This chapter presents a Design for Service (DFS) tool developed at the University of Rhode Island (URI) to help design teams address the serviceability of their designs at the same time as the important decisions are being made for ease of initial assembly. The DFS analysis procedure covers the range of disassembly and reassembly operations commonly carried out in service work (Whyland, 1993; Subramani and Dewhurst, 1994; Dewhurst, 1993).

Henry Ford is quoted with the remark that “in the Ford Motor Company we emphasize service equal with sales.” However for the early pioneers of mass production, service meant little more than the availability of replacement parts used for repairs at service shops widely spread across the country. For the customers of those mass produced automobiles, ownership was viewed as a luxury which could be suspended occasionally for repair work. For today’s consumers, however, most mass-produced appliances, including automobiles, have become a necessity of everyday life. For this reason, quality measured by reliability standards is now the most important attribute for success in the marketplace. In addition, customers expect service procedures to be carried out with the absolute minimum disruption of product use.

Reliability and serviceability are linked in the minds of both the manufacturer and the owner. For the manufacturer, they jointly determine the cost of the product warranty, while for the owner they define part of the continued cost of ownership. For example, for US automakers, annual warranty costs are now measured in billions of dollars (greatly in excess of profits) and approximately half this amount is for service labor. For the owner, the high maintenance costs as a product gets older translates into a too-rapid loss of value and dissatisfaction with the rate of depreciation. For low cost appliances, this often means early disposal in the municipal landfill when the likely cost of repair is felt to exceed the perceived product value.
14.1 INTRODUCTION

A major improvement in product serviceability would be beneficial to both the manufacturer and their customers. However, it appears that this is one aspect of product design that has not been improving. An extreme example is the use of spot welding in automobile body construction, coupled with the move to seamless body designs. This makes the repair of even minor body damage prohibitively expensive, even though the event is an anticipated part of normal product use.

It is clear that significant improvements in the serviceability of products will only occur if there are changes in the way in which products are designed. The current approach in most companies, of carrying out service reviews only when the design has been fully executed, only serves to avoid those service tasks which would be considered totally unacceptable. It is usually too late in the process to make changes to reduce long service procedures which can, nevertheless, be carried out in a routine manner. It is the belief of the authors that the analysis of important service tasks on new products should be carried out concurrently with the earliest design for assembly studies, and that these should take the place at the early concept-layout stage of product design. The goals of ease of initial assembly and that of subsequent service tasks, can be closely aligned provided that they are considered together by the development team. When they are separated, however, decisions about part locations and securing methods may be made with little consideration of later disassembly.

One important aspect of design for assembly which can have a positive influence on serviceability is the goal of reducing both part count and the use of separate fasteners. A review of the literature on DFA shows that in 74 case studies, which have been published on the results of using the Boothroyd Dewhurst DFA software (Boothroyd Dewhurst Inc., 1994), the average reduction in the number of parts to be assembled is 56 percent and the average reduction in the number of separate fasteners is 72 percent. These new designs are not necessarily easier to service. However, when designs are simplified in this way the potential for substantially easier service tasks clearly exists. Consider, for example, the service procedure of the replacement of a headlamp bulb shown in Figure 14.1. This illustration, taken from the owner's manual, shows that much of the front trim of the vehicle has to be removed to access the headlamp assembly; Figure 14.1(a). Then additional screws, trim, glass and the seal must be removed to uncover the bulb; Figure 14.1(b). In total, 32 items are removed and then reassembled in order to replace a relatively inexpensive item, which has a high likelihood of failure. In contrast, Table 14.1 shows the results of the proposed redesign of the GM-10 Headlamps and Panel assembly resulting from a DFA analysis of the previous design. The point of showing the GM-10 statistics in the present context is not that the new headlamp will necessarily be easier to service. With poor access or inappropriate securing methods it could even be more difficult to service. However, it is clear, that with fewer assembly operations, the new design has the potential to be easier to service than the older model. The challenge is to empower design teams to achieve that potential.

At the present time, concurrent engineering product development teams are driven by engineering designers together with manufacturing and industrial engineers. At the earliest concept stages, in some companies, marketing will also be involved in the identification of the concept layout of the new product. However, service engineers presently play a minor and somewhat negative role. At one large company, their participation in early design was described recently as pouring water on the campfire while the rest of the team were trying to keep the flames going. The main reason for this attitude is that service engineers have not had