Research Experience for Undergraduates

1. RESEARCH TOPIC: Remote Sensing of Bomb Detonations

2. FACULTY SPONSOR: Dr Glen Perram, Professor of Physics, Air Force Institute of Technology, glen.perram@afit.edu, 937-255-3636 x 4504

3. BACKGROUND/PROBLEM: The detonation of high explosive materials involves a complex interaction of reactive chemistry and fluid dynamics, and the resulting fireball dynamics are strongly dependent on many factors including type and size of the munitions, target interactions, environmental conditions, detonation methods, and operational considerations. The classification of bomb type and size from the remote optical signatures of the fireball is challenging, in large part due the inherent variability of explosive events. In a series of six field tests, the temporally-resolved infrared and visible spectra and the visible and near infrared imagery of both conventional and novel explosive materials has been recorded. Novel key features have been identified that will aid in discriminating various types and sizes of flashes. These features include spectral dependent projections of one event's temporal data onto another event's temporal data, time dependence of the fireball size, ratios of specific integrated bands, and spectral dependence of temporal fit constants. In particular, two empirical models of the detonation fireballs have been developed and fit to the field data to extract key features and reduce data dimensionality. Using Fisher discrimination and principal component techniques will be applied to the extracted features for classification.

The undergraduate student will be working with three PhD student researchers.