THE AUSTRALIAN BLACK COAL INDUSTRY at the time of this project faced a difficult medium-term challenge. Based on the technology, costs and coal prices current then, many of the established coalfields had depleted reserves of flat dip, shallow depth, and surface-mineable coal. Maintaining Australia’s competitive position in the export market in coming years would become significantly more difficult given the requirement to mine deeper and/or more geologically complex structures. In addition to having deeper overburden, these mines were likely to have increasing levels of groundwater flows and other associated geotechnical problems. In the past, problems of deepening overburden and the need to move increasing volumes of coal had largely been solved by increasing the size of stripping equipment, thus gaining economies of scale, increased efficiency and hence productivity gains. However, the size of stripping equipment had reached a plateau by the early 1970s, and by the mid-1980s efficiency improvements were only marginal, even when mines were operating to near full capacity.

INVESTIGATE NEW ALTERNATIVES

In association with industry, The Warren Centre determined that there was a need to review current surface coal mining practices and investigate the potential new alternatives that could meet the mining parameters likely to confront the industry within the next twenty years. The objectives of the project were to rank the application of existing equipment and systems, and any future innovative systems, in relation to their suitability for operation in the mines of the future. A team of twenty-nine Project Fellows and Associates working in five task groups and on four case studies worked in two distinct phases.

DATA CAPTURE AND HYPOTHETICALS

The first phase of preparatory data-gathering involved three task groups, who were charged with identifying the most promising applications of component mining systems worthy of further study in the second phase. PRESENT STATE OF AUSTRALIAN SURFACE COAL MINING captured data on major items of equipment and operational experience via a research questionnaire which was sent out to the mining industry. NEW SURFACE MINING METHODS AND EQUIPMENT TENDENCY identified the thrust of future development by examining individual equipment items and operations. It reviewed conventional equipment, including draglines, blast hole drills, shovels and trucks, as well as less conventional equipment such as continuous excavators and high angle conveyors. REPRESENTATIVE COAL PROSPECTS looked at the geological, geotechnical and hydrogeological data on significant existing coal deposits and those likely to be significant in the future.

In phase two of the project, four study groups analysed numerous scenarios involving the conceptual application of potential mining systems, basing their analyses on four different deposit types most likely to represent expected surface coal mining operations over the next twenty years. At the same time, two other task groups undertook further research with industry-wide ramifications. OPERATIONAL RESEARCH examined the operational research aspects associated with each of the four deposit types mentioned above, during which they looked particularly for opportunities to improve productivity. TECHNOLOGICAL OPPORTUNITIES explored the possibilities that technological developments could open up within the fields of research, development and education.
CULTURE SHIFT AND IMPRESSIVE PRODUCTIVITY

Major changes in the Australian surface coal mining industry were consistent with the project’s recommendations:

- A fundamental CULTURE SHIFT in the management and workforce of the major mining companies resulted in significant PRODUCTIVITY IMPROVEMENTS to the original mining systems, most notably to WORK PRACTICES and, to a lesser extent, equipment capability.
- As an example, in 1984, 45m³ DRAGLINES were reasonably expected to handle a total of 12 million cubic metres of overburden (useful work plus rework) a year. Nearly twenty years on, these same draglines are handling 15 million cubic metres a year.
- Other impressive improvements have been extracted from SHOVEL/TRUCK OPERATIONS, where both operational (actual working hours) and technical (truck capacity) improvements have LIFTED FLEET PRODUCTIVITY from 1984 levels of approximately 4.5 million tonnes per annum to current levels of 20 million tonnes per annum.
- The coal mining industry established its own SUCCESSFUL RESEARCH AND DEVELOPMENT CAPABILITIES in 1992 through the Australian Coal Association Research Program (ACARP). The major benefit is that research funds are targeted at the specific needs of the coal mining industry.

PLAN, MAXIMISE, ADAPT AND DEVELOP

The recommendations arising from this project included:

- Need for advanced mine planning and pre-stripe programming (because of their impact on other interdependent decisions), to ensure that economic coal production levels could be maintained into the future.
- Mining industry should maximise equipment availability (especially since draglines were the preferred stripping mechanism) and labour productivity, if Australian coal was to remain profitable in world markets.
- Mining companies should take advantage of surface mining equipment not typically used in the Australian black coal industry, including bucket wheel excavators, belt conveyors, in-pit crushers, spreaders and cross-pit conveyors.
- In order to meet future mining requirements, the industry should investigate the use of larger trucks, with preliminary design capacity estimates of between 500-600 tonnes, and even up to 1000 tonnes.
- Engineering education should adapt to cater better for future new technologies in surface mining. In particular, education should encourage the business and even entrepreneurial qualities of engineering students, who should also integrate a wide range of interdisciplinary skills and techniques into their professional portfolios.
- Australia should develop a mining equipment manufacturing industry, to maintain the wealth-creating activities of the coal mining industry.