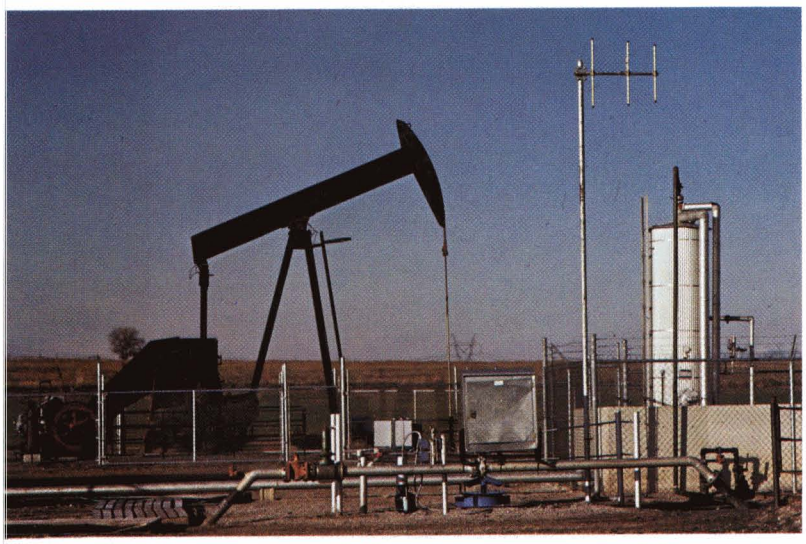
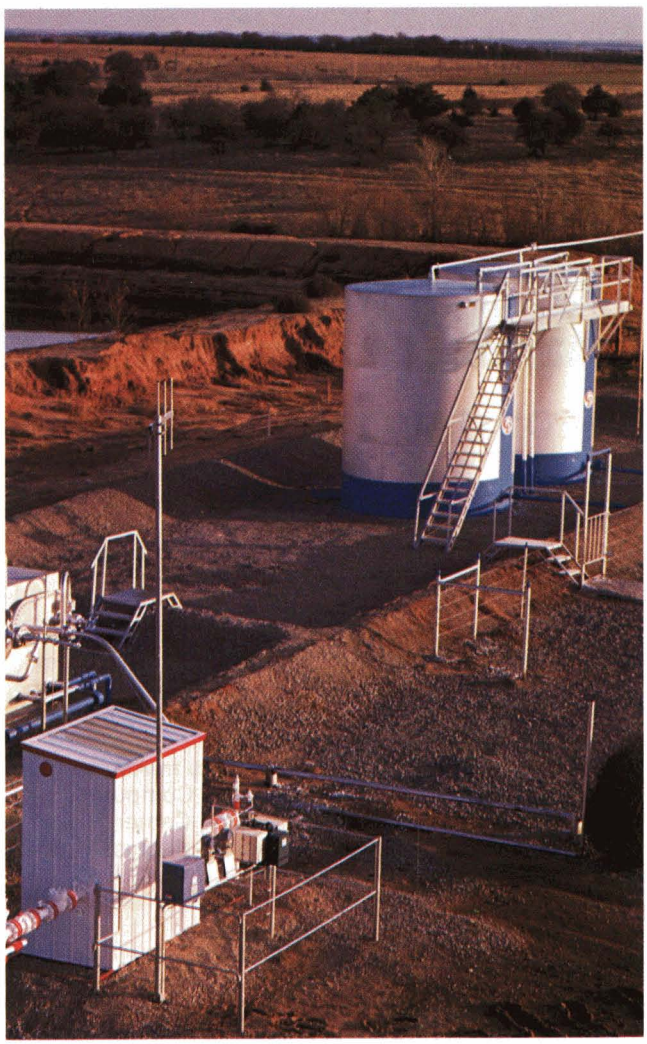
SPACE TELEMETRY FOR THE ENERGY INDUSTRY

An automatic system for monitoring oil and gas flow exemplifies spinoff aids to development, production and conservation of energy

This Oklahoma oil well has an automatic system that measures flow and reports its information to a central computer. The wellhead measurement station consists of the antenna and related equipment in the foreground.





Space telemetry is the process whereby information acquired in orbit is relayed to Earth. Electronic equipment in the spacecraft converts instrument data to coded signals that are transmitted by radio, picked up by an antenna on the ground, fed to a receiver and there decoded to become useful information. Telemetry is a means of moving a lot of information rapidly. The data can be sent in "real time"— meaning right now, as it is acquired, rather than stored on tape and transmitted later. Additionally, a spaceborne system can be interrogated by signals from Earth, or it can be commanded to perform some function.

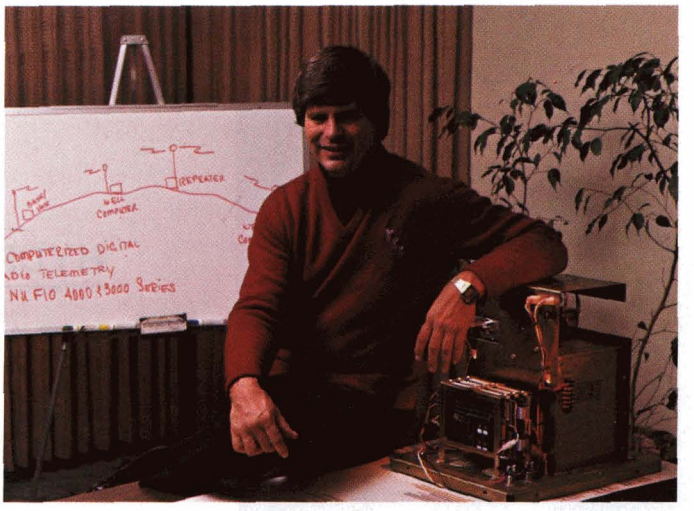
These features make telemetry a natural for Earth applications in an era of explosive communications expansion and growing need for computer-connected systems capable of handling large volumes of information on a two-way, real time basis. It is already being used for air pollution sampling (see page 120), for collecting weather or water quality data from remote stations, by physicians for interrogating human-implanted devices, by hospitals for monitoring the conditions of a number of patients from a single location. A new use of telemetry, introduced last year, is automatic measurement of the flow at unattended oil and gas wells,

offering unprecedented accuracy, cost benefits and a variety of ancillary advantages.

This application is the brainchild of Bill Sheen, president of Nu-Tech Industries Corporation, Oklahoma City, Oklahoma, formed in 1981. Sheen saw a need for a better way of monitoring flow, due to high costs of oil and gas, increasing oil field theft and a mounting requirement for more timely information to speed up accounting procedures. For decades, the energy industry relied on mechanical chart recorders for flow data; these recorders provide basic flow data that must be integrated with other data to get a total flow measurement picture, a time-consuming process often subject to error. Sheen felt that a computerized system would offer far greater accuracy, instantaneous calculation and a cost-effective, automatic means of transferring all data of interest from wellhead to producer and purchaser.

Nu-Tech turned to NASA for assistance, which was provided by Kerr Industrial Applications Center (KIAC), located at Southeastern Oklahoma State University, Durant, Oklahoma. KIAC conducted a search of technical literature in a number of areas specified by Sheen and delivered voluminous information that enabled Nu-Tech to evaluate ways of packaging a flow measurement system from existing equipment and techniques. KIAC's service, says Sheen, saved his company time and money, allowed sharper focus of company research and development, and identified proven equipment and methods as a basis for the design effort. Along with telemetry, Nu-Tech incorporated space-derived gas measurement, microcomputer and microswitch technologies.

The system that emerged from two years of research, now in production at Nu-Tech's Fort Worth, Texas facility, is known as the Remote Measurement and Control Network. It operates at several levels, beginning at the wellhead. Nu-Tech's microprocessor-based measurement station—called Nu-Flo—accurately computes the flow twice every second. The wellhead station also includes a power source and a backup to assure uninterrupted operation; the radio telemetry system for relaying the data and for accepting queries and commands from control stations; and a series of sensors for monitoring and reporting the status of all of the equipment at the wellhead. The system generates an alarm when it detects power or communications anomalies, or when an unusual flow rate suggests problems with production equipment, or—an optional feature—when it senses a sudden drop in storage tank level that might indicate theft.



Above, Bill Sheen, president of Nu-Tech Industries, displays a key element of the energy monitoring system he developed: the Nu-Flo measurement station. Shown in a well installation at left, the compact Nu-Flo "blue box" contains computerized equipment to measure flow and other data, make calculations, generate warnings and relay its findings via radio telemetry.

A centrally-located base operations center continually "polls", or interrogates, each of the wellhead stations within its area of cognizance; with a 185-foot-tall antenna, it can communicate with wells within a 50-mile radius. Base operations builds a computerized activity file on each station, then forwards it to a master station, which Nu-Tech calls the Host Computer Complex. Hub of the network, the host computer collects flow information from each base operations center on a periodic basis, then consolidates and stores the data. Customers have access to either up-to-the-minute flow data or historical representations through Remote Data Access Stations—computer terminals—located in their own offices. A large energy company, of course, may want to operate the host complex itself, to protect proprietary information; for smaller companies, Nu-Tech provides the host computer service and employs secure access codes to insure customer protection.

The big advantage of the electronic measurement network is its demonstrated accuracy. The Nu-Tech system was evaluated, along with a mechanical chart recorder, by the Colorado Engineering Experiment Station, Nunn, Colorado, an independent, non-profit testing organization. The results showed Nu-Tech's equipment to be far superior to the chart recorder in flow measurement accuracy; in 13 test runs, Nu-Tech's biggest error was less than one percent, its best showing was off by only one-fiftieth of one percent.

That kind of accuracy has big economic value—for example, it minimizes errors of overpayment by purchasers or underpayment to producers that occur frequently due to faulty flow data. The real time availability of flow information allows billing accounts on a current basis, rather than the customary 60-90 day delay. Other major advantages include the producer's ability to control his wells remotely and to feed the pipeline exactly the amount of product desired; better utilization of maintenance personnel, who can be dispatched to problem wells as indicated by the wellhead monitors; electronic storage and retrieval of data, eliminating the need for manually maintaining files; theft deterrence through the alarm feature; and early detection of leakage. Collectively, these advantages add up to great potential for cost reductions and increased production efficiency.