1. Introduction

The flow-acoustic coupling present in cavity flows make it an interesting and rich phenomenon to study. The problem has garnered interest from a broad scientific audience consisting of fluid dynamicists and control theoreticians who often seek a means to reduce the oscillations associated with cavity flows. Nearly six decades of research have not yet yielded an effective, adaptive and energy efficient solution to the problem. The following notes will highlight important efforts using passive and active control approaches as well as a brief discussion on the nature of the flow. The interested reader is referred to recent reviews on the topic (Cattafesta et al. 2008, Rowley and Williams 2006, Colonius 2001).

1.1 Motivation

Cavity flows are common in many engineering applications ranging from flows over weapons bays and landing gear bays in aircraft, to automobile sunroofs and gas transport systems. Cavity flow is characterized by large amplitude acoustic tones and increased background noise levels that can lead to structural fatigue of cavity contents, increased cavity drag and passenger discomfort.

1.1.1 Aircraft

Cavity flows are present in landing gear bays and weapons bays. The large unsteady pressure loads endanger the cavity's structural integrity. In the supersonic and high subsonic regimes, the flowfield near the cavity distorts any optical beam passing through it. This presents a problem in smart weapons deployment and targeting systems (Bower et al. 2004).

Figure 1 Weapons and landing gear bays.
Adapted from Song (2007).

1.1.2 Automobiles

A main source of passenger discomfort comes in the form of "buffeting" when a sunroof or a window is opened. The incoming grazing flow creates a large unsteady flowfield responsible for buffeting noise. The effects on the passengers range from fatigue to nausea (Kook et al. 1997). In a recent effort to study sunroof noise, Kook (2008) performed extensive particle image velocimetry (PIV) experiments to understand the effect of a tube-like deflector placed at the leading edge of the sunroof of a sports utility vehicle. Results demonstrated a thickening of the shear layer as the mechanism responsible for noise suppression.