Declan Gaylo

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Summary

Ph.D. candidate at MIT studying Hydrodynamics. Seeking to understand the creation and evolution of bubbles in turbulent free surface flow to enable better prediction of ship-wake signatures. Demonstrated skill in: fundamental hydrodynamics research, naval architecture and marine engineering, development of novel computational methods, teaching and communication.

Education

Ph.D., Ocean Engineering | Minor, Acoustics **Fall, 2025**
Massachusetts Institute of Technology – Cambridge, MA
Thesis: *Evolution of Turbulent Bubbly Flow Beneath an Entraining Free Surface*, supervised by Prof. Yue.

S.M., Naval Architecture & Marine Engineering **2021**
Massachusetts Institute of Technology – Cambridge, MA

B.S., Naval Architecture & Marine Engineering **2019**
Webb Institute – Glen Cove, NY

Research and Teaching

Research Assistant Massachusetts Institute of Technology – Cambridge, MA **2019 – Present**
- Formulated a new computational algorithm for tracking bubbles in two-phase DNS, which enabled the first direct measurement of bubble creation mechanisms in simulations of turbulent free surface flow (*J. Comput. Phys.*, 2022).
- To inform modeling and predicting of ship-wake signatures, used theory and simulations to show how the size distribution of bubbles created in the wake of a ship depends on the strength of turbulence, and that the distribution is distinct from that created by breaking waves (*J. Fluid Mech.*, 2024; *SNH*, 2024).
- Invented a new method to improve ship sonar performance by combining knowledge of bubble populations and acoustics.
- Wrote a white paper and subsequent proposal which led to a five year grant from ONR for our lab to continue working on bubbly ship wakes; presented quarterly research updates to ONR and other groups working on the problem.
- Mentored a first-year graduate student in the use our lab's CFD tools; significantly improved the documentation of the code to make it easier for them and future graduate students to understand.
- Served as system administrator; responded to outages and updated the networking infrastructure and off-site file backup process to improve reliability.

Teaching Assistant Massachusetts Institute of Technology – Cambridge, MA **2020 – Present**
- Graduate courses: Marine Hydrodynamics (Fall 2020, 2021); Design Principles for Ocean Vehicles (Spring 2023, 2025); Stochastic Systems (Spring 2023, 2025).
- Developed and presented weekly recitations to teach students how to apply the theories learned in lecture to practice.
- Held office hours twice a week to work one-on-one with students to answer questions about assignments.
- Created and graded exams and weekly assignments.

Skills

High Performance Computing
Compiled languages (C++ and FORTRAN); Parallel programming (MPI and OpenMP); Build systems (Make, CMake); Version control (Git and Github); Job scheduling (Slurm and PBS); Parallel program debugging and profiling (ARM and Intel software); Linear matrix solver (HYPRE); Post-processing large data sets (ParaView, MATLAB, Python).

Acoustics
Scattering and absorption by populations of air bubbles; Modeling ocean propagation (Bellhop, KRAKEN); Fourier analysis.

Software
Fluids: Star-CCM+; AEGIR (potential flow); GHS; XFOIL; OpenProp (propeller design). **3D Modeling:** AutoCAD; Rhino; SolidWorks; Blender. **General:** Latex; Excel; Power Point; Word.

Work Experience

Student Intern Navatek, Ltd. – Portland, ME **Jan – Feb, 2019**

– Created a graphical user interface to enable faster calculation of static stability while exploring trimaran design spaces.
– Generated 3D models of advanced hull form concepts for CFD evaluation.
– Produced illustrative renderings of new undersea technology in support of an SBIR proposal.

Student Intern Donald L. Blount and Associates – Chesapeake, VA **Jun – Aug, 2018**

– Analyzed dynamic stability of military and recreational high-speed planing craft for design reports.
– Developed GHS macros which made analysis of multiple static loading conditions much faster.
– Interpreted tow tank results for a report on the powering requirements of a vessel.

Student Intern Gilbert Associates, Inc. – Braintree, MA **Jan – Feb, 2018**

– Developed structural arrangements and machinery selection for motor vehicle ferries, including designs for installing a new bow thruster and the addition of a crew berth designed to ABS rules.

Student Intern General Dynamics Electric Boat – New London, CT **Jun – Aug, 2017**

– Worked in the Internal Structures and Arrangements department developing finite element meshes for shock analysis.

Student Intern General Dynamics NASSCO – San Diego, CA **Jan – Feb, 2016**

– Inspected spaces on naval vessels undergoing repair and produced daily reports documenting any outstanding work.

Leadership Experience

Student President of Edgerton Graduate Dorm	2022 – 2024
Captain of MIT Curling Team	2020 – 2025
Captain of Webb Sailing Team	2016 – 2018

Awards

Clement F. Burnap Award (2024). Awarded by the Mechanical Engineering Department at MIT for an outstanding Masters of Science in the marine field. **The William M. Kennedy Scholarship** (2019). Graduate scholarship awarded by the Society of Naval Architects & Marine Engineers. **Charles A. Ward, Jr. Memorial Prize** (2019). Commencement award from Webb Institute for excellence in Naval Architecture & Marine Engineering.

Journal Papers

D. Gaylo & D. K.P. Yue. "Size distribution of large air bubbles entrained by strong free-surface turbulence". *in preparation*.

D. Gaylo, K. Hendrickson & D. K.P. Yue (2024). "Effect of degassing on bubble populations in air-entraining free-surface turbulent flows". *Journal of Fluid Mechanics* 995, A12.

D. Gaylo, K. Hendrickson & D. K.P. Yue (2023). "Fundamental time scales of bubble fragmentation in homogeneous isotropic turbulence". *Journal of Fluid Mechanics* 962, A25.

D. Gaylo, K. Hendrickson & D. K.P. Yue (2022). "An Eulerian label advection method for conservative volume-based tracking of bubbles/droplets". *Journal of Computational Physics* 479, 111560.

D. Gaylo, K. Hendrickson & D. K.P. Yue (2021). "Effects of power-law entrainment on bubble fragmentation cascades". *Journal of Fluid Mechanics* 917, R1.

Conference Presentations

For a complete list, see dgaylo.com/publications

D. Gaylo, K. Hendrickson & D. K.P. Yue (2024). "Quantifying Entrainment and Degassing of Bubbles by Free-Surface Turbulence for Ship Wake Applications". *35th Symposium on Naval Hydrodynamics*, Nantes, France.

D. Gaylo, K. Hendrickson & D. K.P. Yue (2024). "Degassing-dominated bubble populations in air-entraining free-surface turbulence". *77th Annual Meeting of the APS Division of Fluid Dynamics*, Salt Lake City, USA.

D. Gaylo, K. Hendrickson & D. K.P. Yue (2022). "Quantifying Fragmentation Statistics in Two-Phase Turbulent Flows for Ship Wake Applications". *34th Symposium on Naval Hydrodynamics*, Washington D.C., USA.