comprehensive knowledge of the machines currently in use.

This speculation, however, has led to a standard science fiction computer that appears to have — by current computer standards — a range of facilities that are impossible to achieve. To begin with, this standard computer has stored in its memory absolutely every piece of information and idea ever thought of, and it can retrieve any of this information instantaneously, by processes analogous to the workings of the human mind. The computer HAL in *2001 — A Space Odyssey* is one such super-intelligent machine.

Spaced Oddity

HAL — the Heuristically programmed ALgorithmic computer in Arthur C Clarke's '2001 — A Space Odyssey' is a good example of the omnipotent computing machine often seen in science fiction films. In this case HAL is entrusted with details of the mission's objectives while the human crew members are not, which leads the machine to believe the men to be dispensable. It is widely believed that Clarke chose the letters HAL for their proximity to IBM in the alphabet
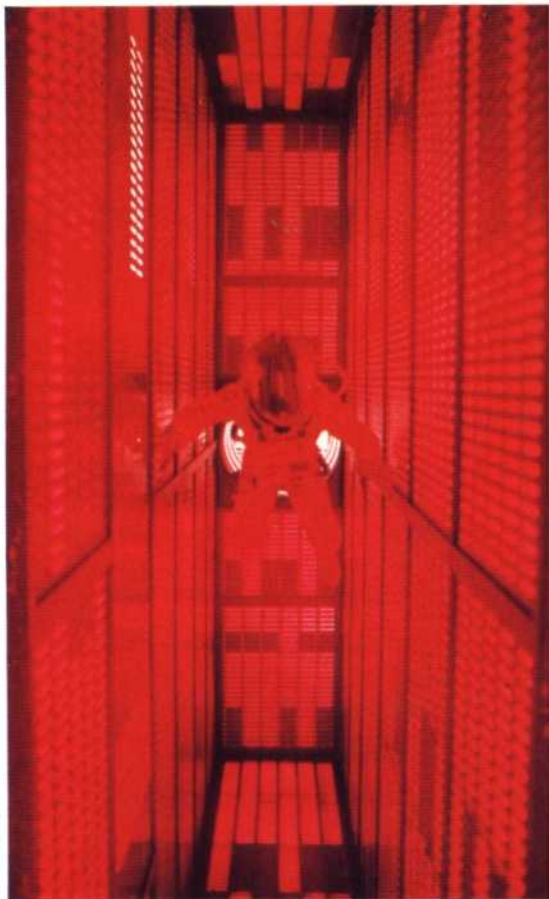
B.F.I. STILLS

The supercomputer generally postulated by science fiction writers is omnipresent as well, although it appears to each user that he alone has access to the machine. Spoken output (with no hint that it might be a synthetic product of strung together phonemes) and voice recognition (which infallibly makes allowance for the characteristics of individual speech patterns) are both essential requirements of this supermachine; while visual object recognition and the ability to synthesise food (perhaps from its basic elemental constituents) are other useful attributes.

The supercomputer that we have outlined here is usually enlivened with human attributes as well, and this characterisation makes it appear as some sort of superbeing. However, the character of the computer can sometimes turn decidedly malevolent or deranged. In the film *Dark Star*, for example, a computer-controlled bomb is given the unsettling characteristics of a psychopathic killer.

When portrayed in this way, the supercomputer certainly does belong in the realms of fantasy. But, on the other hand, we can recognise in modern computing equipment the possible ancestors of some of the other attributes we have outlined.

High capacity memory with a very short access time is already possible. By the early 1980's, gigabyte memories (a thousand million bytes) had been created, and the fastest commercial machines were processing information at much more than ten million instructions per second. Again, in the field of spoken output, we are very close to achieving the perfection shown in films where computers talk to their operators. The quality of spoken output simply depends on available memory space, processing speed and programming time. Voice recognition, however, is more difficult to achieve because there is such a wide divergence between individual speech patterns. Two people may be speaking the same language, but to the computer they can seem to be speaking entirely different ones.

Visual object recognition is also in its infancy, but the technology is advancing rapidly. When we looked at industrial robots (see page 281), we noted that a great deal of progress was being made in object recognition by means of charge-coupled device television cameras, and that the robot could pick a specified item out of a mixed bag. Meaningful visual recognition depends on the size of the visual vocabulary, which again is a function of memory size and processor power. As for food synthesis, it may not be possible to make a meal look like meat and potatoes or fried fish, but it is certainly possible to make it taste and smell like them, even if computers cannot, as yet, create them from their elements.

Not all authors go to these lengths of attributing remarkable powers to their fictional machines. John Brunner, for example, in the science fiction novel *Stand On Zanzibar*, published in 1969, describes the world as it might be in 2010 when the problems of overcrowding and starvation have reached crisis level. The computer that he describes, which he calls Shalmaneser, obviously has considerable memory capacity and processor speed (for it is on-line to every television set on earth) but its interrogation language is very similar to something we might use today:

```
PROGRAMME REJECTED
Q reason for rejection
ANOMALIES IN GROUND DATA
Q define Q specify
DATA IN FOLLOWING CATEGORIES NOT
ACCEPTABLE. HISTORY COMMERCE SOCIAL
INTERACTION CULTURE
Q accept data as given
QUESTION MEANINGLESS AND INOPERABLE
```

Brunner has obviously gone to some lengths to use nearly-normal English within a context that a computer user would recognise as an operating system response. His other predictions are equally convincing, and it is not surprising that the novel