

Dr. Shane Ross and the Ross Dynamics Lab

Dr. Shane Ross is the Roanoke Electric Steel Professor of Engineering at Virginia Tech and a faculty member in the Kevin T. Crofton Department of Aerospace and Ocean Engineering. He leads the Ross Dynamics Lab, which focuses on data-driven modeling, nonlinear dynamics, and simulation of complex systems across space, air, water, and biological domains.

Dr. Ross is internationally recognized for advancing the use of dynamical systems methods to understand transport and movement — from spacecraft trajectories in the Earth-Moon system to airborne particles, gliding animals, and flexible structures. His research integrates theory, computation, and field experiments to uncover organizing structures in flows, inform decision-making, and explain emergent behavior in natural and engineered systems.

Dr. Ross has advanced the state of the art in analyzing and visualizing environmental transport in the atmosphere and oceans. He was the first to apply Lagrangian coherent structures to the study of biological invasions, particularly the spread of plant pathogens in agriculture. His research combines field experiments with Lagrangian transport modeling to investigate the dispersal of hazardous materials in aquatic environments such as lakes and oceans, with additional applications to debris drift and search-and-rescue operations.

Dr. Ross' work in astrodynamics helped initiate the widespread use of dynamical systems methods for space mission design, particularly through the application of invariant manifolds and resonance structures to low-energy trajectory planning. These same techniques have been extended to environmental transport in oceans and the atmosphere, with applications ranging from biological dispersal to search and rescue. His contributions have been recognized with several NASA awards, and he is the author of the open-access book *Dynamical Systems, the Three-Body Problem, and Space Mission Design*.

Dr. Ross founded the interdisciplinary graduate program Biotrans in 2010, which has since cross-trained more than 30 PhD students at the interface of engineering and biology. He also guided its successful transition to sustained internal funding, helping to establish a long-term infrastructure for interdisciplinary research and discovery that continues to influence work at the intersection of the life sciences and engineering.

Dr. Ross has authored over 160 publications, including 100 peer-reviewed journal articles, with nearly 8,000 citations and an h-index of 42. He has been awarded over \$17 million in research funding from agencies such as the NSF, NASA, USDA, the Air Force Office of Scientific Research, and the U.S. Space Force. A recipient of the NSF CAREER award, he has mentored 17 PhD students and 3 postdocs, many of whom have gone on to academic and research leadership roles. He currently oversees a team of 10 graduate students and one postdoc.

His work has been featured in leading scientific journals and media outlets, including *Nature*, *Science*, *Scientific American*, *New Scientist*, *Science News*, *American Scientist*, *Astronomy*, the *Times of London*, the BBC, and several other international news outlets including those in India, Russia, Finland, Poland, Turkey, Brazil, and China.

Dr. Ross holds a Ph.D. in Control and Dynamical Systems and a B.S. in Physics, both from Caltech. He has previously worked at NASA's Jet Propulsion Laboratory (JPL), Boeing, and in consulting roles.