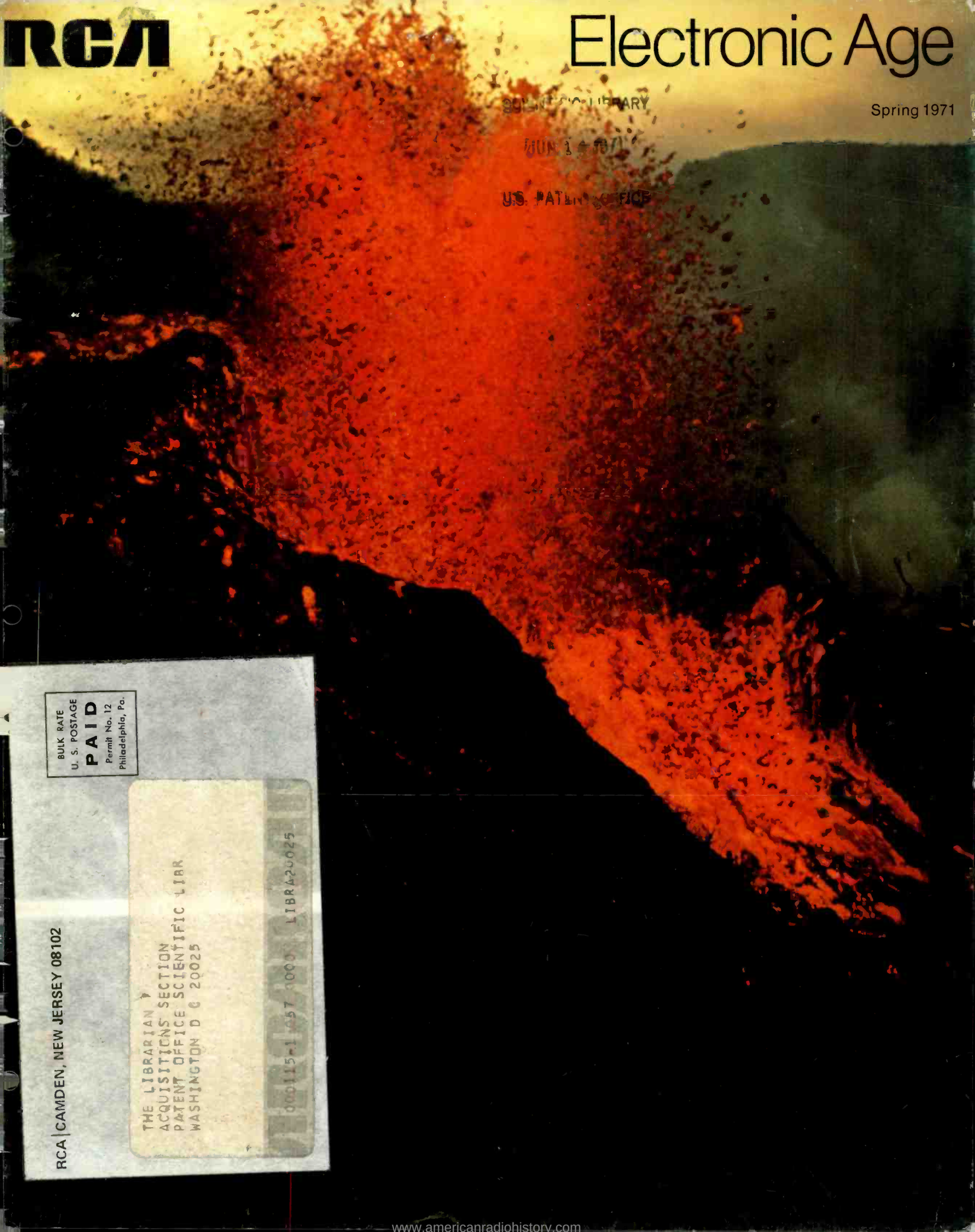
RCA

# Electronic Age

Spring 1971






Cover: Spewing molten lava, this volcanic island rose out of the sea off the coast of Iceland in 1963. Why such islands rise and how the continents, as we know them today, were formed out of one or more supercontinents have been topics of controversy in the scientific community for decades. A survey of the study of "continental drift" begins on page 18.

# Electronic Age



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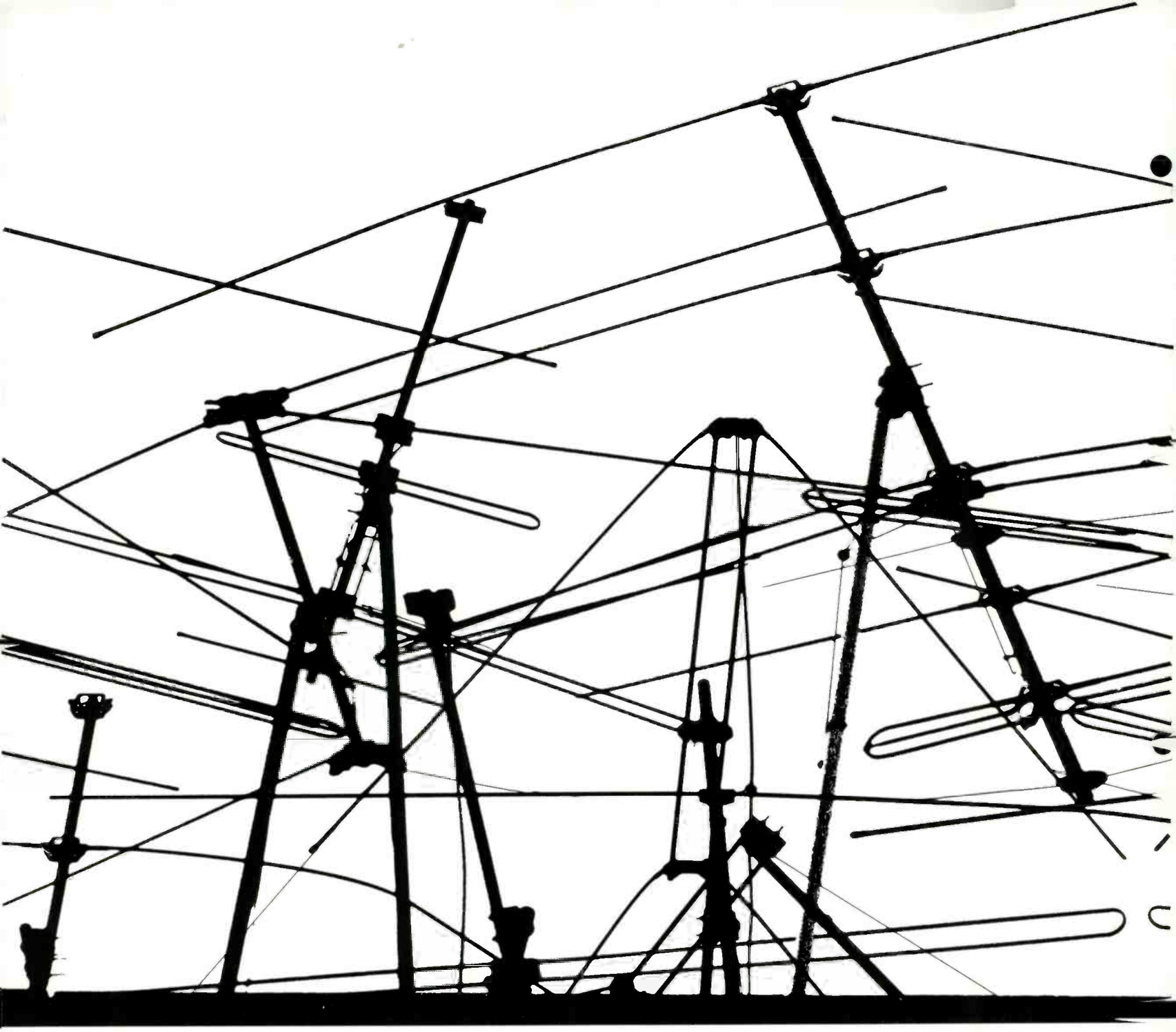
**Contents**

Spring 1971 Vol. 30/No. 2



# A Broadcaster Looks at Broadcasting

A major network head explains the continuing growth of television and its social responsibilities.

by Julian Goodman

Julian Goodman is president and chief executive officer of the National Broadcasting Company.

**How do you see the role of broadcasting in American society?**

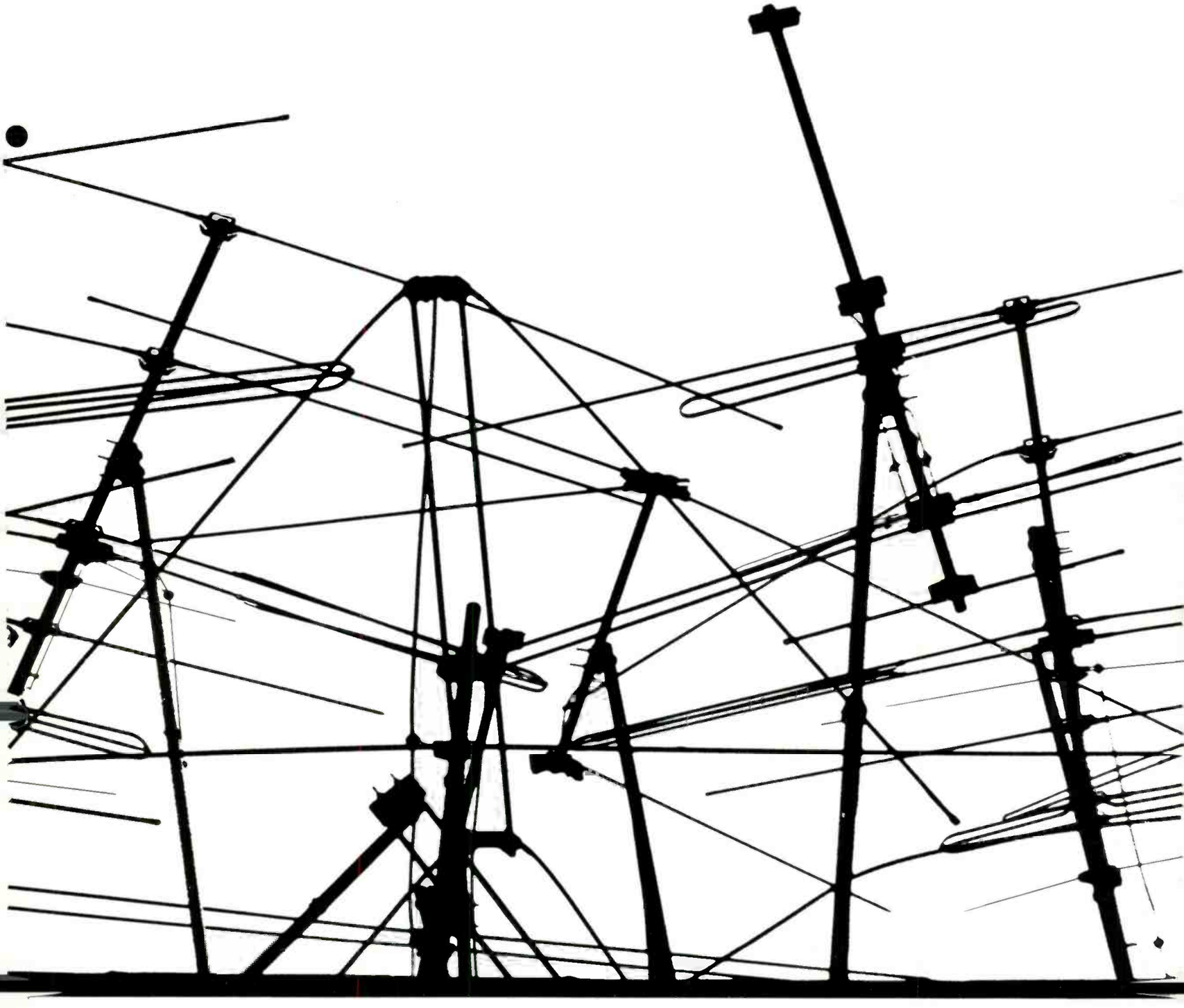
The function of broadcasting — consistent with that of any mass medium — is to provide a service most people will find interesting and useful most of the time. More than 60 million American households rely on television, and a medium with that enormous and diverse an audience cannot place primary emphasis on programming that appeals only to minority segments of that audience. Conversely, to program only to majority tastes would slight legitimate minority interests.

We try to strike a balance in our programs in a way that gives weight to varying tastes. Commercial network schedules contain programs of every description: drama; comedy; variety; game shows; children's fare; sports; studies of significant issues; documentaries on music, art, dance; and more news and informational programming than most people are aware of. In fact, some 25 per cent of NBC's total network schedule is produced by NBC News.

There are some who claim that the networks are too heavy with entertainment in prime evening time. That, of course, is a personal judgment, and it is not shared by the majority of viewers. Entertainment does constitute the bulk of television programming because that is what most viewers want most of the time. A big part of our job as an entertainment medium is to give people enjoyment. The fact that we also make them think is evident by the vast majority of children and young adults who have grown up watching the medium and who are more conscious of, and concerned about, their world than were previous generations. This certainly isn't due to television alone, but the medium has been a major factor.

In the effectiveness and immediacy of its news coverage, television is the information medium most people rely upon for news. This means television can be a powerful influence — a propaganda tool at one extreme, a truthful reflecting mirror at the other. One of our main problems is to resist efforts to make the medium conform to any prescribed point of view. The fact that we are a government-regulated and -supervised medium does offer a convenient handle for some groups to try to influence or even control output.

Broadcasters have no quarrel with government regulation, although we think it gets into dangerous areas when it seeks to influence — directly or indirectly — news and information programming. What we insist on — what we must insist



on — is the right to make independent, professional judgments about what we present. Without this, television would cease to have a role; it would simply become an instrument of whatever force applied the greatest pressure.

**In what ways has programming changed over the years and what trends are developing?**

Like any innovation with roots in an older development, television at first borrowed heavily from radio, the movies, and the stage. Of course, this didn't last. There was quick recognition that television was a distinctive medium with unique characteristics, problems, and opportunities. The demand for television programming made it impossible simply to continue adapting timeworn materials, techniques, and concepts.

Out of this need for fresh material, television began to attract a new generation of creative people who had no links to radio and who were free to develop new techniques and approaches — writers, directors, producers, performers.

Originally, the network schedules were based on radio's pattern — mostly half-hour series at set time periods on the same day of the week. Television entertainment was largely escapist — the big musical variety shows, situation comedies, the big-money game shows, with a sprinkling of dramatic shows and sports.

Today, television is more freely structured. We have series that introduce different casts and story lines within a single format — NBC's "Name of the Game," for example. Original drama, often inventive and unusual, is represented in such regular series as the NBC World Premieres. More programs are presented because of their timeliness and pertinence, not because they fit into a pattern. We are going in for longer time periods — 90-minute and even two-hour presentations. Entertainment programs, even when they are amusing, increasingly relate to social issues and problems. As a result, there is a stronger appeal to younger people, more sophisticated in their tastes and concerned with the happenings around them.

Comparable changes have taken place in news. In the early days, television news was little more than a visual facsimile of the old, 15-minute rip-and-read radio newscast. The 1948 national political conventions proved that television could cover actual events with tremendous realism and impact. Correspondents and cameras began to go farther and farther afield. Provocative documentaries and news specials made their appearance. Ed Murrow, Huntley-Brinkley, Cronkite became instantly recognized faces and respected voices.

It was not until the 1960s that television really demonstrated its power as a news medium. Events such as the death of John F. Kennedy and the first moon landing turned the entire world into a single community, sharing the same emotions and responses. Considering national and world developments and the growing ability of television to cover them, I think we are going to see even more penetrating and comprehensive news reporting and analysis in the years ahead.

(Below) The Flip Wilson Show, introduced in the fall of 1970, became the major new hit of the 1970-71 season. Flip Wilson, dressed as "Geraldine," is shown here with guest Muhammad Ali.

(Below) This maze of metal branches, on stage D of England's Associated Television in Elstree, is a careful arrangement of telescopic arms from which 240 studio lights are suspended.

(Right) Network television has covered U.S. space missions from the beginning of the country's space program.

(Below right) Sherlock Hemlock, a Muppet puppet, introduces young viewers to the concept of problem solving by looking for clues on the popular "Sesame Street" series.


However, the greatest change, and it's only beginning, is the recognition that television is a unique electronic medium and not just a derivation of stage, film, and radio. We are learning how to produce new effects with videotape and to give television added dimensions. At the same time, we are looking for new creative talent. Not long ago, for example, NBC presented a program of film techniques, "The New Communicators," which resulted from a worldwide search for unknown young film makers.

But it's still not possible to say in what directions these and other developments will take the medium. However, I think it is safe to say that television 10 years from now will be as different from today as is "Laugh-In" from the roller derbies of the early 1950s.

**How do you see your own role as head of a major network?**

It's very popular these days to discuss the social responsibility of business. I don't believe it is widely enough understood that those of us in broadcasting have lived by that tenet and operated in the public interest from the time the first station went on the air. Some do it better than others, but all do it — not just because it is required by the license under which our stations operate but because it is a part of our nature, training, and instinct. We earn our livelihood, after all, by serving the public. Whereas congressmen stand for election every two years and senators every six years, we stand for election every minute of every day all year long by tens of millions of voters who vote us up or down by changing channels or turning off their sets. To serve this large public well, and fairly, is what makes a job like mine both demanding and satisfying.

I don't think I would be holding the position I now hold if I were only a businessman, interested in profit and loss. The profit is necessary to make a high-cost, high-risk business run, but it is both a means to an end and a result of good service to the audience. My background is in news, and my interest is broadcasting — all forms of it and ways to improve it within the framework of our free competitive society.

**There is a great deal of discussion about the impact of television on children. What do you think about this?**

No one knows conclusively what the impact of television on children is, although practically every parent, psychologist, or self-appointed expert has an opinion. Some use the fact that children spend a great deal of time watching television to assert that it's the cause of everything bad about the young generation. This, of course, ignores all the other influences on a child — family, school, friends — and critics of TV tend to disregard any research findings at odds with their own theories.

Television affects everybody, including children, and broadcasters are making an effort to determine with some precision what the effects are. NBC and CBS, for instance, are underwriting separate behavioral studies. But without waiting for conclusive findings, NBC is intensifying its efforts to improve children's programs — to provide shows that are both entertaining and educational and that instill healthy values in young viewers. We were the first network to give management authority to a creative producer of children's programming, by making him a vice president in charge of that field, so that we could focus and concentrate on developing this programming as a specific element in the network schedule.

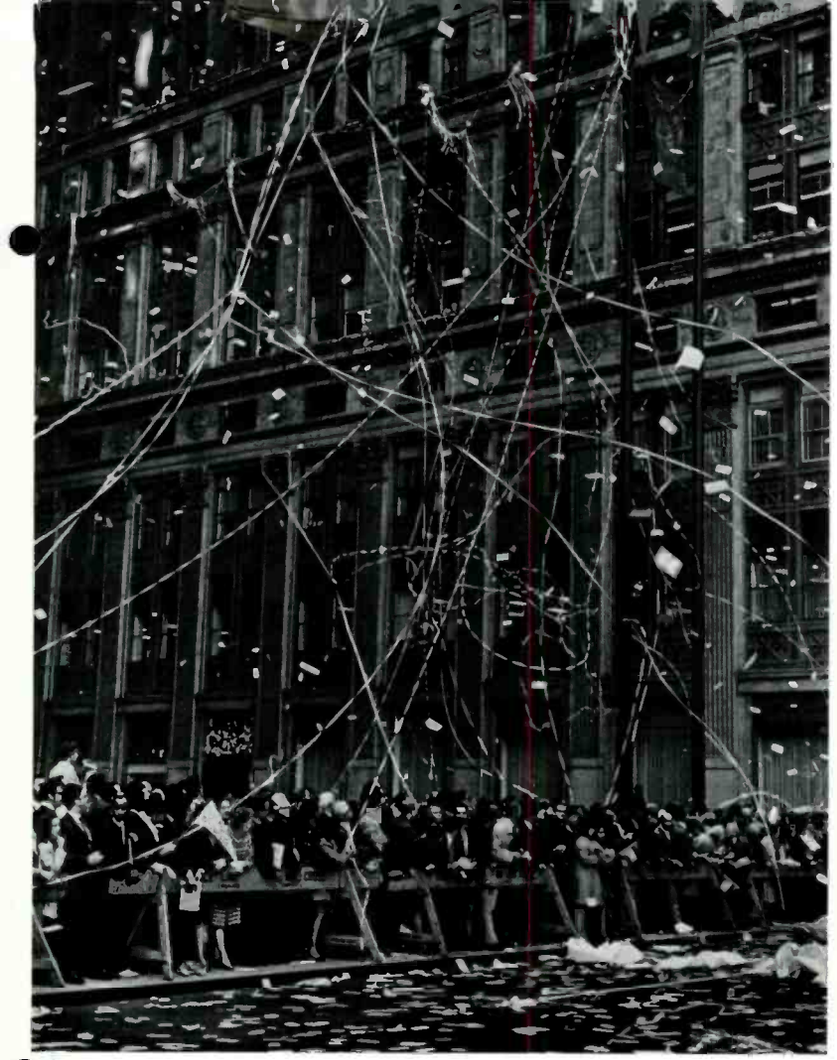
We have made significant changes in the Saturday morning schedule. One program, "Hot Dog," uses humor and top talent to explain the origin of the everyday things of life to youngsters. Even the comic cartoon fights, which older generations enjoyed at kiddie matinees, have largely disappeared from television or been greatly modified to minimize physical conflict as an entertainment device.

Innovations are being made to teach children through television. Noncommercial television's "Sesame Street," of course, comes immediately to mind, but the commercial networks have also been actively engaged in this effort for some time. NBC is now working with the author-educator Dr. Caleb Gattegno, an innovator in the field of visual education and president of Educational Solutions Inc. A result of this collaboration is the network's "Pop-Up" series of one-minute films that are designed to help children learn to read as naturally as they learn to speak.

We don't have all the answers, but we are finding out more every day and applying it to our programming. One thing is certain. A child's world is no longer bounded by his block, his neighborhood, or his hometown. Television has extended it around the globe and to the moon. The impact has been tremendous. By and large, I think it's also been very positive.

**Has success tended to make network television less daring and innovative than it was years ago, less willing to gamble on the long shot?**

It's fashionable for television's detractors to make this claim, but I don't think there's much to it. When people refer to the Golden Age of Television, they have a dim recollection of what was programmed during the medium's youth when almost



TV cameras recorded ticker-tape parade for the New York Mets, 1969 World Series winners (left), and victory celebration of Sen. Eugene McCarthy following the 1968 Oregon presidential primary (below).

everything it did was new — and therefore different — because there were no precedents. There's no question that there were some outstanding and often daring programs and concepts for their time — "Playhouse 90," "Wide, Wide World," and "Omnibus." But there were many more long-forgotten entries with such names as "Mysteries of Chinatown" and "Wrestling From Newark."

The fact is that times change. The public tastes of 20 or even 10 years ago are not the public tastes of today, and what went over then would not necessarily succeed now. Experimenting has not been shunted aside for the safe and the profitable. More than 1,300 television series have been broadcast by the networks since 1947. The number of discarded pilot shows may easily be double or triple that. If only a small portion of all this represents a truly novel theme or approach, it's still a lot of innovating. And this isn't even taking into account the many hundreds of individual special programs that have appeared.

"Rowan and Martin's Laugh-In" heralded a new television comedy form. This season's two-hour productions of "Hamlet" and "Jane Eyre" will stand comparison with quality drama presented at any time in any other medium. Flip Wilson's hit comedy show this season was a long-shot gamble for NBC. The NBC Program Department worked for three years with Flip, made two pilots — including a disappointing one we never aired — before the series ever started.

Obviously, we expect a return on these "front-line" shows. And even if we're not always right, we have enough expertise and feel for a show's chances to know when to gamble.

There are other times when we experiment on a different basis, when we program a show not because we anticipate it will be a hit but because we think it will interest selected tastes and broaden the diversity of our schedule. Most of our documentaries are in that category.

Finally, there is a form of taking a chance on such programs as "Experiment in Television," where we look to find the kernel of a new concept, uncover a new writing talent, or see the potential in a new actor or actress. This is experimenting with the creative elements that can lead to future advances in television.

I can't buy the line that success has taken creativity out of network television. It hasn't.

**One hears a lot about the race to get high ratings. How important and how accurate are ratings in the determination of a network's schedule?**
So much attention has been given to ratings by people who don't understand fully how they are used that I believe the public has a distorted view of their significance. Those lists of the top 10, 20, or 30 shows, the hairline comparisons of the ratings of the three networks, put a lot of emphasis where it does not belong.

Broadcasters need to know how many people — and what kinds of people — are watching their programs, or they can't do a proper job. After all, our purpose is to satisfy our audiences, and they express their satisfaction — or dissatisfaction — by watching or tuning out. So audience analysis is important to us as a program operation.

It's also important to us as an advertising medium and to the companies that advertise on our programs. It's certainly as important as circulation figures are to magazines and newspapers.

We would be negligent if we ignored the public reaction indicated by ratings, and we're pleased if our shows achieve high ratings. But that is not — and cannot be — the only consideration in developing a schedule.

The television audience really comprises many different audiences with many different tastes and interests. We try for balance and diversity to meet those interests, and a program may be retained in the schedule, or dropped from it, to obtain that balance even though ratings alone might dictate an opposite action. It's important to keep this in mind whenever the question of audience ratings comes up.

Basically, ratings are nothing more or less than a research tool. As such, they are extremely valuable.

Interpreted correctly by experts and used wisely by programmers, ratings can be a positive influence on programming and, consequently, beneficial to the television viewer. But numbers as just numbers mean very little.

**The Federal Communications Commission has ordered a cutback of network prime-time programming to three hours nightly next fall. How will this affect the broadcasting business?**
The stated purpose of the FCC's Prime-Time Access Rule — cutting back more than 500 hours of television network programming a year — is to encourage new sources of programs. I don't know many people in broadcasting or film production who believe this will happen. Even FCC Chairman Dean Burch voted against the rule because he felt that it would not accomplish the stated purpose but might have opposite results. Many producers and most stations — the very industry elements the rule is supposed to help — have protested against it.

The effect of the rule will be to leave most small-market and many middle-market stations hard pressed to replace the network programming they now depend on. It will also deprive the program

(Above) Television coverage of the 1968 Democratic National Convention in Chicago included protest rallies held in Grant Park.

production industry of network financial underwriting of some 12 hours of programming a week without providing an alternative source to take this risk.

Because of the added expense of producing for themselves or buying more syndicated programs to make up the half-hour a night they're going to have to fill, some stations may cut back on their news costs and curtail a lot of local and regional news coverage. This is a public disservice the FCC may not have foreseen. As for the networks themselves, a shortened prime-time period is going to make it difficult to schedule specials, particularly in their longer forms. A cut in specials will be ironic because they represent quality and diversity both in content and production sources — the very things this new access rule is supposed to encourage.

We are hopeful that the rule may eventually be rescinded either through court action or FCC reconsideration when predicted shortcomings become apparent. Unfortunately, it looks as though the industry is going to have to work within the new restrictions until this happens.

**In your 25 years in broadcasting, the television audience has grown to about 100 million people daily. Do you think it has reached its peak?**

When you consider that, in 1950, less than 10 per cent of the homes in this country had a television set and that, today, 96 per cent have at least one set, the growth has been impressive. Obviously, television cannot grow at the spectacular rate of the 1950s. I believe, however, that we will still see a continuing increase in viewing interest.

Television has been with us for a quarter-century, and it is no longer a novelty. But if it had stopped being interesting, it would have reached its peak years ago. Instead, there has been a steady rise in its popularity. An audience survey last fall showed that the average household watches television approximately six hours a day, and this figure is expected to go higher.

The medium, of course, is continuously evolving. Programs have changed, subjects have changed, programming itself has become more flexible and more capable of dealing with contemporary and controversial themes and issues as they arise.

Another factor is that television is unique as a medium of news and information. We have become a country that gets its news primarily from the television screen. I am sure that television's status as a medium of journalism will continue to increase.

New technical developments also will keep the medium growing. The split screen and instant replay, for example, have added dimension to sports coverage. Satellite transmissions have made it possible to receive instant coverage from almost any part of the world. As equipment gets smaller, as the reach of the equipment grows longer, and as the medium becomes more versatile, there will be further opportunities for expanding audience interest.

There are several other growth elements beyond programming and technical developments. Only 41 per cent of the country's homes have color sets. Research has shown that to new viewers color television is like a new medium. And the amount of color viewing per home averages about an hour a day more than in homes with black-and-white sets. As the number of color sets increases, the trend toward more watching by color set owners will continue.

Moreover, the number of new households will increase by approximately 5 million between now and 1975.

Multiple-set ownership is another factor that will contribute to the medium's growth. Today, 34 per cent of the television homes in the country have more than one set, and this percentage is rising.

Summing it up, I am confident that, as long as the population keeps growing and television continues to adapt, the medium will continue to grow.

**Do you think that the television audience will eventually fragment and localize the way that radio's has and that the network concept will become obsolete?**

In a society such as ours, exposure to a broad range of choices enables people to pick what they need and like and discard what isn't essential or what displeases them. Greater education and increasing affluence support the process. In this sense, I think Americans are forming some sizable special audiences with similar tastes. You have low- to middle- to high-brow groupings with numerous shadings in between — ethnic interests, urban and rural preferences, age groups.

But whatever differences there are among people, the fact is that we are a nation with a common language, history, culture, and outlook. The 100 million adults who watch network television daily attest to that. Bob Hope's humor has coast-to-coast appeal. The moon shots and landings are matters of national pride. The satire of Rowan and Martin

(Above) An anti-war demonstration in New York's Central Park.

strikes a typically American response. The World Series and pro football games are huge national drawing cards.

Keep in mind that network radio once had this same broad audience appeal. Radio became locally oriented not because the public fragmented but because radio itself was replaced as a national service by a more comprehensive medium. There is no other reason. And, if national network television didn't exist, something else would have to take its place.

**That leads to the question of cable and cassettes. There have been some gloomy forecasts in the press recently about the effect they may have on the future of commercial television. Will these developments make serious inroads?**

Well, various magazines that compete with television have been carrying articles speculating on the decline and fall of commercial television. Some of the most intriguing magazine think-pieces I've read on the industry were done in the late 1950s. They concluded with penetrating logic that network television would level off in audience and advertising by 1960-61 and then fade away. *Fortune* headed it: "TV: The Light That Failed." Obviously the light hasn't failed, although a number of magazines have. The medium has continued to grow, and the ominous predictions have proved little more than imagination, possibly mixed in some quarters with wishful thinking.

Today's conjectures about cable and cassettes becoming serious competition for network television are greatly overstated. Cable television is almost as old as network television, yet only about 9 per cent of all television homes are on cable, and there is nothing we have seen in the recent growth of cable TV to bear out predictions of 80-per cent penetration by the end of the decade. In fact, cable has gained access to fewer than 3.5 million homes in the last five years. Over the same period, the total number of homes with TV sets increased by 6.9 million. At this rate, the 80-per cent figure is a long way off.

Until now, cable has generally retransmitted television programs it hasn't paid for. Cable proponents say they look forward to a service based on program origination for 30- or 40-channel systems. To me this describes a specialized service for fragmented audiences. It does not describe a mass medium like commercial television.

For cable ever to become a substantial national medium it would have to invest enormous sums in its own national program and distribution service. These costs would have to be recovered by charging the public or taking on new advertising, probably both. Growth would also depend on saturating the large cities, where there are high proportions of low-income families — which is not a promising market for a paid service, especially when a variety of broadcast stations already make popular programming available free of charge.

Many of the things that apply to cable will also apply to cassettes. It seems to me that their great appeal — much like that of the phonograph record — will be personal program selection at any time by buying or renting a recorded television program. Because of this, cassette television will be a specialized, costly service attractive on a selective or individual customer basis.

Cable and cassettes promise to be important businesses for the people who get into them in the right way as well as productive services for certain purposes. But they don't serve the purpose of mass-medium television. They will not supplant it because their structures, purposes, and markets are very different.

**You say that cable and cassettes will flourish as special-appeal services. Mass-appeal magazines, however, have declined in favor of special-interest publications. Isn't there a significant parallel here?**

I think it's an artificial parallel. The mass-circulation magazines have declined because television replaced them as the primary national mass medium. Special-appeal magazines have succeeded because they don't have to compete with television.

Again, the future success of cable and cassettes — like the already proved success of many special-interest publications — will depend on their ability to develop specialized services distinct from those of the mass media. As long as network television continues to furnish a service that engages enormous numbers of people and does it more comprehensively, effectively, and economically than any other medium, I believe that it will continue to thrive and expand with an expanding population and economy.

**With satellite transmission coming into wider use, what are the prospects for a greater international exchange of television programs?**

With the exception of news and sports, I think program exchange between nations via satellite will proceed very slowly. Such events as de Gaulle's funeral, a presidential inauguration, a space trip, and the Olympics make live satellite television exciting. Films of lesser news and sports events from around the world also are sent by satellite and replayed almost nightly on the network news programs, and this kind of satellite activity will increase. But I think that time, language, and even copyright differences will limit worldwide entertainment via satellite on a regular basis. An exchange in this area by conventional distribution methods — allowing time for dubbing, control and clearance procedures, and effective scheduling — still makes the most sense.

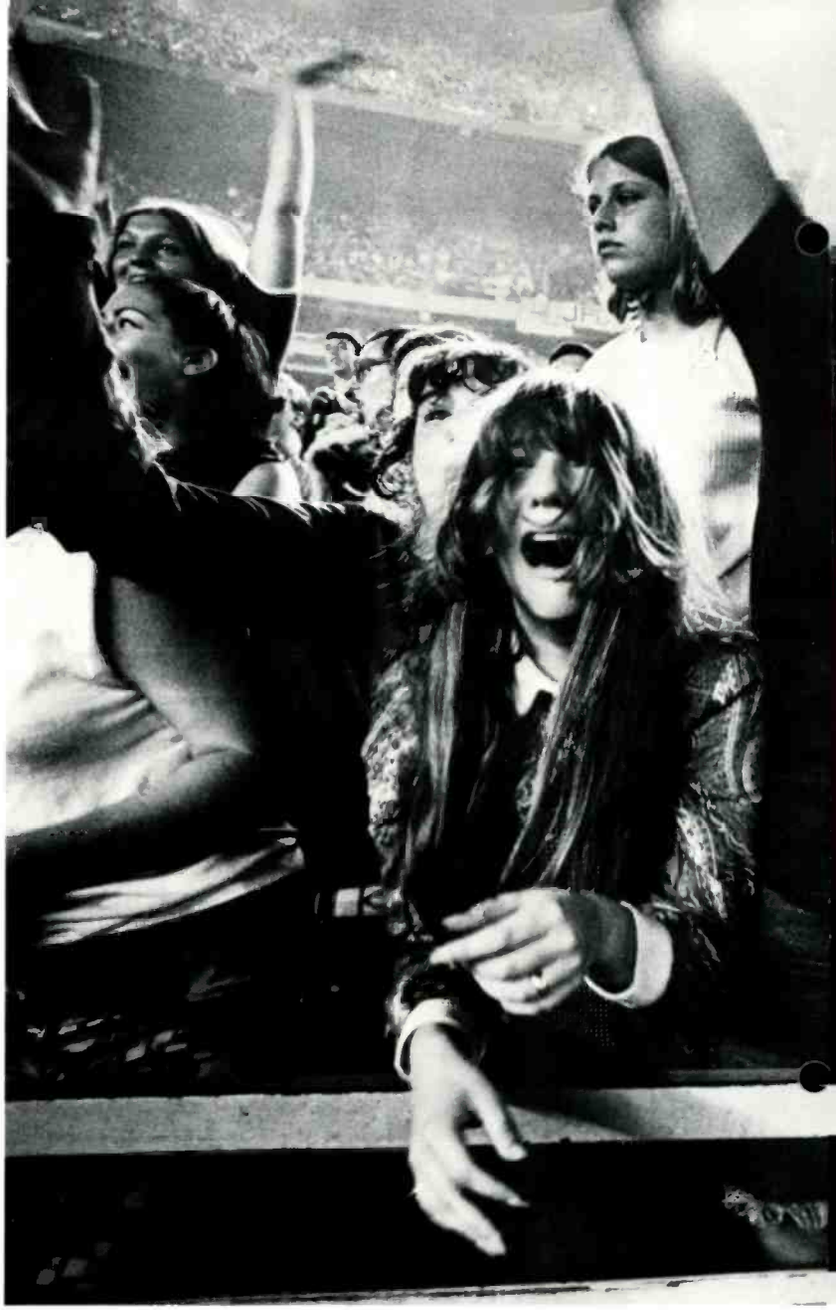
Here in the United States, however, I think that domestic satellite technology will have a far-reaching effect on broadcasting. The technology is ready, but a great deal of administrative and policy work by the FCC needs to be done. Network program distribution by satellite to and from broadcast stations could make national networking more flexible, comprehensive, and far less costly. Such states as Alaska and Hawaii could begin to receive direct service. Low-cost earth relay stations would also make it more feasible to interconnect television stations in small markets where the high cost of land-line facilities now precludes such service. Stations and viewers could receive more programs and better pictures than they may now be getting. Additional opportunities would be presented for noncommercial broadcasting to advance on a fully national basis.

**How do you view the relationship between commercial and noncommercial television? Are they destined to be competitive?**

I've always resisted many of the comparisons made between the two systems. We are not rivals. The issue is not which is serving the public better but how we can, together, serve the public best, each with its own emphasis — commercial broadcasting aiming basically at broad audiences and noncommercial programming to more specialized interests.

Yet, apart from these differences, there are some overlaps, and the two systems really should complement each other. Last fall, we initiated a project at NBC whereby we created and broadcast promotional spots for outstanding programs that were appearing on ABC and CBS as well as on our own network and on public broadcasting. Similarly, NBC and the Xerox Corporation last September broadcast a special one-hour highlight preview of the then-forthcoming "Civilisation" series, which Xerox funded on noncommercial television. We did a similar network program of "Sesame Street" just before that extraordinary children's program was introduced on noncommercial television. I'd like to think our commercial presentations won for these excellent programs a lot of viewers they might not otherwise have had.

Over the last two or three years, there has been great improvement in noncommercial programming. I'm sure some of it draws some audience from commercial channels, just as commercial television sometimes presents specialized material that might have been on noncommercial facilities. I think the public should respond to whatever is produced well regardless of source and regardless of label. The important thing is that commercial and noncommercial television exist side by side to satisfy many tastes, supplementing each other to provide a complete system well suited to the American society.



Teen-age fans react hysterically at Beatles concert.

**Turning to news and information, recent surveys indicate that a large part of the adult public relies primarily on television for the news. Do you see this as a limiting or broadening factor in public understanding?**

Television's emergence as a news medium certainly hasn't limited public understanding. On the contrary, because so many millions of people watch television news day in and day out, all levels of the public become exposed to much more information about issues and events than they otherwise would through any other means.

Still, no one should depend on a single source of news. Each news medium — television, newspapers, magazines, radio — fills a somewhat different need and function. Although recent surveys indicate that 60 per cent of Americans get most of their news from television, 9 out of 10 who watch television news also regularly read a newspaper. Newspapers and magazines will always be important for the extensive treatment that only the flexibility of print allows.

Except for being there in person, however, nothing can duplicate television's realism and impact in covering events as they happen. While it is true that television journalism is limited to fewer words than print journalism can use, a great deal of information can be conveyed through sight, motion, and sound — and in a very short time.

Television presents the essentials of major developments and issues. Its coverage of events — political conventions, elections, hearings, space exploration, earthquakes — is unmatched. But I still want to read the daily papers and weekly newsmagazines, and I think most people feel the same way.

**It has been said that the presence of television cameras can change the circumstances of a news event. Is the argument valid, and, if so, what can be done to minimize the problem?**

Most of the feeling that the camera creates the event stems from the reactions of viewers who dislike what they see and blame the camera. But the mirror cannot be held accountable for what it reflects, and television should not be assailed for the turbulence and tensions it reports. Capping the lens would not put an end to these things.

The presence of reporters and photographers can, of course, affect the actions of participants in a news event. But this was true long before television existed, and it is true today in areas where television cannot go. For example, outbursts frequently disrupted the trials of both the Chicago 7 and Charles Manson when there were no cameras of any sort. And I suspect that, if television cameras had been there, they would have been blamed for the disturbances.

It is quite true that national television coverage can make an important event out of one that is not important. Competent professional newsmen are aware that people with causes will try to "use" the medium. Their job is to distinguish the artificial from the real, the non-event from the event.

In the coverage of any event involving violence, NBC newsmen are required to follow strict guidelines. For example, NBC News has strict rules against broadcasting unverified rumors, and every statement characterizing an incident must come from an authentic, qualified source. Cameras are concealed as much as possible — which recent technological advances have made easier to do by reducing the size of cameras and the need for bright lights.

In the final analysis, there is no substitute for the discretion and skill of experienced journalists. They can normally spot exhibitionists or groups trying to grab attention and can focus, instead, on the meaningful.


Young Chicagoans who support Mayor Richard J. Daley protest the presence of TV cameras and newsmen in the city's streets during the 1968 Democratic Convention.

Newsmen set up broadcast equipment in the Rose Garden of the White House for press conference with President Nixon.

**Given the impact of television and the power of the presidency, should political opposition automatically have the opportunity to respond to televised presidential appearances?**
Like every complex problem, this one has attracted a swarm of simple, deficient solutions. A president's use of television is said to give him a partisan advantage. His opposition calls it an "unfair" advantage and demands its own time.The issue heats up even more during election campaigns, and we can look forward to some hot debate again as we get closer to the 1972 election. But there is no formula, no automatic policy that I can see, that will ensure complete fairness as to who does and who does not get television access to the American public.

Important presidential addresses are carried live by the networks because what the president says is usually top news. What he says and how he says it can influence national and world events. If newspapers could give simultaneous coverage to these messages, they would. Some do the next best thing by carrying the full text. The real need here is public information. And, so far as television is concerned, the need can best be met by letting journalists, rather than politicians, legislators, or regulators, judge what will most fairly and completely cover an issue. Unlike political leaders, the television news organizations have no political aims. Their training and their instincts are aimed at identifying and probing issues, not winning votes or elections.

A president does not stand above public discussion or rebuttal, of course, and NBC has long followed the practice of presenting analyses of presidential addresses and often following up with opportunities for opposing political leaders to express their differences. However, the speech of an opposing politician is not the only way nor always the most effective way to provide balancing information to an address. News interviews, analyses, and panel discussions — day-in and day-out network news coverage — often afford better and sharper information plus a larger, more interested audience.

For these reasons I believe the idea of legislative or regulatory formulas for determining fairness in presenting political issues is unrealistic and undemocratic. No fixed formulas are going to work either, because issues, circumstances, positions, and oppositions change with new developments and tomorrow's needs. I'd rather put my faith in a free press and journalistic judgment. They offer more enduring guarantees of the public's right to know.

**What about the argument that a handful of men in New York and Washington — the so-called Eastern Establishment — determines what the nation will see?**
The theory of a small band of powerful men in New York and Washington leading — or misleading — the public with a single voice is a fantasy. New York is the nation's headquarters for commerce, communications, finance, and other interests. Washington is the center of government activity. An extraordinary amount of news is generated in both cities; it always has been. But a lot of news arises elsewhere in this country and all over the world.

Network news presentation is not the view of a few journalists. It is a mixing of the efforts and skills of hundreds of different network news team members — reporters, researchers, writers, cameramen, editors, producers, and executives. Moreover, this is a national and worldwide process involving news bureaus wherever stories may be breaking. And these areas have great autonomy in their selection and coverage of stories.

As in all news media, decisions are made hourly on what story is more important than another; what pictures are most representative; what portion of all the available material is most significant.

This process of selection and editing is the heart of any news operation, whatever the medium. It works the same in every part of the country.

The men making today's news decisions have usually risen to the top of their profession because of their ability and integrity — not their political, regional, or social backgrounds. They vary widely in personal attitudes and viewpoints. In fact, it so happens that few of them were born or grew up in the East. And I know from my own background — coming from Kentucky and spending 20 years with NBC News both in Washington and New York — that the strongest bond is the professional one of straightforward journalism.

**Still, considering these currents of thought in the nation and television's public interest obligation, does the medium have a responsibility to reflect the views of the majority?**

This is a question on which most journalists and a few politicians part company.

Ours is a pluralistic society. The views of America are many and varied, and the obligation of any news medium is to make all views known — popular and unpopular, majority and minority, for and against. The role of journalism in this country is to serve the public in all its variety. It is not to advance the views of the government, the major political parties, or any specific group — and certainly not the views of NBC.

In his famous speech on network news — made famous in large part by the very network news coverage he criticized — Vice President Agnew asked that broadcast news be made more responsive to the views of the nation. I think what the vice president was really asking was that we be more responsive to the views of the administration.

The power of news selection and analysis in America is, of course, in the hands of the media. But we are equally aware that the power of the nation, political and economic, rests largely in the hands of the federal government. And government power that is highly concentrated is tremendously more pervasive and influential than the fervor of the press. The U.S. Constitution, in its guarantees of freedom, did not intend a single power structure responsive to a single view. Our system of government rests on the premise that a free press will audit and analyze the policies and actions of government and present them for public scrutiny because there is no other force balancing government power. That is why a free press is not permitted in an autocratic government but becomes an instrument of government itself.

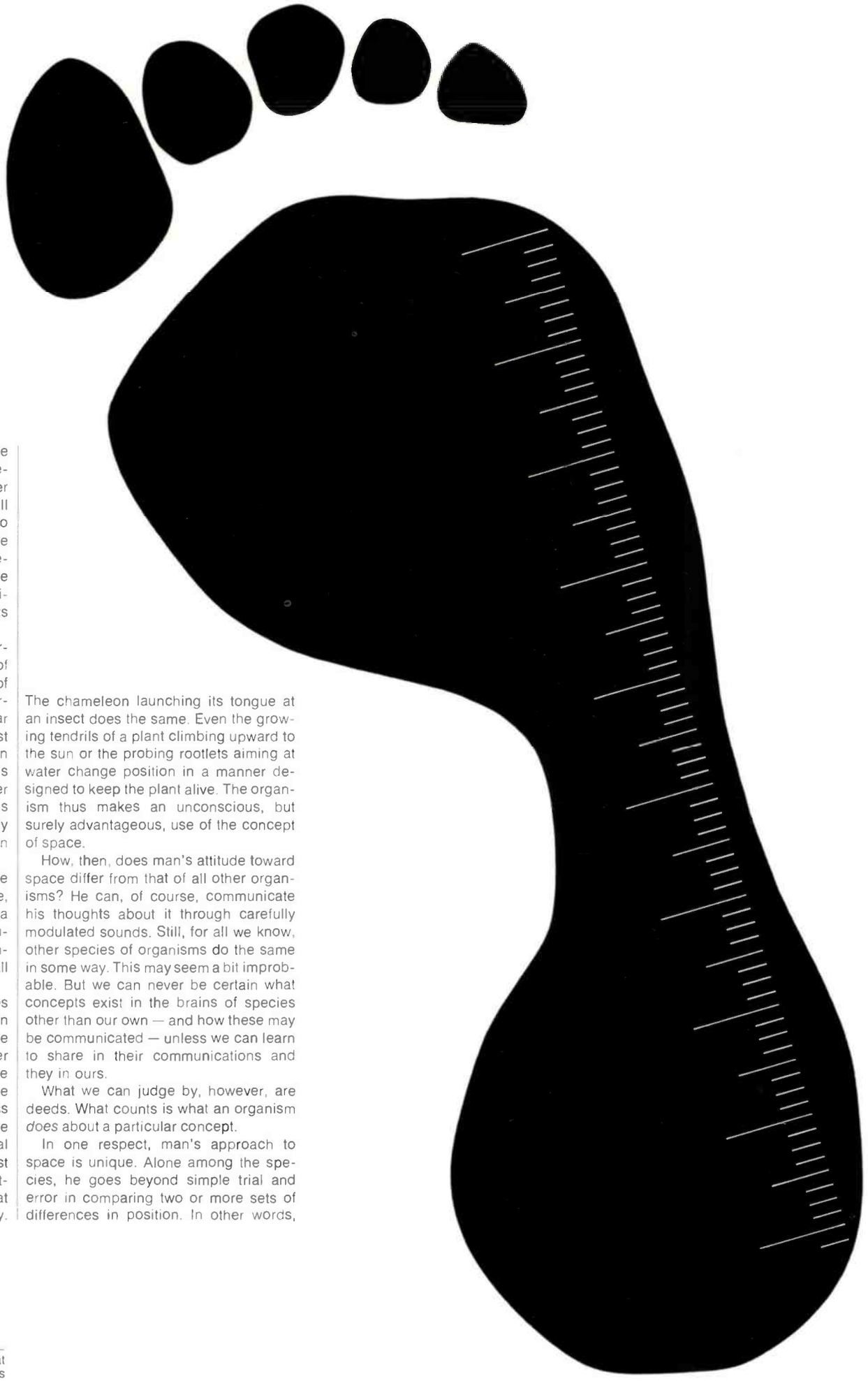
There is a fundamental question as to what is meant by the views of the nation. Or the silent majority. I would have to ask: What majority? On what issues? At what point in time?

There is no such thing as a permanent consensus. Public views shift from issue to issue. A majority on one issue may be the minority on another. The prevailing opinion in December may take an opposite tack in May. If broadcasting tried to follow the footsteps of a so-called majority, it would end its usefulness to a free society.

It's pretentious to say that television news should lead public opinion. It's dangerous as well as foolish to say it should follow public opinion. I feel the public is capable of forming its own opinions. If it were not, we would have to question the very precepts on which our democracy is based. ■

# "Here, Not There": Man's Concept of Space

by Isaac Asimov



When people think of space, they are very likely to think of the vast stretch between earth and moon and the vaster stretches beyond. Actually, space lies all about us, and the distance between two atoms in our bodies represents space just as much as does the distance between two stars. In fact, it was with the notion of the space in our immediate vicinity that mankind began his thoughts on the subject.

Space is what makes possible differences in position. We become aware of differences of position—and, therefore, of an extension within which those differences can exist—as a result of muscular effort. We must turn our heads, or at least our eyes, to see first one thing and then another. We must reach out our arms this way, then that, this far, then that, in order to make our fingertips coincide with this object or that. Or we must move bodily here, then there, to reach first this, then that.

The notion of space begins with the concept of "here, not there" or "there, not here." As soon as one can localize a particular object as being in one particular place, the idea of a limitless extension of potential place within which all objects are located becomes possible.

Naturally, the idea of extension does not have to be specifically formulated in the mind to be made use of. We can be reasonably sure that no species other than man has a clear idea of space in the abstract. Yet, all organisms that move seem to utilize the concept. The tigress that springs upon her prey makes some obscure judgment, however mechanical and unconscious, of the effort she must make to change her position from a starting point in space to another point that will coincide with the position of her prey. The chameleon launching its tongue at an insect does the same. Even the growing tendrils of a plant climbing upward to the sun or the probing rootlets aiming at water change position in a manner designed to keep the plant alive. The organism thus makes an unconscious, but surely advantageous, use of the concept of space.

How, then, does man's attitude toward space differ from that of all other organisms? He can, of course, communicate his thoughts about it through carefully modulated sounds. Still, for all we know, other species of organisms do the same in some way. This may seem a bit improbable. But we can never be certain what concepts exist in the brains of species other than our own — and how these may be communicated — unless we can learn to share in their communications and they in ours.

What we can judge by, however, are deeds. What counts is what an organism *does* about a particular concept.

In one respect, man's approach to space is unique. Alone among the species, he goes beyond simple trial and error in comparing two or more sets of differences in position. In other words,

Isaac Asimov, professor of biochemistry at Boston University, is the author of numerous books and articles on scientific subjects.

**"Space is what makes possible differences in position. We become aware of differences of position — and therefore of an extension within which those differences can exist...."**

man measures distance (the separation of position) in a mechanical way. In this way, he reduces the notion of extension in space to a form that makes possible accurate comparisons without need for superimposition.

The tigress and the chameleon judge distance; but they do so intuitively, guiding muscular effort by the subtle adjustments of the focusing mechanisms of their eyes. (We do that, too, every time we pick up a pencil or do almost anything else.) The beaver building a dam or the bird building a nest makes use of logs and twigs that are more or less the right size for its purpose. At best, however, there is a hit-and-miss quality to the process, and the final decision is the attempt at a direct fit, which either succeeds or fails.

What mankind adds, at the very simplest, is counting. He might begin by placing a log across an opening until he finds one that is sufficiently long to stretch across it without falling in. The log that fits can then be used as a reference log against which other logs are measured so that no effort is wasted bringing back logs that are too short. It is simpler, though, to use a handspan and to count. There are so many handspans across the log that fits; therefore, man need only find other logs that are as many handspans long. He might even learn to cut a log to reduce it to the proper size. One doesn't need to carry along a reference log in that case; he possesses the ability to count and to remember the count in terms of handspans.

Many parts of the body can be used to make measurements of various sizes, and their use has left a mark on a variety of current measures. The foot is exactly what its name implies — the length of a foot. The height of horses is measured in hands, and the mile is from the Latin *mille passus,* which means a thousand paces.

As long as man's measurements were individual, his advantage over other species was small. The human could be more efficient than the beaver at finding logs of the right size, but not crucially more so if each man worked alone. But to relate one's measuring system to that of others — and thus establish a community of labor — produces problems, since the foot or pace of one person is not the same size as that of another.

To suit a number of different people, the notion of a "standard measure" had to be developed. A primitive tribe might, for example, use the chief's foot to measure the length of logs. And, since the chief would not be available for everyone's measuring (nor wish to be), it might occur to some genius to produce logs measuring exactly the length of the chief's foot for distribution to those who had need for such a standard measure. It would be the "standard log" once again. But it would be the same for all users and adaptable to all purposes, particularly if it were neatly subdivided into still smaller units.

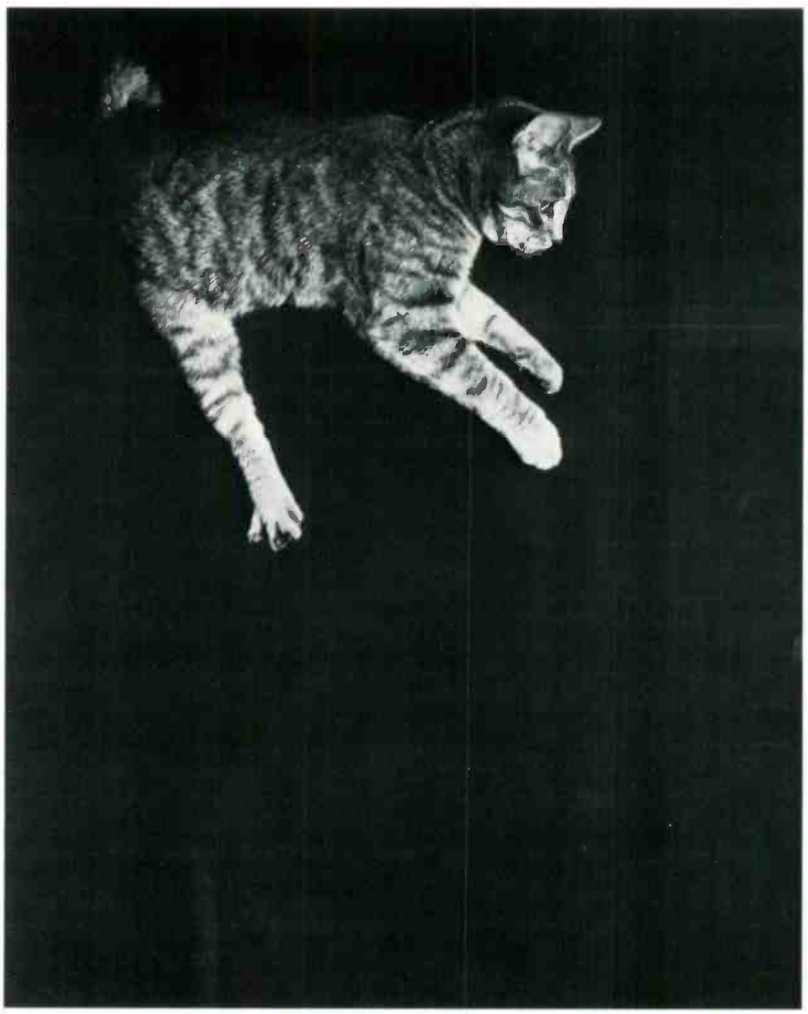
When did the notion of a standard measure arise? It surely could not have come much later than the development of agriculture, about 8000 B.C. It is most unlikely that men could have cultivated their farms in peace unless there were some agreement (by measurements according to accepted standards) as to how large a piece of land belonged to each. The simple use of boundary stones invited surreptitious shiftings.

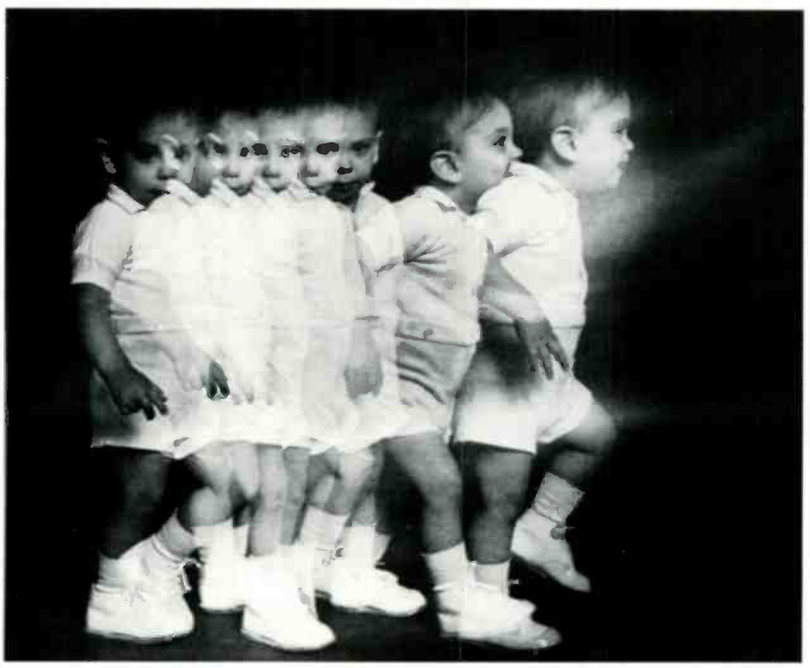
By the time civilization developed to the point of the invention of writing, elaborate systems of measurement were in use. And it was considered an important part of the governmental apparatus to maintain the integrity of the standard measure. That integrity was even made part of the biblical command (Leviticus 19:35:37): "You shall not pervert justice in measurement of length, weight, or quantity. You shall have true scales, true weights, true measures dry and liquid. I am the Lord your God who brought you out of Egypt."

The next important step in understanding space came with the development of geometry, the study of interconnected measures. By understanding the relationship of one part of a figure to another, it became possible to measure the length, let us say, of one part and from that measurement to deduce the length of a second part without actually measuring it.

For instance, it is quite impractical to measure the height of the Great Pyramid directly, since one cannot stand at the apex, bore a hole to the ground through its rocky structure, drop a plumb line through the hole, and then measure the length of line needed to reach the ground. However, one can measure along the slope of the pyramid from ground to apex (if one wants to climb it and drag a cord behind him). From that, and with a knowledge of the angle the slope makes with the ground, one can calculate the height of the pyramid.

Even this is an arduous task, requiring much muscular effort and a line about 615 feet long. One alternative would be the ability to relate the measurements of one figure to that of a second figure that is easier to handle. A small triangle, for instance, would have the same measurement relationships as would another,





In the second century B.C., Hipparchus used geometric principles to calculate the distance between earth and moon.

much larger triangle of the same shape. So why not work with the convenient former rather than with the inconvenient (perhaps impossible) latter?

There is a story that the Greek philosopher, Thales, in about 570 B.C., measured the height of the Great Pyramid without ever climbing a foot. He noted that, when the sun was in a certain position in the sky, his shadow was the same length he was. (He and his shadow formed the two legs, we would now say, of an isosceles right triangle.) Thales presumed this was true for all objects at that time of day. He, therefore, measured the length of the pyramid's shadow on the ground, then added it to the known distance from the edge of the base to the center of the large square on which the pyramid stood.

The measurement of all such objects not directly accessible can be reduced to the manipulation of triangles of similar shapes. That branch of mathematics is trigonometry.

One of the major accomplishments of trigonometry, as far as our planet is concerned, came in 240 B.C. That was when the Greek astronomer Eratosthenes, working in Alexandria, Egypt, accurately measured the circumference of the earth. Travelers had told Eratosthenes that, in the city of Syene (the modern Aswan) in southern Egypt, the noonday sun was directly overhead at the summer solstice so that every object stood on its own shadow. On that same day, however, Eratosthenes could tell that the noonday sun in Alexandria was 7° south of the zenith — by measuring the length of the shadow as compared with the length of the object casting the shadow.

This difference, Eratosthenes realized, was due to the curvature of the earth. The sun looked down (so to speak) directly on one part but looked at the surface somewhat to the north or south of that part at a slant because the surface curved away. There are 360° in a circle, and the distance from Syene to Alexandria represented 7°. The distance around the earth was, then, about 360/7 (or some 50) times that between the two cities. The north-south distance between Syene and Alexandria was 500 miles, so the circumference of the earth must be about 25,000 miles.

Until the time of the Greeks, there was no way of measuring distance anywhere but at or very near the surface of the earth. Nor did there seem any way to compare distances in the sky and get any but the most primitive notions. It was clear, for instance, that the moon passed in front of the sun during solar eclipses, so the moon was obviously closer to the earth than was the sun.

Less obvious reasoning gave rise to the notion that both the moon and the sun, together with five bright stars that constantly changed position against the background of the other "fixed" stars, were closer to the earth than those fixed stars were. From the rapidity of motion of these "planets" (from a Greek word meaning wanderer), the Greeks decided their order of distance away from the earth was the moon, Mercury, Venus, the sun, Mars, Jupiter, and Saturn.

This order is not exactly correct; yet, without a real notion of heavenly distances, there could be no true understanding of the size of the heavenly bodies and the nature of the structure of the universe. Mankind was forced to suppose that the heavenly bodies were, in actuality, exactly what they seemed to be. The stars were small specks of light, fixed to a solid sky that was blue in the day and black at night. The planets were fixed to other, closer spheres, which were perfectly transparent and thus perfectly invisible. (For all anyone could tell, each sphere touched the one beyond.) The moon and sun were spheres of light as small as they seemed to be.

The Greek philosopher Anaxagoras, however, argued that things were not necessarily as they seemed. The sun might be a great distance off, he said. If so, though it looked small, the sun might be a large, glowing rock hundreds of miles across. His speculations, made in about the year 435 B.C., created a furor that eventually forced him into exile.

The first person to try to transfer to space the mathematical methods that worked on earth was the Greek astronomer Aristarchus of Samos in about 280 B.C. The earth's shadow falls on the moon during a lunar eclipse; and, from the size of the shadow, he argued that the moon was much larger than anything previously suspected. He presented the mathematics to prove it and weathered the ensuing political storm better than Anaxagoras had.

In about 150 B.C., Hipparchus, the greatest astronomer of ancient times, recorded the position of the moon against the stars from two widely separated positions on earth at the same time. (Naturally, two observers were required.) This enabled him to draw an imaginary triangle from the moon to those two points on earth. He could determine the angle at the apex — at the moon — and measure the length of the base of the triangle on the earth. From this he could calculate the altitude of the triangle — which represented the moon's distance from the earth — by comparing it with a small triangle of the same shape.

Hipparchus could show, then, that the moon was at a distance equal to 30 times the diameter of the earth, or 240,000 miles, if Eratosthenes' earlier figure of the size of the earth were accepted. It thus appeared that the moon was a body about one-fourth the size of the earth (or 2,100 miles) in diameter.

In theory, the distance of any other heavenly body could be determined in the same way; but, for all bodies other than the moon, the angle at the apex was so small that it was impossible to measure with the unaided eye. All Hipparchus could say was that all other heavenly bodies were much farther away than the moon.

It was not until the 17th century that man's concept of the nature of space beyond the surface of the earth was radically altered, and then it was not through any measurement in the heavens, oddly enough. It involved something very much earthbound.

It had long been known that it was impossible to pump water higher than 33 feet above its natural level. In 1643, the Italian physicist, Evangelista Torricelli, wondered if a water pump worked by allowing the weight of air to push the water upward. If that were true, then when a column of water reached a height of 33 feet, its weight per unit area was perhaps equal to that of air. Air, exerting its maximum force under those conditions, could support no more.

If this were so, then a liquid less dense than water could be pumped higher and one that was more dense than water not as high. It would be convenient to experiment with short columns and other substances. What about mercury, which is 13½ times denser than water? Air should hold up a correspondingly shorter column of mercury, one only about 30 inches tall.

Torricelli filled a four-foot length of glass tubing (closed at one end) with mercury, put his thumb over the opening, and upended it into a large dish of mercury. The mercury began to empty out of the tube, as one might expect, but it did not do so altogether. Thirty inches of mercury remained in the tube, supported by the weight of the air pressing down on the mercury in the dish.

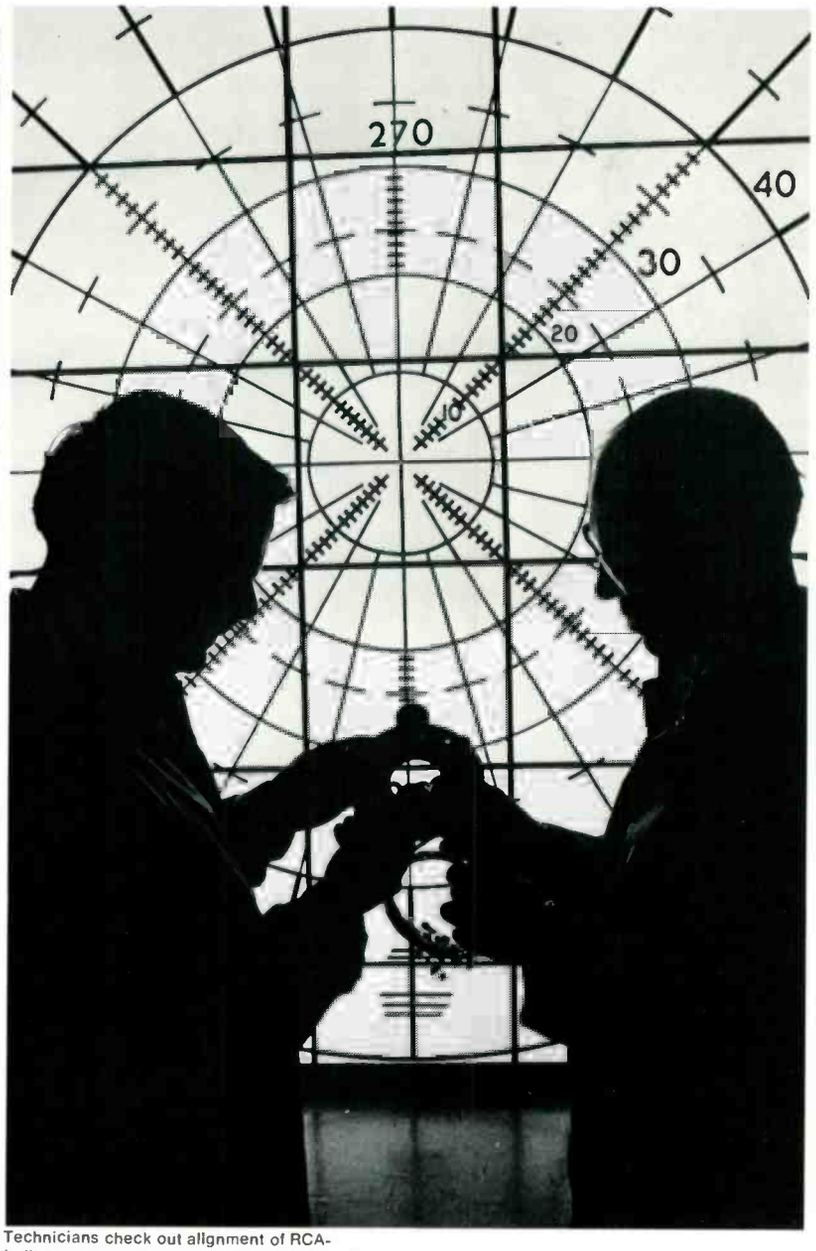
Torricelli had invented the barometer, proved that air had weight, and demonstrated that it was air that made a water pump work. In addition, he had produced the first good vacuum that mankind had ever known. When the mercury began to pour out of the tube, the space between the top of the mercury level and the closed end of the tube contained nothing but a vanishingly small trace of mercury vapor.

That nature abhors a vacuum is a classic concept. But Torricelli had not only demonstrated the presence of a small vacuum; he had also indicated the whereabouts of an infinitely larger one. If air had only enough weight to support a column of mercury 30 inches high and if it had the same density everywhere that it had near the surface of the earth, then the atmosphere was only about five miles high. Even if air spread out and grew thinner as one traveled higher (as demonstrated, shortly thereafter, by Pascal), it would still be only a few dozen miles above earth's surface before it thinned out to the extent that it might as well be considered vacuum. And the moon was 240,000 miles away.

Torricelli's experiment meant that, for the first time, mankind had to face the fact that air made up only an exceedingly shallow shell of gases immediately surrounding the earth and that beyond it lay mile upon limitless mile of nothing — of vacuum — broken only occasionally by the presence of some heavenly body.

It was with Torricelli that there arose the notion of "outer space" as a special entity of limitless nothingness.

Then, in 1672, the Italian-French astronomer Giovanni Domenico Cassini determined by the use of trigonometry the distance of Mars from the earth. (He had a telescope, which Hipparchus had not, and could measure tinier angles.)



Technicians check out allgnment of RCA-built camera system used in U.S. global weather satellites.

A portion of the sky is reflected in the 200-inch mirror of the telescope at Palomar Observatory, Calif.

By that time, the true structure of the solar system was known — thanks to the renowned astronomers Nicolaus Copernicus and Johannes Kepler — so from Mars' distance, all other planetary distances could be calculated. As the measurement was refined, it turned out that the sun was more than 90 million miles from earth and that Saturn was nearly 900 million miles away. Other planets, still more distant, were discovered and their distances measured.

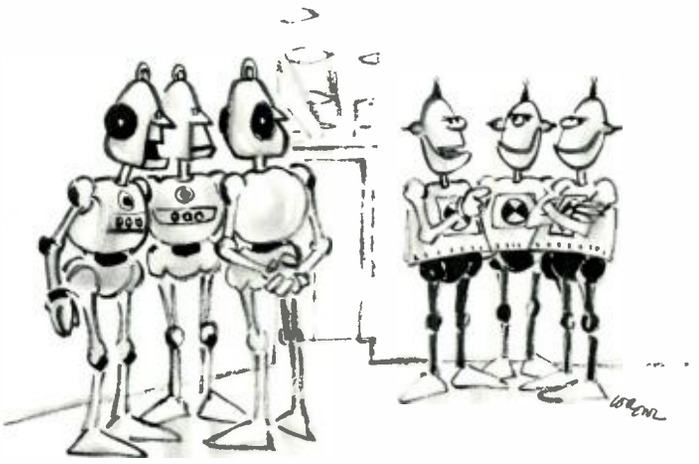
The vast distances of empty space were dumbfounding. Yet man was only at the beginning of his exploration of space. The positions of certain stars were then determined at two intervals during the year, six months apart, when the earth was at opposite ends of its orbit about the sun. With a base line more than 185 million miles across, a triangle could be measured with its apex at, for instance, a star called 61 Cygni.

In 1838, the German astronomer Friedrich Wilhelm Bessel announced the distance of that star to be 35 million miles away. It was already known that light traveled at the unheard-of speed of some 186,000 miles per second; but, even at that speed, it took six years for light to reach earth from 61 Cygni, so that the star was said to be six light-years away.

The closest star, Alpha Centauri, is 4⅓ light-years away from earth. Probing ever outward, with ever newer and more sophisticated techniques and facilities, astronomers had, by 1971, detected heavenly bodies as far away as 9 billion light-years.

Space is much vaster than man would imagine from just looking at the sky. And, by developing from the point of being able to measure a handspan to that of being able to measure a trillion handspans, man might just dimly grasp something of its dimensions. ■

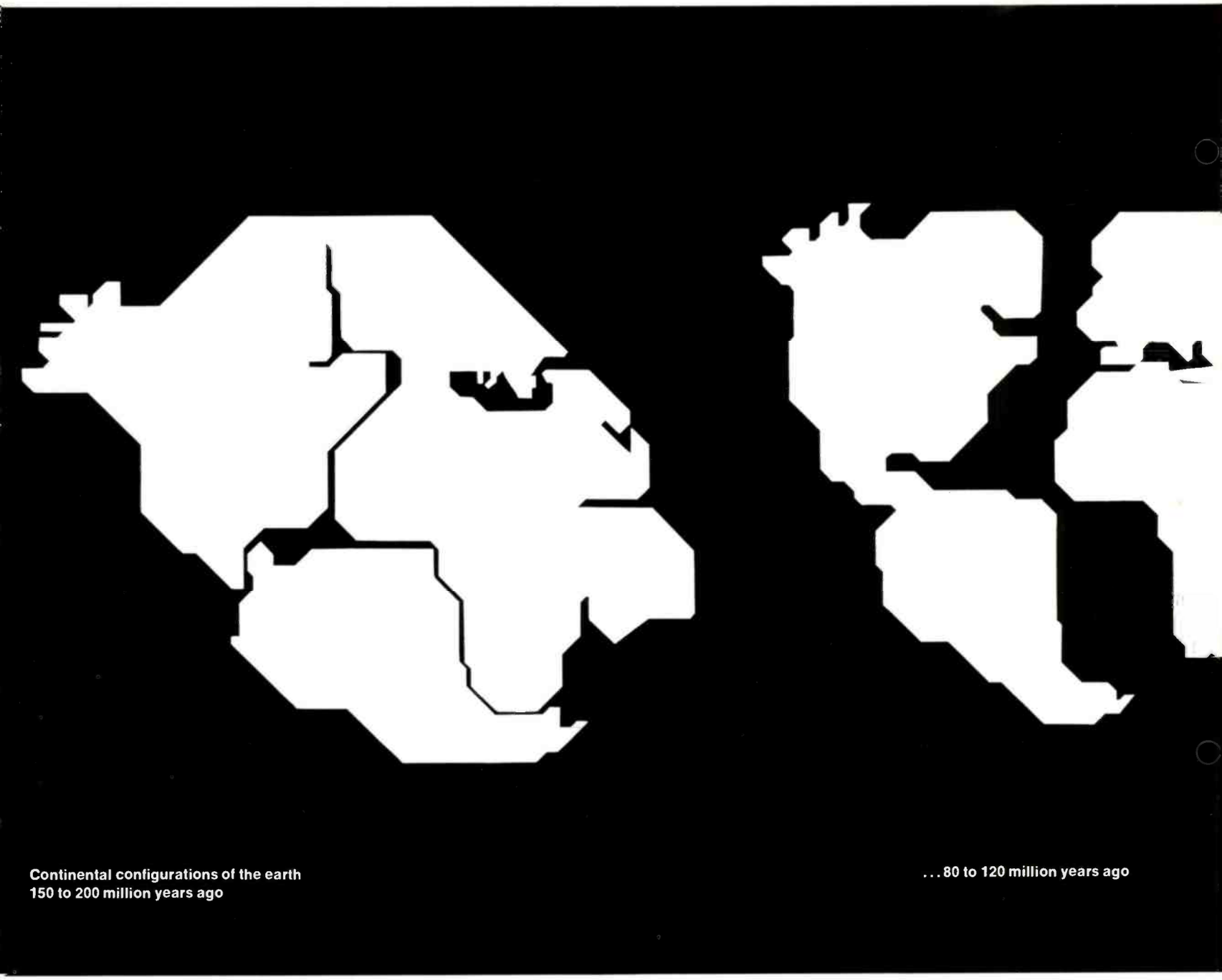
# This Electronic Age...

"That's rather an exclusive group.
They trace themselves back to first-generation computers."


"Which one of you is the Messiah?"

"Hi there, boy. That's a good boy.
Now you be a good doggie and
watch after things till we get home.
Hi there, boy. That's a good boy..."



Continental configurations of the earth 150 to 200 million years ago

. . . 80 to 120 million years ago

# Continental Drift: The Rolling Stones

Once spurned by the scientific community, the "pavement theory" of our planet's evolution is now gaining wide support.

by John Lear

Although the opinion is not yet unanimous, most geologists and geophysicists nowadays agree that the planet earth is surfaced with upward of a half-dozen huge paving stones and many smaller ones. Shaped like spherical caps, they are all in slow but constant motion, some gliding under and some pushing over the edges of their neighbors, piling mountains at this intersection, digging deep trenches at that, here swallowed by earth's molten interior and there regurgitated as bubbling red lava.

This mobile planetary pavement seems to be somewhere between 30 and 90 miles thick. The cause of its movement has not yet been determined. But turbulence within the earth is almost certainly expressing itself, and it is possible that such internal churning has been going on since the planet captured its moon at least 3 billion years ago.

The pavement theory is a unique triumph of human thought. Never before has the scientific mind been able to assemble such a unified concept of the dynamics governing the spaceship on which we live. Because it has coalesced quickly — within less than 20 years — the theory still is not integrated into textbooks. It soon should be, for it goes a long way toward explaining age-old mysteries: the presence of mountains, the appearance of seashells and sandstones in high mountain valleys, the occurrence of earthquakes, the eruption of volcanoes, the discovery of coal in the Antarctic and of the bodies of tropical behemoths within the North Polar Circle of Siberia — perhaps even the variety of living species.

Marie Tharp and Dr. Bruce Heezen of the Lamont-Doherty Geological Observatory.

By a coincidence curiously appropriate to these days of Women's Liberation, development of the pavement theory was triggered by an inquisitive female. Her name was Marie Tharp. A land surveyor's daughter, Miss Tharp had studied geology in Michigan, worked for an oil company in Oklahoma, and moved to New York to become involved in geological research at Columbia University. She was working in a basement room in Columbia's Geology Department when oceanogra-

John Lear is science editor of *Saturday Review*.

. . . and today.

pher Maurice Ewing set up the Lamont (since renamed Lamont-Doherty) Geological Observatory on the Hudson River Palisades. She went along and there became an expert draftswoman.

In inaugurating his regime at Lamont, Ewing staked out the entire sea bottom as his research province. The closest sea was the Atlantic Ocean. Its floor had been mapped by German echo sounders in the 1920s. The soundings had shown two deep Atlantic basins divided by a mountain chain. Details of the mountain elevations had been destroyed by Allied bombings of Berlin in World War II. Marie Tharp was assigned the job of drawing a simpler map from soundings made by American oceanographic research vessels.

She sketched a half-dozen profiles of the Atlantic bottom between eastern United States and western European and African ports. On all of them she was surprised to see, running through the very crest of the mountains, a rift that measured from 8 to 30 miles in width and from a mile to a mile-and-a-half deep. These dimensions surpassed those of the Grand Canyon.

She called this remarkable valley to the attention of her immediate superior, oceanographer Bruce Heezen. He was unwilling to focus on it, because to accept its existence would require an explanation of its presence, and the simplest conceivable explanation would be that the continents had been drifting apart from that mountain rift over a very long period of time. Such a drifting process had been suggested, off and on, for more than 100 years. But it had been dismissed as a crackpot delusion. No young scientist who cared about his future dared risk the ostracism that inevitably would follow involvement in the continental drift argument. To profess oneself a "drifter" was worse than confessing to membership in the Communist Party.

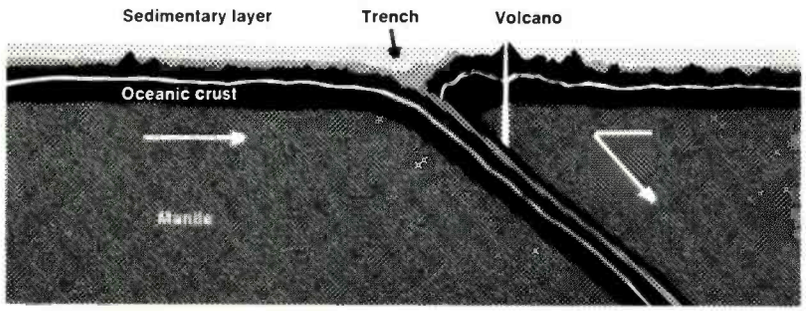
Marie Tharp put her maps in a drawer and didn't look at them again until Bell Telephone Laboratories asked Heezen's help in finding the cause of an epidemic of breaks in transatlantic telephone cables. Earthquakes might be to blame, so Heezen told his draftswoman to chart the cable partings in relation to known quake epicenters. Although she could see no relationship between the quakes and the cable breaks, she did notice that the epicenters fell in that valley in the crest of the sea bottom mountains.

Again, Miss Tharp experienced the feeling that the valley must have some special significance. Again, she called it to Heezen's attention. And this time he responded. Since the earthquake pattern had been clearly established all over the globe long before, he followed it southward through the Atlantic, eastward around Africa into the Indian Ocean, and westward around South America into the Pacific, matching echo soundings against it wherever they were available. The soundings always matched. The earthquakes always centered in the mountains, and the mountaintops were always bisected by the valley.

Thanks to the precision of Miss Tharp's work and the fidelity of her instinct for meaningful coincidence in scientific observation, Heezen had discovered the grandest single geographical feature on the face of the planet — an undersea mountain chain 40,000 miles long. He shared the formal announcement of it with her and with Ewing, as chief of the observatory, in 1955.

Two years later, nature staged a demonstration of how those mountains had come to be where they were. The valley in the mid-Atlantic ridge exploded in September, 1957, pushing a new island up into the Azores, alongside the island

The ocean floor is continuously renewed as older portions of the crust are forced down into deep trenches in the earth's mantle. New crust is formed at the ridge, forced aside, and carried away to the trench areas.




of Fayal. Slowly the newcomer grew until it joined Fayal. In 1961, the valley exploded twice more, once at Askja in Iceland (which sits atop the mountain ridge) and once at Tristan da Cunha in the South Atlantic. The people of Cunha abandoned their homes. In 1963, another new island, Surtsey, appeared off Iceland.

Meanwhile, a Princeton geology professor, the late Harry Hess, had seen to it that his students and professional colleagues were exposed to lectures by Heezen. Hess rightly deduced what was really happening in that pyrotechnical valley. The continents were being moved, just as Antonio Snider had suggested in a pair of maps published in Paris in the mid-19th century, as the Austrian geologist Eduard Suess had postulated in 1885, as the American F. B. Taylor had said in 1908, and as German meteorologist Alfred Wegener had argued in 1910. But all these men had neglected to discern a reasonable mechanism that would account for the motion. They had talked as though the continents could plow across the sea floors in violation of the most fundamental laws of physics. Hess realized that the sea floors were actually spreading, like oppositely directed conveyer belts, from the mid-ocean ridge cleft, and were carrying the continents along.

Hess was a quiet man, not much of a promoter. His ideas might never have gained currency but for a more articulate scientist, Robert Dietz, of the U.S. Coast and Geodetic Survey. Dietz spelled out some of the implications. One of these was that new surfacing could not be set in place unless older surfacing were removed to make room. The only way to dispose of old surfacing was to take it down into the melting pot below the planet's crust.

All this was surprisingly similar to what had been taught in many British schools since 1944. *Principles of Physical Geology,* a textbook written by Arthur Holmes, had laid it out in almost identical phrasing. But a peculiar lack of recognition of Holmes' work prevailed in the early 1960s. Even the eminent Canadian physicist, J. Tuzo Wilson, of the University of Toronto, accepted Hess' ideas as though they were revolutionary innovations.

Wilson, indeed, was close behind Dietz in dramatizing Hess' theory. Early in 1963, Wilson published a comparison of the ages of islands in relation to their distances from the mid-ocean ridges. He found that the older an island was the farther it was from a ridge. In a corollary paper, he used the Hawaiian archipelago as an illustration. That string of islands could have been formed by simple spreading of the ocean floor over a convective plume rising through a hot spot in the earth's mantle and crust. Lava would push through the hot spot to produce a volcano there, and the volcano would become an island. As time passed, that island would move away, another volcano would be fed by the convective plume, and another island would form. That island, in time, would move, making way for still another island. All the Hawaiian islands were once volcanically active, but nowadays only the cauldrons on the easternmost isle — Hawaii itself — still erupt.

Resistance to the continental drift idea within the American scientific community, however, remained strong. Wilson's papers were declined by scientific journals in the United States. After several months' delay, his practical demonstration of the emerging concept of earth's mobility finally reached print in the *Canadian Journal of Physics.*

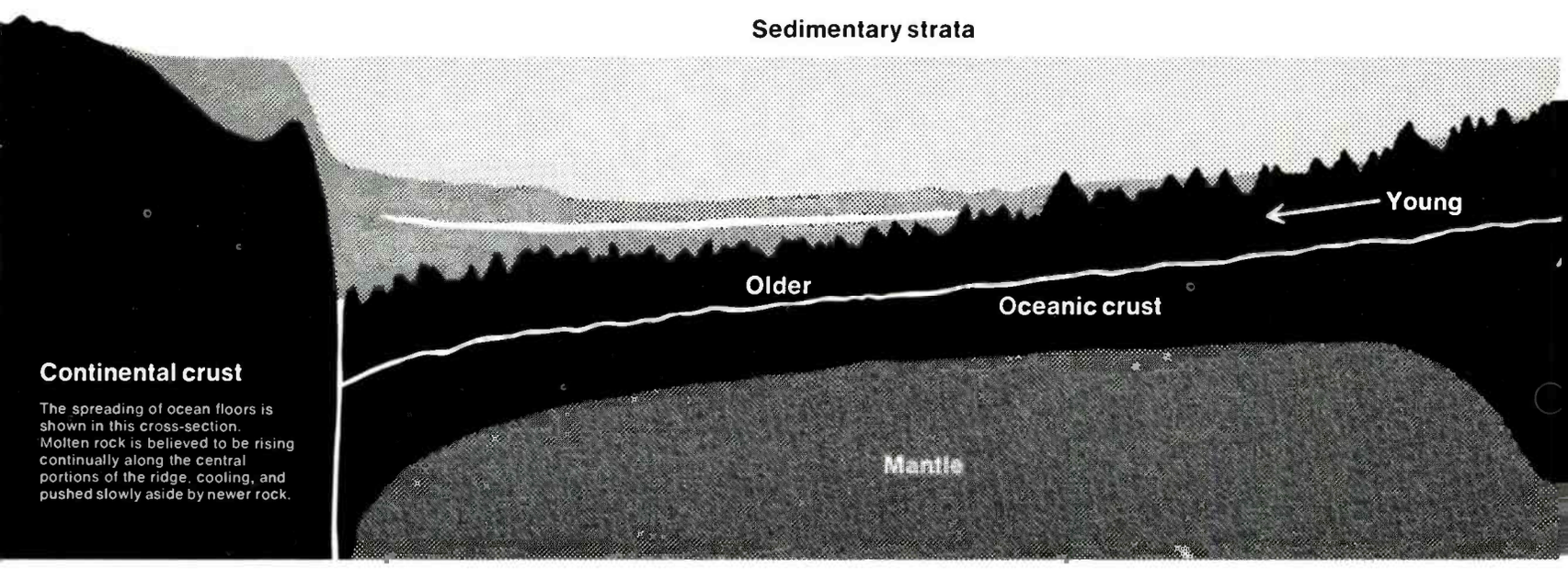
The first actual proof of Hess' thesis was recognized by one of Wilson's protégés, L. W. Morley, of the Geological Survey of Canada. Morley kept in mind several facts for which most people hadn't much regard. One was that the magnetic field of the earth flips periodically. From a North Polar orientation, the field changes to the direction of the South Pole. These shifts can be detected in rocks, which are magnetized in whatever direction prevails at the time the rocks are formed.

A long series of magnetic reversals was clear in a survey made of the east Pacific Ocean bottom by R. G. Mason and A. D. Raff, researchers attached to the Scripps Institution of Oceanography at La Jolla, Calif. Morley was examining the Mason-Raff maps in his office at Ottawa when it occurred to him that he might be looking at a magnetic recording of sea floor spreading. He turned from the maps and wrote a letter to his scientific colleagues:

"If one accepts in principle the concept of mantle convection currents rising under ocean ridges, traveling horizontally under the ocean floor and sinking at ocean troughs, one cannot escape the argument that the upwelling rock under the ocean ridges, as it rises . . . must become magnetized in the direction of the earth's field prevailing at the time. If this portion of rock moves upward and then horizontally to make room for new upwelling material, and if, in the meantime, the earth's field has reversed, and the same process continues, it stands to reason that a linear magnetic anomaly pattern of the type observed [by Mason and Raff] would result."

Morley mailed the letter to a scientific journal in England. The editors rejected the communication. He then approached a journal in the United States, which returned the letter with a referee's opinion that such speculation made interesting cocktail party talk but ought not be published as serious scientific thought.

Three months after Morley presented his observations orally at the annual meeting of the Royal Society of Canada in Quebec City on June 4, 1963, the British journal *Nature* published essentially the same hypothesis in a letter signed by F. J. Vine and D. H. Matthews of Cambridge University's Department of Geodesy and Geophysics. The only essential difference between the two letters was that Morley had synthesized the research work of others while Vine and




**Continental crust**

The spreading of ocean floors is shown in this cross-section. Molten rock is believed to be rising continually along the central portions of the ridge, cooling, and pushed slowly aside by newer rock.

Matthews reported on magnetic studies they themselves had made of the floor of the Indian Ocean.

In 1965, the climate of hostility to the theory of continental drift began to moderate. The thaw was due largely to the prestige of the Nobel Prize-winning British physicist P. M. S. Blackett, whose studies of magnetism in the earth's rocks convinced him that continental movement was the only intellectually satisfying explanation for the record the rocks held of "wandering" of the northern pole during ages past. With Blackett speaking out alongside S. K. Runcorn, a pioneer among advocates of drifting, other men on both sides of the Atlantic were encouraged to contribute to development of the theory.

Wilson became one of the foremost contributors. He pointed out that the mid-ocean mountain chains were segmented, appearing on maps as a series of steps, one offset laterally from the next. He called the top of each step a "transform fault" and predicted that — although the faults sometimes extended across the full width of an ocean — earthquakes would be found to occur along them only between one segment of mountain and the next. Not explicitly stated, but implicit in this prediction, was a forecast that new sea floor, spreading out from a particular source, could go only so far before encountering new floor spreading from another source. Here was the first hint of separate paving stones.

Lynn Sykes, of the Lamont-Doherty Observatory, gave enormous impetus to the discussion with an analysis of earthquake movements that showed Wilson's prediction about the transform faults to be correct. Bryan Isaacks and Jack Oliver, also of Lamont, later joined him in marshaling further earthquake testimony that emphasized the importance of the transform faults as boundary markers. Vine (by that time at Princeton) brought out more magnetic data. Still more came from Lamont through James Heirtzler and Walter Pittman.

This volcanic island, named Surtsey, rose out of the ocean off the coast of Iceland in 1963. The original crater is still active.

All these papers described movements of crust about six miles thick. The dimensions suddenly changed when D. P. McKenzie, of Cambridge, and R. L. Parker, of Scripps, set up a geometrical framework for a finite number of paving stones (which they called "plates") as thick as earth's lithosphere and extending as far as 90 miles down. W. Jason Morgan, of Princeton, then fixed the number of "plates" (or stones, as I persist in thinking they should properly be called) at six. The total body of magnetic and seismic data underlying the mobile pavement concept was finally gathered together at Lamont and published by Xavier Le Pinchon.

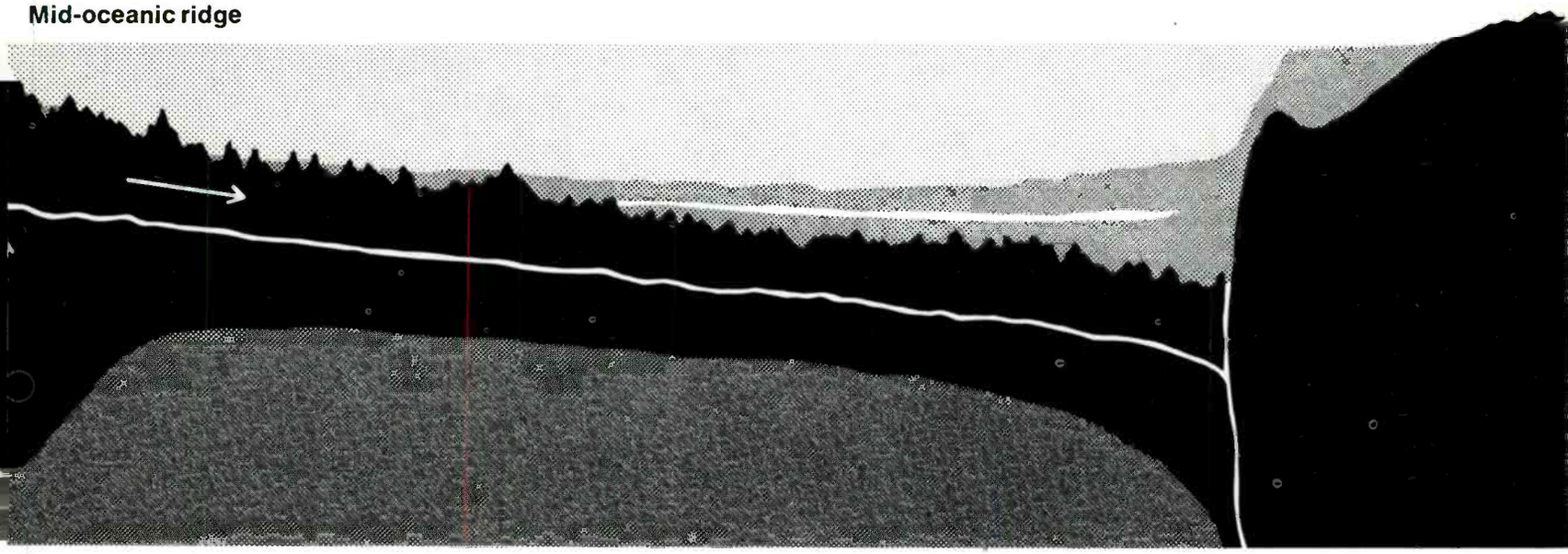
The boundaries of these six huge stones are not precisely described. But one of them carries North and South America and the western half of the Atlantic Ocean floor. Another carries the eastern half of the South Atlantic floor, all of Africa, and part of the Indian Ocean floor. Europe and Asia, except for India and Arabia, ride on another stone. Australia has a stone to itself. So does Antarctica. The Pacific Ocean basin rests on one stone, which is the only one that does not carry a continent.

Almost all earthquakes and volcanic eruptions occur where one stone meets another. When two stones carrying continents collide, the force of their meeting crumples the land into mountains. The Himalayas are assumed to have been formed in this fashion when India, breaking loose from Australia long ago, crashed into Asia. When a stone that bears no land meets one that carries a continent, the edge of the former glides under the lighter and more buoyant continent-bearing stone and falls back into earth's interior. This underthrusting forms a deep trench in the ocean bottom and pushes up mountains on the other side of the trench — a process that is now taking place along the west coast of South America and accounts not only for the Andes Mountains but the recent calamitous earthquakes in Chile and Peru.

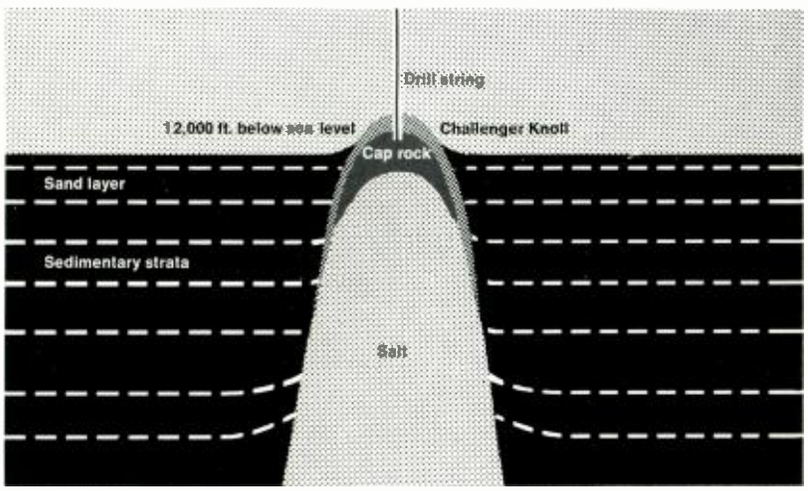
The mobile paving stones do not always collide. Sometimes they simply grind against each other. This is happening along the West Coast of the United States, where the stone bearing the Pacific basin is tearing lower California and a sliver of California west of the San Andreas fault (including Los Angeles) from the North American continent — an action that is expected to put Los Angeles abreast of San Francisco 50 million years from now.

The stone that carries Africa is moving north, compressing the Mediterranean Sea against the Euro-Asian stone and pushing Europe northward. At the same time, the Red Sea and the Gulf of Aden are widening, swinging the Arabian Peninsula away from Africa on a separate, smaller stone that is thought to be bounded by the mountains of Iran and Turkey, which are so often seized by earthquakes. Still another new ocean

**Mid-oceanic ridge**



Underwater exploration undertaken by the crew of the *Glomar Challenger* (above) has proved, among other things, that oil exists in some parts of the Gulf of Mexico. A core sample taken from one of the Sigsbee Knolls (cross-section below) revealed that the knolls are salt domes, while a second sample, taken at a lower depth, contained oil.




seems to be forming in the Danikil Depression of Ethiopia, and some scientists think a new continent is beginning to take shape behind the Aleutian Island arc.

All these phenomena are being intensively examined. The longer the search continues, the greater grows the necessity for postulating the existence of additional small stones in the paving pattern. It is fun for the scientists and keeps them employed. But why should most of the rest of us have any interest in this research? What possible effect can knowledge of this sort have on our daily lives?

Much more than might be supposed. For example, an integral part of the drifting continent theory is that all the present-day continents once were aggregated in either one great land mass or two lesser masses. In the Northern Hemisphere, the Appalachian Mountains of the United States clearly rose contiguously with the mountains in Scotland. At the opposite pole of the earth, evidence has been accumulating for many years in support of the proposition that at least Africa, South America, Australia, India, and Antarctica were bound together. Antarctica has come to be accepted as the key to the puzzle. Long ago, Antarctic explorers found fossils of green plants familiar to Africa, South America, and India. More recently, bones of ancient amphibians common to those continents were discovered by researchers from Ohio State University's Institute of Polar Studies sent out by the National Science Foundation. Still more recently, the remains of reptilian descendants of these amphibians have been picked out of the ice — not just one set of bones or the bones of one family of animals, but bones of different species and even fragments of wood from African-type trees.

If these age-old associations can be unequivocally established and the former continental configurations can be fixed, ore deposits on one present-day continent can be used as clues in locating deposits elsewhere. This kind of detective work has already been done in identifying belts of tin ore that cross the Atlantic. Likely sites for oil exploration also can be located by mapping salt domes that formed around the rims of oceans when the oceans were young and shallow. Geothermal steam is another resource associated with continental drifting. Pools of hot brine, rich in suspended metals, lie above the rift in the mountains that cross the bottom of the Red Sea; these have raised the question of how ore deposits generally originate. And one scientist, Robert Rex, of the University of California, has suggested the eventual possibility of mining the earth's riches by floating them upward in holes drilled deep beneath the surface.

To be effective, the realignment of ancient continental margins must be precise. To make it so, the National Science Foundation is financing a round-and-round-the-world voyage by the *Glomar Challenger,* a vessel especially designed and built to carry out a process of drilling deep into the sea bottom. Up to this time, scientists assigned to the *Glomar Challenger* by a consortium of oceanographic research institutions (Lamont, Woods Hole, Scripps, and Miami prominent among them) have determined beyond doubt that no ocean floor anywhere on earth is older than 200 million years (the oldest rocks on the continents are 3.5 billion years old) and that continental drift has been proceeding in the North Atlantic Ocean during most of that time.

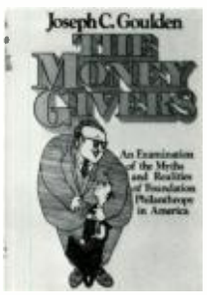
John Dewey, who recently left Cambridge University to join the faculty of the State University of New York at Albany, is working with three men at Lamont — Pittman, William Ryan, and Jean Bonnin, a French geologist — to fix the exact route the North American continent followed in moving away from Europe and the route North America followed in moving away from Africa. Once those paths are known, it will be possible to see which way Africa traveled in splitting from Europe and how that movement erected the Alps around the Mediterranean basin. The job will take at least a decade and may engage hundreds of men in many lands before it is done. The team hopes that the project will be expedited by diverting monies now spent on long-winded scientific meetings; a number of field expeditions, converging at a given point and reporting results there, could be sent out at no more, and maybe even less, expense.

Later, Dewey may be able to return to a project he initiated some time ago with John Bird, a member of the Albany faculty. The object of it was to discover how far back in time the drifting of continents began. The clues in this quest were remnants of mountains, which Bird and Dewey took to be sutures of paving stones that collided early in the earth's history. One such suture, found in southwest Africa, is at least 3 billion years old.

That point in time falls within the period when astrophysicist Fred Singer's theory says the moon was captured by the earth. Energy released by that event would have caused some melting of both the earth and the moon. Astronauts who have gone to the moon have brought back evidence of melting there. Comparable evidence exists on earth in a particular kind of rock, called anorthosite.

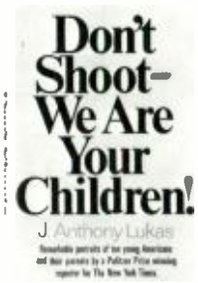
If, in capturing the moon, the earth did undergo melting, it would explain why the oldest rocks on the planet are a billion or more years younger than the planet itself is supposed to be. The melting would also explain how iron, heaviest of the metals, became concentrated in the earth's core to generate its magnetic field, how volcanic eruption was initiated, how the atmosphere and oceans were formed from volcanic exhalations, why the planet quakes so violently. The same internal turbulence that produced volcanoes and earthquakes could account for the endless drifting of the continents. ■

# Books at Random...



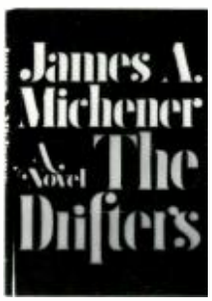

**The Money Givers**
An Examination of the
Myths and Realities
of Foundation Philanthropy
in America
by Joseph C. Goulden (Random House)

What is a foundation? One person in the philanthropy business defines it as "proof that, even if you can't take it with you, you can keep it away from the federal government." There are over 22,000 foundations in the United States, with assets of more than $20 billion; yet the public knows little about this enormous industry. *The Money Givers* examines these tax-exempt institutions, the vast sums of money they control, the way their monies are spent, who receives them, and what benefits — both financial and in prestige — accrue to the givers.




**Don't Shoot — We Are Your Children!**
by J. Anthony Lukas (Random House)

On October 7, 1967, Linda Fitzpatrick, the 18-year-old daughter of a wealthy Connecticut businessman, was bludgeoned to death on New York's Lower East Side. J. Anthony Lukas' chilling account of the crime in *The New York Times* won him nearly every possible journalistic award, including the Pulitzer Prize. Now Mr. Lukas has delved even deeper into the story, gathering new material that suggests the gap in Linda's two worlds was not so broad as it first seemed. He also finds continuities in the troubled lives of nine other young Americans and their parents and concludes that the "generation gap" is an outworn cliché masking far more complex connections between generations.




**The Drifters**
by James A. Michener (Random House)

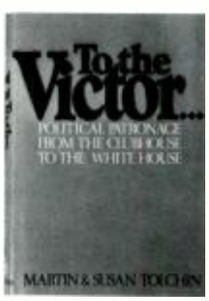
One of the major characteristics of Mr. Michener's storytelling art is his skill in setting credible, imaginary characters and actions in authentic backgrounds. Once again, in *The Drifters,* he is eminently successful in depicting the traumas that afflict a segment of today's society. This series of adventures begins in the Spanish resort of Torremolinos and moves from Spain to Portugal, back to Spain, and then on to Mozambique and Morocco. The eight protagonists, from three different generations, shun the lifestyles and values of the past and are pulled toward the mad orbit of expatriates and dropouts, of drugs and rock music.


**Smith's Gazelle**
by Lionel Davidson (Alfred A. Knopf)

In this novel, Lionel Davidson has woven a superlative tale around the discovery of a beautiful, supposedly extinct creature: Smith's gazelle. Six such animals are sighted in the Israeli desert. But, before a naturalist can convince anyone of their existence, five are killed by hunters and the last, a female in kid, escapes into a ravine. Years later, two boys — an Arab and a Jew, who have been taught since infancy to hate each other — enter the ravine from opposite sides. There they discover an aged shepherd tending the now-multiplying flock of gazelles. Overhead, shelling begins.To Jews and Arabs, it is the Six-Day War. But to Smith's gazelle, it is once again the threat of extinction.

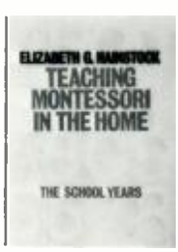

**The Other**
by Thomas Tryon (Alfred A. Knopf)

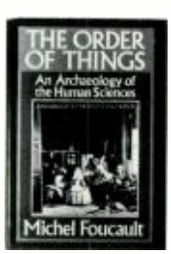
Fearful mysteries that slowly overwhelm a Connecticut town are depicted in this engrossing new novel. Young twin sons of the old and respected Perry family — complicated, secretive, bound together in the intense fidelity of twinship — play strangely imaginative and mystic games in an ancient barn and dungeon-like cellar. As the rumors, conflicts, and attachments characteristic of large families and small towns occupy and distract the household, the twins' elegant and fragile mother recedes into her own private world and their strong-willed grandmother labors to guide her loved ones. Ultimately, the whole town is shaken by a horrifying series of inexplicable deaths and disasters.




**To the Victor...**
Political Patronage From the Clubhouse
to the White House
by Martin and Susan Tolchin
(Random House)

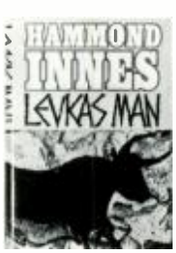
Idealism, charisma, and "the issues" are for public consumption. What really determines who gets a presidential nomination or becomes a federal judge or a local sheriff is service to the party and to the interests that hold it together. Such is the contention of authors Martin and Susan Tolchin — a *New York Times* reporter and a political science professor, respectively. Successful American politicians practice what is called "the art of obligation." This involves the buying and selling of favors, whether a zoning variance or a billion-dollar appropriation to help a local aircraft plant.


Other Recent Random House Books





# "Operation Bootstrap" Revisited

## After 450 years of foreign domination, Puerto Rico is fast becoming an economic and political force in its own right.

by Manuel Suarez

Puerto Rico is a land of contrasts, a mixture of two cultures that sometimes blend, sometimes clash. Throughout its 450-year history, many of its problems have stemmed from the domination of one culture over another. It is a country that has yet to determine its political future, and what its decision will be is uncertain. Yet, Puerto Rico has been compared to 20th-century Japan as one of the economic miracles of this generation.

It was not an instant miracle. The island's economic reforms began gradually in the 1940s. Prior to that time, the economy was based almost exclusively on sugar production, and the Gross National Product was $287 million. Of the 536,000 people in the labor force, 40 per cent worked only six months a year or less during the sugar harvest, the mainstay of the island's economy.

The Depression of the 1930s affected the island severely. The population, about 1.5 million in 1930, was growing rapidly; so was unemployment. The average sugar worker earned about 12 cents a day, and Puerto Ricans began to realize that they needed an extensive program of economic and social reform.

Industrialization began successfully in 1948 with "Operation Bootstrap," an effort to attract American manufacturers to the island. What money the island could spare from its overwhelming social needs went to establish the basic services needed by industry — water, power, and transportation — and to seek out manufacturers who could contribute to the island's development.

During the first three years of Operation Bootstrap, 82 factories employing 6,200 people were set up by mainland companies. In 1950, the Economic Development Administration (nicknamed *Fomento*, the Spanish word for development) was created by the government. Led by a pharmacist named Teodoro Moscoso, *Fomento* offered as inducements 10- to 17-year tax exemptions, depending on where a company chose to locate; low wages, which are now being adjusted upward at a rate that will close the gap in a few years; and tariff-free movement of goods between Puerto Rico and the mainland.

One of the main problems in attracting factories to the island was that Puerto Rico was considered to have no natural resources. Most of the jobs created in the early years of Operation Bootstrap were low-paying, such as in the garment industry. *Fomento* gradually diversified its efforts and started to attract industries with such products as machinery, chemicals, pharmaceuticals, and scientific instruments. Among the electronics companies, for example, is RCA's subsidiary in the town of Juncos, which employs 550 workers and makes electron-gun mounts for color television tubes. Another RCA plant has been built in Barceloneta for the manufacture of shadow masks for color television tubes.

*Fomento* has also actively promoted the growth of petrochemical complexes that could use oil brought in from nearby Venezuela. The petroleum by-products could supply other industries with materials for manufacture into plastics, synthetic fibers, fertilizers, paints, aromatics, and pharmaceutical products. At present, the largest petrochemical complex in the world is operating in southwest Puerto Rico. By 1969, that industry's cumulative investment on the island had reached $726 million, with still higher expenditures projected for the early 1970s.

Economic problems continue, of course. Puerto Rico's explosive population growth is one of the factors contributing to the high rate of unemployment: 13 to 15 per cent in the late 1950s, around 11 or 12 per cent in the 1960s. In the spring of 1969, the unemployment rate dropped below 10 per cent for the first time in recent years, only to rise again as the recession in the United States was felt on the island.

But by 1960, the number of plants had increased to 700, by 1968 to 1,700. These provided employment for more than 103,000 people. The Gross National Product, rising at the rate of 10 per cent a year for the past 10 years, neared $4.6 billion in 1970.

The political party that brought about the industrialization of the island was the Popular Democratic Party, founded in the late 1930s by Luis Muñoz Marín. The PDP came into power in the election of 1940, when it gained control of the Senate. (At the time, Puerto Rico's governors were still appointed by the United States. Luis Muñoz Marín became the island's first elected governor in 1948.)

Today, the political sentiments of the island's 2.8 million inhabitants are divided among three alternatives for Puerto Rico's status: independence, statehood, and Commonwealth. The ideal of independence had been very strong in the 19th century, and many Puerto Ricans fought for the freedom of Cuba, Venezuela, and other Latin American nations. In 1897, Puerto Rico had been granted autonomy by Spain, which gave it greater self-government in certain respects than it subsequently had for many years under United States rule.

After the Spanish-American War in 1898, the United States acquired Puerto Rico and other lands from Spain through the Treaty of Paris. Some Puerto Ricans wanted immediate independence; others wanted statehood. Although United States citizenship was granted to Puerto Ricans in 1917, the United States kept Puerto Rico as a "possession" until 1952, when it granted the island its Commonwealth status.

During its early years, the Popular Democratic Party advocated both independence and economic reform. However, it changed its platform soon after coming into power and now advocates permanent association with the United States as a Commonwealth. But many of its opponents — advocates of statehood, in this case — believed that the PDP actually continued to favor independence and was only trying to bolster the economy until the party could sue for independence. Even after 1952, when Congress and the people of Puerto Rico approved the constitution that created Commonwealth status, this feeling still prevailed.

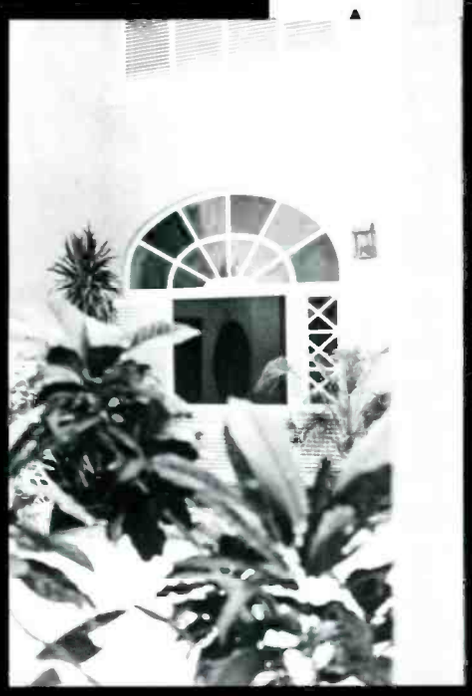
In 1968, a severe split in the Popular Democratic Party permitted the New Progressive Party (an offshoot of the Statehood Republican Party formed by Luis A. Ferré in 1967) to win control of the governorship and the House of Representatives by a small plurality while the PDP retained control of the Senate.

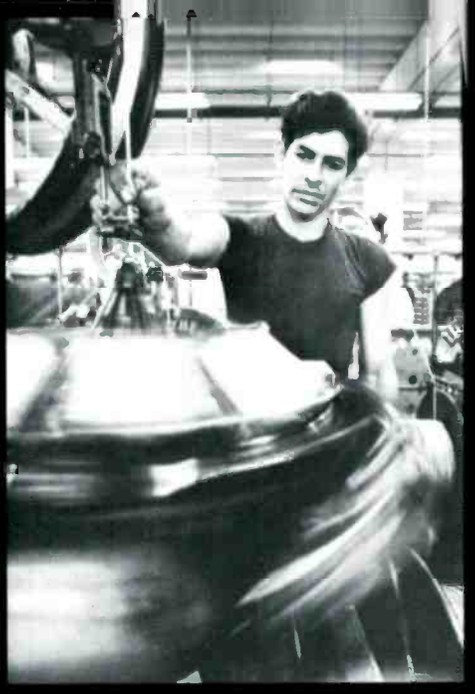
With a statehood party in power, the islanders started to polarize around the two extremes, statehood and independence. There are no reliable political polls to tell how sentiment may have changed since the 1968 election, but evidence indicates that both the statehood and the independence parties have gained strength at the expense of the PDP.

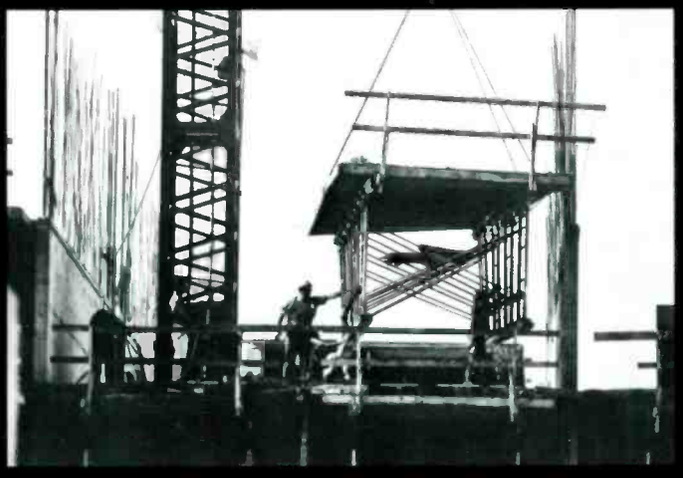
Moreover, the victory of the statehood party has had a radicalizing effect on some of the independentists, particularly on the youth division of the party. Anti-government demonstrations have become more numerous, and upheavals at the University of Puerto Rico in San Juan led to the burning of the ROTC building,

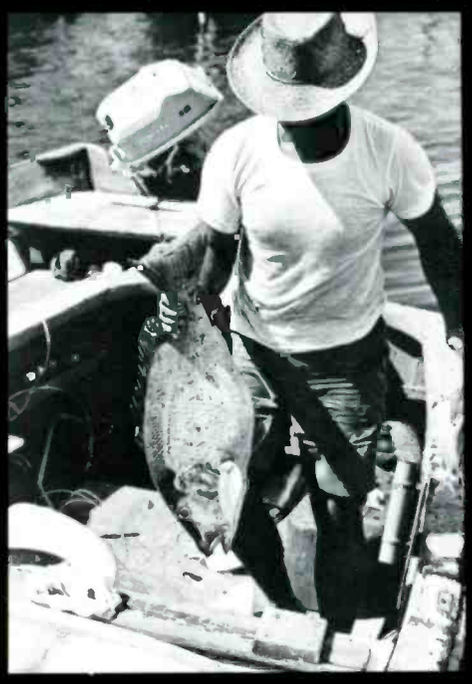
**" 'Puerto Ricans have two languages, two citizenships, two basic philosophies of life, two flags, two anthems, two loyalties.' "**
**René Marqués**

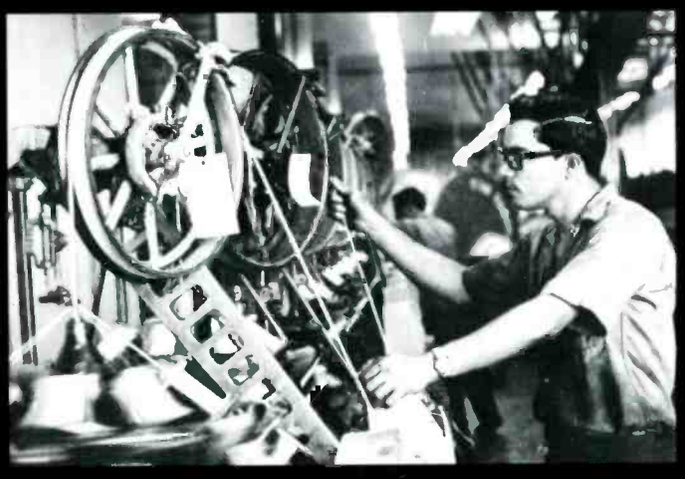
Manuel Suarez is a reporter for the *San Juan Star*.











injuries, and the death of one student in early 1970. On March 11, 1971, two policemen and an ROTC student were killed and more than 60 persons injured at the university, which subsequently was closed for 31 days. Fire bombings of American-owned businesses also have increased, resulting in millions of dollars' worth of damage.

Under its Commonwealth status, Puerto Rico is largely autonomous in its internal affairs. Its government assumes responsibility for functions such as police and fire protection, education, road and highway construction, and public health and welfare programs and supervises municipal fiscal affairs.

The United States provides defense (Puerto Ricans serve in the U.S. armed forces) and legislates in such areas as customs collections. Writs of error and appeals from judgments may be submitted to the U.S. Court of Appeals and the Supreme Court. Residents of the Commonwealth, although they do not vote in federal elections and do not have voting representation in Congress, are represented in the House of Representatives by a Resident Commissioner who has a voice but not a vote.

Puerto Ricans do not pay federal income taxes, although the island qualifies for most federal state-aid programs. However, the Puerto Rican income-tax rate is almost as high as the federal.

Other federal taxes do not apply except by mutual consent, as in the case of social security taxes. Excise taxes collected by the government on Puerto Rican exports such as rum and tobacco and tariffs collected by the U.S. Customs Bureau on foreign products sold on the island are returned to the Commonwealth treasury.

Yet, the granting of Commonwealth status in 1952 — and confirmation of the island's desire to maintain permanent association with the United States in the plebiscite of 1967 — has not put an end to the controversy. It remains one of the most divisive problems on the island and goes well beyond political or economic considerations.

Puerto Rico values its cultural heritage highly, and one of the main arguments in favor of independence is that American influence may overwhelm the island's culture. This view is shared by some who favor Commonwealth status — although they tend to believe that, w th some modifications in the relationship, Puerto Rico's cultural heritage could be preserved. However, the political and economic relationship with the mainland has led to a divided sense of national identity. Puerto Ricans do not feel completely American nor completely Puerto Rican. As playwright René Marqués explains: "This is really a schizophrenic society. Puerto Ricans have two languages, two citizenships, two basic philosophies of life, two flags, two anthems, two loyalties. It is very hard for human beings to deal with this ambivalence."

Part of the problem of preserving the cultural heritage has its roots in the first 40 years of U.S. rule when, unfamiliar with the ways of colonialism, the United States attempted to reshape the island in its own image. Since more than 83 per cent of the population over 10 was illiterate, the Americans built schools. But, in the attempt at Americanization, the U.S. government ordered all schools to use English as the language of instruction. Since the few available textbooks were printed in Spanish, and since teachers were forced to lecture in a language neither they nor their students had mastered, it was a miracle that anyone learned anything at all.

Although its current activity in the arts is remarkable, much of Puerto Rico's cultural activity goes back to the 19th century. Formal education was still the province of the wealthy; but many Puerto Rican artists were self-taught, and cultural life blossomed. Many critics and historians consider the last 25 years of the 19th century the golden age of the island's cultural life.

By the mid-20th century, as education became more readily available and the literacy rate soared to 90 per cent, cultural activity once again began to revive. Pablo Casals, the Spanish cellist, opened the annual Casals Festival in 1957. The Symphony Orchestra of Puerto Rico was established by legislative action in 1958. The need for more local musicians led to the founding of the Puerto Rican Conservatory of Music in 1959.

The Ballets de San Juan presents three series of performances a year — two in San Juan and one in Ponce. It commissions music from local and international composers, offers classroom lectures and demonstrations in high schools, and brings leading dancers and ballet teachers from outside the island to work with the company. In the fall, its presentations are shown as part of the International Theater Festival — one of five annual theater festivals in Puerto Rico.

Since few Latin American writers are translated into English, most Puerto Rican authors remain unknown in the United States. Classic literary figures include poets Luis Lloréns Torres and Luis Palés Matos, novelist Pedro Juan Soto, and playwright René Marqués.

The Spanish influence on the island and the island's culture and pleasant climate are factors that attract many tourists to the island. Tourism owes its growth to the opening, in 1949, of the Caribe Hilton Hotel, still a showpiece of the island's $223-million tourist industry. When the Economic Development Administration could not find a hotel chain interested in investing several million dollars in Puerto Rico, it offered Conrad Hilton the kind of deal few businessmen could refuse: *Fomento* would build a hotel at no cost to Hilton if he would operate it and share the profits with the government. The $8-million structure was designed so that it could be easily converted into a hospital if it did not succeed as a hotel. Despite early uncertainty, the hotel proved an immediate success and was the beginning of the Hilton Hotels international empire. The jet age put San Juan only three-and-one-half hours from New York; and tourism grew rapidly.

However, the government remained somewhat ambivalent toward this development throughout the extraordinary period of growth, and, even now, Puerto Rico does not want to evoke a Miami- or Las Vegas-type image — spending much less on promotion than do most countries with a large tourist industry. Other problems have also beset the industry. Rising costs have forced hotel operators to raise prices; at the same time, the recession in the United States has made many people reluctant to travel.

Much remains to be done in terms of social and economic improvement on the island. But the progress Puerto Ricans have made so far indicates that they are highly capable of solving their own problems. In April, the government announced a new program aimed at attracting some $4 billion in industrial development by 1980. Says Manuel A. Casiano, recently appointed director of the Economic Development Administration, "This will mean that we will be doing twice as much as before in half the time."

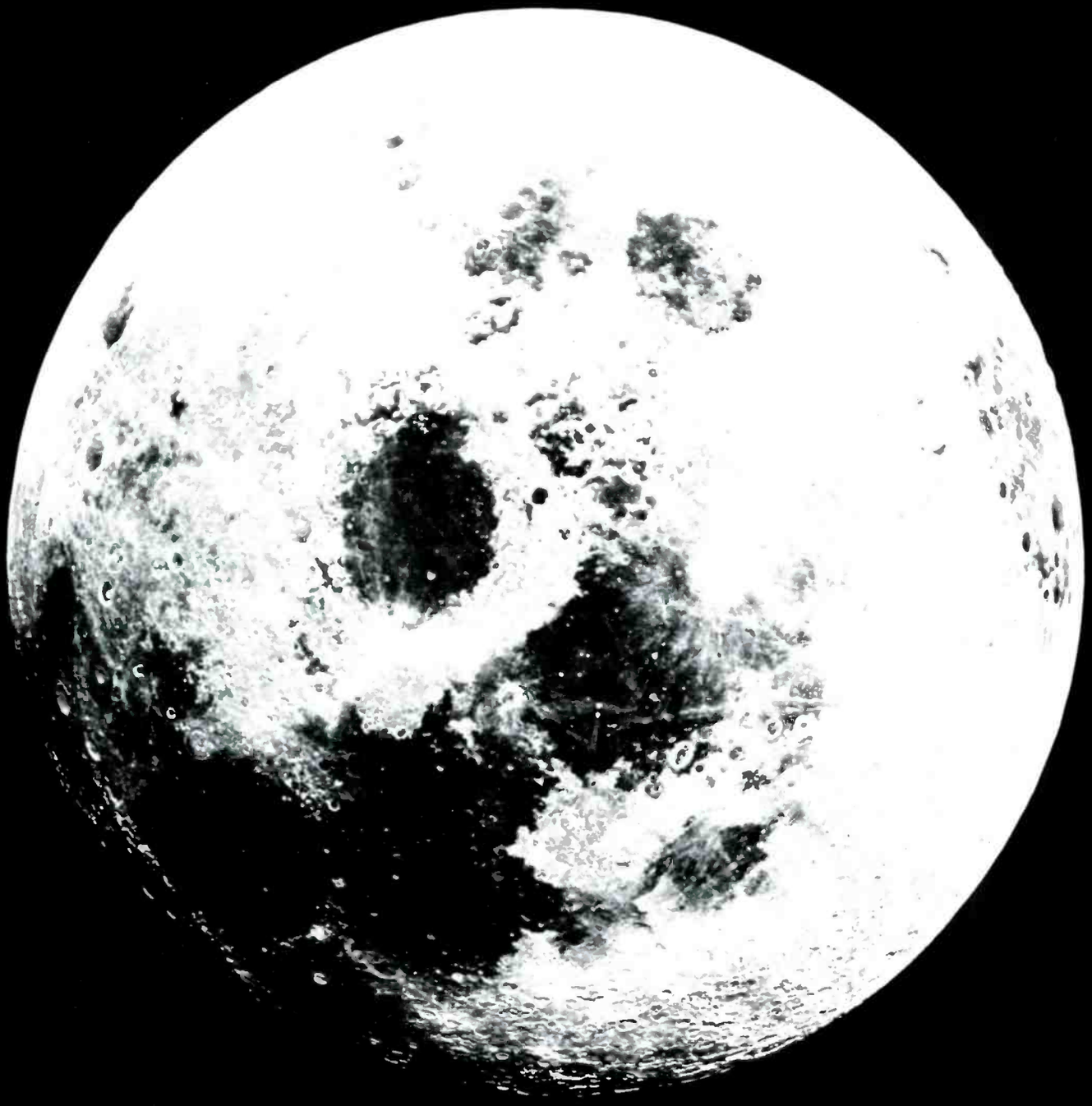
The days of "Operation Bootstrap" are over. And a major push toward rapid expansion of the island's economy is under way. ■

**"Puerto Rico has been compared to 20th-century Japan as one of the economic miracles of this generation."**

# Lunar Rover

by Sanders LaMont

Scheduled for first use in July, this moon-probing vehicle may provide an innovative approach to the exploration of outer space.



**"'This isn't like earth terrain,'" Scott says, "'and naturally, we'll have to go slower. We have enough flexibility to spend whatever time is needed at any given point.'"**

Man will take his first extraterrestrial motor trip this summer when U.S. astronauts climb aboard a "moon buggy" and drive around the lunar surface. Their vehicle will be the Lunar Rover, designed to allow greater exploration of the moon than has been possible by men on foot. Space officials are convinced that the Rover and vehicles similar to it will open up new possibilities — not just for the remaining three Apollo crews but for astronauts of future generations.

First to use the Rover will be Apollo 15 spacemen David R. Scott and James B. Irwin, who are scheduled to land on the moon in late July. Major Alfred M. Worden will remain in orbit while Scott and Irwin are on the moon.

"Driving on the surface is going to be most interesting," Irwin says. "It should be a beautiful view, and I hope everybody will enjoy it with us."

Indeed, what the astronauts see should be quite spectacular. Their landing site, the northernmost so far, is a smooth basin 465 miles north of the lunar equator, surrounded by rugged terrain, in an area called the Hadley-Apennines. The site was picked for its access to a variety of topographical features. Immediately to the south is a mountain 11,000 feet high. To the west is Hadley Rille, a valley-like gorge 1,200 feet deep and three-quarters of a mile wide. East of the basin is the Apennine Front, a 14,000-foot-high mountain range that will have to be crossed just before landing, and the ruggedness of the terrain will force an approach twice as steep as that for Fra Mauro, the hilly destination of Apollo 14. Adding to the difficulty of the landing is the extra weight load on the Lunar Module — the Lunar Rover, its equipment, and extra fuel for the flight — although for this mission the designers have given the LM an extra 20 seconds of hovering time at 100 feet.

The astronauts will explore three distinctly different types of terrain during their seven-hour journeys, each designed as a geological traverse. The first "moonride" will consist of a trip to the base of the Apennine Front and a stop at the edge of Hadley Rille. On the second exploration, the men will return to the base of the mountain range, passing by several large craters. Craters are of continuing interest to scientists because their age can be determined, and the astronauts will be able to distinguish the newer craters from older ones that have eroded. The third and final excursion will be to a group of hills north of the landing site that seem to have resulted from volcanic activity.

The Rover looks deceptively simple. It is actually a complex piece of equipment with a difficult job to do. It is, in reality, a 480-pound spacecraft on wheels and is equipped with its own computer, communications, and earth-controlled color TV systems as well as two separate steering systems.

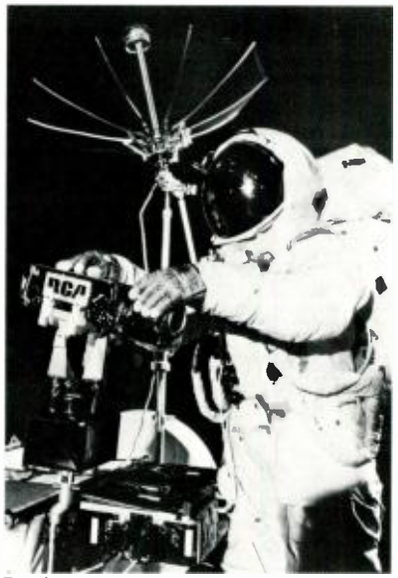
After the Lunar Module has landed, one astronaut, probably Irwin, will climb down the ladder to the moon's surface and remove the Mylar thermal protection around the Rover, which has been stored in the bottom of the LM with its wheels folded on top. By pulling a white nylon tape attached to a worm gear, Irwin will maneuver the front end of the Rover down to the surface — its weight carried by the LM structure, not by Irwin. As the front swings down through a 45° arc, the wheels will pivot and lock into travel position.

Next, Irwin will climb about halfway up the ladder, pull another tape, and work the rear of the Rover down to the surface. Finally, he will disconnect the telescoping metal tubes and cables that have eased the vehicle down and check to make sure that all the wheels are locked properly into place. Irwin will then unfold the left seat, climb aboard, and drive the Rover out of the Lunar Module's shadow into the sunlight. (Were it to stay in the shadow too long, its batteries might become too cold to function adequately.)

Meanwhile, astronaut Scott will collect the tools, rock bags, cameras, antennas, drills, and the communications unit and put them all into the Rover. Preparations may take the two astronauts 30 to 45 minutes, and then they are ready to go — almost.

The navigation system must be set before they drive off. Since the moon has no magnetic north pole, the astronauts will have to find their bearings by the angle of the sun. After turning on the power, they will point the Rover away from the sun and use a sundial-like device on the dashboard to tell them exactly in which azimuth (horizontal direction) the Rover is pointing. That information in turn is used to set the gyroscope in the navigation system, and the vehicle is ready. In effect, they will have given the navigation system an artificial (geographic) north that will enable it to orient itself accurately.

The astronauts will navigate the Rover by means of a dead-reckoning system capable of telling them the direction and distance to the LM and reporting total distance traveled at any time during the mission. The navigation system includes the directional gyroscopic unit, a signal-processing unit (essentially a small solid-state computer for solving navigational trigonometry problems), and display units showing heading and odometer readouts.




Training exercise for upcoming Apollo 15 flight demonstrates how the RCA ground-commanded color TV camera will be placed aboard the vehicle in which astronauts Scott and Irwin will explore the moon's surface.

Either astronaut can drive the Rover. Instead of a steering wheel, the vehicle has a T-shaped control stick between the two seats. Push it forward, and the Rover goes forward. Lean it right, and it goes to the right. Pulling straight back on the stick applies the brakes, and the Rover can be locked in that position.

The Rover is powered by two sets of batteries, each of which is sufficient to power the vehicle. The batteries feed electricity to a motor in each wheel, a version of four-wheel drive that gives the vehicle more climbing power as well as an extra safety margin. The four motors operate independently, so that if one of them fails it can be disconnected and the wheel allowed to roll free.

These batteries also power the navigation system; and, if that fails, the astronauts would be able to follow the Rover's tracks back to the LM. In an emergency, the same batteries could be used to power the communications unit, which has its own batteries. In fact, the Rover and its equipment are designed to continue functioning through most failures. But, to ensure further safety, another precaution had to be taken: The astronauts will not travel to any point farther than three miles away from the LM — a reasonable walking distance.

Do the astronauts expect trouble?

"This isn't like earth terrain," Scott says, "and naturally, we'll have to go slower. We have enough flexibility to spend whatever time is needed at any given point." But he adds that a geologist on earth would take several weeks to cover the same amount of territory.

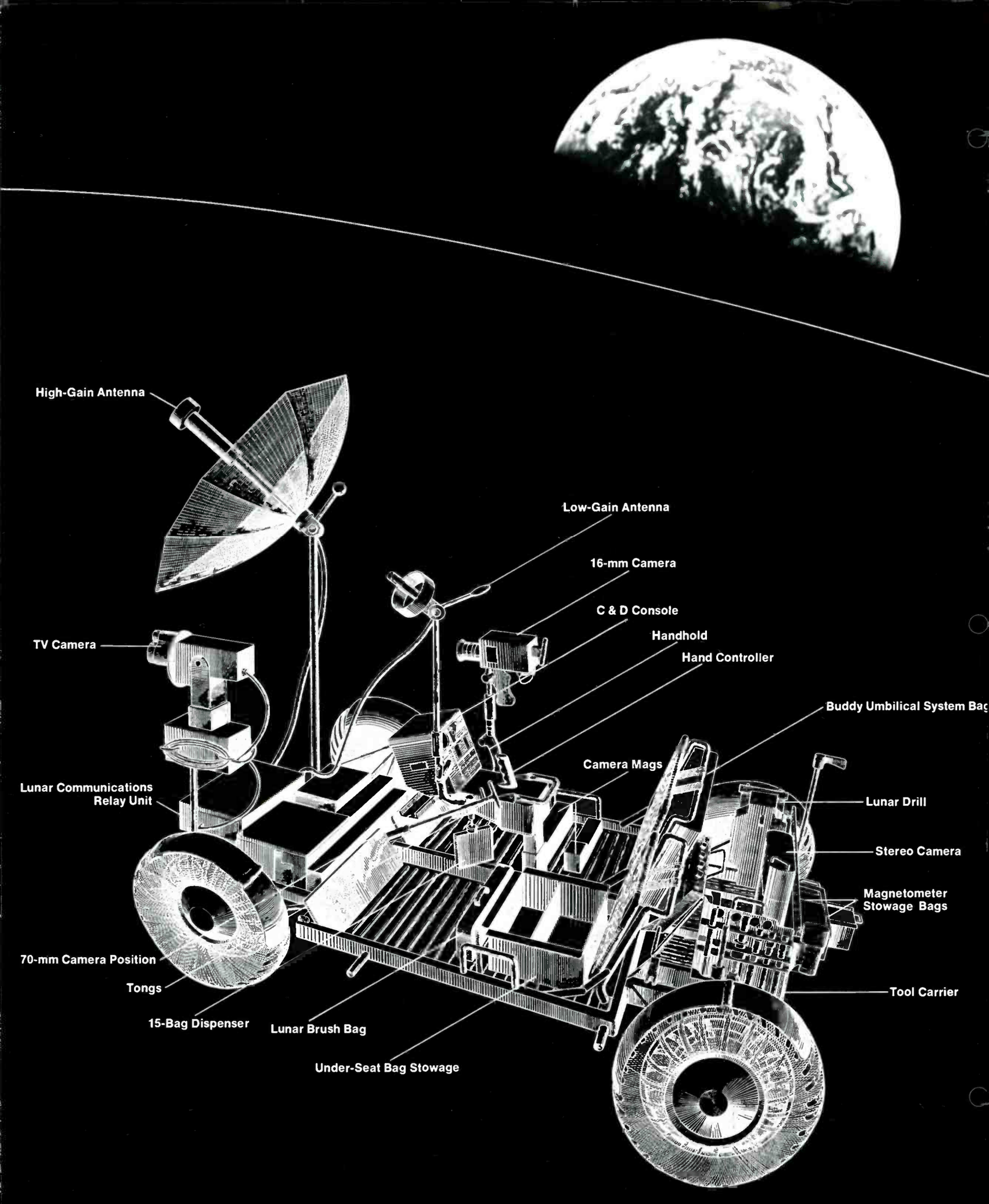
Several innovations that extend the capability of the Rover will make it possible for the astronauts to share what they see with TV audiences. On previous Apollo missions, television cameras had depended on power supplies within the Lunar Module and were hooked to the LM by a TV cable about 100 feet long. Because of this power limitation, people have never seen an astronaut as far as 100 yards away from the LM. On their July mission, however, the Apollo 15 astronauts will carry a color television camera, designed by RCA, and their own power supply aboard the Rover.

Before their first journey, Scott and Irwin will mount the television camera and antennas on the vehicle. The umbrella-shaped, high-gain antenna for color transmission, mounted on the front of the vehicle, will have to be folded as the spacemen travel so as not to obscure their vision. So, when they stop to explore an area, the astronauts' first order of business will be to unfold the antenna and point it toward earth. The Rover will be positioned so that the two men can work in front of the camera.

Once the camera is in place, the astronauts won't have to worry about its operation. At the NASA Manned Spacecraft Center in Houston, engineers Edward I. Fendell and Granvil A. Pennington will be watching a small television screen and serving as directors and remote-control cameramen for the lunar TV show. By radio, they will be able to turn the camera on and off, swing it around, and tilt it up and down to follow the astronauts' activities. If the astronauts go into a shadowed area, the engineers can adjust the light control — again by earth-moon radio link — to obtain the best picture. Fendell and Pennington also will be able to zoom the camera's lens in and out to get the best view of any scene or activity. They will have great flexibility in following the exploration since damage to the camera from sunlight will not be a concern. The camera employs RCA's silicon intensifier tube, or SIT, which cannot be harmed by bright light — even when pointed directly into the sun. The SIT also performs very well under low light levels; therefore, the camera will be able to provide views of the astronauts even when they are working in heavily shadowed areas.

However, even as they drive, the astronauts can maintain radio contact with earth through the RCA-designed Lunar Communications Relay Unit. This briefcase-sized package, which will be car-

Sanders LaMont is science editor of the Cocoa, Fla., newspaper *Today*.



**"Whereas on previous missions any communication had to be retransmitted through the Lunar Module, the new relay unit will be able to transmit television, voice, and telemetry signals directly to earth."**

ried on the Rover, has a small, omnidirectional antenna as well as the folding umbrella antenna, which is 38 inches in diameter. Whereas on previous missions any communication from astronauts on the lunar surface had to be retransmitted through the Lunar Module, the new relay unit will be able to transmit television, voice, and telemetry signals directly to earth.

Weighing only nine pounds on the moon and measuring 6 x 16 x 22 inches, the LCRU could be hand carried. The color TV camera will be connected to the LCRU by cable, while the astronauts' voice and telemetry data will be transmitted to the LCRU from their backpack radios, also built by RCA. The mission commander's backpack radio will receive the voice and telemetry from the second astronaut, mix those signals with the commander's voice and telemetry signals, and transmit everything to the LCRU on a very high frequency. The LCRU then will convert the astronauts' VHF signals to ultra-high frequency, combine them with the TV signals fed in from the camera by cable, and transmit the information to earth-based receiving sites. The signals then will be relayed via radio links, telephone lines, and satellites from the receiving sites to Mission Control in Houston. There, the TV signals will be converted to commercial television standards and released for broadcast. Transmission from the moon takes less than two seconds, and conversion of the TV signals to commercial standards takes about four seconds more. Earth-to-moon transmissions will follow the same route from Houston, except in reverse and at slightly different frequencies.

Part of the astronauts' work on the moon will be to evaluate the Rover as a tool for exploration. Duplicating exactly the way the vehicle will perform on the moon is impossible on earth, but extensive training and preparation have made them confident of its success. They have used a prototype to train on simulated lunar terrain in Houston and at Cape Kennedy; they have also undergone simulations of lunar gravity at Houston and parabolic aircraft flights in Air Force jets and have worked with computer models.

Designing and building the Rover has not been an easy job. Aerospace firms were invited to submit proposals in July, 1969, giving the winner 17 months to deliver the finished product. But it was the difference between designing a car for moon rather than earth travel that caused much difficulty. One of the requirements was that the Rover must be able to carry more than twice its own weight, something no conventional automobile or truck can do. Also, the Rover has to be able to withstand a temperature range of 500° F with complete reliability; many metals used on earth would become brittle and break under such conditions. Furthermore, it will have to travel 40 miles in 78 hours with unlimited starts and stops. Other problems involved designing the navigation unit and the deployment system that lowers the Rover to the surface. The latter has to fit within a very limited space on the LM and function at one-sixth the earth's gravity. Despite the difficulties, Boeing, which won the contract, delivered the Rover two weeks early.

Convinced of the Rover's success, space experts have been discussing the possibility, however unlikely, of a remote-control package that could be developed in time for the last Apollo moon flight in the fall of 1972. That would allow the astronauts to use the Rover, then leave it hooked up for Mission Control to operate after their departure, much in the manner of Russia's Lunokhod vehicle.

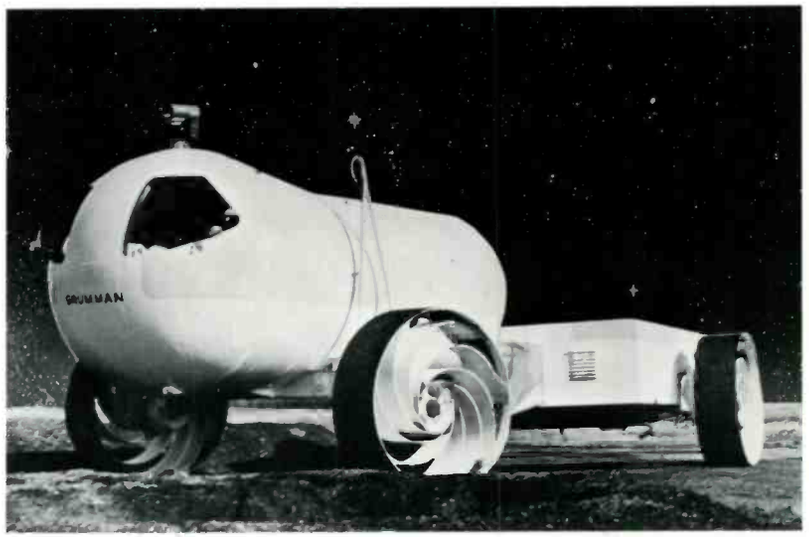
Plans are being considered for development of bigger and better lunar roving vehicles, multiwheeled laboratories that could land on the moon unmanned and be boarded by crews that would arrive in another spaceship.

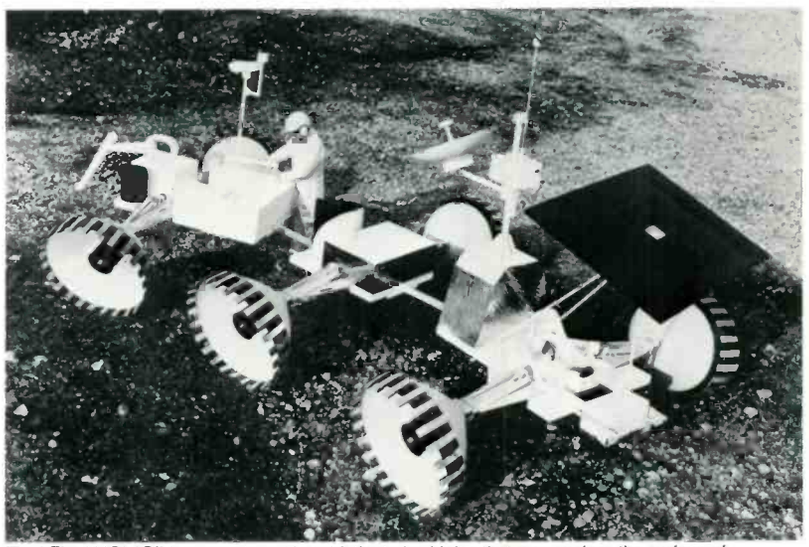
NASA already has the germ of an idea for a Martian Rover that could carry men to the surface of Mars on a saucer-shaped lander, allow them to explore, and then carry them back to an orbiting spacecraft.

Although space experts predict these things will happen, they cannot predict when. There are no manned landings planned for the moon or other planets by the United States after 1972, and at present the most optimistic guess by NASA is that we will not return to manned lunar exploration until the 1980s.

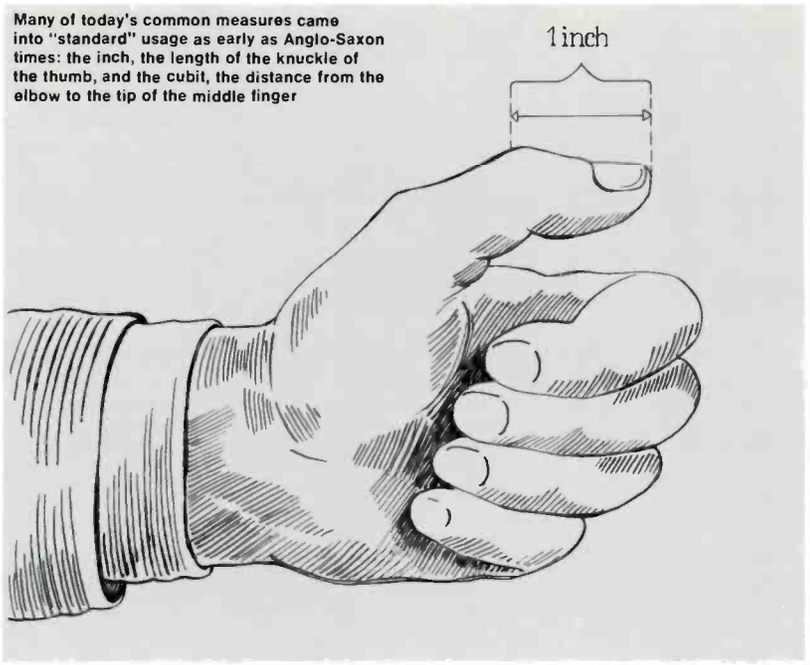
The Russians, who do not announce space plans in advance, do provide some hints as to what they are thinking about. In a technical paper praising the recent Soviet moon car accomplishments, the authoritative science writer, Yuri Marinin, concluded: "There are some advantages of astronauts exploring the moon too, especially if they are scientists specialized in lunar studies. In the long run, the most important thing is to find an optimum combination of manned and unmanned vehicles."

And that is what Dave Scott and Jim Irwin plan to do with their Lunar Rover this July. ■



(Top) The "MOLAB" is a prototype of sophisticated vehicles that may explore the surface of the moon later in this century. (Center) This full-sized working model of a "moon car" is expected to enable astronauts to range as far as 600 miles over the lunar surface by the end of the 1970s. (Bottom) During a training session in New Mexico, astronauts Irwin (left) and Scott maneuver a model of the Lunar Rover.




Many of today's common measures came into "standard" usage as early as Anglo-Saxon times: the inch, the length of the knuckle of the thumb, and the cubit, the distance from the elbow to the tip of the middle finger

# Going Metric: A Technology Assessment

After two centuries of congressional debate, the United States may soon convert to a metric system of measurement: meters for yards, liters for gallons, and kilograms for pounds. Are we ready?

by Lewis M. Branscomb

The ability of technology to produce social change has been brought home by the impact of industrialization on the environment and on political and social institutions. The concept of "technology assessment" calls for a rational evaluation of the consequences of technological change so that man may manage it more prudently.

Although much has been said and written about technology assessment, only a few such assessments have been attempted by the federal government. The most recent is the U.S. Metric Study, still in progress. It examines the social, technical, and economic consequences of a change that some proclaim would entail enormous costs and disruptions to American society, while others concentrate on the overriding benefits to be gained.

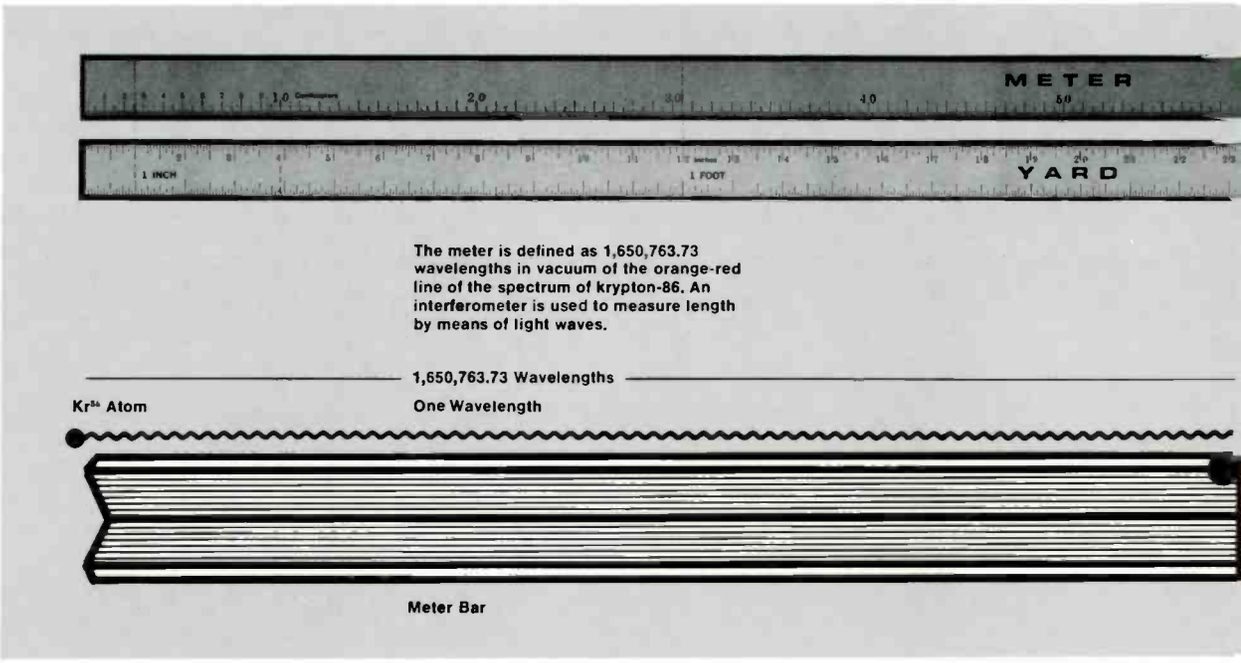
In 1968, Congress passed Public Law 90-472. It charged the Secretary of Commerce with an evaluation of the consequences to the United States of the increasing use of metric measurement throughout the world. The secretary was also called upon to describe alternative courses of action. The task of carrying out the study was assigned to the National Bureau of Standards, and a report is due in August, 1971.

Congressional discussion about the metric system arose at the very beginning of our republic. The United States was the first nation to adopt a decimalized currency, but it stopped short of adopting metric measures at the time they were introduced in France. In 1866, a long congressional debate terminated in a compromise; and a law was passed to legalize use of the metric system in trade and commerce. Ever since that date, we have been legally dual with respect to commercial uses of measurement.

In 1893, the basic measurement standards through which all U.S. measurement compatibility is assured became metric. This change came about through the Treaty of the Metre, which provided for a General Conference on Weights and Measures at which 43 nations — including the United States — agreed upon a uniform basis for measurement. Thus evolved the first complete, compatible system of measurement, the International System of Measurement (S.I.).

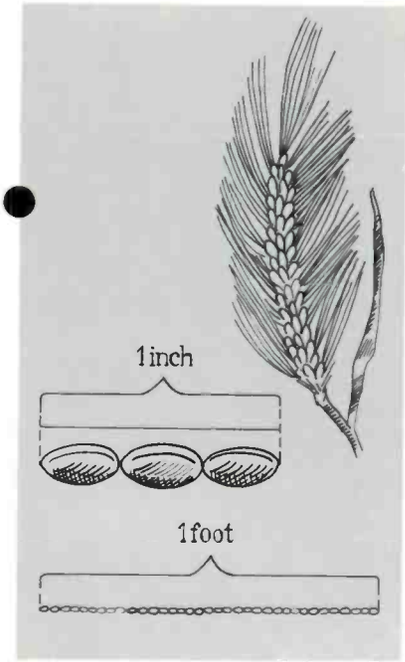
At the close of World War I, General Pershing called public attention to the advantages the Army would gain if troops serving in metric countries were familiar with the metric system. This began another period of congressional debate on whether the United States should change to the metric system, which ended with opponents and proponents once again exhausting the attention span of Congress and with the issue still unresolved.

This long history seems to demonstrate that only the most compelling circumstances can justify a social decision to change such a personal and instinctive




The meter is defined as 1,650,763.73 wavelengths in vacuum of the orange-red line of the spectrum of krypton-86. An interferometer is used to measure length by means of light waves.

Dr. Branscomb is director of the National Bureau of Standards.




thing as one's familiar notions of dimension and quantity. Why, then, has Congress once again posed the question, "What should we do about the metric problem?"

Circumstances have changed. Since World War II, Japan, India, Great Britain, South Africa, Australia, New Zealand, and other countries have either converted to metric usage or committed themselves to doing so. Canada recently declared conversion to metric measure a definite goal of national policy. Eventually, the United States will be the only major nation using an English-based measurement system.

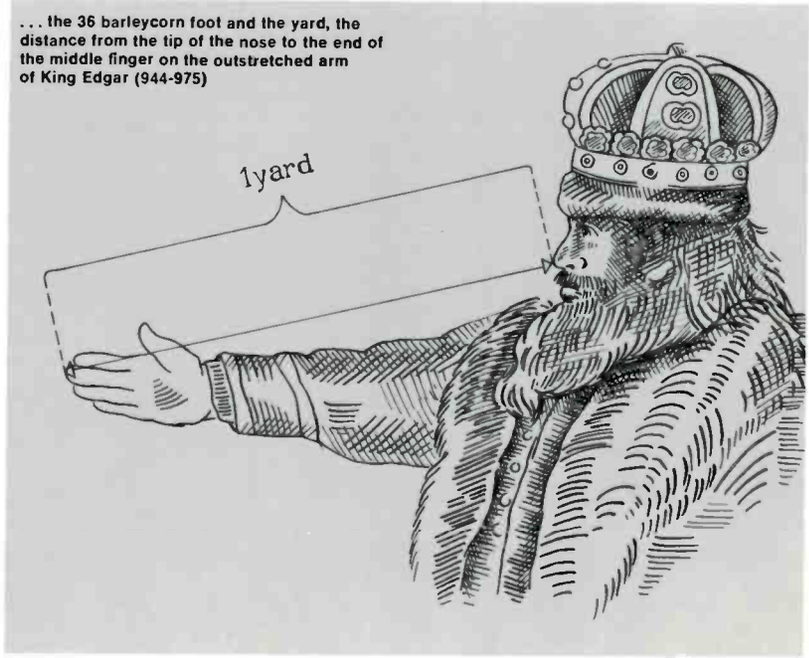
The world is shrinking with extraordinary rapidity. International communications and travel facilitate increasing contact among the peoples of the world. International trade is an increasingly important element in the world economic scene. Indeed, the United States boasts the largest international trade activity in the world. Yet, this multibillion-dollar business is small compared to the sales of overseas enterprises capitalized by U.S. corporations. Overseas investment is the most rapidly growing segment of our economy.

These new patterns in the world have been brought about largely by technology. Further progress depends upon continued strength in research and development and the streams of technology itself. The America that contemplates once again the possibility of metric conversion is, therefore, a very different America from that which previously considered such a change. The reasons for desiring international harmony in measurement language have become more compelling. But so has the extent to which our national life is locked into our technology and through it our customary measurement language.

When we recognize that a period of 10 to 20 years would probably be required for the United States to become primarily metric, we must appreciate that our decision on the metric issue should not rest on the needs of America today but on those of America in the 1980s, '90s, and into the 21st century. We may be tempted to postpone consideration of the metric question, but the problem of a rational decision will only get more difficult with each passing year.

It is possible that events will overtake us. The use of metric language may increase spontaneously at such a rate that we will find ourselves with extensive dual usage but without any national policy decision. True, we are far from that situation today, with only a small percentage of our manufactured goods made to metric specifications and only perhaps 10 per cent of our school children trained in metric measurement language. However, there are signs of change all around us.

In research and development, the use of metric measurement is often extensive. RCA, for example, uses metric standards in such areas as laser technology and acoustic holography. In terms of manufactured goods, more than 10 per cent of the automobiles driven by Americans are made abroad according to metric




**. . . the 36 barleycorn foot and the yard, the distance from the tip of the nose to the end of the middle finger on the outstretched arm of King Edgar (944-975)**

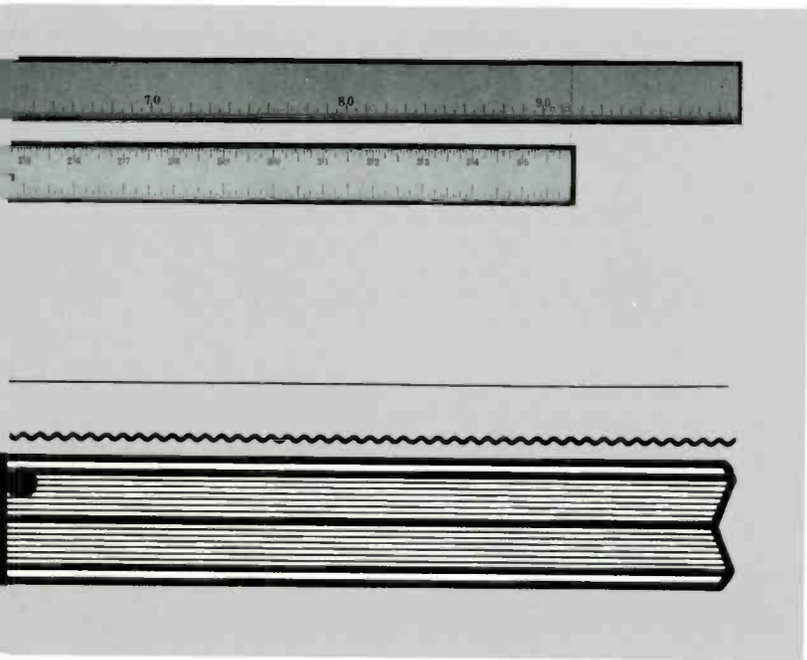
measurements. Moreover, both the Ford Pinto and GM's Vega contain parts made to metric standards. American-made skis, which until recently were sized in feet and inches, are now sold in standard metric lengths. The pharmaceutical industry and the medical profession are almost completely metric in practice. Many prepackaged grocery products specify quantities in both metric and the customary American units.

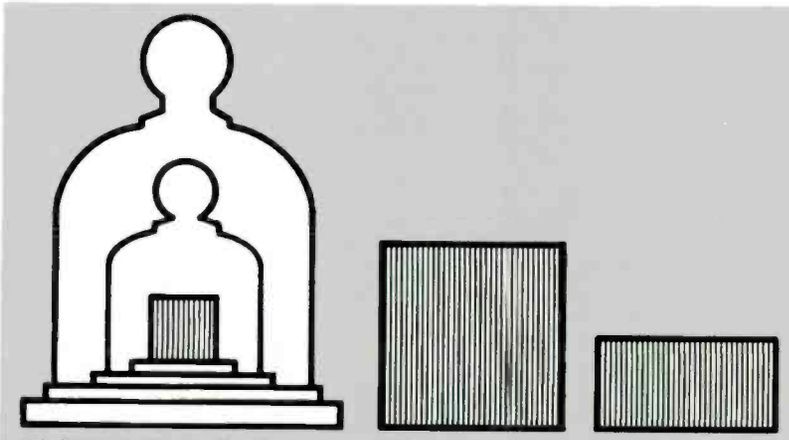
There is little doubt that the use of metric language in America will increase. The question is how quickly.

Much of the confusion in the debate about metric conversion centers on three aspects: language, mathematics, and design. Metrication is not the same thing as decimalization, but it would undoubtedly facilitate decimalization and improved ease of mathematical operations for those who receive the proper decimal training.

Our natural predeliction for the use of whole numbers in design — and a preference for whole numbers to specify product quality as an aid in unit-price comparison — links changes in measurement language to necessary changes in hardware. Hardware changes are the largest source of cost and confusion in any program of metric conversion. Some oppose such a program because they believe that virtually everything — the gauge of railroad tracks, the width of highways, and the size of toothbrushes — would have to be changed accordingly. In fact, most of the astronomical cost estimates involving metric conversion are based on such fallacious assumptions.

However, most of the hardware changes that would be needed would result from the use of whole numbers in design for new products developed by metric-trained engineers — plus those changes in present products and practices needed



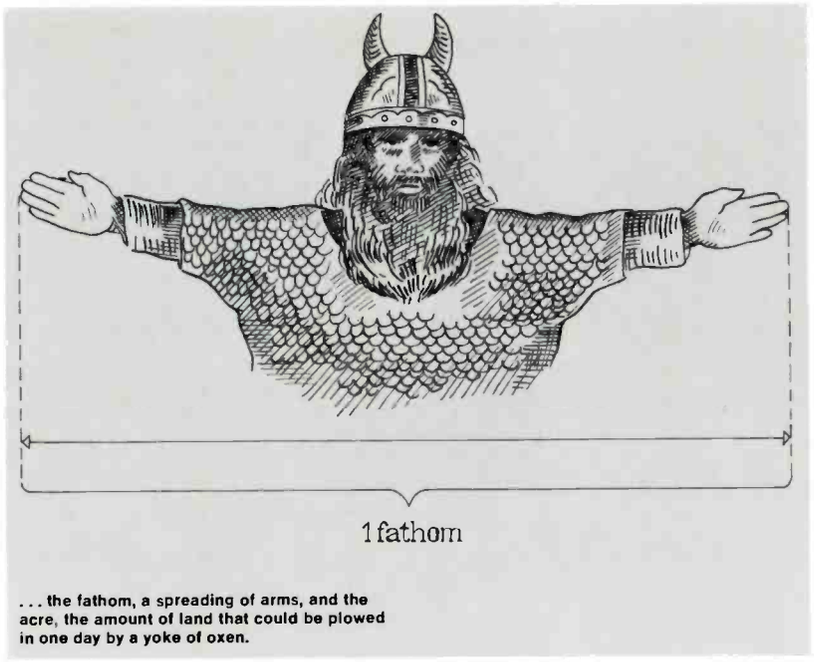


**U.S. Prototype Kilogram No. 20**

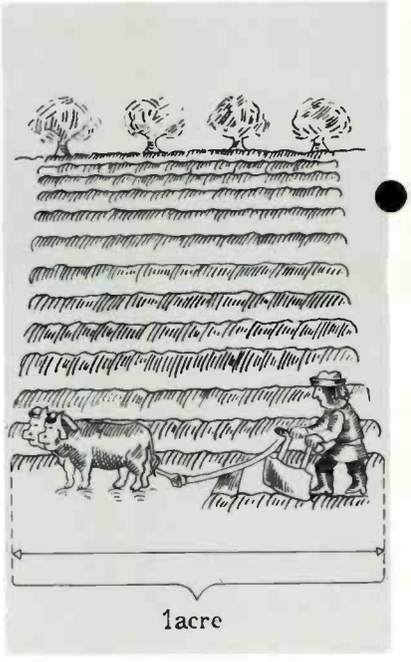
**The standard for the unit of mass, the kilogram, is a cylinder of platinum-iridium alloy kept by the International Bureau of Weights and Measures at Paris. A duplicate in the custody of the National Bureau of Standards serves as the mass standard for the United States. This is the only base unit still defined by an artifact.**

**1 Kilogram** **1 Pound**

**1 pound (avdp)=0.45359237 kg**




**. . . the fathom, a spreading of arms, and the acre, the amount of land that could be plowed in one day by a yoke of oxen.**




to conform to internationally compatible industrial standards. It is in this area that the United States faces one of the greatest opportunities inherent in the metric issue.

Until recently, the complete system of scientific units had never been internationally defined. Because of variations from one country to another, one could still say that there are several metric systems in use. The International System is built on the metric base but is extended to include compatible units for measuring not only length, mass, temperatures, and time but also electricity, radiation, and the many other fields in which scientists work. The United States could thus take a leadership role in the international development of a compatible body of high-quality, internationally accepted standards. And we might be better prepared to accept the use of international metric-measurement language if the best American technology were embodied in the engineering specifications themselves. The first interim report of the metric study, transmitted to Congress by the Secretary of Commerce in December, 1970, supports the wisdom of this international standards strategy as an advantageous course for America regardless of the decision on domestic metric conversion.

Going metric will produce no miracles. Whether metrication will change the future and solve our problems is not the question before us. There is evidence that metric conversion might improve our balance of trade, and many importers and exporters support conversion. But it is product, price, and quality — not measurement language — that dominate trade patterns.

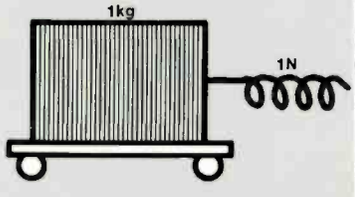
An internationally compatible measurement language might facilitate communications among nations; but the dissimilarity of spoken languages is clearly a greater barrier to communication than is dissimilar measurement language. *Going* metric will probably not cure any major problem facing the nation. On the other hand, *being* metric might be a significant element in the national posture needed for the 1980s and beyond.

Although it is difficult for different groups to agree on the cost or benefits of conversion, there is general agreement on the question of the time-scale for conversion. Virtually no one believes that a period of conversion could be shorter than five to seven years, and almost everyone agrees that a prolonged period during which dual inventories of both metric and customary materials and components are maintained will be excessively costly. Indeed, the very concept of 100-per cent conversion is not only an illusion but not even a desirable or necessary objective — even if the preponderance of evidence should suggest that a national conversion program be in the public interest.

In evaluating the option of continuing the present laissez-faire policy — in which engineers, workers, manufacturers, and teachers use whichever measurement system they prefer — one must pay close attention to the possibility that such a policy may tend to impose serious burdens on our society. It would be unfortunate if large numbers of workers, small businessmen, operating engineers, and tradesmen found that a measurement-language barrier put them at a disadvantage vis-à-vis research scientists, design engineers, and the well-trained, highly skilled work force of large and internationally based manufacturers that may have relatively little difficulty in accommodating to metric change wherever and whenever they find it advantageous.

Does the solution lie in the direction of inhibiting the development of metrication? Or does it lie in programs to bring all segments of society along together in some form of national, voluntary cooperation toward increased metric usage? Such questions lie at the heart of the current study.

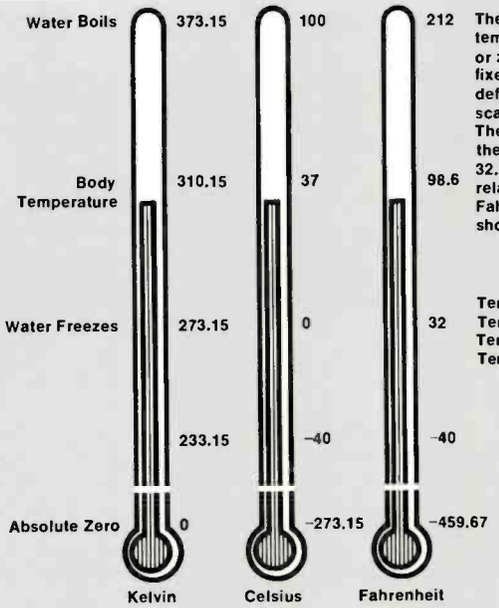
The final answers to such questions may not be widely accepted. Beyond the available facts, there is plenty of room for major differences in point of view. With this in mind, the Bureau of Standards' metric-study team has concentrated on the objective of providing every representative group or concerned firm or individual an opportunity to be heard. Through extensive statistical studies, widely publicized national conferences and other means, the study team has received the views of organizations representing some 40 million individuals and more than 1 million individual enterprises. Even so, the subject continues to be widely misunderstood and to produce reactions on both sides that are based more on emotion than on objective fact. The most valuable contribution that any individual or organization can make to the national position with respect to metric conversion is to ensure that his neighbors and colleagues have informed themselves about the true issues and have made every effort to express their views. ■




Acceleration of 1m/s²

$$1N = \frac{1kg \cdot 1m}{1s^2}$$

**Closely allied to the concept of mass is that of force. The SI unit of force is the newton (N). A force of 1 newton, when applied for 1 second, will give to a 1-kilogram mass a speed of 1 meter per second (an acceleration of 1 meter per second per second). One newton equals approximately two-tenths of a pound of force.**




**The thermodynamic, or Kelvin, scale o temperature used in SI has its origin or zero point at absolute zero and has fixed point at the triple point of water defined as 273.16 kelvins. The Celsiu scale is derived from the Kelvin scale. The triple point is defined as 0.01°C o the Celsius scale, which is approxima 32.02°F on the Fahrenheit scale. The relationship of the Kelvin, Celsius, an Fahrenheit temperature scales is shown below.**

**Temp F+40=1.8(Temp C+40)**
**Temp F=1.8(Temp C)+32**
**Temp C=(Temp F−32)/1.8**
**Temp K=Temp C+273.15**

# For the Records...


**Great Operatic Heroines**
Montserrat Caballé, soprano
Carlo Felice Cillario conducting
the Barcelona Symphony Orchestra
LSC-3209

The magnificent vocal instrument of Montserrat Caballé portrays four great heroines at terrifying or trying moments of their lives and one heroine in a moment of ecstatic happiness on this Red Seal release. These arias range from the "Willow Song" and "Ave Maria" of Verdi's *Otello* to "Vissi d'arte" of Puccini's *Tosca*. With her natural expressiveness and sense of majestic power, Mme. Caballé evokes feelings of passion, pathos, tenderness, and violence.


**Beethoven: The Complete String Quartets and the Grosse Fuge**
The Guarneri Quartet VCS-11-100

Beethoven's 16 quartets round off the great tradition begun and carried to magnificent heights by Mozart and Haydn — some of the most sophisticated, intellectual, and beautiful music ever written. The Guarneri Quartet is perhaps today's foremost performing chamber group as well as the youngest. During the past five years, the Guarneri has recorded all the quartets now assembled in an 11-record Red Seal set. The recordings are also available in three separate packages — "early," "middle," and "late" — in accordance with the periods during which the quartets were composed.


**Beethoven: The 32 Piano Sonatas**
Claude Frank, pianist VICS-9000

To honor the bicentenary of the birth of Ludwig van Beethoven in December, 1971, virtuoso Claude Frank spent the previous two years recording the complete piano sonata repertory of that composer. Released under the RCA Victrola label, this monumental 12-record set was selected by *Time* magazine as one of the 10 best albums of 1970 — popular or classical — commenting that it was "not only the first complete 32 ever recorded in the U.S., but one of the two or three best since Artur Schnabel set the record in the 1930s."


**Shostakovich, Symphony No. 14, Op. 135**
Eugene Ormandy conducting
The Philadelphia Orchestra
Phyllis Curtin, soprano
Simon Estes, bass LSC-3206

This is the first recording made outside the Soviet Union of the latest work of Dmitri Shostakovich. It has been recorded by Eugene Ormandy and The Philadelphia Orchestra, with Phyllis Curtin and Simon Estes, who performed the North American premiere of this work on New Year's Day, 1971, at the Academy of Music, Philadelphia. Unlike the Thirteenth Symphony, the subsequent work is more a cycle of poems about death than it is a symphony and was written more for a chamber ensemble and two soloists than for a full orchestra.


**The Point !**
Nilsson LSPX-1003

A feature-length, animated musical fantasy called "The Point" was premiered on network television in February, 1971. Based on an original story by Nilsson, the popular composer-performer who also wrote the score and sang its lyrics on the soundtrack, "The Point" tells the story of a little boy who lives in a land where everybody and everything is pointed and who is banished to the pointless forest because his head is round. There, he and the audience learn some gentle truths and get a few points. Original songs include "Are You Sleeping?," "Me and My Arrow," "Think About Your Troubles," as well as the title song.


**The Third World**
The Third World LSP-4502

The Third World, a brand-new five-man rock band from St. Petersburg, Fla., performs nine original compositions in its initial RCA album. These run the gamut from driving, explosive beats to tender ballads and reflect the best of today's soft-rock sound. Though their work concentrates on the ills of society — as in such numbers as "Frozen Man" and "Shot Down" — it also expresses the hope that these ills will be corrected soon.









Other Current RCA Releases

# Electronically Speaking...

Recent RCA Developments in Electronics

**Walt Disney World**

The new Walt Disney World complex, under construction near Orlando, Fla., will have an RCA-built computer system to check constantly the condition of any functioning equipment — from fire alarms to golf-course sprinklers. The Automatic Monitoring and Control System for the "Magic Kingdom" Theme Park will check fire-prevention facilities and health and safety services. It will also monitor equipment at the central energy plant and two resort hotels, the central entrance, golf course and club house, and waste-disposal plants.

If equipment malfunctions or an alarm condition such as a fire occurs, the system will identify the problem by flashing a coded message on video data terminals that will be located at two fire stations, two security locations, and the maintenance console in the main service area.

The terminals will display information as to the kind of problem, building number, location of incident within the building, type of sensor, and time and date of the incident. Eighteen separate alarm conditions can be displayed simultaneously on the terminals. As Walt Disney World expands, the RCA system will be enlarged through a building-block (or add-on) approach so that it will not be disrupted during expansion.

**Experimental System Links Ground and Airborne Computers**

A communications system to link the ground-based and airborne computers that help control the nation's nuclear retaliatory forces is under development by RCA for the Air Force.

Data entered into computers at Strategic Air Command headquarters will automatically be relayed directly to an RCA-developed computer system aboard one of SAC's "Looking Glass" aircraft. These aircraft remain aloft 24 hours a day to assume control of the nation's strategic missiles and bombers in case ground-control centers are destroyed.

RCA developed and installed the experimental computer system, known as Post Attack Command Control System-Airborne Data Automation (PACCS-ADA), aboard one of the "Looking Glass" aircraft last year. Under the new contract, RCA will develop an operationally secure data link between the aircraft and the ground and will install and integrate the system aboard the PACCS-ADA aircraft. The data link will permit extensive tests and evaluation of air-to-ground communication between the two computers under operational conditions.

Data compiled and evaluated from flight tests of the PACCS-ADA aircraft will be used as a guide for system performance and specifications, thereby eliminating high technical risks in the development of a fully automated fleet of Advanced Airborne Command Posts.

**Domestic Satellite System Proposed**

RCA Global Communications, Inc., and RCA Alaska Communications, Inc., have filed applications with the FCC to construct and operate a domestic communication satellite. The proposed system would offer new services, greatly augment terrestrial facilities, and dramatically reduce the cost of network broadcasting and business communication services. Prompt approval of the application — and an investment that might amount to $198 million by the end of 1977 — could result in the system beginning operation in 1974.

The system would consist of three satellites in geostationary orbits positioned for coverage of all 50 states and Puerto Rico. It would affect national communications operations and policies by reducing distribution costs some 50 per cent in commercial television and radio network programming; encouraging the growth of educational television; and expanding rapidly developing private line, digital, and analog data transmission as well as video, voice, and other services at rates 50 per cent lower than those currently in effect. It would also permit major improvements in service for Alaska, particularly in remote locations; creation of new opportunities to serve the community antenna television (CATV) industry and other public or private enterprises; and establishment of ancillary communications services — such as stereo sound broadcasting by TV and radio networks — and a variety of new services to meet the specialized requirements of the rapidly growing data processing industry.

The satellites, which would operate in conjunction with 13 major earth stations in the United States, would be implemented in two basic stages. Two satellites, one for operations and the other as a spare, would be launched by NASA in 1974. A third would be held in reserve on the ground.

It is anticipated that increases in traffic and demand for new and additional services would exceed the initial capacity. A fourth spacecraft would, therefore, be built and held in reserve on the ground.

A primary function of the system would be to carry network programs to individual broadcast stations throughout the country. This would result in major cost savings over present methods, since satellites minimize distance as a factor in the expense of communications services. The lower distribution costs would be a major benefit to noncommercial television enterprises.

The proposed system could also provide closed-circuit TV to theaters on a regular basis, with major savings in distribution costs. In addition, it could provide other services — such as sending radio signals "piggyback" on the same carrier used by a network to transmit television, resulting in reductions for radio program distribution.

**Infrared Laser Searchlights**

A new system that makes possible major advances in infrared laser searchlights has been developed by RCA under contract for the U.S. Army Night Vision Laboratories. This is the first infrared laser illuminator whose critical components are maintained at cryogenic temperatures without being kept in a vacuum.

Elimination of the vacuum solves a number of operational problems that previously detracted from the efficiency of infrared illuminators, particularly the difficulty of maintaining a vacuum state under field conditions. The new design is also a major step forward in systems maintenance, since components can be removed for repair or replacement without breaking the vacuum, which would then have to be re-created before operations resumed.

The illuminator operates much like an invisible searchlight. It transmits infrared laser beams that, although invisible to the human eye, can be seen by such night-vision devices as a low light-level TV unit or a pulse-gated viewer system with a broad spectral response. Thus, when the illuminator beam strikes an object, the resulting infrared reflections are seen by the sensor to permit observations of objects and areas obscured to the unaided eye.

**Atmosphere Explorers**

RCA has received a contract from NASA to provide three Atmosphere Explorer satellites for launch in 1973, 1974, and 1975. Designed to study the thermosphere, where most of the sun's ultraviolet radiation is absorbed, the spacecraft will fly extreme elliptical orbits. Their closest approach will be 75 to 93 miles from the earth and their farthest about 2,500 miles away.

Absorption of ultraviolet radiation generates the energy reactions and chemical processes that determine the thermosphere's composition — and the composition of higher regions, whose constituents are also formed principally in the thermosphere and then rise.

Sensors to be carried by the Atmosphere Explorers will gather data on such subjects as the presence of neutral particles and ions; electron, ion, and neutral gas temperatures; thermal electrons and photoelectrons; extreme ultraviolet radiation and airglow. The satellites will gather data mainly at the lowest point of the orbit, or perigee. However, the spacecraft also will continue to acquire information as they swing away from earth, providing observations of higher regions that are of particular interest during times of intense solar activity.

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Space — either real or abstract — is often a rare commodity in our crowded world. Such is the mood conveyed by this multiple-image photograph of a New York City street. It is reasonably certain that no species other than man has a clear idea of space in the abstract. An article dealing with man's concept of space and how this concept evolved over the centuries begins on page 12.

RCA

# Electronic Age

Spring 197