THE PROPERTIES OF A BLAST WAVE PRODUCED BY A LARGE-SCALE DETONABLE GAS EXPLOSION

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On 22 July 1966 a hemispherical balloon 38m in diameter, filled with a mixture of oxygen and propane, was detonated at Suffield, Alberta as part of a series of experiments to evaluate the use of detonable gases for the simulation of point source explosions. The gas was successfully detonated but wind conditions during the filling period were far from ideal, and caused a number of problems, including a displacement of the balloon from the prescribed centre. Two forms of high speed photogrammetry were used on this experiment, In the first, four cameras were used to photograph the hemispherical shock against a striped backdrop. In the second, two cameras were used to photograph a series of white smoke trails which acted as particle flow tracers. In addition a Dynafax camera was used to study the initial growth of the fireball. Unfortunately, analysis of the photogrammetrical results was not possible because such a study depends on an accurate knowledge of the centre of the explosion, and this was not available. Subsequent examination of the films for this experiment, coupled with improved photogrammetrical techniques that are now available, suggest that an accurate determination of the explosion centre can be made from the films themselves. Since the time of the experiment, significant improvements have been made in the techniques for the analysis of shock front and particle trajectories, and these are being applied to the data for the gaseous explosion. The analysis will provide a measure of the variation of the peak overpressure with distance and this will permit a determination of the TNT equivalent energy yield. Analysis of the particle trajectories will provide a mapping in space and time of the particle velocity, density, pressure and specific energy fields which will be compared with those from TNT explosions.

The difficulty of handling large volumes of detonable gas under various atmospheric conditions restricts the use of this material for large scale simulations. However, the assessment of the explosive hazard associated with the storage and transportation of very large quantities of gaseous and liquefied fuels, requires the most detailed information possible about the equivalence of the blast waves produced by detonable gas and TNT. The determination of such equivalencies is the subject of this paper.