

## OF THE WEEK

Science budget for '79	
Federal R&D	52
ERDA	52
NSF	53
NASA	53
EPA	53
NIMH	54
NIH	54
Changing collegiate values seen	54
The commercial debut of wind power	55
India's monkey ban hurts U.S. research	55
Nobel laureate to head Rockefeller U.	55

## RESEARCH NOTES

Biomedicine	58
Behavior	58
Biology	59
Earth Sciences	59

## ARTICLES

Japan's flowering computer industry	60
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## DEPARTMENTS

Books	50
Science on TV.	50

**COVER:** Experimental test pattern etched on silicon by variable spot electron beam. Electron beams and X-rays are among the methods Japanese researchers are using in attempts to increase the number of circuits that can be etched on computer chips. This is part of the research that makes Japan a serious contender in the international computer race. See story p. 60 (Photo: VLSI Technology Research Association)

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# Twenty Years in Space

Random thoughts on the new world

On Jan. 31, 1958, as anyone with the slightest access to the media must have been reminded by now, the United States conducted its first successful launch of a satellite into orbit. Carried aloft by a modified Jupiter missile, the 31-pound Explorer 1 operated for nearly four months, providing data that included detection of the trapped-radiation phenomenon now known as the Van Allen belts. It was not the beginning of the Space Age—that honor was signalled by the beeping of Sputnik 1 on Oct. 4, 1957—but it did herald the presence of a major participant in a technological and sociopolitical arena that would see major changes in the planet earth—and in mankind's place on it.

Much has been written and spoken about that event, and more is being generated for its bicentennial anniversary. Rather than add to the large-scale rhetoric of the occasion, I'd simply like to share some random thoughts, such as might occur to one who smugly believes that these 20 years have merely been a case of reality catching up.

- One of the most significant artifacts of the Space Age—more so, perhaps, even than Neil Armstrong's first footprint on the moon—is a single black-and-white photograph, taken on Dec. 9, 1966, by an orbiting device known as Applications Technology Satellite 1. To me, it is the symbol of major changes, both present and potential, to be wrought in human understanding: the first full-disk photo, taken from a previously impossible perspective, of the earth.

- The barriers that have been assailed in advancing through the Space Age have been one of its most important contributions. Even some of the most staunch opponents of space spending are wont to begin comparisons with, "If we can put a man on the moon, why can't we...?"

- After seeing the puzzlement of old-time pilots at younger people who think nothing of an airplane flight, it pleases me each time I rediscover that achievements and discoveries in space still impress those who were not even born when the Space Age began.

- Even so, I feel lucky to have the beginning of this era in my memory. Try to recall where you were, and how you felt, during the first announcements of Sputnik 1, the first earth creature in space (the Soviet dog Laika), the first spaceman (Yuri Gagarin), the first close-up of the moon, the first manned lunar landing...

- The "solar polar" mission proposed in the new NASA budget used to be identified as the "out-of-the-ecliptic" mission, rather than by the fact that it will provide the first data on the sun's poles. A few years ago, in fact, when I first heard of the idea, it was from a scientist captivated by the chance of studying not the sun, but a part of space where the *planets* are *not*. Data from interplanetary probes had already established that much of the emptiness between worlds was in fact strongly influenced by the planets' presence, a fact even better known today. How quickly our new sky is filling in.

It is by now a homily that the world is shrinking, that the distances between people are daily becoming lesser and lesser obstacles to togetherness. (A look at a daily newspaper can sometimes make one wonder if sheer proximity is always a good thing, but it's certainly true that new tools are taking bigger, more efficient steps.) The seeming ease with which spacecraft have been sent off to report from other worlds would appear to represent a still greater gathering-in of space—but in another sense it is just the opposite. Consider Jupiter: It is obviously far away, by a typically gigantic Space-Age number of kilometers, a number so great as to be truly inconceivable. Some people no doubt feel that getting a spacecraft out there has somehow "conquered" that distance—yet it remains as inconceivable as ever. Furthermore, now there is a manmade object, an easily conceivable chunk of stainless steel and what-have-you, to sit on the far side of that vast space and provide an anchor for the mind, *marking* the great nothing in between, as if daring human consciousness to deal with it. But has the distance been conquered—or merely finessed?

The first 20 years of the Space Age has stretched humanity's perspective into formerly unimagined shapes. The species will have taken its next great step when comprehension catches up.

—Jonathan Eberhart

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