Don Kellerman taps ceiling with sparkless brass mallet to make sure it is safe to work under. Don’s shirt and overall pockets bulge with record-keeping notebooks.
FACE FOREMAN
Coal Mining's Toughest Assignment

DONALD G. KELLERMAN holds a job that few men want—and even fewer can master.

Don is known in his coal-mining profession as a face foreman. He manages a seven-man crew for eight hours, five days a week, at the mine’s face 650 feet underground.

Don works for Sohio's Old Ben Coal Corporation subsidiary at the year-old, ultramodern Mine 26 under Southern Illinois' rolling farmlands near Sesser.

Not every man aspires to become a face foreman. The job's unremitting responsibility for the welfare of others is too much for many. The foreman is responsible for, among other things, his men’s safety, their on-the-job training, and their production.

A face foreman is a leader, able to cajole reluctant men, humor them, encourage them—and above all, to earn their respect.

For all of these reasons, the face foreman's work is demanding. Eugene T. Moroni, Old Ben’s vice-president for Underground Mines, once a face foreman himself, says it is the toughest job a coal miner can tackle. It's far easier to worry only about one's own problems and never shoulder those of others. And only after intensive training—and a grueling state-administered examination—is a man licensed to be a face foreman.

Don Kellerman joined Old Ben as a coal miner five years ago. He is the first coal miner in his family, although his grandfather was a steam engineer at a mine when steam powered above-ground equipment. Don's father was a railway engineer.

Don was graduated from Pinckneyville, Illinois, High School, served three and a half years in the Seabees, and worked as an earthmover operator for several years.

"I didn't mind the work," says Don, who speaks softly and deliberately. "But to work steady often meant driving 70 miles to the job. That's too far and still have any family life. And the work was seasonal, which meant we lived well in summer but were pretty tight the rest of the time."

Changing to coal mining was natural. In Southern Illinois the coal industry is big. Every person is touched by it in some fashion from youth on. To Don the work sounded fascinating, for he always had welcomed the challenges of nature, whether it be remodeling her with earthmovers or harvesting farm crops.

Coal mining also offered work close to home. Steady work, too. His first job was helping sink an air shaft to Old Ben's Mine 21. From that job he became a miner.

In a couple of years, he stood on the top rung of the nonmanagement ladder. He was a miner operator, the man who guides a 42-ton boring-type mining machine through the coal seam.

MINER operator is a responsible and difficult job, because the seven-man team cannot be successful unless he is successful. It requires a certain innate capacity to keep up production yet prevent harm to yourself and the machine.

After a year Don decided to try the leap into management that most men don't attempt. He asked Moroni, who had hired him at Mine 21, for advice.

Past industry-wide practice held that becoming a face foreman was a man's own business. He attended classes on his own over a long period of time. It so happened

Carolyn and Don Kellerman enjoy their large lawn with daughter Kim. Son Kent, 8, was in school. Later in the afternoon Don reported for work at Mine 26.
A summer weekend may find the close-knit family water skiing on the Ohio River. Don also occasionally helps a neighbor farm.

The Kellermans' property is carved out of farmland, and livestock are on three sides. "My neighbors don't give me any trouble when I'm working nights and sleeping days," Don says with a wink. "But when they do get noisy, I just put them into another pasture. You can't do that in a city."

The young foreman approaches his job with enthusiasm and confidence, which he allows is the result of his training.

Before going underground, as the shifts change, Don talks at length with the face foreman he is relieving, as well as the general and section foremen. He learns about the condition of the equipment. And he brings himself up to date on conditions in the mine, which change constantly.

Mother Nature is as capricious underground as aboveground. "It's hard to make a new man understand, but every time the arms on the mining machine go around (which is quite a few times a minute), conditions change," explains Don. "The more you know about conditions before you go down there, the better off you are." Don carefully notes—mentally and in writing—everything that might foretell the unexpected.

Upon arriving at the mine face aboard a miniature electric train, Don's team, one of nine or ten working at different faces that shift, immediately checks equipment. This includes the boring machine, which may require replacement of its many thumb-sized, diamond-hard teeth; two electric shuttle cars, which haul seven tons of coal each; and a roof-bolting machine.

Don checks for gases and reports his findings in a log required by Federal regulations. He gauges ventilation in the tunnels, which measure 12 feet 2 inches wide and 6 feet 6 inches high. He surveys to ascertain that the electric miner is moving arrow straight in the right direction. He taps the roof with a brass hammer to check its soundness. Except for battery-powered lights on each miner's safety helmet and an occasional light bulb along the ceiling, the mine is dark.

When the crew is ready, the miner begins its growling, grinding, scraping crawl through the coal seam. An electric shuttle car moves in behind it to receive coal via a conveyor system. In moments the miner has moved two feet, which means the shuttle car has seven tons of coal aboard. The miner pauses, the buggy bogs back away and disappears in the darkness with its heavy electric extension cord trailing behind.

The second shuttle car moves in behind the miner, and the process repeats. The shuttle cars unload coal onto a conveyor belt system which moves the coal to the mine shaft for automatic transport via a hoist to the surface.

Two men operating the bolter, meanwhile, drill closely spaced holes in the roof and insert long bolts to clamp the roof of the mine to layers of rock above.

"We try to load at least a hundred shuttle cars each shift," Don says. "And barring equipment problems we usually make it."

Vice-President Moroni sees in Don Kellerman the qualities he believes are necessary in every good face foreman.

"We look for someone with ambition who wants to get ahead," Moroni says. "Initiative and the desire to do a good job are important. A face foreman has to be a leader; he must have get-up-and-go."

Old Ben Coal Corporation set a coal production record in 1969—nearly 12 million tons. Moroni gives much of the credit to his face foremen.
THE SCIENCE OF MAKING DECISIONS
by Joe Franko

If a poker player knew what the next card in the deck would be, he'd know whether it would pay him to draw.

A manager faces the same kind of problem when he makes a decision. Knowledge and experience aren't always enough. Intuitive judgment can betray him. If he had some way to reliably forecast the consequences of his action—if he could accurately measure the odds—he could make better decisions.

In recent years science has come to the aid of the manager. It is helping him look around those decision-making corners through a concept called management science.

Management science techniques were used for military planning in World War I.
but it wasn't until World War II that a unified concept of management science evolved. The British employed it, under the name operations research, to quantify various military alternatives. Their problem at first was to achieve maximum use of a relative handful of Royal Air Force fighters in repulsing hordes of enemy bombers. They later employed the scientific method in deploying radar and antiaircraft units, in determining the pattern for hunting submarines by air, and for designing communications systems.

The concept proved itself during the war, and subsequently industry in Britain and the United States gradually adapted its techniques. When the computer era boomed, so did management science. Computers dramatically expanded the application of management science to decision-making.

Management science has been in use at Sohio since the late 1940's. It was used primarily for allocating crude oil to refineries and relatively simple problem-solving until 1960. Then the various localized management science functions within the company were gathered into a corporate staff at Home Office.

Today's Management Science staff comprises 15 persons whose backgrounds are generally in mechanical and chemical engineering and mathematics, plus graduate degrees in operations research.

When the manager of an operating unit has a problem, he "hires" Management Science to try to solve it. A Management Science study team of from one to four members is assigned. Studies usually take from a few weeks to a few months.

At first glance management science seems like a contradiction of terms. Management is an inexact art—hunchy, fast-moving, and basically people-oriented. Science is precise, methodical, and essentially thing-oriented. They don't seem to be compatible.

But the two can be married when the alternatives facing management can be translated to the language of science: mathematics.

Remember your high school algebra where the equation $A + B = C$ was a kind of shorthand for "real" numbers? In somewhat the same fashion, management science translates the factors involved in a decision—such as sales, costs, and profits—to mathematical symbols.

By so doing, it's possible to superimpose, say, future market demands on present refining capacity and see that Sohio needs to expand Lima Refinery, as it is indeed doing.

"Broadly speaking," says Saber, "Management Science seeks to test alternatives to see what might happen if you took any one of a number of possible actions. We try to quantify factors affecting the decision so you have some measurement of how good or how poor are the chances of a given possibility succeeding.

"How much gasoline are we going to have to sell ten years from now in order to recoup our costs of expanding the refinery? How big should the expansion be? What is going to be the effect on our supply sources and distribution system? What will the increased operating costs be?"

Management Science strives to eliminate or minimize the hunch-playing in decision-making. The application of management science does not insure perfect decision-making, but it offers a systematic way to increase the chances for correct decisions.

Management Science—both the staff and the philosophy—was employed in selecting the sites for Sohio's two packaged products and TBA warehouses in Ohio.

Using a computer model, the Management Science staff was able to pinpoint the areas where the ton-mile cost of shipping from supplier to warehouse and from warehouse to distribution points was minimized.

The keystone of management science is the application of a "measure of effectiveness" to each problem. Management scientists call this "optimization.

Suppose you are trying to find the optimum inventory for a service station. You could fill every shelf with windshield wipers, thus making certain you are able to fill every customer's order. That kind of stockpiling ties up capital, and it courts disaster if the products can spoil or become obsolete.

On the other hand, you could carry a meager inventory of blades, thereby spending little money but also losing sales and making customers unhappy.

Somewhere between these extremes is the optimum, the most rewarding blend of costs versus sales. Management science helps identify that optimum.

Saber and his staff developed suggested mathematical models for optimum service station inventories. They also evolved an inventory model for the Twinsburg warehouse. Fed into the computer, this series of equations and quantities makes it possible to automatically control inventory levels at Twinsburg.

"The computer keeps track of inventory," Saber explains, "and when it gets down to a certain level the computer prints out an order for replenishment."

Mathematical models are numerical descriptions of a real situation, system, or problem. They are used to predict what would happen in a "real-life" situation if certain changes were made or conditions were modified.

The value of simulation is illustrated by Management Science's contributions to Sohio's electrokinetics research. The research chemists' problem was: How should a battery be shaped to yield maximum power output per pound? The chemists could have experimented directly by making different sizes and shapes of batteries and
Management scientists apply mathematical measurements to the factors involved in making a decision. They can do it with pencil and paper, but computers have dramatically enlarged their role in corporate decision-making.

Measuring the relative power output of each. But it is expensive to handcraft batteries. Trial and error would have been prohibitively costly.

Management Science formulated a mathematical model of the problem and, by manipulating the variable factors in the computer instead of the laboratory, was able to identify the optimum battery size in relation to power and cost.

When the problem is too complex for pencil-and-paper jottings, the Management Science analyst uses the computer.

Such a complicated computer simulation or model evolved Sohio’s “recipe” for blending gasoline—without ever touching a drop of product at the refinery itself.

By using algebra-like equations to represent ingredients and performance characteristics of the product, it was possible to simulate the refinery blending situations and evolve an optimum blend.

Other basic applications of management science include determining inventory levels, allocating resources, sequencing or scheduling, and random sampling—as in quality control procedures.

While Management Science has worked for nearly every department, its “best customers” are Marketing, Refining, Research and Engineering, and Vistran Corporation.

A model for the manufacture and distribution of Vistran’s nitrogen products has become a guideline for the agricultural chemicals industry. “Supply planners now base their thinking and cost patterns on it,” Saber comments.

Management Science also will be attacking problems for Old Ben Coal Corporation and for BP Oil’s marketing operations.

While management science has become highly sophisticated in recent years, Bob Saber still considers it an emerging management tool. “Management science is becoming an essential part of the management technique,” he says. “It’s now part of business administration training in colleges, and the younger generation of managers almost takes it for granted.

“But management science still is working largely at the frontiers of its potential. “We management science specialists have to become a lot smarter. We have to assist in decisions of greater magnitude. The real potential of management science is to make possible more-sophisticated top-policy decisions through scientific techniques.

“When you know what the odds are,” Bob Saber says, “you have a better chance of winning.”
BUILDING A GIANT

Working on a job in which a bolt can be the size of your arm and 450-ton steel towers swing into place at the end of a crane, a man could well get the idea that he’s pretty small. Such is the work of the employees of Fluor Corp., general contractor, and the subcontractors who are building Sohio’s $75-million Lima Refinery addition.

Far from being intimidated by the sheer size of the project, the men scale the giant towers and manipulate the huge machinery with a casualness born of confidence and experience. Sohio photographer Charles Proctor caught some of this atmosphere of busy craftsmanship in these photographs.

When the expansion is completed this June, it will increase Lima Refinery’s capacity from 59,600 to 130,000 barrels of oil per day.