

ENGINEERING

Total Technology

A LIMITED but enthusiastic backing for Total Technology emerges from a Science Research Council report published last week. Total Technology—one of those multi-disciplinary concepts that industry advocates and universities abhor—is the brainchild of Professor Hugh Ford of Imperial College London, who chaired the panel that has now recommended that PhDs in total technology should be awarded in the near future, with the intention of producing about 20 doctorates a year in the subject.

This course of action is rather more modest than the approach suggested by an earlier SRC working party on the subject chaired by Professor J. H. Horlock. His group's work laid the ground for Professor Ford's panel, but Horlock's recommendation was that at least 25% of postgraduate engineering students supported by the SRC should receive training in Total Technology by the end of the decade. In real numbers this would be about 200 PhDs a year.

But what is Total Technology? The report explains it by stating that the practice of engineering comprises research, development, design, production, marketing and operation of plant, while the service and construction industries require a special emphasis on planning and operations management. Total Technology is all these functions merged together to produce success.

What that means in practice is likely to be discovered this autumn at the Universities of Cambridge, Strathclyde and Aston where the first courses are to be run. The basic emphasis is to build up an appreciation of managerial functions combined with the ability to communicate with others during work as an engineer.

Inevitably this implies a deal of course work. But Professor Ford and his panel are adamant that they are not proposing the award of a PhD for purely course work. In the outline syllabus that is appended to their report the panel—which was drawn from industry as well as the universities—proposes that the three year doctorate should cover course work on the chief sectors of industry from raw materials to primary and secondary industry, large-scale manufacturing, mass production and small specialized industries, combined with detailed work on two background disciplines chosen from such areas as design function, industrial sociology, the economics of companies, systems analysis and plant maintenance.

This part of the course might be compressed into one year to become a master's degree, the panel suggest. But the really meaty part of the operation—the part that the panel maintain makes

the operation worthy of a PhD rather than just a master's degree—is work on industrial projects. These should extend over the last two years of the course, comprising one, two or possibly three open-ended projects broadly associated with the subjects studied earlier. The choice of subject would be made in collaboration with industry. "The student would thus" the panel say, "attack an industrially relevant problem, of direct interest to the firm, and obtain a solution in a realistic time".

Clearly the panel is convinced of the value of what it recommends. But what does industry think? The reaction to Professor Horlock's original proposals was a little cool. The relevance of existing PhDs was eagerly attacked, and Total Technology as an idea was warmly received, but industry doubted whether the target of 25% of SRC-supported engineering PhDs being total technologists by the end of the decade was a desirable or even a possible target, and the old bugbear of producing more doctorates than could be employed was raised. A one year MSc was thought to be a more preferable alternative.

The result of all this is that Total Technology will appear, but slowly. The panel stresses the difficulties of intro-

ducing the subject and emphasizes that the new courses must benefit from the experience gained by their first students. A gradual introduction is more likely to produce a course that produces the type of doctorate that industry wants.

NAUTICAL ARCHAEOLOGY

Protecting Wrecks

from a Correspondent

THE first sites of wrecks to be given protection under the recently passed Protection of Wrecks Act were announced last week by Mr Cranley Onslow, Under Secretary of State for Aerospace and Shipping. The act provides for specific wreck sites of cultural interest within British territorial waters to be given something of the status of an ancient monument on land.

British wreck sites are typically collections of related objects rather than well-preserved ancient hulls, which, paradoxically, are found in river banks, marshes and harbours. And three of the four sites initially designated by Viscount Runciman's committee will be just such a collection of historical objects.

The four sites are the royal yacht, *Mary*, a gift from the Dutch to Charles II and wrecked off Anglesey in 1675; the Dutch East Indiaman, *Amsterdam*, beached near Hastings when outward bound on her maiden voyage in 1749; Henry VIII's *Mary Rose*, capsized near Spithead in 1545 and preserved to her gundeck in seabed silt, and the *Grace Dieu*.

The *Mary Rose* is thought by the survey team currently working on her to be sufficiently well preserved to be raised whole. The construction of the boat is of great interest but the prospect that her contents might be recovered—the Solent silt is a good preservative—creates even more excitement. The *Mary Rose* is known to have sunk during a battle manoeuvre, thought to have been planned by King Henry VIII himself who watched the scene from the battlements of Southsea Castle, so the possibility is high of there being documents of great historical interest on board.

The fourth candidate, however, is a very special case. Henry V's *Grace Dieu*—a ship from the early 1400s—was built for wars that were over by the time she was ready. The largest ship built in Europe for over 200 years, she has lain in the tidal Hamble river since she sank. It is thought that only five feet of her timbers above the keel are left, for, in spite of being largely submerged, she has been the object of souvenir hunters for centuries and is now threatened by a motorway. Nevertheless those five feet are of compelling interest, for they are of unique triple-clinker construction.

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Dr David Davies takes up the editorship of Nature next Monday, August 20.