

FLUID DYNAMIC ISSUES IN THE DEVELOPMENT OF A SINGLE SHOT VORTEX GUN

Prof. J A Edwards
DSTL Fort Halstead
Sevenoaks,
Kent TN14 7BP
United Kingdom

Dr. K Kontis
University of Manchester
Institute of Science and
Technology
Manchester
United Kingdom

Abstract

In this paper we present the results of some of the fluid dynamic issues relating to the strength and control of vortices and assess some mechanisms whereby the vortex can be tuned to purpose. A number of issues need to be addressed in this context; the generation of vortices, the coherence and integrity of a vortex with range, stability and turbulence, growth and dissipation, and the effects of geometry on vortex formation and muzzle blast. Here we concentrate on validating our computations against experimental data, and addressing, in particular, the requirements necessary to generate a single vortex for use as a kinetic energy transmitter.

The results of two experimental test cases with driver pressures of eight and twelve bar are presented. Flow visualisation, static and pitot pressure measurements have been carried out.

Computations to help determine the critical issues in the driver pressure (shock Mach number) and driver to driven length ratio in an axi-symmetric 30 millimetre diameter, two metre long, shock tube are shown. Driver pressures of 8, 12 and 100 bar have been simulated. Keeping the total length of the shock tube constant, the effects of reducing the driver length are shown. Flows with a single vortex, two vortices and a jet dominated flow are examined. Vortex generation, the elimination of jet effects and the limitation of acoustic disturbances are discussed.

Future directions for the research are outlined and the critical technical issues, which need to be overcome in the development of a fieldable weapon, are discussed.

Keywords: Vortex, Vortex Gun, Jet, Non-lethal Weapon