# MODELING AND IMAGE ANALYSIS OF FAE

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## ABSTRACT

A method for modeling detonations and shock propagation of fuel-air explosives (FAE) from an initial fuel-air cloud is presented together with a technique for extracting pressure data from a high speed film of an explosion. Results from experiments carried out at DRDC in Suffield, Canada with liquid propylene-oxide as fuel are compared with results from simulations and image analysis of the high speed films of the tests. Fuel masses of 55 kg and 166 kg are dispersed to form fuel-air clouds. A high explosive charge initializes the detonation in the FAE-cloud. The image analysis method is based on Background Oriented Schlieren (BOS). For simulations a flux limiter centered (FLIC) method is used to solve the simplified conservation equations of mass, momentum and energy. Two conservation equations of mass fractions are included for a three-specie system with reactants, products and air. Two source models are tested, a one step Arrhenius type equation for the reaction rate and a simple constant volume combustion. Both free field tests and tests with a Container Observation Post (COP) are simulated. For the tests with the COP the center of the fuel-air cloud was located 20 m from the center of  the COP. The free field tests are simulated as 2D axis symmetric, these cases are used for model and grid tests. The experiments with COP are simulated as full 3D. Results from the simulations and image analysis are compared with pressure records from the experiments. Results from both simulations and the BOS-method are in good agreement with the experimental pressure records. We conclude that the FLIC scheme with the reaction rate model can produce pressure and impulses that agrees quite well with experimental results of fuel-air explosives.