

An introduction to the development of scientific apparatus.

Science is about extending the boundaries of our knowledge and this can be done in a number of ways. Theoreticians use paper, pen and now computers to formulate and consolidate their thoughts, whilst experimentalists will use apparatus of various types to carry out a systematic study of the particular aspect under investigation.

In the 19th and early 20th century experimental apparatus were usually modest in size and probably constructed by a single technician. During the Second World War, the Manhattan Project for developing the Atomic Bomb resulted in a massive experimental programme and currently, the Large Hadron Collider (HAC) represents another gigantic experimental project involving a monster experimental apparatus, thousands of people and huge sums of money.

Today most University or development laboratory experimental apparatus use commercially manufactured units where scientists assemble the necessary existing commercial apparatus they need in order to conduct any one set of experiments. This is generally an efficient way to proceed, however sometimes it is necessary to develop a new type of apparatus in order to carry out an untried experiment and this is where the fun and pain of doing something original can begin.

There is a saying, “It is the pioneers who get the arrows in their back” and this can be true about pioneering novel scientific apparatus where initially, it is a journey into the unknown and where there is potential for taking a wrong turning. Often, a prototype design will not work properly and it may take a Mk2, Mk3 or even a Mk4 design before the apparatus works effectively. Collaboration with others will almost certainly be essential as most scientific apparatus now include high level engineering, electronics, computing and other specialist elements.

My own experience has involved building apparatus in conjunction with University workshops, where in the past there was a reluctance to work from proper engineering drawings. This can be effective; but in the 21st century, computer drawings should be the correct starting point for almost any design. If elevated temperatures are involved, this should be an early consideration as it is often difficult to introduce good temperature control into a design at a later stage. Incorporating already developed components from other applications can also save a significant amount of time; reinventing the wheel is not a good idea.

Inventing and developing a unique apparatus that examines previously unexplored areas of science can provide a huge amount of satisfaction and reward. It can also however be very frustrating, demanding, and time consuming. On balance, the final reward should far out way the pain involved in reaching that final destination.