

A Numerical Investigation of Blast Wave Propagation in Branched pipes

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The objective of the present effort is to investigate blast propagation in complex pipe systems. The typical system is shown in Figs 1, with a long pipe and several combinations of branching pipes. These can be either placed at single or multiple axial locations. While blast wave propagation in either smooth or rough-surface pipes has been studied extensively, this system is unique as it contains several expansion chambers with variable cross-sectional area. In the process of studying HE detonation and blast propagation in the main pipe and its diffraction into the branching pipes and expansion chambers, it became clear that the charge placement in the pipe affects the maximum pressure and impulse values observed in the chambers. Hence, a question was posed: is it possible to optimize the placement of a given size charge in the main pipe as to yield a maximum pressure and impulse values in the chambers? Further, what are the critical parameters controlling this optimal location, is it charge size, pipe diameter, the ratio of branch to pipe diameter or a combination of all of the above.

While the effort examined a main pipe with multiple branches, in this paper we focus on a simpler geometry: a long pipe where the explosive is placed (Fig 1a), coupled to either a single branch via a T intersection (Fig 1b) or a V-shape branch (Fig 1c).

The numerical simulations were conducted using the FEFLO CFD solver. The investigation examined the dependence of the peak pressure observed within the expansion chambers on charge placement within the main pipe, charge size and ratio of main to branch pipe diameter. Initial results of the 3-D simulations showed some very interesting blast wave propagation and reverberations within the branched pipes and the expansion chambers. Full description of the results will be presented in the final paper.

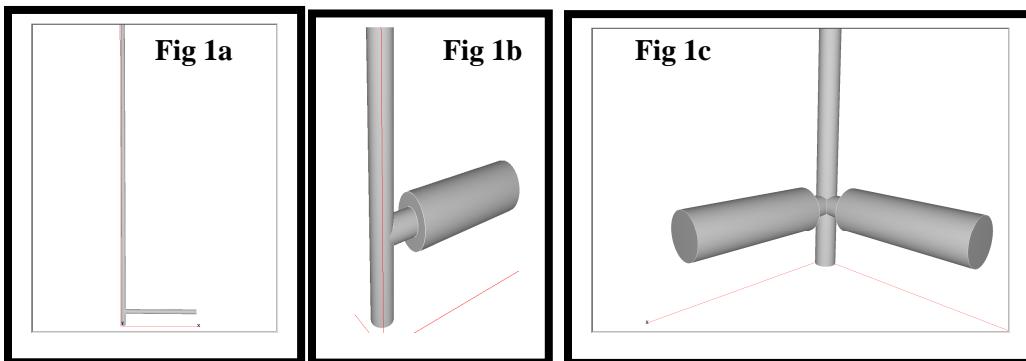


Fig 1. The geometry modeled includes a long main pipe (Fig 1a) with either a T-branch coupled to a single expansion chamber (Fig 1b) or a V-branch (Fig 1c) coupled to two expansion chambers.