Pacific drilling dates Atlantic opening

It is typical of the new global view of earth-shaping forces brought to us by discoveries in geophysics in the last decade that ocean-bottom rocks recovered from beneath the Pacific Ocean can tell scientists something about the processes that created the Atlantic Ocean.

That's exactly what has happened as a result of the 32nd voyage of the Glomar Challenger, completed in October. The research vessel of the Deep Sea Drilling Project recovered cores from the Pacific floor between Japan and Hawaii. One of the most significant results established that an unusual magnetic band in the northwest Pacific corresponds to a similar band existing on both sides of the Atlantic Ocean. Geophysicists read these magnetic stripes—"frozen" into cooling rock shortly after new ocean crust is created—in much the same way archaeologists read tree rings to determine the age of the tree and conditions during the past.

From geologic study of the cores retrieved near the magnetic band, the scientists determined that it represents the period of approximately 115 million to 150 million years ago; its width indicates that sea-floor spreading was creating new ocean crust about twice as fast as normal during that period.

The correlation with the magnetic stripes in the South Atlantic allows the scientists to obtain the most accurate date yet for the opening of the South Atlantic Ocean: That event occurred about 125 million to 130 million years ago. At that time the fledgling Atlantic was just a narrow strip of water, like the Red Sea or the Gulf of California today.

Balloon-borne antennas: Boon to communications

More than two miles in the air above balmy Grand Bahama Island floats a balloon. But what a balloon it is. Taller than a 15-story building, the 175-foot behemoth is a brilliant white, held in place by a brawny cable that anchors it to the ground. By day, brightly colored pennants mark the cable every 500 feet, while by night both balloon and tether are illuminated by flashing strobe lights. Airplane pilots give it a three-mile berth.

It sounds (and looks) like some bromdignagian beach-front billboard dreamed up by the department of tourism. In fact, however, the bulbous bubble is all business. Attached to its belly is a compartment packed with automatic television and radio equipment which its owners hope will make it the answer to the communications needs of developing nations.

The balloon's lofty vantage point, according to a Westinghouse subsidiary called TCOM (for Tethered COMmunications) Corp., would enable it to take the place of at least 15 conventional broadcast and microwave towers. A 3.2-watt transmitter aboard the "aerostat," says the company, would produce the same signal strength 100 miles away as a 1,000-foot tower with a radiating power of 100,000 watts.

No people ride the aerostat. At present the electronics are powered by a gasoline engine, and about once a week the balloon is reeled in, the engine gassed up and the whole thing let out again, a process that takes under two hours. For two years, however, TCOM has been working to replace the tether with a giant extension cord—"so you don't have to play the elevator game," says one engineer. The balloon arrived at Grand Bahama in August, and its aerodynamic stability—a major factor in the design—has exceeded expectations. After a test broadcast of the sixth game of the World Series, TCOM engineers discovered that their baby had been calmly riding out 93-mile-per-hour winds from Hurricane Gilda with less than 1,000 feet of drift.

A typical one-balloon system might cost $5 million, but tethered-balloon broadcasts themselves are nothing new. In 1920, a Pittsburgh radio station lofted a balloon-borne antenna to carry the election of Warren G. Harding. □

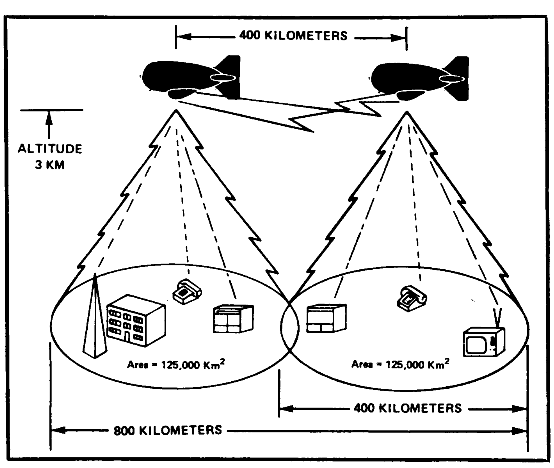
How the cat's tail twitches

This is the time of year when cats yowl at the Harvest moon or twitch their tails from broomsticks. But 20 cats at the National Institutes of Health have just finished lending their tails to muscle research.

They were under the supervision of D. A. Riley, a muscle anatomist who is attempting to find out how nerves influence the muscles they innervate. He chose cat tails for several reasons.

The muscle fibers in the tails were segregated from the rest of the cats' bodies so the cats could go about their normal business while their tails were being studied. Sensory nerves innervating the muscles in their tails could be severed, so they did not feel the tests being conducted on their tails. The nerves innervating the tail muscles could be silenced so that Riley could stimulate them at will. Riley was also able to surgically remove various muscle fibers from the tails for examination under the microscope, then sew the tails back up. "The cats were not disturbed by this," says Riley.

Each unit of muscle fibers is innervated by one nerve. That nerve stimulates the fibers with a particular electrical pattern. Low electrical frequencies in long bursts—tonic stimulation—are sent into muscle fibers involved in ongoing muscle activities, such as jogging, running, holding something in your hand, maintaining posture. High frequencies in short bursts—phasic



TCOM

Balloon-borne antennas: Possible answer to communications needs.

stimulation—activate muscle fibers needed for quick action, such as lifting weights, throwing a rock or running after a purse snatcher. But do different patterns of nerve stimulation (electrical stimulation) affect muscles at the biochemical level? And if so, how? This is what Riley is trying to determine. He has made progress in that direction, thanks to his feline charges.

He stimulated the nerves innervating the muscles in the cats' tails. The nerves in turn stimulated the muscles, as they normally would have had they not been silenced. He used either tonic or phasic electrical programs, and found that both kinds of stimulation affected the muscle fibers at the biochemical level. The patterns activated the specific energy-deriving enzymes that one would expect.

Tonic bursts activated oxidative enzymes. These are the enzymes that, with the help of oxygen, convert glycogen stored in muscle into ATP (energy molecules). Tonic stimulation is known to be involved in ongoing muscle activities, and oxygen is the most efficient source of energy metabolism. So understandably stimulation of oxidative enzymes would give muscles the efficient source of energy needed to carry out long-range activities.

Phasic stimulation, on the other hand, stimulated glycolytic enzymes. These enzymes can convert glycogen to ATP without the presence of oxygen. This is a much less efficient source of energy than oxidative glycolysis. Yet during rapid motion, muscles do not get enough oxygen for enzymes to use for energy conversion. So glycolytic enzymes probably have to be switched on for emergency energy use.

Although Riley's work is basic research, he thinks his findings have implications for everyday human muscle activity. "We have units of muscle fibers that are rich in oxidative enzymes, and units that are rich in glycolytic enzymes," he says. "The former are called into action for long-range muscle use, and the latter for short bursts of action. If you train for long-distance running, you call on your oxidative enzymes. If you train for weight lifting, you call on your glycolytic enzymes."

Riley hopes to look into the effects of nerve firing on diseased muscle. In chronic spasticity such as Parkinson's disease, nerves fire continuously or more often than normal. It is quite possible, Riley speculates, that an overabundance of tonic stimulation leads to the tremors (muscle contraction) associated with the disease. At first muscles fatigue from being required to continually contract. But they eventually build up enough oxidative enzymes to provide the energy necessary for chronic contraction. □

An entire observatory under computer control

Astronomers have long used computers for computation and for such other matters as directing radio telescopes. Now the Massachusetts Institute of Technology claims the world's first completely computer-controlled astronomical observatory. It is the George R. Wallace Observatory located in Westford, Mass., about 40 miles from the MIT campus. Its director is Thomas B. McCord, associate professor of planetary physics. The observatory was dedicated on Oct. 14; its 24-inch computer-controlled telescope was turned on Oct. 31.

All the astronomer has to do is pick a star; the computer does the rest. The astronomer types identification coordinates for the star he wants into the main computer, a Datacraft 6000. The computer searches star catalogues in its memory for the location of the star. It then brings the telescope to bear on the star and instructs a slave computer to track it. Meanwhile the main computer takes data, analyzes it, performs whatever experiments the observer wants and reports back to him.

One of the main reasons for automating an observatory is the current crush on telescope time. There are many more astronomers with observations that they want to do than there is telescope time to accommodate them. As McCord puts it, "So much time must be spent positioning the telescope, aborting observations because of poor guidance, adjusting experimental instruments for each observation and recording useless data because the astronomer can't know when he has all he needs. The MIT telescope system reduces or eliminates all these problems, making it possible for more astronomers to use a single telescope."

The computerized telescope can also do some things that conventional ones cannot. It can find invisible infrared objects even in the daytime; it can conduct precise scans of the sky for mapping, and it can quickly reposition itself for multisource observations. The computer system cost $500,000, of which $300,000 was given by a retired industrialist from Fitchburg, Mass., George R. Wallace. The 24-inch telescope is not large as telescopes go, but the installation may indicate the way to go to apply computerization to larger installations. □