John? Corrects omissions?
Neil?

Must get text to DK today
before he goes OOC on holiday

Z berths:

What are they?

Z berths are emergency anchorages for nuclear-powered submarines in trouble.

Where are they?
(list)

What facilities do they have?

No special facilities for nuclear problems. Some are no more than mooring buoys in the middle of a loch. Others allow quayside mooring, for instance in a container port. Others, such as Gibraltar, are in dockyards and therefore have a range of general ship-repair facilities. However *none* has any purpose-built nuclear survey or repair facilities. Nor do they have any nuclear waste storage or nuclear leak containment facilities.

What are they for, then?

They are, almost literally, ports in a storm. A damaged submarine can limp in to a protected anchorage and tie-up while the problem is examined and possibly put right.

All nuclear-powered submarines have an emergency, alternative diesel engine that can be used if the nuclear-propulsion unit has to be shut down. This will provide power to keep the vital reactor cooling system working and is sufficient to bring the submarine into port, on the surface, at slow speed.

Where can repairs be done?

Britain has three bases (designated X berths) where there are full facilities for the maintenance and repair of nuclear-powered submarines. These are the Clyde Naval Base at **Faslane**, where the four Trident nuclear-missile submarines are based along with some of the nuclear-powered hunter-killer submarines. **Rosyth** on the Firth of Forth and **Devonport** which is both the base for the remainder of the hunter-killer submarines and also the future refit yard for all nuclear-powered submarines.

Both Rosyth and Devonport are also dumping grounds for old, withdrawn nuclear submarines.

Naval nuclear reactors

These are all built by Rolls Royce at Derby and delivered as fuelled-up, sealed units, either to the Barrow shipyard where all British nuclear-powered submarines have been built, or to the Rosyth or Devonport refit yards..

Unlike nuclear reactors for power stations, there is no need for regular re-fuelling. When a submarine is refitted (at approximately ten year intervals), a new sealed unit

is installed and the old one taken out. The very radioactive core containing the fuel rods is sent to British Nuclear Fuels' Sellafield (Cumbria) site. Designated as High Level Waste (HLW) the cores are placed in cooling ponds where, along with growing quantities of other HLW, both military and civil, they await the eventual construction of safe, long-term storage underground facilities.

Other parts of the reactor, together with other radioactive parts, are designated as Intermediate Level Waste (ILW), are also taken to Sellafield. Current plans are for this waste to be moved to a secure, above ground site where it will be left to cool off for a further sixty years.

No decision regarding where such a site may be has been made but the most likely candidate is Burghfield, near Reading, where all Britain's nuclear warheads are at present assembled.

Radioactive leaks

All nuclear reactors have to be continuously cooled. The coolant, in submarines, liquid sodium, is under pressure and becomes to some extent radioactive. If there is a leak, the coolant will probably be discharged into the water. This may not matter too much on the open sea but in the confined area of a harbour or dock, could be extremely dangerous.

Internal leaks, both of radioactive liquid and gases, are likely to lead to the evacuation of the ship. Repairs, especially to the pressure vessel that contains the reactor, can only be done by specialists, working for limited periods, using protective suits in a radioactive environment.

Support ships

Because of the lack of any specialist nuclear repair systems at any Z berth, a naval support ship has to be brought in. However these do not have any nuclear waste storage capacity or radioactive leak containment equipment.

The probability is that a broken-down nuclear submarine will have to be towed to one of the fully-equipped refit yards.