

would be very small, as the table shows, and the only penalty for joining late would be the exclusion of a British site for the accelerator. (By all accounts, the piece of land originally suggested for this purpose in East Anglia would not have passed the clinical examination to which the other sites have been subjected.) If, on the other hand, the CERN council fails to reach a decision next month, a further postponement would place the project so far behind the American 200 GeV accelerator at Batavia, Illinois, that it might even be reluctantly abandoned.

Table 1. COST OF 300 GeV ACCELERATOR
(millions of Swiss francs at 1969 prices)

Year	Cost
1	16
2	50
3	140
4	220
5	235
6	250
7	260
8	260
Total	1,431

ENGINEERING MANPOWER

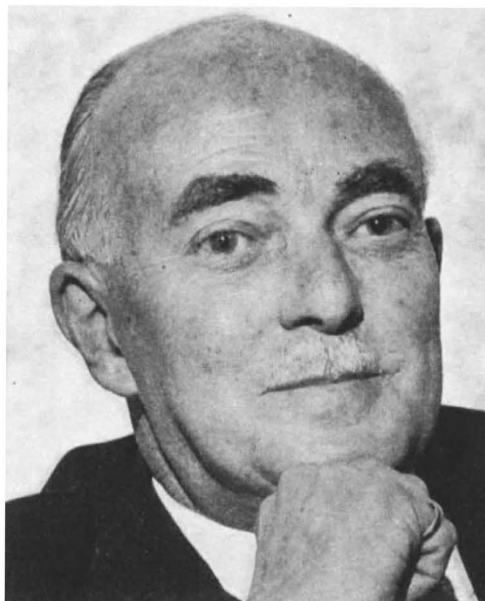
Call to Action

LORD JACKSON OF BURNLEY (lately Sir Willis Jackson) had some harsh words for the engineering institutions and the senior engineering staff at universities when he gave the first Willis Jackson lecture last week to commemorate the golden jubilee of the British Association for Commercial and Technical Education. Speaking on the problems of engineering manpower, he said that the engineering institutions have not been pulling their weight in instilling a sense of social responsibility in the junior members of the profession, and many engineering lecturers are far too fond of their ivory towers. "There are so many engineering teachers who are antipathetic to activities other than research," he said; "in particular towards the productive industries. This causes me great concern."

On the shortage of engineering manpower, Lord Jackson, who is the chairman of the Committee on Manpower Resources and president of the newly formed Institute of Manpower Studies, said that it is more important to train people for the right job than simply to worry about manpower shortage in numerical terms. For one thing, graduate output is growing faster than its supporting manpower, and people will end up doing jobs for which they were not trained. The present ratio of technical supporting manpower to engineering graduates is still quite high at about five to one, but the trend is downwards and the danger signals are evident enough.

The new Institute of Manpower Studies will be faced with considerable problems, not least in defining the nature of its own investigations. As Lord Jackson pointed out, the Committee for Manpower Resources has been unable to assess the manpower needs of the country independently of the demand from employers, which may well prove a very inaccurate guide. The new institute will have to take a more intimate look at the anatomy of the manpower situation, he said, from the point of view both of usage and of the skills required for particular jobs.

What is the long term remedy to the problem of engineering manpower? Lord Jackson saw this as part of a wider question affecting the educational system as a whole. The fundamental problem is that many science teachers have a poor knowledge of technology, and science students are too often left unaware of the technological implications of their subject. He felt that science should be taught from the outset with a greater emphasis on its relevance to technology. He also had some thoughts for the arts pupil. "The highly specialized character of sixth forms forces many pupils



Lord Jackson of Burnley.

to withdraw totally from science at an early age. This is very harmful. I would like to see the emergence of a new breed of graduate, who would be a sociologist, lawyer or economist with a substantial scientific background."

Mr Edward Short, Secretary of State for Education and Science, who was chairman of the meeting, put a different gloss on engineering at the universities. He thought that universities should be a bit like ivory towers, but that they should always be aware of and responsive to what went on on the shop floor.

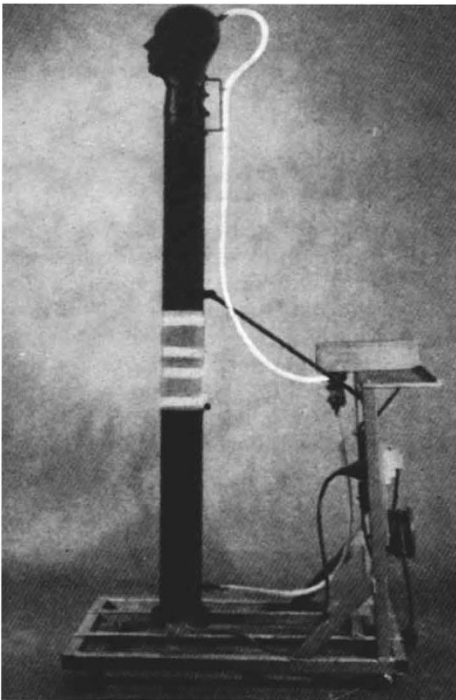
CITY UNIVERSITY

Industrialized Academics

IN the three years since it was created out of the Northampton College of Advanced Technology, the City University has managed both to expand its own research activities and to build up an impressive number of projects backed by industrial money, ranging from a study of the hydrology of rivers flowing into Morecambe Bay to methods for detecting flaws in metals by ultrasonic pulses. Much of this work was to be seen on the open days held last week. There also seems to be increasing cooperation with other national and industrial research establishments.

An investigation of the aerodynamics of the human body by Professor R. N. Cox of the department of aeronautics illustrates particularly well the benefits of

cooperation between difficult disciplines and with outside bodies (in this case the National Institute for Medical Research) and the discovery of common ground between the pure and applied approaches to the same piece of work. The basis of the research is the discovery in detail, by Schlieren photography, of how the layer of air next to the skin flows upwards along the body surface. There has been a study of bacteria transport—apparently the airflow from most of the body converges beneath the nose—and information has emerged which can be used to improve the design of protective clothing. The result is that medical benefits are emerging from a department chiefly concerned with aircraft.



Model for simulating convection currents around the human body.

Finding a suspension mechanism for fast trains has kept the department of automation engineering in close touch with the British Rail Technical Centre, chiefly because of the advanced passenger train now being developed (see *Nature*, 223, 663; 1969). In this case, the university is dealing with the dynamics and British Rail is looking after the engineering, and the result is a system with great potential export value.

Cooperation also works the other way round with other organizations providing facilities needed by staff of the university. Mr R. J. MacAnulla of the department of electrical and electronic engineering, for example, is working in a laboratory of the Electricity Council Research Centre at Capenhurst in an attempt to find physiological effects of weak magnetic fields by measuring reaction times when a field is applied across a subject's head.

The limitations of a working relationship with industry are nevertheless apparent from the almost exclusive concentration on physical and engineering sciences. Apart from medical and physiological applications such as those of Professor Cox and Mr MacAnulla, the research approaches no closer to

biology than ophthalmic optics, and the resulting intellectual environment might be thought unattractively narrow for the university's students. There is at least an active department of social studies and humanities, which in spite of its small size covers a broad field of interests from economics to philosophy, and provides courses for all undergraduates. Anyone who thought that the university's activities were totally utilitarian, however, would have been suitably re-educated at the open days by discovering a proudly exhibited working model which had reached the finals of a national competition for designing an Emmett-type automatic instant mashed potato machine.

LAW

Software Protection

from a Correspondent

A MOTLEY gathering including lawyers, scientists, patent agents and commercial executives attended a conference on the legal protection of computer programs at Brighton on November 13 and 14. They heard from Dr A. S. Douglas (London School of Economics) that the "unbundling" of software from hardware as a market commodity by IBM had increased the importance of software. After discussing such things as the nature of computer stores and the skills involved in producing programs, he left the impression that, as an academic, he was against the creation of patent monopolies in programs. In this he was joined, oddly enough, by Dr H. Aspden (IBM) who confirmed that IBM is against patenting of programs but strongly favours adequate copyright protection and, of course, an IBM proposal which ignores all existing laws and attempts to compromise between users, manufacturers and software houses.

The American view, expressed by Mr R. C. Lawlor (patent and copyright attorney, Los Angeles), strongly favours patenting whenever an invention is present, registration (in the United States) of copyright of at least part of the program and retention of the remainder, when possible, as a trade secret. Mr R. Lattes (SIA Ltd, and Metra International), discussing the European scene, seemed to agree with Dr Douglas. He was opposed to the protection of the ideas involved in a program on the basis that it amounted to obtaining monopolies for pure mathematics, but was not against some form of protection to cover the work put into writing a program. He did not consider the present law in France adequate but seemed to despair of communicating the problem to the lawyers. In general he seemed content with bilateral contracts but said that there should be a Society of Software Houses and some sort of boycotting policy, presumably against those who offended against a professional code.

The general impression of the conference was that, although there will inevitably be some patenting as the law stands, the future protection of software lies chiefly with copyright law. Mr E. P. Skone James (London), who summarized British literary copyright law, was firmly of the opinion that, subject to some amending legislation, it would give adequate protection to computer programs. He said that a literary work need not be humanly readable nor understandable to attract copyright and therefore, contrary to what is often thought, a program on magnetic tape could be an infringement of copyright.