

ANALYTICAL SEMINAR

Patrick W. Fedick



Senior Research Chemist and Director of University Engagement
Naval Air Warfare Center Weapons Division

***“Advancing Mass Spectrometry at the Naval Air Warfare
Center Weapons Division: Accelerated Reaction
Discovery to Next-Generation Ionization Sources”***

Mass spectrometry at the Naval Air Warfare Center Weapons Division (NAWCWD) serves as a cornerstone capability for accelerating synthetic chemistry, energetic materials discovery, and field analytics. This presentation highlights how ambient ionization mass spectrometry drives the rapid identification of energetic molecules and novel reaction pathways through high-throughput robotic screening and reaction acceleration in microdroplets and thin films. To transition microscale discoveries into preparative quantities, scalable reactor platforms, utilizing continuous droplet generation and thin-film architectures have been engineered, bridging the discovery to synthetic tool gap by delivering orders of magnitude faster production rates without compromising target yields. In parallel, NAWCWD is advancing next-generation ambient ionization technologies engineered for rugged, cost-effective, and rapid deployment. A featured innovation, 3D-printed cone spray ionization mass spectrometry (3D-PCSI-MS), utilizes conductive polymer cones that function simultaneously as sample collection, extraction, and direct-ionization devices. Compared to conventional liquid chromatography - mass spectrometry workflows, 3D-PCSI-MS drastically shortens analysis times, eliminates heavy solvent consumption, and interfaces directly with field-portable instrumentation to eliminate sample transport delays and provide real-time chemical intelligence. Finally, once environmental analytes such as per- and polyfluoroalkyl substances (PFAS) are identified at the point of need, this analytical workflow integrates with ongoing remediation research utilizing boron nitride nanomaterial (BNNM) photocatalysts for rapid, light-driven degradation.