

The title of my Editorial was *High Technology Accidents — Unpredictable and Inevitable*. To prove the truth of this claim, I analysed the accidents of the Apollo 13 Moon Flight and the Three-Mile-Island Nuclear Accident. In case of Apollo 13, it took two months (April-June 1970) to determine that testing and re-testing of one small component, a thermostat switch inside a liquid oxygen tank, led to its permanent welding together, thus causing an explosion. It was an accident which was totally unpredictable. This issue of ISR was published in June 1980.

That accidents are inevitable is only now slowly being realised. Nothing, but absolutely nothing, made by man is perfect and will therefore have inherent faults, in design, material or manufacture. In a low-technology, like the car-road system, the fatal accident rate is appalling, and familiarity with road deaths has certainly bred contempt. High technology has its rare, but spectacular accidents, like Apollo 13, Three-Mile-Island, (Chernobyl was still in the future, April 1986), DC-10 aircraft disasters [see Title 281] or historically the sinking of the Titanic in 1911 and the burning of the hydrogen- filled *Hindenburg* Zeppelin in 1937. Both were hailed as highest technology in their days.

The best that engineers can achieve in their striving for perfection is to gain sufficient experience, allow a large enough safety factor and provide a back-up system in case a vital component fails. And most important, where human guidance is involved, as in the control of spacecraft, aircraft and atomic reactors, to provide training for the operators in the prevention of accidents by frequent simulation exercises. Or if they do occur, to rehearse and master the necessary rescue and escape operations. Instrument-Systems of greatest reliability, simplicity and clarity are also an essential requirement; these were not available at the Three-Mile-Island reactor control station.

In the Kemeny Report (October 1979) on the Three-Mile-Island accident one reads: "Training did not adequately prepare the operators to cope with the accident". The cost of the accident was estimated as \$ 1.5 thousand million, so it is obviously cheaper to train the operators better, and to provide modern computer control systems, as for example the hierarchical computer control philosophy developed at CERN for their Super Proton Synchrotron.

I summarised the lessons to be learnt: Accidents will inevitably happen at nuclear power stations, as Chernobyl proved 6 years after I wrote my Editorial: Highly trained operators; the most modern and simplest computer control systems are mandatory. When an accident has happened, a highly efficient aid and rescue service, trained by frequent rehearsals of their tasks, must be on constant alert.