Charlotte Barbier, R&D Manager & Engineer

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DOMAINS OF EXPERTISE AND AREAS OF INTEREST

- R&D Project development and management
- Fluid Mechanics, heat transfer: CFD, HPC, turbulence, two-phase flow, cavitation, safety, experimentations
- Mechanics: conception, design, testing, CAD

WORK EXPERIENCE

15 - Now ***R&D Manager & Engineer, Oak Ridge National Laboratory, Oak Ridge, TN***
Spallation Neutron Source Directorate

- **R&D Manager for the Proton Power Upgrade (PPU) R&D: development and management of a R&D program** and its associated **cost estimate** (**$4.5M**) for the First Target Station
- **Level 3 manager** for the **Safety and Controls** update related to the first target station for PPU ($2.1M)
- **High-Performance Compute (HPC)** management, deplyment and user support of a **Linux cluster** to run Abaqus and ANSYS simulations.
- **Flow and heat transfer simulations** for different target station components (**CFX**): target, HX, mercury process loop, inner reflector plug, moderators, proton beam window, etc.
- **Experiments** in water and mercury to support the implementation of gas injection in the SNS mercury loop (PIV, high speed camera, image analysis, pressure and flow measurements)
- **Technical documentations** for SNS target station to support:
  - Target and shroud design change
  - Sensor alarms in the mercury loop
  - Cryogenic safety design
  - Safety issues related with the implementation of gas injection in the mercury loop
- Participation to several **conferences, workshops, and DOE reviews**
- **Collaboration** with J-PARC, Univ. of Michigan, UPitt.

09 - 15 ***Mechanical Engineering Researcher, Oak Ridge National Laboratory, Oak Ridge, TN***
Computing and Computational Sciences Directorate

- **Management** of a 5-members team on **large scale simulations** of hydraulic fracturing performed on **supercomputer** TITAN (**PFLOTRAN**)
- CFD and heat transfer simulations for US ITER (**CFX** and **OpenFOAM**):
  - Cryogenic Viscous Compressor
  - Ion Cyclotron Heating Transmission Lines
  - Disruption Mitigation System
- Development and investigation of the ability of **superhydrophobic surfaces** to reduce drag in water (**numerical** and **experimental** work).
- CFD and heat transfer simulations for other ORNL's divisions (**CFX** and **OpenFOAM)**:
  - Flow past an open top chamber
  - Belowground heating system
  - Sludge mixing in a large cylindrical tank
  - Surface sampling probe for mass spectrometry application
  - Ventricular catheter
  - Microfluidic CTC chip
  - Wendelstein 7-X
- Author and co-author of **over 20 scientific publications**
- **Two successful proposals: SEED Money and LDRD**.
- Active member of the WIC (Women in Computing at ORNL)
  - Organization of seminars for students
  - Participation to Grace Hopper Conference (2013 & 2015)

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08 - 09 ***Senior Research Scientist, Dynaflow Inc, Jessup, MD***

07 - 08 ***Research Scientist, Dynaflow Inc, Jessup, MD***

- 2D and 3D **free surface** and **bubble dynamic** calculations using **BEM** method (2DynaFS and 3DynaFS).
- **Underwater explosion** (UNDEX) calculations with **Gemini** (shock and fluid dynamic solver)**.**
- **Two-phase flow experiments (PIV, particle tracking, high speed camera, pitot tube, pressure and acoustic measurements, strain gages)**
- **Material testing** (Split Hopkinson pressure bar, erosion test
- **Design and conception** of **prototypes**, **experimental rigs.**
- **Mitigation of cavitation damage.**
- Development of **fortran**, **C++**, and **Matlab** codes for experimental setup, post-processing (experimental and numerical), **image processing**.
- **Preparation of technical proposals for submission to US government agencies**.
- **Two successful proposals in 2008**.

05 - 07 ***Research Associate, dept. of Mechanical & Aerospace Engineering, University of Virginia, Charlottesville, VA***

- 2D and 3D **CFD** calculations using a **fortran** program
- Development of **flow macro-sensors** based on biological sensors
- Design **of controlled fluid and mechanical experiments**
- **Experimental flow** description and analysis
- **Publications** in international journals and conferences

02 - 05 ***Research Assistant, dept. of Mechanical & Aerospace Engineering, University of Virginia, Charlottesville, VA***

- **PIV** and **hotwire measurements** in a simulated **hard disk drive**
- **CFD calculations** of the unsteady 3D flow around the arm in a **hard disk drive**

02 - 05 ***Teaching Assistant, School of Engineering and Applied Science, University of Virginia, Charlottesville, VA***

- *Introduction to Aerospace Engineering*, Prof. H. Wood
- *Experimental Methods Laboratory*, Prof. T. Scott

2004 ***Intern, ONERA (National Aerospace Research Center in France), Toulouse, France***

4 months of **research internship** to obtain my Msc. Mechanical

- **LDV** measurements on a **centrifugal compressor** benchmark
- **Calculation** of the **flow in a centrifugal compressor** with the code colibri (2.5D, Euler-NS)

EDUCATION

2006 ***PhD in Mechanical and Aerospace Engineering****, University of Virginia*
Experimental and Numerical Study of the Flow in a Simulated Disk Drive
Advisor: Prof. J.A.C. Humphrey

2002 ***Msc. Mechanical engineering (with honors),*** *USTL, Lille, France*

2002 ***Msc. Mechanical engineering, major in fluid mechanics,*** *Ecole Centrale Lille, France*

AWARDS/HONORS

2018 ***ORNL Significant Event Award***

Successful implementation of gas injection in the SNS target

2015 ***ORNL Significant Event Award***

Successful start of the prototype-warming chamber for the Spruce and Peatland Response Under Climatic and Environmental change experiment (SPRUCE)

2011 ***Secretary of Energy Achievement Honor Award***

Member of the Flow Rate Technical Group/Nodal Analysis Team that estimated the amount of oil flowing from the Deepwater Horizon well after the incident in summer 2010

2011 ***CCSD Employee of the month***

2010 ***ORNL Significant Event Award***

Successful design, development and initiation of the prototype-warming chamber for the Spruce and Peatland Response Under Climatic and Environmental change experiment (SPRUCE)

2005 ***Stipend from TSFP4 Organizing Committee***
To support the attendance of the Fourth International Symposium on Turbulence and Shear Flow Phenomena (TSFP4), Williamsburg, VA, June 27-29, 2005

2004 ***Founder's Prize and Grant from the American Academy of Engineering***
Sponsored by the R. & M. Haythornthwaite Foundation for the essay “Progress Through Mechanics: the Quantum Computer

03 - 05 ***Full scholarship***, Information Storage Industry Consortium (INSIC), San Diego, CA

02 - 03 ***Full scholarship***, School of Eng. and Applied Science, University of Virginia, Charlottesville, VA

COMPUTER SKILLS

ANSYS CFX/Fluent/Mechanical, OpenFoam, *Comsol****,*** *Starccm+, Matlab****, SpaceClaim,*** *Solidworks****, python, fortran,*** **Torque/PBS scripting**, linux OS, linux cluster management***,***

SELECTED PUBLICATIONS

Hanson, Paul J., et al. "Attaining whole-ecosystem warming using air and deep-soil heating methods with an elevated CO2 atmosphere." *Biogeosciences (Online)*, 2017, 14.4.

Lu, D., Zhang, G., Webster, C., & Barbier, C. “An improved multilevel Monte Carlo method for estimating probability distribution functions in stochastic oil reservoir simulations.” *Water resources research*, 2016, *52*(12), 9642-9660.

Baylor L.R., Barbier C., Carmichael J.R., Combs S.K., Ericson M.N., Bull Ezell N.D., and Smith S. F., “Disruption mitigation system developments and design for ITER”, *Fusion Science and Technology*, 2015, 68(2), 211-215.

Jenner E., Barbier C., D’Urso B., “Durability of hydrophobic coatings for superhydrophobic aluminum oxide”, *Applied Surface Science*, 2013, 282, 73-76.

ElNaggar M.S., Barbier C., Van Berkel G.J., “Liquid microjunction surface sampling probe fluid dynamics: computational and experimental analysis of coaxial intercapillary positioning effects on sample manipulation”, *Journal of The American Society for Mass Spectrometry*, 2011, 22(7), 1157.

Barbier C., Humphrey J.A., “Drag force acting on a neuromast in the fish lateral line trunk canal. I. Numerical modelling of external–internal flow coupling”, *Journal of The Royal Society Interface*, 2009, 6(36), 627-640.

Barbier C., Humphrey J.A.C., Paulus J., Appleby M., “Design, Fabrication and testing of a bioinspired hybrid hair-like fluid motion sensor array “, 2007 *ASME International Mechanical Engineering Congress and Exposition, Seattle, Washington,* November 2007.

Barbier C., Humphrey J. A. C., “Numerical calculation of the flow in the fish lateral line: applications to predators tracking prey”, *2006 ASME International Mechanical Engineering Congress and Exposition*, *Chicago, Illinois*, November 2006.

Complete list of publications available on google scholar profile

FUNDED RESEARCH PROGRAMS

LDRD, ORNL, Large Scale Hydarulic Fracture Simulation, 2014-2015. $750K

SEED Money, Drag Reduction With Superhydrophobic Surface, 2010, $180K

Free Vortex Generator, NRA NNH08ZTT002N, Research Opportunities in Fluid Physics, 2009. $95K

Development of a Bubble Generator Suitable for Spallation Neutron Source (SNS) Shock Mitigation Applications. DOE Grant No. DE-FG02-07ER84840, 2008. $750K