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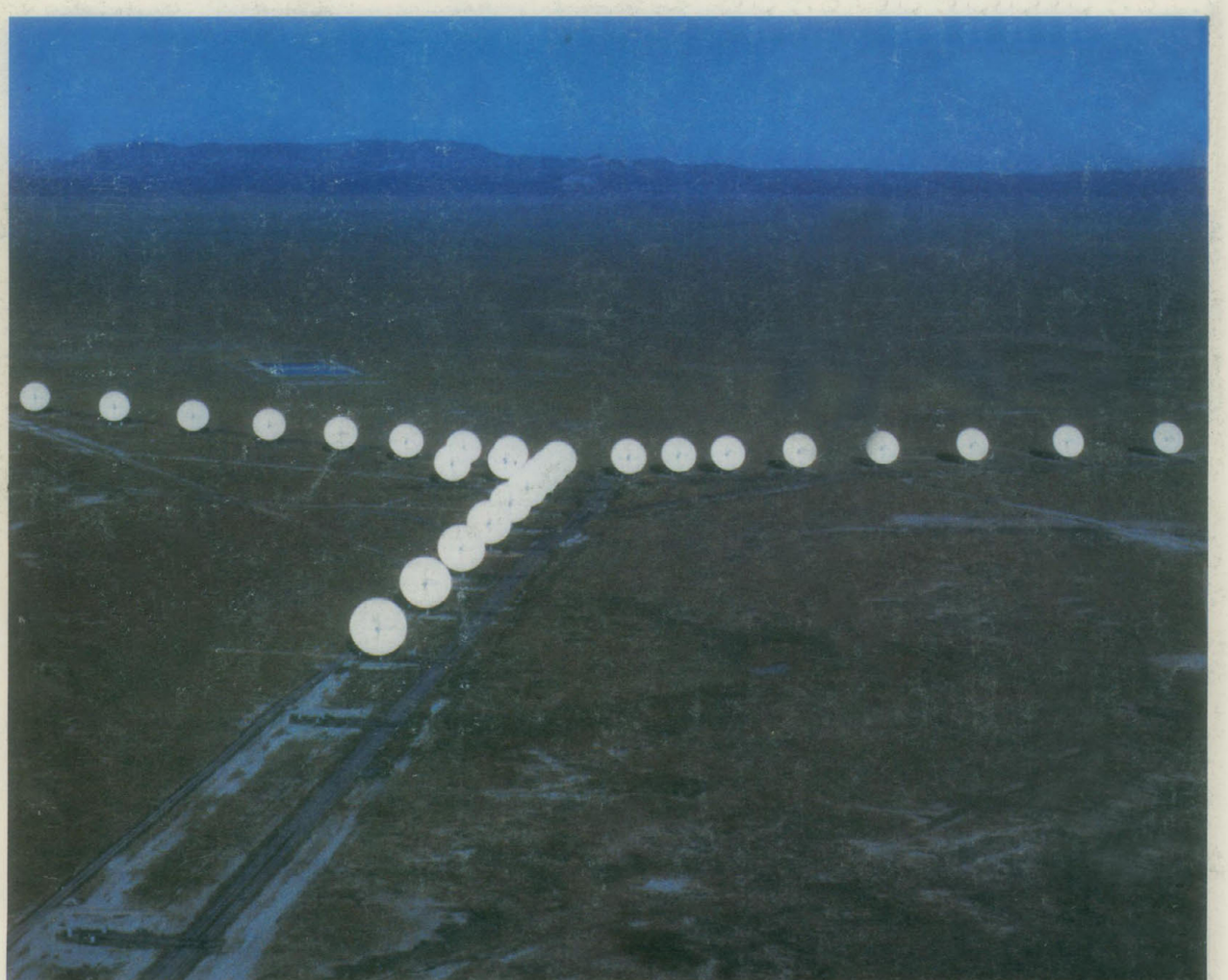

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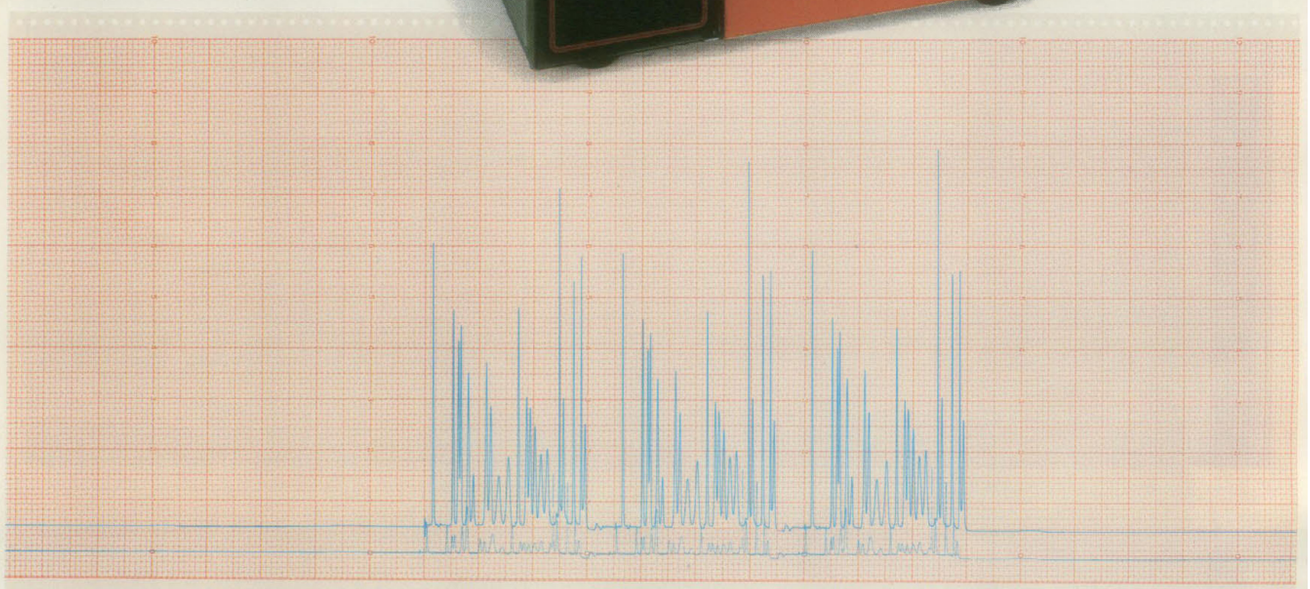

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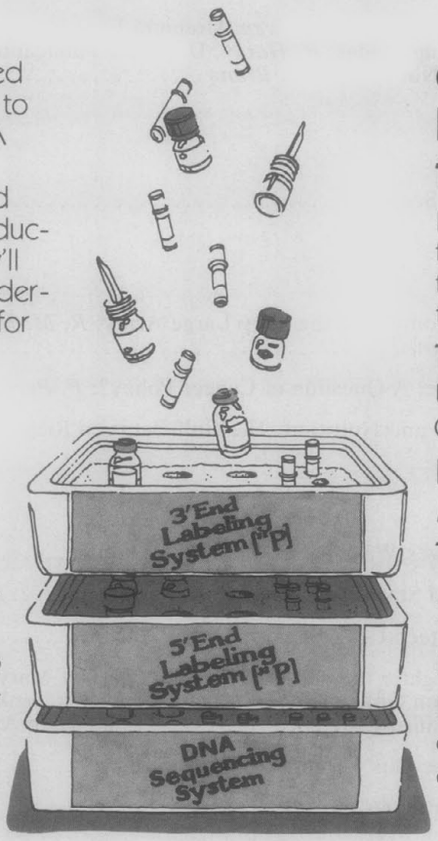

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LEADER IN BIOTECHNOLOGY

ISSN 0036-8075

18 June 1982

Volume 216, No. 4552

SCIENCE

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with **The Science Monthly®** Copyright © 1982 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): $48. Domestic institutional subscription (51 issues): $85. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $55. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $3 ($3.50 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

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COVER

The Very Large Array (VLA) of 27 radio telescopes, seen here in its smallest (1 kilometer) configuration on a high plain in New Mexico, is an instrument used by U.S. astronomers to make radio pictures of the sky with the resolution of optical telescopes. See page 1279. [Photograph provided by the National Radio Astronomy Observatory, operated by Associated Universities, Inc., under contract with the National Science Foundation]

High Tide in New Mexico

Tidal movements of the earth have long been a subject of man's speculation.

A remarkable oscilloscope inside "Frustration Mine" in the Manzano Mountains records the output of tiltmeters. Highly sensitive transducers send out analog signals which measure the slant of the earth's surface in nano-radians (1 nradian = 57×10^{-9} degrees). With digitizing rates as slow as 1 sample/200 seconds, the Nicolet digital oscilloscope captures and stores up to 72 days of continuous data without human intervention. (Figures 1 and 2).

Whether making measurements for months or microseconds, Nicolet oscilloscopes increase data accuracy. Figures 3 and 4 show pressure waves in a seismic core sample. Waves from separate trials with different core pressures are superimposed on the screen and plotted for comparison. The 1.05 microsecond difference in arrival times is easily read from the screen's numerics.

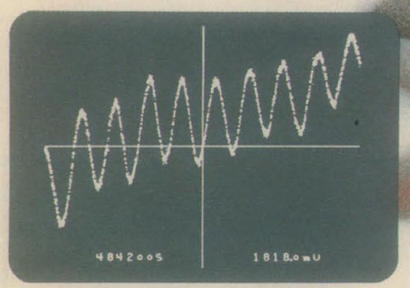

Fig. 1: 5-day section of earth tide record centered 2-1/2 days from start. Sun and moon are in phase (new moon).

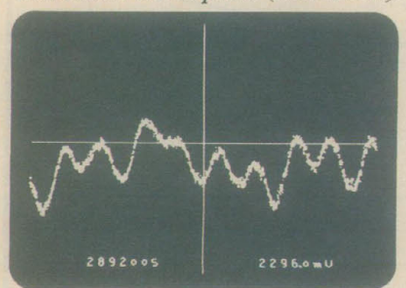

Fig. 2: 5-day section of earth tide record when sun and moon are in quadrature (6 hours apart).

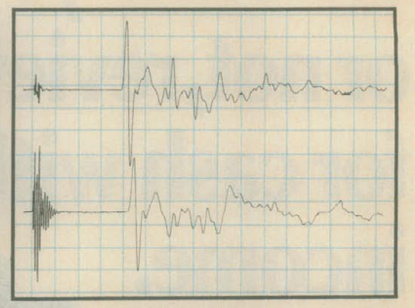

Fig. 3: Plot of pressure waves in seismic core samples.

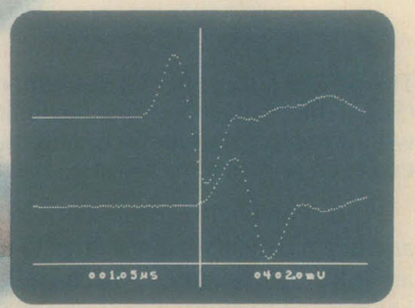

Fig 4: Screen expansion of waveforms plotted in figure 3.

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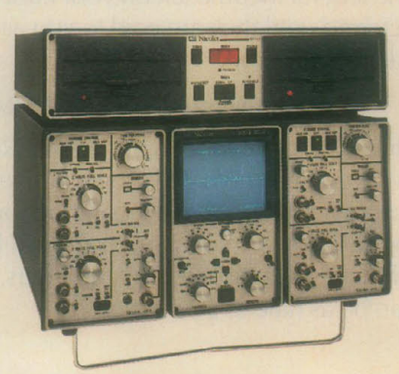

* *Waveforms courtesy of Bob Peet and Jack Schwarz of Sandia National Laboratories and the R & D Laboratory of the ARCO Oil and Gas Company.*

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Dilemmas of Scale

The theatre of national politics currently features the long-playing struggle to control vast budgetary deficits without risk to political life and limb. At its best it exemplifies the robust properties of choice in the modern American experience. At its worst it suggests the approaching limits of consensual governance. Echoing from the past is a durable observation by Robert Lovett that straight-line policy-making has never been our forte because the Founding Fathers injected a "foul-up factor" into governance by designing the system to permit the play of group conflicts.

Not much is being said about it, but the 200th anniversary of the Constitution is only 5 years away. That calls for sober thought about the capacity to govern in the face of dilemmas of very large scale. They abound, and in the third century of constitutional government they are sure to multiply. The most conspicuous is the dismal state of conflict resolution where it concerns the potential for nuclear war. It is against that record of political futility on the part of the superpowers that public opinion has lined up with Ground Zero and the nuclear freeze.

Dilemmas of scale take on other shapes, as well. Barring a possible hard landing in the interim, the U.S. economy is likely in this decade to generate an aggregate gross national product approaching $30 trillion in today's dollars. The sum is prodigious and, as usual, no thought is being given to surrounding this prospect with even a suggestive frame of strategies, intentions, objectives, or constraints. We will simply wing it, and the explanation lies with the foul-up factor and the likelihood that scale has outrun the growth in knowledge that ought to furnish the ground for such guidelines. There is no comfort in contemplating a pileup of dilemmas of scale in the face of disarray in the connections between knowledge and the national policy machinery. Sadder still is the diminishing value assigned by government to investments in education and the social sciences, as though there were no public stake in scaling scholarship to match the unknowns.

Despite the notable wide misses that have afflicted Soviet comprehensive planning, there can be no doubt that goals, frameworks, and strategies hold high ground in the Soviet version of policy management. Institutes for policy research line the streets of Moscow. They are staffed in depth and in quality, and they are more than mere cosmetic facing on an authoritarian state. They are occupied compulsively with charting political and economic navigation, and they are doing it with an alert eye to the likely turns in the affairs of other societies of all species. It is worth reflecting, in such a context, that notions of "superiority" perhaps should not be confined to comparing warheads and throw-weight. In the long run, brainware is likely to count for more than hardware, as John King Fairbank reminds us. And in that vein, it would be instructive to compare Soviet investments in area and language studies with the semistarved state of these fields in the United States.

Both science and technology figure in the emergence of dilemmas of scale, even as they offer something toward their management. Their roles in advancing military assets are well exercised, but their potential for building political assets and diminishing East-West tensions takes a backseat. Compelling in the short term as budgetary restraint may be, the winding down of space research and technology preempts initiatives that might go a long way toward providing a larger measure of global security than arming both sides to the teeth.

The approaching salute to the Constitution should go beyond showcasing inherited political assets. After all, assets rarely have static value. They grow or deplete as the case may be. If the bicentennial is to serve as more than a historical marker, we should prepare to look hard at the efficacy of our national policy machinery, and especially at its needs for a stronger capacity to meet dilemmas of scale with confidence.—WILLIAM D. CAREY

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