for 15 major oil companies over most of this period, while 15 independent oil companies employed an average of 7%. All oil companies together accounted for 75% of the total membership in all areas.

Membership trends in California alone for each year bear a resemblance to exploration activity over the period analyzed. The peak year in California's drilling record for exploratory holes completed and footage drilled corresponds closely with the high point in Pacific Section membership.

Membership figures used in this analysis consist of the total number of active and subscriber members. Only paid members could be counted inasmuch as all available lists include only this group. A check was made against the geographical roster of the national A.A.P.G. March *Bulletin* for each year to find the relation between national and Pacific Section members.

CHARLES C. BATES, Advanced Research Projects Agency

Vela Uniform—Nation's Quest for Better Detection of Underground Nuclear Explosions

Negotiations between the USSR, United Kingdom, and the United States have been in progress since 1958 in an effort to achieve a treaty for cessation of nuclear weapons testing under an effective control system. To support these negotiations, the President announced in May, 1960, a major expansion of the present research and development program, VELA UNIFORM, directed by the Advanced Research Projects Agency. The program's goal is to provide a markedly improved capability in detecting and identifying underground nuclear explosions during the coming two years. Starting as a $10,000,000 effort in the fiscal year just past, spending during the present year is at the rate of about $66,000,000, making the project the largest terrestrial science effort underway within the U. S. at the present time.

The Advanced Research Projects Agency, with the technical assistance of the Air Force's Technical Applications Center, is employing several approaches for rapidly improving the state of the art in subsurface nuclear test detection. These include a several-fold expansion of the effort going into basic seismological research; procurement of instruments for a world-wide seismic research program; development of improved seismic instruments; construction and operation of prototype seismic detection stations; and an experimental program of underground explosions encompassing both high explosive and, where necessary, nuclear explosions. Already in the program are such government agencies as the Department of Defense, Atomic Energy Commission, Department of Commerce, and Department of Interior, as well as universities and private organizations, both profit and non-profit. Provision has been made for investigation of all aspects of improvement considered feasible. To this end, unsolicited proposals bearing on such improvement from both profit and non-profit organizations, domestic and foreign, are invited. Outstanding unsolved problems include development of a better global knowledge of the layering of the earth's crust, a need for improved instrumentation and data analysis capable of markedly improving signal-to-noise relationships, improvement of techniques for distinguishing at great distances the differences between earthquake and explosion-induced seismic signals, and the providing of on-site inspection techniques that are much more rapid and economical than those existing today.

CHARLES B. OFFICER, Marine Geophysical Services Corporation

Petroleum Exploration with Gas Exploder and Sparker Offshore California

Petroleum exploration with the Gas Exploder and Sparker has been conducted over a number of offshore and inland water-covered areas of interest throughout the world. One of these areas which has received considerable attention has been offshore California.

A description of both the Gas Exploder and Sparker equipments and methods of operation is given; illustrative records of each are shown and discussed. The results are presented in the form of a geologic cross section. The structural configuration is shown in detail. In general offshore California, both the configuration of anticlines and the strike and dip of fault planes can be mapped.

The Gas Exploder obtains continuous reflections down to depths of 3,000–4,000 ft. The seismic source for the Gas Exploder is the underwater explosion of a mixture of propane and oxygen in an open cylinder.

The Sparker obtains continuous reflections down to depths of 600–800 ft. The sound source for the Sparker is the underwater detonation of a 10,000-volt spark discharge. The Sparker shows more detail of the structural configuration down to 600–800 ft. than the Gas Exploder.

Both the Gas Exploder and the Sparker can be operated at the same time on the same survey. Several of the more recent surveys have been conducted in this manner.

CARL H. SAVIT, Western Geophysical Company of America

Solving the Singing Record

Extensive theoretical study and experimentation reveal that theoretical models do not approximate actual singing situations to better than the first order. Measurements of singing amplitudes, however, indicate that, in many cases, attenuation of singing must be of the order of 40 db in order to produce a useful record. Based on these observations, a system was designed using cascaded frequency-domain filters and empirically determined parameters to remove the singing-complex from tape-recorded data. Application of this system to singing records from various areas of both the eastern and western hemispheres has been spectacularly successful.

WENDELL H. RUSSELL, Baroid Division, National Lead Company

Quantitative Mud Analysis for Hydrocarbons

Prior to recent developments, results obtained by mud-analysis logging have been qualitative not quantitative. The magnitude of gas shows obtained was not necessarily an accurate reflection of the concentration of gas entrained in the drilling mud. Nor could one safely assume that similar concentrations of gas in different mud samples would yield readings of similar magnitude.

The analytical method employed in determining the type and concentration of hydrocarbon gases in the drilling mud was the weak point in early mud logging. The gas chromatograph, incorporated in present equipment, has overcome the analytical problem. The remaining obstacle to precise mud analysis has been that of extracting all the hydrocarbon gases from the drilling mud for analysis. With the development of equipment