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Photogrammetry and the Future

Photogrammetry, as much as any other profession except politics, can contribute to the solution of the world's problems of population, pollution, mineral and land resources, and energy.

INTRODUCTION

FOUR YEARS AGO many of us attended the XIth Congress of this International Society in Lausanne. We came away from there impressed by the hospitality of our Swiss hosts, by the efficiency with which they conducted the Congress affairs, and by the well-being of our profession. We had listened to a number of exceptional papers, seen an outstanding exhibit of photogrammetric instruments and products, and enjoyed stimulating personal exchanges with our colleagues from different countries. There was good reason to believe that all was well in the world of photogrammetry.

In the intervening four years the world around us has changed so much that it is hardly recognizable. Astonishing technological events have taken place. Supersonic transports have reduced intercontinental travel time by one half. Five times men have walked on the surface of the Moon and brought parts of it back to Earth. Spacecraft are currently photographing Mars and are on the way to Jupiter. Instantaneous voice and television communication around the world is an everyday occurrence. The extent of automation makes us wonder how essential man himself will be in the next few years. A whole new industry called Remote Sensing has grown up around us. The ubiquitous computer has entered every phase of our professional and private lives. Laymen are astonished to find that the circuits of the fourth generation computers are far too complicated for engineers to understand; they have to be designed by another computer—a fact which, as far as I can tell, has no theological significance and has nothing to do with the origin of life!

At the same time that all these advances were taking place, we have begun to realize that maybe this is not the best of all possible worlds. Astronaut Jim Lovell on the historic first manned mission around the Moon in December 1968 radioed back, "From here the Earth looks like a fragile blue-green Christmas tree ornament." Though men of wisdom have for decades appreciated the fragility of our planet, it is only in the past few years that the general public has become aware that the vaunted progress of modern civilization may be only a thin cloak for global catastrophe. Characteristically, they are demanding that their leaders do something about it. Ecology and environmentalism are household words and have become a major driving political force. Fundamentally the problems can be summarized as: population, pollution, mineral and land resources, and energy.

POPULATION

I suppose that if any government official were asked to name the most valuable resource of his country, he would inevitably reply that it is the energy and spirit of his people. And yet burgeoning human population is clearly a principal root of the world's problems. Those who specialize in such estimates say that by the year 2000 world population will grow from the present 3.7 billion to 6 to 8 billion. It doesn't really make any difference what the number is—either one would strain the planet's ability to support human life at present levels of consumption. The biblical injunction, "Be fruitful and multiply," has apparently backfired. God continues to make more people, but He doesn't make any more land. And we seem to have created a life form which is inimical to the natural environment of the planet we live on. This is not the forum to discuss arguments for Zero Population Growth, Legalized Abortion, or other forms of population control. But to me it seems a great tragedy that the one limitless resource—

* Edited after presentation as the Keynote Address at the XII Congress of the International Society for Photogrammetry, Ottawa, Canada, July 24, 1972.

people—is the one that we have not learned to utilize.

Of more immediate impact than the eventual numbers of total population, is the changing pattern of population distribution. Anyone traveling through western Canada or the western United States would have a hard time believing that overpopulation is a problem. If the population in the United States should rise to a billion, the average density would only be 130 people per square kilometer. The Netherlands has a density of 380; Japan, 290; Britain, 360. The real difficulty is that 75 percent of the people have been concentrated on 2 percent of the land. The attendant urban problems of housing, transportation, power and light, water and sewage, police and fire protection, education, overlapping administrative responsibilities, tax inequities, ethnic concentrations, central city decay, and suburban sprawl, are almost more than the mind can comprehend, and make one wonder why anyone would seek political office.

There is another aspect of population that is of particular importance to us as scientists and engineers. There is strong evidence, particularly among the young people and students, that the public has become disenchanted with science and technology generally. On American college campuses ten times as many students are currently enrolled in astrology courses as in astrophysics courses. There exists, at best, an indifference to, and, at worst, an active antipathy towards science and technology. There is a mistrust of rational, conceptual, calculative, and abstract modes of thought. Logical minded managers, technologists, engineers, business administrators, planners, accountants, experimenters, for whom rational, orderly, and logical methods are the royal road to truth—instead of being regarded as the professionals who keep our society running—find themselves accused of having presided over the sacrifice of man and his environment on the altar of continuing economic growth.

There is, indeed, a certain attractiveness in the desire to stop our frantic rush to bend nature to the human will and in its place to restore a vital, more harmonious, and more humble balance with nature. But as Stuart Chase has said, "Retreat to a simpler era may have had some merit 200 years ago when Rousseau was extolling the virtues of Cro-Magnon man, but too much water has gone through the turbines." The emotional urge to return to the forests, to live on nuts and berries, is simply not a viable alternative. Much of the public, and particularly the young, are nearly unaware of the width and depth of the intricate technological base upon which every moment of their comfort and even their daily survival depends. Although it may be true that technology has helped to get us into our present plight, it remains the only real hope for getting us out of it. Through constructive accomplishment we must reassure those people who are wary of the effects of science and technology on the better life, the natural surroundings, and the national environment.

Pollution

Certainly no world problem has had more exposure in the press than that of pollution—pollution of the water, the air, and the land.

Factory wastes and human sewage have been dumped into streams and rivers since the beginning of the industrial revolution 200 years ago. This was not really done with malice aforethought. It was simply that as an optimistic people, we considered water an inexhaustible resource, an efficient heat sink, and a wondrously effective means of removing unwanted material. When industries were small and people were few this worked quite well. But now we find our rivers are made of sterner stuff than water—such stuff as cadmium, and coliform bacteria, and polychloride biphenyls. Walking on the water is no longer considered much of a trick along the Rhine, a man overboard in the Hudson will likely rot to death before he can drown, and photographic film dipped in the Cuyahoga will be effectively developed. Overloaded streams and rivers are dumping their foul burdens into the lakes and seas so that concentrations of petroleum, heavy metals, plastics, pesticides, and other contaminants can be encountered throughout the oceans.

About the best that can be said about water pollution is that it is recognized, in most cases the solution is known, and energy, money, and goodwill may again make drowning practicable.

The products of combustion have created a worldwide problem of air pollution. The sight of belching smokestacks, which a few years back was looked upon as a sure sign of progress (to the point that they were actually featured on company letterheads) is now anathema to even the youngest child. Steel mills, power plants, oil refineries—once a source of great national pride—are now something we would like to hide, even though we recognize our dependence on their products.

The internal combustion automobile (once considered so desirable that "two cars in every garage" was an acceptable and successful political slogan) has become a Frankenstein monster destroying its owner. Exhaust emissions create a poisonous, photochemical smog which can be seen from an airplane as a brown pall extending hundreds of miles from major cities. Along the east coast we have just experienced a week-long "air pollution alert" in which elderly and infirm people were advised to remain indoors, and everyone was requested to use public transportation rather than personal automobiles. Public transportation has, incidentally, almost disappeared under pressure of expanding personal automobile use. Americans may have had more reason than they knew at the time in questioning whether what was good for General Motors was really good for the country.

The solutions to air pollution problems are illusive. We can precipitate the solids from smoke stacks, but it takes energy to do it, and power plants are a major producer of air pollution. Furthermore we are then left with solid wastes to dispose of. How? By flushing them down the rivers? We can reduce automotive emissions by catalytic converters, but the cost of the car increases, and its fuel efficiency decreases. My 1955 Pontiac gave me 18 miles per gallon; my 1971 Plymouth gives me 9. I probably put out half as much noxious emissions per gallon, but I burn twice as many gallons, and they cost me half-again as much as they used to. Is that really progress?

Nobody is against clean air; the biggest polluters run television commercials about oil refineries disguised as bird sanctuaries. And when corporations solve the problems the consumer must inevitably pay the bill.

The ability of the land to absorb solid wastes is also a cause of concern. A large part of the problem results from the fact that since World War II, technology has replaced many natural products and processes with man-made substances and methods. While population has grown by 42 percent, production of nonreturnable bottles has gone up by 53,000 percent, and production of synthetic fibers by 6,000 percent. Nitrogen fertilizers (up 1,000 percent) have reduced harvested acreage but have caused nitrogen to leach from the soil and pollute rivers. Permanent pesticides like DDT increase their concentration as they cycle through the food chain again and again. The automobile is again a major contributor to the rape of the land. Highways unroll ribbons of concrete and asphalt across cultivated lands and cut through cities dividing neighborhoods, and decreasing adjacent property values with air and noise pollution. Sprawling interchanges paraphrase Coleridge's poem:

> "Thus twice five miles of
> fertile ground
> With roads and bridges
> were circled round."

Dumps of discarded automobiles disfigure the periphery of major cities. Clearly the land is in a mess!

Mineral and Land Resources

World use of natural resources by the year 2000 is expected to be five times that of today. It is inevitably true that as the standard of living increases, the per capita consumption of resources increases. In the United States the percentage of minerals consumed is approximately four times larger than our percentage of the world's population. As population standards of living increase elsewhere, where will all these materials come from? One can find all kinds of numbers—pessimistic or optimistic, depending upon the point one wishes to make—about proven reserves and those yet to be discovered. But it is time to stop playing the numbers game. The inevitable truth is that a finite world cannot produce an infinite amount of non-renewable resources. There is a clear requirement for ingenuity in the discovery and development of new materials, in more efficient processing of lower grade raw materials, and in the recycling of processed materials.

One of the bright spots in the resource picture is the productivity of the land itself. The United Nations Food and Agriculture Organization has estimated the total world area of arable land and land under tree crops at 1.4 billion hectares while there is another 1.6 billion hectares of uncultivated but potentially arable land. Even faster than the rate of population growth has been that of agricultural productivity. In the United States the total is up 40 percent since 1945, but almost 250 percent for the individual farm worker. One man now farms enough food for 35 people as against 14 in 1945. Average yields per hectare are up 60 percent above 1950, and are expected to be 100 percent by 2000. If this increased productivity could be extended worldwide, there is no fundamental reason why total food supply could not support any reasonably foreseen population. What is lacking is the political, economic, and organizational structure to transfer agricultural technology and to achieve adequate distribution of the current and potential food supply. Unless these adjustments are made, widespread famines are nearly inevitable.

Energy

In 1850, coal, oil, and gas supplied 5 percent of the world's energy, and wood and the muscles of men and beasts 94 percent. Today those figures are exactly reversed. With a high standard of living goes high energy consumption. While population has grown 70 percent in the last 40 years, energy consumption has increased 310 percent. Americans now use more than six times as much energy per capita as the world average. The consumption of electrical power has shown by far the greatest growth. The U.S. Federal Power Commission estimates that electrical power usage is doubling every ten years. During the 1980s a new one-million-kilowatt plant must be brought into service every 12 days to satisfy power needs. The phenomenal growth of electrical consumption has emphasized the shortage of clean, cheap fuels (oil and gas) to make electricity.

Domestic oil production is down 8 percent from its peak in November 1970. Although Alaska's North Slope will add 2 million barrels a day by 1980, the one rich fields in Texas and Oklahoma are dwindling so rapidly that domestic output may never again reach its peak of 11 million barrels a day.

Fully 37 percent of our oil supply is consumed on the highway, and it is the oil industry's largest single market. Furthermore, between 80 and 90 percent of all that gasoline is burned up in urban trips in which the average car occupancy is only 1.3 persons and average trip length is less than 15 kilometers.

Coal is our most abundant fossil fuel, but its use is decreasing. The main reason is that coal is dirty. Coal burning in the United States discharged 4 million metric tons of sulfur into the atmosphere last year. The constraints of environmental laws will simply not allow this in the future. Unless current research programs in sulfur scrubbing and coal gasification are successful, the use of coal must continue to decline. In order to provide economic supplies, coal industry leaders argue that strip mining is essential. Ecologists and the public alike deplore this destroyer of the American countryside.

There are 52.3 million kilowatts of hydroelectric capacity in the United States, which is less than one third the country's ultimate potential. Most of the remaining two-thirds will never be used, largely because of conservationist opposition.

Nuclear power plants are the great hope for the future. Though building costs are high, operating costs are low, and adequate uranium fuel seems assured for at least a few decades. By that time the fastbreeder reactor, which actually produces more fuel than it consumes, hopefully will be ready to take over. But if environmentalists are upset over strip mining, air pollution and hydroelectirc dams, they become positively outraged over thermal pollution, disposition of radioactive solid wastes, and the spectre of the ultimate pollutant—lethal, long-lived radiation—that could result from an accidental catastrophe in a nuclear plant. So far lawsuits have blocked plans for many new nuclear power plants.

Interconnection of Problems

It would indeed be fortunate if these problems—population, pollution, resources, and energy—could be attacked individually. But they are obviously interrelated in a most disheartening way. This spring the Club of Rome sponsored a computer study carried out by Massachusetts Institute of Technology, tracing the interaction of population, food supply, resource consumption, industrial production, and pollution over long spans of time. The results showed that even when the hypothetical inputs were most optimistic the forecast was roughly the same: **bad.** If current trends continue unchanged, the team found, "the limits to growth on this planet will be reached sometime within the next 100 years. The most probable result will be a rather sudden and uncontrollable decline in population and industrial capacity."

A similar British study, called a "Blueprint for Survival" concluded that "indefinite growth cannot be sustained by finite resources." The demand for natural resources is becoming so great that it will inevitably cause "the breakdown of society and the irreversible destruction of the life support systems on this planet, possibly by the end of the century, certainly within the lifetimes of our children."

This summer the Stockholm Conference on the Human Environment discovered that not everyone sees the problems in the same way. Ethnic minority groups see population control as a way for the industrial powers to remain rich by preserving the status quo (which is Latin for "the mess we are in"). Poorer nations cannot afford, and rightfully feel that they should not be required, to pay for cleaning up a global mess that they did not create. They also are aware that ecological restraints will penalize them, directly or indirectly. Intensive recycling of used goods will cut the demand for their raw materials. Pollution controls on factories in the industrial nations will inevitably raise the cost that poor nations must pay for finished goods. Developing nations see recommendations for slowing industrialization in order to preserve the environment as attempts to deny them the high standards of living enjoyed by those who have already done the polluting. It is as difficult for the developer of a paper mill in Brazil to think that he can pollute the mighty Amazon as it was for the American colonist to think that his factory would destroy the Hudson.

These Facts Are Not New

But all these facts are not new or original with me. As we used to say at the University, "If you copy from one source, that's plagiarism; if you copy from many, that's research." This talk is based on that kind of research. These statistics have been published and examined again and again. As economist Barbara Ward said at Stockholm, "Truth is moving toward platitude with alarming speed." Somebody else said that if all the time spent writing and listening to speeches about ecology were spent picking up beer cans, the world would already be a better place to live. This being so, and in view of an earnest concern of mine not to waste your time, why didn't I send you out to clean the streets rather than repeating things you already know. Well, apart from the fact that the streets of Ottawa are already well kept, the reason is that I think photogrammetry, as much as any other profession except politics, can contribute to the solution of the world's problems. And we must see them in their totality before we can attack them. United Nations Secretary General U Thant, speaking to the Apollo 15 crew, said, "You saw our planet Earth from the Moon as an indivisible entity, a small planet orbiting in space, without boundaries, without frontiers, without any indication whatsoever of which part is rich, and which is poor; which part is black or white or yellow. This is a correct vision of this small planet." The space ship Earth (like Apollo) is a closed ecological system. The Second Law of Thermodynamics says that it is easier to get into trouble than to get out of it. Our space ship is in trouble and planetary engineering and management are required to help restore the balance. The role of photogrammetry in that task is one that we must appreciate and accept with vigor. Just as there are several separate, but interrelated, problems, I think there are several actions that photogrammetrists should undertake.

Find the Facts

The first action is *not* to decrease the number of photogrammetrists. Like everyone else, I believe that the population that should be controlled is not *us* but some faceless, nameless *they* somewhere else in the world.

Quite clearly the task with which we are all faced is to learn to manage the entire world. We need to develop the scientific, political, and social mechanisms to provide enough food, reasonable freedom from onerous labor, and a life expectancy beyond age 35 to every person on the globe. We need to find and distribute the resources to do this, being at the same time responsive to the legitimate concern that near-time gains are not taken at the expense of long-term deterioration of the planet which we hold in trust for future generations.

The most obvious prerequisite for effective management is information. And much of the information required for resource discovery, distribution, and management is most efficiently collected by the techniques of photogrammetry and photointerpretation. The requirement for basic topographic mapping as a fundamental tool for planning does not need to be elaborated before this audience. Our first (and probably easiest) task is to continue to develop our photogrammetric technology so that more information about the terrain can be produced at less expense and in shorter time.

We have come to appreciate that the conventional line-drawn map does not provide all the information which land planners need and can use. The orthophotomap seems to be a nearly ideal method of presenting all the information on the photograph while at the same time preserving the metric accuracy on which photogrammetrists pride themselves. Last year the Institut Geographique National in Paris held a Symposium on Orthophotography. It was attended by representatives from 25 countries. Their consensus was that orthophotomapping was essential to provide speed of compilation, completeness of detail, and low cost. It was agreed that orthophotomaps would be most useful in urban areas, but as yet we do not know how to handle the discontinuities in scale presented by tall buildings.

Those of you who have known me for years know that I have generally been somewhat scornful of photointerpretation as an art rather than a science. I am still inclined to feel that way. I have attended too many meetings where one speaker gets up and says, in effect, "I knew there were land and water down there, and I flew my camera over the area. And when I looked at the pictures, sure enough, there were land and water. The experiment was a success." And the next speaker will say, "I knew there were wheat and oats down there, and I flew my scanner over the area. And when I looked at the records, sure enough, there were wheat and oats." The empirical, pragmatic, approach has not been adequately supported by the science which causes and permits unambiguous recognition of the signatures. Yet I firmly believe that the total contribution of photogrammetry will be more attributable to the photointerpreters and remote sensor types than to us micron chasers whose god is positional accuracy rather than content. The development of the science, rather than the art, of image interpretation is certainly one of the most challenging tasks immediately before us.

One of the favorite targets of environmentalists and of many scientists whose personal ox has been gored by lack of funding, is the space program. I recently encountered a satirical note that said, "What is a spacecraft but the precise dynamic equivalent, in terms of our present theology and cosmology, of the static Egyptian pyramid? Both are devices for securing, at extravagant cost, a passage to heaven for the favored few."

I am not suggesting that remote sensing from space can, or should, replace conventional means. But surveys of the environment must be global. Satellites provide a means of obtaining worldwide and timely data needed to determine and make visible those problems that deserve our most vigorous attention.

One of the most significant events of our lifetime was the launch, yesterday, of the Earth Resources Technology Satellite (ERTS). It is the first attempt to apply the techniques of photogrammetry and photointerpretation on a worldwide scale. Doubtless, we will be hearing a great deal about ERTS. Photogrammetrists will find much to criticize in the lack of stereo coverage, the relatively poor resolution, and the geometric distortions. Nevertheless ERTS will provide an enormous amount of information at scales which are compatible with the scope of global problems. We had better learn to use this type of data before we clamor for the higher resolution, larger scale, and stereo coverage which we know could be obtained.

I would like to interpose a word of tribute to William T. Pecora. As Director of the U.S. Geological Survey, his foresight, planning, and vigorous support, more than that of any other man, were responsible for the success of ERTS. Bill Pecora died last Wednesday, four days before his bird was launched.

The progress of science and the global scope of environmental and resource problems inevitably decree that we are all to live in an increasingly open world. Spacecraft are inherently global in operation and the capability of taking high resolution photographs any place in the world gives rise to questions of international legality and political sensitivity. We must hope that our statesmen will be as astute in solving these problems as our engineers are in solving the technological ones. Personally, I believe the public is ahead of the politicians in recognizing that the potential benefits of space photography far outweigh the possible problems. There is an increasing understanding throughout the world that secrecy and national welfare are not necessarily synonymous.

Because of my deep personal involvement in the program, I cannot pass the opportunity to mention the Apollo flights. Regardless of what one may feel about lunar exploration as an objective, we did succeed in putting together the first truly photogrammetric space system. The lessons learned from that experience—particularly in the area of triangulation and data reduction—will, I believe, have great importance when high-quality space photography eventually becomes available for the Earth.

Develop the Science

In 1855 the French scientist Poincare wrote: "Science is built up with facts, as a house is built of stones. But a collection of facts is not more a science than a heap of stones is a house." That leads me to the second task facing photogrammetrists. Our cameras and sensors can be wondrously efficient in collecting facts. But unless we understand their significance, bald facts are liable to do us as much harm as good.

Consider any major project in construction, mineral extraction, manufacturing, energy production, or transportation, having environmental, social, economic, and political impact. Now collect any set of facts that might conceivably bear on the problem: soil types, geologic structure, property ownership, construction costs for various alternatives, impact on wildlife, population distribution, water and mineral consumption, climatological factors, etc. Say that every one of these factors is determined absolutely. Then tell me how you are led inevitably to a single conclusion about the value of the project. I doubt that it can be done. The point is that the results of analysis are extremely sensitive to particular assumptions about highly uncertain and ill-defined relationships, and this uncertainty increases as we attempt to extend the predictions into the future.

Clearly what is missing is the mathematical model—the science, if you will—to describe the complex cause-effect interactions between the works of man and his natural and social environment. I suggest that the development of these scientific relationships is a worthy challenge for any photogrammetrist. Our welfare, in the words of Dr. Philip Handler, president of the National Academy of Sciences, "no longer rests on our natural resources. It rests on our brains, and on our application of scientific understanding."

Get Involved

The third area in which I believe photogrammetrists need to become involved is the application of the information they provide. Increasingly, scientists are being called upon to advise policy makers, particularly at the interface between environment and technology. As President Kennedy told the National Academy of Sciences in 1961: "One of the problems of a free society is that all of the questions we must decide are extremely sophisticated questions. Those of us who are not expert must turn, in the last resort, to objective, disinterested scientists who bring a strong sense of public responsibility and public obligation."

It is often difficult, but always vitally important, to reach the proper balance between the role of "objective, disinterested scientist" and "public responsibility and obligation." Traditionally, scientists and engineers have taken the attitude that their role is simply to provide information on technological capability, and have left the decisions on what should be done with that knowledge to elected officials who assign national priorities. That is a comfortable role, but I believe that the myth of the neutrality of science has long since foundered on the hard rock of evidence that both theories and applications of science have a continuing effect upon man's welfare.

As science advisors to policy makers we need to look beyond the immediate problem and judge the second- and third-order consequences for individual human beings and the implications for society as a whole. Science and technology can provide the miracle of the loaves and fishes. Now we must make sure that the miracle extends to the proper use and distribution of the benefits. Advance assessment of projects, by showing the tradeoffs between beneficial and harmful effects can assure an advantageous utilization of our resources and energy.

In the role of adviser we must be careful to differentiate between consulting within the scope of our expertise, and expressing personal views on issues of public policy, to which we are entitled no more and no less than our fellow citizens. In this regard it is helpful to remember that if an issue can be decided adequately by vote, it is not a scientific issue, for nature is the final arbiter of science.

Nevertheless, policy making eventually involves a matter of choice, and choice means a rejection of some things and acceptance of others. It does not mean that because something *can* be done, it ought to be done. We must contribute to a better system for making choices than response to, or reaction to, protests. In the end, of course, choice means *morality:* defining a set of values and acting on them.

We are agreed that morality includes making the benefits of civilization available to all men. We are agreed that it includes preservation of the world for the benefit of future generations. We, as a profession, have a major contribution to make to the attainment of those goals.

Conclusion

There is an old Arab proverb: "Four things never return: the spent arrow, the lost youth, the spoken word, and the missed opportunity." Well, the spent arrow is probably stuck in the polluted air; our lost youth has slipped from our chests to our waists; the spoken word is often best forgotten. All that remains is the opportunity. As we go through our deliberations in the next two weeks, let us keep in mind both the opportunity and the challenge which we face. And in the words of Ecclesiastes, "Whatsoever thy hand findeth to do, do it with thy might."

Meetings Schedule

ANNUAL CONVENTIONS

March 11–16, 1973* Washington Hilton, Washington D. C.

March 1974* Chase-Park Plaza, St. Louis, Mo.

March 7–12, 1975* Washington Hilton, Washington, D. C.

FALL TECHNICAL MEETINGS

1973* Oct. 2-5, Disney World, Orlando, Florida; Jon S. Beazley, Florida Dept. of Transportation, H. Burns Bldg., Tallahassee, Florida 32304.

Sept. 8–13, 1974,† Washington Hilton, Washington, D. C.

1975,* (open), Phoenix, Arizona.

Sept. 28–Oct. 1, 1976,* Olympic Hotel, Seattle, Wash.; C. E. Buckner, 803 Seattle Municipal Bldg., Seattle, Wash. 98104.

Oct. 18–21, 1977, Little Rock, Arkansas.

SEMINARS AND SYMPOSIUMS

July 1973, Univ. of Maine, Orono, Maine. Fourth Biennial Workshop—Color Aerial Photography in the Plant Sciences.

October 1973, Sioux Falls, S. Dak. Management & Utilization of Remote Sensing Data. Convention Center and USGS EROS Data Center. Cosponsored by AIAA, IEEE and AGI. Dr. Harold T. Rib, 10129 Glenmere Road, Fairfax, Va. 22030.

INTERNATIONAL MEETINGS

July 1973, Mexico City, Mexico. Joint Technical Meeting with the Mexican Society of Photogrammetry.

Sept. 9–16, 1974, Washington Hilton, Washington, D. C., *14th Congress of the International Federation of Surveyors,* (FIG); Jeter P. Battley, Jr., P.O. Box 14262, Washington, D. C. 20044.

* Jointly with the American Congress of Surveying and Mapping.

† To be held as part of the international Congress of FIG.

Notice to Contributors

1. Manuscripts should be typed, double-spaced on $8\frac{1}{2} \times 11$ or $8 \times 10\frac{1}{2}$ white bond, on *one* side only. References, footnotes, captions—everything should be double-spaced. Margins should be $1\frac{1}{2}$ inches.
2. Ordinarily *two* copies of the manuscript and two sets of illustrations should be submitted where the second set of illustrations need not be prime quality; EXCEPT that *five* copies of papers on Remote Sensing and Photointerpretation are needed, all with prime quality illustrations to facilitate the review process.
3. Each article should include an abstract, which is a *digest* of the article. An abstract should be 100 to 150 words in length.
4. Tables should be designed to fit into a width no more than five inches.
5. Illustrations should not be more than twice the final print size: *glossy* prints of photos should be submitted. Lettering should be neat, and designed for the reduction anticipated. Please include a separate list of captions.
6. Formulas should be expressed as simply as possible, keeping in mind the difficulties and limitations encountered in setting type.