

Nolan E. Goth

NUCLEAR ENGINEER

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Career Profile

Nolan is an R&D Associate of Nuclear Engineering for the Energy Systems Development Group within the Nuclear Energy and Fuel Cycle Division at Oak Ridge National Laboratory. He earned his Ph.D. in nuclear engineering from Texas A&M, an M.S. in nuclear engineering from Texas A&M, and B.S. degrees in nuclear engineering and economics from Missouri S&T.

His primary interests are in experimental and computational thermal-hydraulics. This includes analyzing two large molten salt forced convection loops for fluoride (LSTL) and chloride (FASTR) salts. He is investigating radioisotope thermoelectric generators for land-, sea-, and space-power applications. Other areas include the design of isotope production targets and systems for ^{99}Mo and ^{238}Pu , dynamic modeling of cryogenic neutron moderating systems, and high-temperature pebble bed reactor cores.

Dr. Goth has received recognition from the U.S. Department of Energy for innovations in nuclear technology R&D. The Nuclear Regulatory Commission has granted him a Senior Reactor Operator License. Current funding secured is \$190K as a Principal Investigator and \$750K as a Contributor.

Dr. Goth's research centers on advancing the technological readiness of advanced fission, neutron, and radioisotope systems. Current Areas of focus include:

- Molten salt reactor development
- Radioisotope thermoelectric generators
- Radioisotope production targets (^{99}Mo and ^{238}Pu)
- Experimental flow visualization measurements
- CFD and heat transfer modeling for high temperature applications

Education

Texas A&M University

PHD IN NUCLEAR ENGINEERING
MS IN NUCLEAR ENGINEERING

College Station, Texas

2018

Missouri S&T

BS IN NUCLEAR ENGINEERING
BA IN ECONOMICS

Rolla, Missouri

2012

Experience

Oak Ridge National Lab

R&D STAFF NUCLEAR ENGINEER

- Designed and tested non-nuclear radioisotope thermoelectric generators
- Designed and constructed a supercritical carbon dioxide flow loop for advanced thermodynamic cycles

Oak Ridge, Tennessee

2024 - Present

Oak Ridge National Lab

R&D ASSOCIATE NUCLEAR ENGINEER

- Designed and constructed a molten chloride salt bearing test rig for salt-wetted bearing development
- Designed and tested HALEU targets to address molybdenum-99 domestic supply chain issues

Oak Ridge, Tennessee

2021 - 2024

R&D ASSISTANT NUCLEAR ENGINEER

- Analyzed thermal-hydraulics of high-temperature pebble bed reactor cores
- Designed and analyzed fluoride and chloride molten salt heat exchangers and test sections

2019 - 2021

Texas A&M University

GRADUATE RESEARCHER, FAST REACTOR FUEL ASSEMBLY FLOW CHARACTERIZATION

- Group leader of a six-person team with \$1.2M budget
- Designed, procured, constructed, and operated an experimental flow facility

College Station, Texas

2015 - 2018

The Babcock & Wilcox Company, mPower SMR

OPERATIONS ENGINEER & PROJECT MANAGER

- Performed system design reviews of mPower SMR systems
- Developed budget trends, tracked critical paths, and formulated weekly plans

Lynchburg, Virginia

2013 - 2014

Missouri S&T

SENIOR REACTOR OPERATOR & OPERATIONS INSTRUCTOR

- Conducted reactor power maneuvers and supervised fuel movements, material irradiations, and handling activities
- Taught introductory reactor operations classes

Rolla, Missouri

2010 - 2012

Smith-Goth Engineers, Inc.

AUTOCAD TECHNICIAN

- Designed and drafted HVAC, lighting, and fire protection systems

Springfield, Missouri

2006 - 2008

Skills

Thermal Hydraulics (Sim)	StarCCM+, OpenFOAM, Ansys, BISON, EcosimPro, COBRA-TF
Thermal Hydraulics (Exp)	Test Loops, Optics, Instrumentation, Sensors, LDV, PIV, SPIV, PTV
Neutronics (Sim)	Serpent, MPACT, MCNP, SCALE/ORIGEN, Homemade Diffusion/Transport/MOC Codes
Neutronics (Exp)	Shielding, Dosimetry, Directional Detectors
Reactor Operations	Senior Reactor Operator, Fuel Movement, Power Maneuver, Operator Training
Programming	Python, MATLAB, \LaTeX , C++, SQL
Modeling	Solidworks, AutoCAD, Tecplot, Paraview, Gmsh

Certifications and Awards

- 2021 **ORNL Inventor**, UT-Battelle
- 2018 **Innovations in Nuclear Technology R&D Award - 2nd Place**, U.S. Department of Energy
- 2017 **Workshop and First Place Poster**, Consortium for Advanced Simulation of LWRs (CASL) Summer Institute
- 2017 **Crane Operator**, National Commission for the Certification of Crane Operators
- 2012 **Magna Cum Laude**, Missouri S&T
- 2011-12 **Senior Reactor Operator License**, Nuclear Regulatory Commission
- 2008-12 **Bright Flight Scholarship**, Missouri Dept of Higher Education
- 2008-12 **NRC Scholarship**, Nuclear Regulatory Commission

Professional Service

- 2014-22 **Reviewer**, Nuclear Engineering and Design Journal
- 2022 **Reviewer**, International Journal of Heat and Fluid Flow
- 2021 **Reviewer**, Physics of Fluids
- 2021 **Reviewer**, Journal of The Minerals, Metals & Materials Society
- 2020 **Reviewer**, International Journal of Infectious Diseases
- 2020 **Reviewer**, Journal of Turbulence
- 2012 **Vice President**, Alpha Nu Sigma Nuclear Honor Society
- 2008-22 **Member, Session Chair**, American Nuclear Society
- 2009 **Member**, Kappa Mu Epsilon Mathematics Honor Society

Select Publications

JOURNAL

- [1] Thien Nguyen, **Goth, Nolan**, Philip Jones, Saya Lee, Rodolfo Vaghetto, and Yassin Hassan. "PIV measurements of turbulent flows in a 61-pin wire-wrapped hexagonal fuel bundle". In: *International Journal of Heat and Fluid Flow* 65 (2017), pp. 47–59.
- [2] **Goth, Nolan**, P Jones, DT Nguyen, R Vaghetto, YA Hassan, A Obabko, E Merzari, and PF Fischer. "Comparison of experimental and simulation results on interior subchannels of a 61-pin wire-wrapped hexagonal fuel bundle". In: *Nuclear Engineering and Design* 338 (2018), pp. 130–136.
- [3] **Goth, Nolan**, Philip Jones, Thien Nguyen, Rodolfo Vaghetto, and Yassin Hassan. "PTV/PIV Measurements of Turbulent Flows in Interior Subchannels of a 61-Pin Wire-Wrapped Hexagonal Fuel Bundle". In: *International Journal of Heat and Fluid Flow* (2018).
- [4] Thien Nguyen, Nolan Goth, Philip Jones, Rodolfo Vaghetto, and Yassin Hassan. "Stereoscopic PIV measurements of near-wall flow in a tightly packed rod bundle with wire spacers". In: *Experimental Thermal and Fluid Science* 92 (2018), pp. 420–435.

- [5] Rodolfo Vaghetto, **Goth, Nolan**, Philip Jones, Mason Childs, Saye Lee, Duy Thien Nguyen, and Yassin A Hassan. "Pressure Measurements in a Wire-Wrapped 61-Pin Hexagonal Fuel Bundle". In: *Journal of Fluids Engineering* 140.3 (2018), p. 031104.
- [6] Mason Childs, Rodolfo Vaghetto, Philip Jones, **Goth, Nolan**, and Yassin Hassan. "Experimental Determination and Analysis of the Transverse Pressure Difference in a Wire-Wrapped Rod Bundle". In: *International Journal of Heat and Mass Transfer* (2020).
- [7] Brian DeGraff, Matthew Howell, Elvis Dominguez-Ontiveros, **Goth, Nolan**, Wesley Williams, and Drew Winder. "Spallation Neutron Source Hydrogen Relief Analysis for the Cryogenic Moderator System". In: *Cryogenic Engineering and International Cryogenic Materials* (2023). To appear.
- [8] **Goth, Nolan**, Frank Liu, Bryan P Maldonado, Pradeep Ramuhalli, Matthew Howell, Ryuji Maekawa, and Sarah Cousineau. "Dynamic systems modeling of the Spallation Neutron Source Cryogenic Moderator System to optimize transient control and prepare for power upgrades". In: *Cryogenic Engineering and International Cryogenic Materials* (2023). To appear.
- [9] Bryan P Maldonado, Frank Liu, **Goth, Nolan**, Pradeep Ramuhalli, Matthew Howell, Ryuji Maekawa, and Sarah Cousineau. "Data-Driven Modeling of a High Capacity Cryogenic System for Control Optimization". In: *IFAC-PapersOnLine* 56.2 (2023), pp. 3986–3993.
- [10] Bryan P Maldonado, Frank Liu, **Goth, Nolan**, Pradeep Ramuhalli, Matthew Howell, Ryuji Maekawa, and Sarah Cousineau. "Transient Optimization of the Cryogenic Moderator System Controller at the Spallation Neutron Source for Improved Performance". In: *IEEE Control Systems Letters* (2024). To appear.

CONFERENCE

- [1] **Goth, Nolan**, Mason Childs, Philip Jones, Saya Lee, D.T. Nguyen, Rodolfo Vaghetto, and Y.A. Hassan. "Particle Image Velocimetry Measurements in a Wire-Wrapped 61-pin Hexagonal Fuel Bundle". In: *American Nuclear Society Winter Meeting*. 2016.
- [2] **Goth, Nolan**, Philip Jones, Mason Childs, Saya Lee, D.T. Nguyen, Rodolfo Vaghetto, and Y.A. Hassan. "Pressure Measurements in a Wire-Wrapped 61-Pin Hexagonal Fuel Bundle". In: *American Nuclear Society Winter Meeting*. 2016.
- [3] **Goth, Nolan**, Philip Jones, Saya Lee, D.T. Nguyen, Rodolfo Vaghetto, and Y.A. Hassan. "Velocity and Pressure Measurements in a Wire-Wrapped 61-Pin Hexagonal Fuel Bundle". In: *Engineering Turbulence Modeling and Measurements* 11. 2016.
- [4] Rodolfo Vaghetto, **Goth, Nolan**, Mason Childs, Philip Jones, Saya Lee, D.T. Nguyen, and Y.A. Hassan. "Flow Field and Pressure Measurements in a 61-Pin Wire-Wrapped Hexagonal Fuel Bundle". In: *American Nuclear Society Winter Meeting*. 2016.
- [5] **Goth, Nolan**, Philip Jones, Saya Lee, D.T. Nguyen, Rodolfo Vaghetto, and Y.A. Hassan. "Time-Resolved PIV/PTV Measurements on Interior Subchannels of a Wire-Wrapped 61-pin Hexagonal Fuel Bundle". In: *American Nuclear Society Annual Meeting*. 2017.
- [6] **Goth, Nolan**, Philip Jones, D.T. Nguyen, Rodolfo Vaghetto, Y.A. Hassan, Aleksandr Obabko, Elia Merzari, and Paul Fisher. "Comparison of Experimental and Simulation Results on Interior Subchannel of a 61-Pin Wire-Wrapped Hexagonal Fuel Bundle". In: *17th International Topical Meeting on Nuclear Reactor Thermal Hydraulics*. 2017.
- [7] **Goth, Nolan**, Philip Jones, D.T. Nguyen, Rodolfo Vaghetto, and Y.A. Hassan. "Turbulent Transverse Plane PIV Measurements on a Wire-Wrapped 61-Pin Hexagonal Fuel Bundle". In: *26th International Conference on Nuclear Engineering*. 2018.
- [8] **Goth, Nolan**, Lance White, William Headley, D.T. Nguyen, Rodolfo Vaghetto, and Y.A. Hassan. "High Resolution Transverse Plane PIV Measurements of a 61-pin LMFBR Fuel Bundle". In: *American Nuclear Society Winter Meeting*. 2018.
- [9] Lance White, **Goth, Nolan**, Thien Nguyen, Rodolfo Vaghetto, and Yassin Hassan. "High-Fidelity Velocity Measurements in a Totally Blocked Interior Sub-channel of a Wire-wrapped 61-Pin Hexagonal Fuel Bundle". In: *Thermal Hydraulic Simulations and Experiments for the Safety Assessment of Metal Cooled Reactors (SESAME)*. 2019.
- [10] **Goth, Nolan**, Marilyn Delgado, Trevor Howard, and Kevin Robb. "Molten Salt Air-Cooled Heat Exchanger Fluid Dynamics". In: *American Nuclear Society Winter Meeting*. 2020.
- [11] **Goth, Nolan**, Trevor Howard, Jorge Navarro, Elliott J Fountain, Nesrin Ozgan Cetiner, and Chris Bryan. "Design and Heat Generation Rate Analysis of LEU-UAlx Dispersion Target Plates for Irradiation in the High Flux Isotope Reactor". In: *American Nuclear Society Annual Meeting*. 2021.
- [12] **Goth, Nolan**, Trevor Howard, Jorge Navarro, Elliott J Fountain, Nesrin Ozgan Cetiner, and Chris Bryan. "Thermal-Hydraulic Analysis and Experimental Flow Testing of LEU-UAlx Dispersion Target Plates for Irradiation in the High Flux Isotope Reactor". In: *American Nuclear Society Annual Meeting*. 2021.
- [13] **Goth, Nolan**, Trevor Howard, Jorge Navarro, Elliott J Fountain, Nesrin Ozgan Cetiner, and Chris Bryan. "Component-and System-Level Thermal-Hydraulic Modeling of LEU-UAlx Dispersion Target Plates for Irradiation in the High Flux Isotope Reactor". In: *19th International Topical Meeting on Nuclear Reactor Thermal Hydraulics*. 2022.
- [14] **Goth, Nolan**, Jorge Navarro, Elliott Fountain, Alex Huning, and Chris Bryan. "Preliminary Design Status of HALEU Annular Targets for Irradiation in the High Flux Isotope Reactor". In: *American Nuclear Society Annual Meeting*. 2022.
- [15] **Goth, Nolan**, Duy Thien Nguyen, and W. David Pointer. "Investigation of Point Contact Strategies for CFD Simulations of Pebble Bed Reactor Cores". In: *American Nuclear Society Annual Meeting*. 2022.
- [16] **Goth, Nolan**, Duy Thien Nguyen, Kevin Robb, and Ethan Kappes. "Numerical Investigation of Cartridge Heater Performance Applied to the FASTR Main Heater for Molten Chloride Salts". In: *American Nuclear Society Annual Meeting*. 2022.
- [17] Bryan Maldonado, Frank Liu, **Goth, Nolan**, Pradeep Ramuhalli, Matthew Howell, Ryuji Maekawa, and Sarah Cousineau. "Data-Driven Modeling of a High Capacity Cryogenic System for Control Optimization". In: *22nd World Congress of the International Federation of Automatic Control (IFAC)*. 2023.
- [18] Thien Duy Nguyen, **Goth, Nolan**, Pablo Moresco, Vincent Jodain, and Vivek Rao. "Preliminary experimental and numerical studies of light-core vortex rings". In: *American Nuclear Society Annual Meeting*. To appear. 2024.
- [19] Nick Russell, **Goth, Nolan**, Richard Howard, and Jim Nash. "Generation III 238Pu Production Target Hydraulic Characterization". In: *American Nuclear Society Annual Meeting*. To appear. 2024.

TECHNICAL REPORTS

- [1] **Goth, Nolan**, Jorge Navarro, Chris Bryan, Chad Denbrock, Robert Wahlen, and Terry Grimm. *Preliminary Thermal-Hydraulic Analysis of the UTA-2 Subcritical Linear Accelerator-Driven System*. ORNL/TM-2022/2494. Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2022.
- [2] **Goth, Nolan**, Jesse Brown, Tarek Ghaddar, and Logan Scott. *Optimal Chloride Salt Mixture for a Fusion Blanket*. ORNL/TM-2023/3052. Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2023.
- [3] Duy Thien Nguyen, **Goth, Nolan**, Pablo Moresco, Vincent Jodoin, and Vivek Rao. *Design and Testing of the Vortex Ring Facility*. ORNL/TM-2023/2843. Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States), 2023.

THESIS & DISSERTATION

- [1] **Goth, Nolan**. "Design and PIV Measurements on a Wire-Wrapped 61-Rod Hexagonal Fuel Assembly Experimental Facility". MA thesis. Texas A&M University, 2017.
- [2] **Goth, Nolan**. "Analysis of Experimental PIV/PTV Measurements on a Matched-Index-of-Refraction 61-Pin Wire-Wrapped Hexagonal Fuel Bundle". PhD thesis. 2018.