CHAPTER

6

AEROTHERMODYNAMICS OF INLETS, COMBUSTORS, AND NOZZLES

6.1 INTRODUCTION

In Chapter 5 we used the laws of thermodynamics and fluid mechanics to explain the behavior of aircraft jet engines. We treated the several engine components as "black boxes," in the sense that we confined discussion to the inlet and outlet conditions of the propellant, without regard to the internal mechanisms that produce its change of state. Where necessary, we related the actual performance to some easily calculated or "ideal" performance by the definition of an appropriate component efficiency or stagnation pressure ratio. The purpose of this and the following chapter is to examine the internal mechanisms of the various components in order to describe the factors that impose practical limits on performance. We consider conditions required for high performance of components and, in some cases, present methods for quantitative prediction of their behavior.

For the ramjet, Eq. (5.34) indicated that a given percentage loss in stagnation pressure has the same effect on engine performance wherever it occurs through the engine. For turbine engines the same conclusion holds, though it is not so easily seen, since component performances are usually stated in terms of adiabatic efficiencies rather than stagnation pressure ratios. Hence high performance is of equal importance for all engine components. The *attainment* of high performance is generally more difficult in those regions requiring a rise in static pressure than in those where the pressure falls. This, as we pointed out in Chapter 4, may be attributed to boundary layer behavior and the tendency for separation in the presence of a rising static pressure. Thus inlets (which generally have rising