1. Introductory Remarks

In a comparatively short period of time it is clearly impossible to cover all the aspects of the A.C.V. cushion and its associated systems and hence in this lecture we can do little more than assess the overall picture. Two main references which have been used in the preparation of the lecture may prove useful to those intending to study A.C.V.'s in more detail are

a) Hovercraft Design and Construction
by G. H. Elsley and A. J. Devereux,
published by David and Charles
Newton Abbot 1968

and b) A Literature Survey on the Aerodynamics of Air Cushion Vehicles
by A. Harting
Agard Report 565, 1969.

2. The Unskirted Cushion

i) Plenum Type

The plenum type is perhaps the simplest of the many types of A.C.V. that have been built and at this point in time most operational craft utilise this principle which has largely superseeded the peripheral jet for reasons which will be discussed later. Figure 1 shows a section through an unskirted plenum craft. At lift off air is pumped into the cavity by a suitable compressor and diffuses to form the cushion. The craft rises until a steady state condition is achieved in which the incoming air matches exactly the air being lost to atmosphere at the periphery.

Assuming that the air within the cushion is at rest we may write using Bernoulli's theorem

$$V_c = \left(\frac{2}{\rho} p_c\right)^{\frac{1}{2}} \qquad \text{........(1)}$$

where V_c = cushion escape velocity

ρ = density of the air

p_c = cushion pressure (relative to atmosphere)

The total volume flow of air is then given by

$$\mathcal{V} = V_c hCD_c = \left(\frac{2}{\rho} p_c\right)^{\frac{1}{2}} hCD_c \qquad \ldots\ldots\ldots(2)$$

where h = air gap or clearance height

D_c = discharge coefficient

C = cushion perimeter

$\mathcal{V}$ = volume flow

The discharge coefficient, which may be defined as the ratio of the actual volume flow to that calculated assuming the gap ran full at the cushion escape velocity i.e.

$$D_c = \frac{\mathcal{V}}{hCV_c} \qquad \ldots\ldots\ldots(3)$$

is a function of the angle θ and the length of the wall. For a long wall theoretical non viscous values of D_c are:-

θ	0	45	90	135	180
D_c	0.500	0.537	0.611	0.746	1.000

The power required at the peripheral gap, i.e. neglecting all losses, is given by

$$P = p_c \mathcal{V} \qquad \ldots\ldots\ldots(4)$$

or

$$P = p_c^{3/2}\left(\frac{2}{\rho}\right)^{\frac{1}{2}} hCD_c \qquad \ldots\ldots\ldots(5)$$

writing $p_c = \frac{W}{S}$ ....(6)

where W = craft weight

S = cushion area

equation 6 may be rewritten as

$$P = \left(\frac{W}{S}\right)^{3/2}\left(\frac{2}{\rho}\right)^{\frac{1}{2}} hCD_c \qquad \ldots\ldots\ldots(7)$$