

Polyurethane components used in the devices often cause the deletion of a subset of immune cells when blood comes in contact with them. This predisposes the patient to some fungal and viral infections.

As of July of 2007, 69 year old Peter Houghton was the longest surviving recipient of a VAD for permanent use. He received an experimental Jarvik 2000 LVAD in June of 2000. Since receiving his LVAD Peter Houghton has completed a 91 mile charity walk, published two books, lectured widely, hiked in the Swiss Alps and the American West, flown in an ultra-light aircraft, and traveled extensively around the world.

VADs not only extend the quantity of life, but also the quality of life. People who have had VADs implanted have had lower rates of depression than those people suffering from cardiac disease that have not undergone implantation surgery. In a small number of cases left ventricular assist devices, combined with drug therapy, have enabled the heart to recover sufficiently for the device to be able to be removed.

The majority of VADs on the market today are somewhat bulky; however one of the smallest devices available weighs only 20g.

Another type of VAD currently being developed relies on magnetic levitation to drive the rotor within the pump, minimizing the wear and reducing the size of the pump substantially. The first magnetically levitating pump has recently been implanted for clinical trials in Greece and started clinical trials in the United State in 2007. Magnetic levitation technologies are expected to result in small, pediatric VADs within the next five years.

Table 3-2 lists the available vascular assist devices both on the market and in clinical trials.

### **TOTAL ARTIFICIAL HEARTS (TAHS)**

Limitations in our current conception of device indications must be addressed. First, the need for biventricular versus univentricular support is difficult to determine. Second, the ultimate utility of a total artificial heart versus a ventricular assist device (VAD) has yet to be determined. Third, the intended duration of mechanical support is an issue that has no clear criteria. The time and type of device utilization is influenced by external factors such as the time to myocardial recovery, donor organ availability, the potential of outpatient therapy, and the unpredictability of adverse

Table 5-1, Figure 5-1 and Figure 5-2 present the estimated markets for devices to treat CHF in the major world healthcare markets by geographic segment, and the trends in these markets from 2007 to 2017.

In terms of the types of devices used in the treatment of CHF, a lot depends on the specific geographic market as to which device will find the strongest ground. While TAHs present the largest compound annual growth rate, they are expected to represent the smallest device segment --- and the high average annual growth rate is a result of the smaller market size. Marginal dollar increases reflect as large percentage

**Table 5-1**

**The Estimated Markets for Devices Used to Treat CHF in the Major World Healthcare Markets by Geographic Segment (\$ Millions)**

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
USA											
Europe											
Japan											
Total											

Source: Kalorama Information

**Average Annual Growth Rate**



Source: Kalorama Information