunctioning parts without perturbing the whole.

Tamara has worked tirelessly to educate herself over the summer. She has performed independent and self-motivated research in many fields related to our project, including subjects as diverse as nonlinear control theory and biological studies of animal locomotion. In addition to her efforts to solve our mechanical faults, she has also worked to understand the electronic and software control aspects of the robot.

We are pleased to offer Tamara this unsolicited recommendation. She has displayed a zeal for research and an aptitude for solving engineering design problems that qualify her for success in any industrial or academic endeavour.

Sincerely,



Kenneth A. McIsaac, M.Sc.



Prof. James P. Ostrowski