

## Opening Ceremony Cérémonie d'ouverture Eröffnungsfeier

Salons - Deville and MacKay - Civic Centre - Lansdowne Park - Ottawa

**Monday July 24 1972, 09:30**

National Anthem - Sung by the Fresh Outlook Singers, Directed by Mr. Robert Boulanger.

*Dr. S.G. Gamble, 1972 Congress Director:* Je présente l'honorable Donald MacDonald, Ministre de l'Énergie, des Mines et des Ressources. Mr. MacDonald.

*Honorable Donald MacDonald:* Mr. Chairman, Distinguished Guests, Ladies and Gentlemen. On behalf of the Government of Canada, I am pleased to welcome you to our country for the XIIIth International Congress on Photogrammetry. I am particularly pleased to have been asked to speak to you today because this is the first time the Congress has been held in Canada, and only the second time it has been held outside Europe. This is also the first in a series of four ISP meetings in Canada this summer, and I hope that those of you from the 56 other nations represented here will have a pleasant and rewarding stay in Canada.

In this country, we have a special interest in the science of photogrammetry and its applications, and I am certain that our scientists will study closely the results of this Congress. As in any other field of study, the new developments discussed here in Ottawa will have major importance to present and future photogrammetric operations in Canada and in other nations. The area of our country is approximately 10 million square kilometers, with unparalleled geographical complexity. There are still regions in the Canadian North and, indeed, in other parts of Canada, which have not been developed, and there are other areas where more development needs to take place. But development must be planned and orderly and, therefore, must be based on knowledge. In many cases, our knowledge of a particular area is still insufficient to begin development, and it is in this field that photogrammetry has been, and will continue to be, valuable to the management of Canadian resources.

Monsieur le Président, ce furent les ingénieurs et les cartographes qui mirent d'abord la photographie au service du développement, comme moyen de trouver un passage au chemin de fer transcontinental à travers les montagnes Rocheuses. La construction de ce chemin de fer, entreprise titanique et ambitieuse, était nécessaire à l'expansion du pays car elle assurait un lien entre régions du Canada autrefois séparées par d'énormes distances et une géographie difficile. La voie ferrée trans-canadienne fut terminée en 1885, et bien que les circonstances et méthodes ne soient maintenant plus les mêmes, la photogrammétrie demeure un outil indispensable au développement du Canada.

As the body of photogrammetric knowledge grows and the range of available techniques widens, the absolute need for photogrammetry in carrying out national goals increases proportionately. The most significant development in this evolution was the beginning of aerial photography, first used in Canada shortly after the 1914-18 War. This was followed in the late 1930's, by the introduction of modern photogrammetric instruments used initially by the Geographical Section of the Canadian Army. I understand that General Burns, who was the commander of the unit at that time, and who has since gone on to a very distinguished career in the Canadian Armed Forces, and with the United Nations, is in the audience today, and is an honorary member of the Congress Organizing Committee. Since that time, Canadian photogrammetrists and their counterparts in other nations have never looked back. Continuous research, together with regular exchanges of knowledge at congresses such as this one, have made photogrammetry an extremely dynamic science, and we, in Canada, are proud of the contribution we have been able to make to the field.

Techniques and instruments pioneered in Canada range, from the analytical plotter and the Hobrough orthophoto system of mapping, to the use of airborne cameras by the Ontario Department of Natural Resources to detect forest damage and disease. Soon, Canada will make extensive use of data received from the Earth Resources Technology Satellite, launched this month by the National Aeronautics and Space Administration in the United States. Data from this source will be particularly valuable to us for Arctic navigation and pollution monitoring. On behalf of my Government, I wish to congratulate NASA on the successful launch yesterday of the Earth Resources Satellite "A". I understand the first imagery will be released by NASA tomorrow, if everything goes well. We are hoping to produce the first Canadian imagery for this meeting on Wednesday of this week.

Le ministère de l'Énergie, des Mines et des Ressources poursuit activement ses recherches sur de nouvelles applications de la photogrammétrie. Actuellement, trois services du ministère, la Direction des levés et de la cartographie, la Commission géologique du Canada et le Centre canadien de télédétection, utilisent les procédés photogrammétriques et exécutent des recherches se rapportant à de nouvelles applications. Ces

recherches vont des méthodes simplifiées de rédaction des cartes aux méthodes perfectionnées de restitution et d'analyse des données par ordinateur. Certaines de ces méthodes sont maintenant universellement appliquées.

Il y a également au Canada un très grand nombre d'entreprises de levés aériens qui offrent leurs services aux gouvernements provinciaux et municipaux ainsi qu'à l'industrie.

Topographic mapping and airborne geophysical prospecting are still extremely important activities for Canada. The Surveys and Mapping Branch completed the mapping of Canada at a scale of 1:250,000 in 1970.

It has taken us only twenty (20) years to map this country at that scale and, considering the size of Canada, this is quite an achievement. I must say, however, that without the help of modern photogrammetry and new developments in cartography, it would have taken far longer to complete. The advances in these two sciences have revolutionized map making to the point that we can now produce better maps faster and more accurately than ever before.

It is also because of the new developments in the fields of photogrammetry and cartography that I am able to announce today a new programme for the production of a National Atlas of Canada every ten years.

We intend to produce a very comprehensive Atlas of Canada covering the topography and geology, as well as the human and economic geography of this country. Our purpose in doing so is to promote a deeper knowledge of Canada by all our people; to promote a sense of national unity and identity, and a clearer image of Canada abroad.

Few of us realize the necessity of having such an atlas. Urban planners, resource managers, engineers, sociologists and scientists need to have access to up to date information in order to do their jobs. The Atlas will answer this need. School children and educators should also make good use of the Atlas because it will contain an extremely wide range of data on many aspects of Canadian life. Perhaps most importantly, an Atlas is an effective way of showing the complex relationships between such factors as geography, population density and growth, industrial growth, income and employment.

We can all appreciate that the production of an atlas as comprehensive as this one is an immense task in itself. But it is made even more awesome when we consider that the data on human and economic geography is constantly changing. At the same time, the number of people and functions requiring current information is rapidly growing. For this reason, we have chosen a ten-year interval between editions of the Atlas so as to coincide with the decennial census of Canada. In addition, individual sheets will be published throughout the revision period to maintain the currency of rapidly changing data.

Certains des outils les plus récemment développés dans le domaine de la photogrammétrie sont en montre ici au centre municipal. Le maire d'Ottawa, M. Pierre Benoit, présidera à l'ouverture de l'exposition demain. La variété des pièces exposées témoigne de l'envergure de la recherche photogrammétrique, tout en illustrant la nécessité d'établir la coopération entre gouvernements, industries et chercheurs individuels, car chaque secteur peut profiter des connaissances de l'autre. Cette coopération déjà a permis de grandes réalisations et j'espère qu'elle se poursuivra à l'avenir.

Finally, I wish you all success in your discussions in Ottawa. For the next two weeks, your ideas will be studied and scrutinized; your many achievements will be judged and a part of your future will be plotted. I would like to remind you that your meetings here will have a bearing on the future development of Canada and many other nations. Above all, you as scientists and we as legislators must keep in mind that the future cannot be like the past. We must plan in such a way that our development is orderly and compatible with national goals and the interest of the people. This will require a more detailed knowledge than was necessary in previous years, and it is up to you as photogrammetrists and scientists to provide us with the tools and the information necessary to gain that knowledge.

Again, I welcome you all to Canada and hope that your stay here will be valuable to you and the nations you represent.

Thank you very much.

*Dr. Gamble:* Unfortunately, the Honourable A.B.R. Lawrence, Minister of the Ontario Department of Resources Development is ill this morning and will not be present. However, it is a fortunate circumstance that

Controller Claude Bennett, besides being a Controller of the City of Ottawa, is also a member of the Provincial Parliament of Ontario. So Mr. Lawrence has asked Mr. Bennett to not only represent the City of Ottawa but the Province of Ontario at this ceremony. I now call upon Controller Claude Bennett of the City of Ottawa.

*Controller Claude Bennett:* Mr. Chairman, Ladies and Gentlemen. May I first of all apologize for the Minister's absence this morning. Unfortunately, we have some of the same ailments that you enjoy in your countries. The Honourable A.B.R. Lawrence has summer flu, and has asked me to fill in for him. The Mayor of the City of Ottawa has asked me to represent him also here today, but he will greet you tomorrow at the opening of your exhibits. So I have the honour and distinct pleasure of representing both the Province of Ontario and the City of Ottawa in bringing greetings and saying how delighted we are that you are with us in the Province of Ontario and in Ottawa.

I am sure, Ladies and Gentlemen, as the next fourteen days pass, that you will have an opportunity to view some of the outstanding features in our Nation's Capital. As Municipal Members of Council, we try to ensure that the City and its buildings, parks and streets are maintained to the standard expected of a Capital City. I visit the City of Toronto two or three days a week as a Provincial Member, and I try to see that the needs of the City of Ottawa are presented from the Provincial point of view. Besides seeing Ottawa, I hope you will take the time to visit other parts of the Province of Ontario. There are many fine features throughout this Province. Next week on your way back from Niagara Falls you should take the opportunity to stop at Toronto. We are very proud of the Provincially designed and controlled Ontario Museum of Science. I am sure if you were to enquire from any of our Provincial participants, they would be pleased to show you where it is and arrange a tour of the building. It has certainly helped in broadening the knowledge of those who have visited it.

Now, if I may return to the City of Ottawa, I hope that you will visit many of its outstanding features, and I must admit in front of the Minister that some of them are the result of a joint effort by the Municipality and the Federal Government. We would like to think that the City was entirely financed by the taxpayers of our community, but we must admit, in all honesty, that the Federal Government does contribute substantially towards the welfare and well-being of this community. And that, coming from a municipal politician, is not easy to admit. So I say to you, as you travel round our City, I trust you will visit the Parliament Buildings and the fine structures in their vicinity, including the National Performing Arts Centre. You will be interested to learn that Canadians also spend their money promoting the arts. Our City Hall is located in one of the finest sites in the city, and I extend to you, on behalf of the Members of Council and His Worship the Mayor, an invitation to visit it. We are located close to the residences of two distinguished Canadians, the Governor-General and our Prime Minister, the Honourable Pierre Trudeau.

To conclude, we are delighted that you have seen fit to bring the 12th Congress to Canada and to the Province of Ontario, and, last but not least, to Ottawa. We bid you a welcome to our City, we trust you will enjoy your stay here. We have already agreed to assist in some small measure by supplying buses for transportation, and would be happy to be able to assist further. Please accept the invitation to visit all of the highlights of our City. Thank you for coming to Canada, to Ontario and to Ottawa.

*Dr. Gamble:* I shall now call upon the President of the host Society. Le président de l'Association Canadienne des Sciences Géodésiques, Dr. George Zarzycki.

*Dr. Zarzycki:* Mr. Minister, M. le président de la Société Internationale de la Photogrammétrie, Congress Director, Members of Council, Delegates, Ladies and Distinguished Guests. It is indeed a great honour and pleasure for me to extend to all attending the 12th International Congress for Photogrammetry the warmest welcome from the Canadian Institute of Surveying and to wish you a fruitful and successful deliberation. We are very proud to host such a distinguished group of scientists and engineers from some 60 countries. Without fear of exaggeration, I can say that you have brought to Ottawa the global knowledge and experience in photogrammetry and the latest development of photogrammetric instruments. I hope that during your stay in our country you will find time to see more of Canada, appreciate our vast territories, diversified landscape, multitude of climate and geography, and that your observations and experiences will imprint a pleasant and lasting memory.

Nous sommes honorés de vous voir chez nous au Canada, et nous vous souhaitons la bienvenue.

Ich heisse sie herzlich willkommen.

*Dr. Gamble:* On behalf of the International Society for Photogrammetry, I shall now call upon our President, Professor Solaini, to reply to the welcoming addresses.

*Prof. Solaini:* The Honourable Minister, Donald MacDonald, Controller Bennett, Dr. Zarzycki. Your presence at this solemn deliberation of the 12th International Congress for Photogrammetry is an honour to our Society and to all participants. On behalf of all the Congressors, I thank you for your presence here this morning and for such cordial greetings. Also for what you have done to ensure that our stay in the lovely City of Ottawa will be pleasurable, and that the Congress will be a great success. Four years ago, the friendly Canadian delegate extended an offer from the Canadian Institute of Surveying to sponsor the Congress in Ottawa. It was greeted with warm and unanimous consent. Another member country, which strongly desired to organize the Congress, declined willingly from its offer, to give priority to Canada. This is the first time that the Congress has been held in your Country, but many of us have already come to Ottawa, either for participation in meetings or symposia for photogrammetry, all of which have been very successful for scientific purposes, with the Department of Energy, Mines and Resources, the National Research Council, and other agencies active in photogrammetry. We had always been able to appreciate the efficiency of the Canadian organizations of research and production. We have always found warm and friendly hospitality in an active but relaxing atmosphere. Thanks to the stamina of Canadian researchers and technicians, to the memory of beneficial and at the same time pleasantness, to the certainty of an extremely efficient technical preparation of the Congress, Canada's invitation has been accepted with warm enthusiasm. The best proof of the photogrammetrist's interest in this meeting in Ottawa is shown by the large attendance of more than 1,000 participants, some of whom have come long distances despite heavy expense.

Dans vos discours vous avez souligné l'importance de la photogrammétrie. Cette importance est vraiment considérable pour tous les pays sans exclusion, et augmente au fur et à mesure que ses techniques se perfectionnent et que les nouveaux champs d'application s'ouvrent à elle. Votre présence ici messieurs les représentants illustres du gouvernement et de la municipalité d'Ottawa, n'est pas seulement un geste de courtoisie auquel nous sommes très sensibles, mais aussi un témoignage de l'intérêt que vous portez aux thèmes de discussion qui nous occuperont durant deux semaines. Permettez-moi donc de vous remercier encore une fois pour la sensibilité et l'ouverture d'esprit qui vous ont conduit à accepter l'invitation du directeur du Congrès et pour la chaleur avec laquelle vous avez accueilli les comités des 56 pays qui collaborent dans un effort commun d'étude et de travail.

Mr. President of the Canadian Institute of Surveying, I congratulate you on the manner in which your Society is carrying out its responsibility for this Congress, and I thank the Honourable Donald MacDonald for opening this 12th Congress of International Society for Photogrammetry.

#### INTERMISSION

During this intermission between the Opening Ceremony and the First Plenary Session, a musical interlude was offered by the Fresh Outlook Singers under the direction of Mr. Robert Boulanger.

#### FIRST PLENARY SESSION

Monday July 24 1972, 10:30

*Dr. Gamble:* I shall now call upon our President for his address to the Plenary Session. Professor Solaini.

*Prof. Dott. ing. L. Solaini:* Mr. Chairman, Ladies and Friends. In the first place I wish to address the most cordial welcome to all the participants in the Congress and to their relatives. Thankful greetings go also to the Exhibitors who have brought here the results of four years of study and realization of new photogrammetric equipment; they have met considerable expenses for the organization of a splendid exhibition really helpful for all of us. Their care goes far beyond their simple commercial interests, and rather means a highly valuable technical collaboration.

We are now faced with two weeks of heavy work, both during and outside the commissions' meetings, since the activity of the Congress goes on also after the meetings, through contacts more or less restricted but always very important.

Dr. Gamble and his collaborators have really helped us in making our stay in Ottawa not only profitable but also pleasant, and I want to thank them right now, on behalf of all of us, for the huge work undergone for the organization of this Congress, accurate also in the least detail.

I wish to address a special greeting to the Honorary Members of the Society who are present in Ottawa. Unfortunately, they are only three - Dr. Härry, Captain Reading and General Brown - since the other two have not been able to come, due to age or health conditions. To all of them our affectionate thoughts and the warmest wishes.

Two Honorary Members have unfortunately deceased during the last four years: Dr. Ermenegildo Santoni, inventor of admirable photogrammetric instruments, and Patrik Mogensen, President of our Society from 1952 to 1956. To these sad losses two more, equally serious, must be added; I'm thinking of Professor Bertil Hallert, a scientist of international reputation, president for many years of the working group on the fundamental problems of photogrammetry, and of Dr. Paes Clemente, President of the Society from 1960 to 1964, well-known figure in geodesy and photogrammetry. The eulogy on Mr. Mogensen and Ing. Santoni appeared in the First Part of Volume XVII of the Archives; Bertil Hallert and Paes Clemente will be remembered in the Volume relative to this Congress. We mourn the loss of all the colleagues who have left us since the last Congress.

It is my duty to relate to the Congress the activity that the various bodies of the Society have carried out in these four years, and about the assigning of the Awards. Furthermore, I've to submit to you the proposals for the nomination of new Honorary Members. I shall report here on the most important facts, because a technical summation will be presented to the General Assembly as an introduction to the discussion of the various subjects on the Agenda.

First of all, I wish to point out that the Archives of the XI Congress were issued in due time. The last one, that is the first section, appeared at the beginning of this year and is drawn up in a really admirable way. I know that this book has cost much labour and trouble, but I hope that now Dr. Härry and Prof. Kasper have forgotten all that and are happy for the work done. As far as we are concerned, and I'm talking on behalf of all the photogrammetrists belonging to the ISP, we thank them heartily.

We have the pleasure of welcoming some new members of our Society. Their admission has been decided after a referendum among all the member bodies. They are: Ceylon, Cyprus, Papua and New Guinea, Nigeria. Very recently the Irish Society of Surveying and Photogrammetry has asked for admission to the ISP. The General Assembly will decide Wednesday on this request. It is a great pleasure and satisfaction to welcome these new colleagues: they will be able to realize how important the International Congress of Photogrammetry is in order to make new acquaintances and friends, and to establish relations for information and collaboration. The exchange of information is essential for us: the environmental and human situations are so many, and the needs in the cartographic fields so different, as to make several surveys a special problem which has to be carefully studied on the basis of local knowledge and openmindedness, exploiting the most suitable techniques that can make it fast, economical and sufficiently accurate.

The last four years were the first ones in which the life of the Society has gone on under the guidance of the new Statutes and Bye-Laws. Both myself and the Council have taken care to comply as exactly as possible with the Statutes, which have been a constant guide to our activity. After a four-year experience, we can maintain that they are a clear, exact and organic guide, and that we almost never found ourselves in trouble in their interpretation and application.

The Council has held four meetings, one per year, as follows:

September 1968 in Otaniemi, in the Technical University of Helsinki;  
September 1970 in Paris, guests of the IGN;  
August 1971 in Milano, in my Institute;  
1972 in Ottawa, two days ago.

The meetings have always been rich in very profitable discussions concerning all the subjects of interest for the life of the Society, the work of the Commissions, the preparation of the Congress, the assigning of the Awards, the proposals for the nomination of the new Honorary Members, the relations with the Finance Commission, the admission of new members. It would be advisable that the meetings of the Council Members be held more frequently, the most important handicap being the long distances. However, we have tried to keep in close contact, both through correspondence and on occasions of the international symposia, so that the collaboration among us has been intense and, we hope, useful.

One of my first tasks as President was the nomination of a Commission, requested by a Resolution of the General Assembly, charged with the preparation of a new organization of the Technical Commissions. I asked the first Vice-President, Prof. Bachmann, to preside and to organize the work: it concerned a very delicate matter, since the ideas on this subject were quite dissimilar. Some of our colleagues wanted a major

transformation; that is to say, a true revolution; others proposed to leave things as they are. Thanks to Prof. Bachmann and to the members of the Commission, an agreement was reached which is at the same time modern and balanced.

If your delegates, as I sincerely hope, will approve the proposals that the Council distributed to the member countries quite a while ago and now submit to the judgement of the General Assembly, the new organization of the Technical Commissions will complete the work of renewal of the Society's structures that started with the adopting of the new Statutes.

I wish to thank the Commissions, at this important meeting, for the work they have carried out both responsibly and efficiently.

The contacts with the Presidents of the Technical Commissions were rather frequent: they were so kind as to send me copies of all the circular letters and to keep me informed of their activity; furthermore, I have been able to get a general idea of the trend of the Commissions' work through the participation in the symposia, of which I'll speak later. The position of the President in respect to the Commissions is rather peculiar because, on the one hand, according to the Statutes, he "co-ordinates the activities of the Technical Commissions and working groups, according to the decisions and intentions of the Congress"; on the other hand, the Technical Commissions are autonomous in scientific matters. It is not easy to make the two things agree, unless by means of mutual friendship and esteem. I hope that the action I have carried out has been of some use for the Commission Presidents, some of whom have been long-time good friends. I apologize if I have not been able to do any better.

During the last quadriennium, the meetings of the Council with the Presidents and secretaries of the Commissions have shown the benefits of the common discussion on the preparation and course of the Congress. We, therefore, decided to repeat the meeting in Paris, on the occasion of the second meeting of the Council, when all the Commissions, but one, had already held their symposia and, hence, planned their activity.

The Council had made some proposals concerning the course of the Congress: that is, on the presentation of the reports and on the discussions, on the publication of the Archives, etc.; Dr. Blachut, for his part, had prepared a scheme of the subdivision of the time to be put at the disposal of the Commissions in Ottawa. All these subjects have been discussed in Paris and, together, we have reached the final formulation of the rules to be followed. I hope that, on the whole, the Commission Presidents are satisfied with the procedure we followed and with the results attained, even though some criticism was raised sometime after the Paris meeting.

Two remarkable variations were introduced in respect of the traditional course of the Congress and of the publication of the Archives. The first one restricts, in general, the exposition and discussions just to the reports of the working groups and to the invited papers; the second one excludes from the Archives the presented papers, the summaries of which will be collected in a volume that will be distributed to the Congressists. We had to take this last decision since the size of the Archives has become enormous, and it would have kept increasing to unmanageable proportions.

The results of this Congress will tell us whether our decisions have been wise. On the basis of the experience of the coming days, the new Council and the future Commission Presidents will be able to take the provisions they will think most suitable for the future, in the light, of course, of the Resolutions that the General Assembly and the Congress will express in the last meetings.

All the Commissions held a symposium between the Congresses, as follows:

Commission I in May 1970 - Columbus, Ohio,  
Commission II in September 1970 - München,  
Commission III in August 1971 - London,  
Commission IV in September 1970 - Delft,  
Commission V in September 1970 - Paris,  
Commission VI in September 1970 - Bratislava,  
Commission VII in September 1970 - Dresden.

As you can see, the symposia of five Commissions have been held within a period of one month, which made me travel over half of Europe in order to follow them as much as humanly possible. It has been quite an interesting experience, even though slightly tiring, in so far as I had the chance to gather, in a short period, a synthesis of all the trends and programmes of the various Commissions.

I must say that all symposia have been organized very carefully and have been useful for the preparation of the Congress, without taking away from it its fundamental importance. In fact, no symposium has taken the look of a small congress. Usually, the discussion concerned some fundamental subjects, to whose development the specialists have given valid contribution of ideas both through the presentation of papers and through the debates. Finally some small meetings have taken place to perfect the programme to be carried out before and during the Congress.

It is my opinion that, if so organized, the symposia have a remarkable importance in the life of the Society, and can be quite useful to the Congress, in that the results of their work, besides being published, are illustrated at the Congress itself; furthermore, it allows the specialists of the various branches of photogrammetry to meet every two years, which permits a frequent exchange of informations, in a time in which science and technique grow so rapidly.

The Secretary-General and myself have taken part in all the symposia; whereas the First Vice-President Bachmann was in Paris, and the Second Vice-President Skládál in Dresden and Bratislava, the Director of the Congress, Dr. Gamble, in Columbus, Ohio, Paris and London, and the Treasurer, Prof. Halonen in Paris and London. As you can see, the Members of our Council take a deep interest in these meetings, not of course merely as officers of the Society, but also as photogrammetrists.

To complete the list of my travels as President, I must add that I intervened in two further meetings: that is, in the symposium on image deformations organized here in Ottawa by Dr. Blachut in collaboration with the President of Commission I; and in the meeting on the architectural applications of photogrammetry held in Brno, on the initiative of the President of Commission V, and of ICOMOS.

My presence at the meeting in Ottawa enabled me to get an idea of the organization of the Congress; while in Brno, besides the interest aroused by the collaboration between different organizations, ISP and ICOMOS, I was finally able to discuss with Vice-President Skládál and with Prof. Gál, President of Commission VI, who were not able to participate in the Paris and Milano meetings, even though to the latter meeting Prof. Gal had been eagerly invited.

You may suggest that I have been rather a globe-trotter, at least for a certain period. I assure you that to travel, especially going from one meeting to the other, sometimes without even a day's rest, is not my vocation. However, I considered that my duty was to maintain as strictly as possible personal ties which are so poorly substituted by correspondence.

All the proceedings of the Symposia have been published, with the exception, possibly, of Commission VI. They have been edited in various forms, either as special issues or in national magazines. The Council holds these documents of ISP activity as being very important; therefore, will make a proposal to the General Assembly suggesting that, in the future, the proceedings be published in a uniform manner, such as to constitute a special volume of the Archives.

I have already mentioned the collaboration between ISP and ICOMOS. This has brought about the constitution of a special organism, the C.I.P.A. (Comité Internationale de Photogramétrie Architectural), which will deal particularly with the applications of Photogrammetry to the survey of architectural monuments. In this field, I've noted the great enthusiasm both of the photogrammetrists and of the curators of the monuments, and the value of the merging of different competencies, directed toward a common aim.

It is highly desirable that photogrammetrists contribute also to other fields; for instance, premise exists of a close collaboration with doctors.

The ISP attended officially the congresses of the FIG. I participated in London, in 1968, soon after our Congress, whereas in Wiesbaden, in 1971, Prof. Bachmann kindly accepted to represent our Society. I hold that the ISP should have closer contacts with FIG, given that the two organizations have, partially, a common field of interest. One of our representatives will also take part in the International Congress of Geology which will take place in a short while here in Canada.

We have invited to our Congress the Presidents of various associations connected in some way or other with us and with whom it would be quite useful to keep in contact for collaboration and information. Unfortunately, many of them have not been able to accept because of pressing engagements due to their office or work, even though all have shown deep interest in our work.

We also regret that we have not with us a representative of UNESCO of which the ISP is a non-governmental member, because photogrammetry plays a fundamental role in the planning and organizing of the territories in developing countries.

I welcome most cordially Mr. Radlinski, who is here as a representative of the International Federation of Surveyors, Prof. Leiczzycki, who represents the International Geographical Union, Mr. Gale, who represents the International Association of Geodesy, and Mr. Kihl, who represents the International Cartographic Association. The Director of our Congress, Dr. Gamble, has been charged to represent here the Pan-American Institute of Geography and History.

Let's pass now to the Second part of our agenda, regarding distinctions and the assigning of awards.

The loss of Santoni and Mogensen has reduced the Honorary Members to five, whereas their maximum number, according to our Statutes, is fixed at seven. The Council considered it opportune to replace these two remarkable personalities. The nomination of new members is up to the Congress, but we thought it is the Council's duty to give indication; that is, to give a preliminary proceedings to facilitate your decisions. Our task has not been easy, since there are several persons who, for their valuable deeds and their long work in the Society, deserve the highest distinction that the International Society for Photogrammetry can give. Besides a careful examination of the merits of different personages, we have asked the opinion of the existing Honorary Members, and have finally reached the decision to subject to your vote the election of two eminent scientists, regretting that the strict, but proper limitation imposed by the Statutes, prevents us from proposing other highly worthy names.

I propose to you, also on behalf of all the Council members, to elect new Honorary Members of the International Society for Photogrammetry: Prof. Kurt Schwidewsky and Prof. Edgar Thompson. (Applause). I can consider your applause as voting for the election of the new Honorary Members.

I thank you sincerely for having accepted our proposal and congratulate heartily the two new Honorary Members, reminding them that this election will engage them even further in their contributions to the life of the Society. They will begin immediately, participating in the work of the General Assembly.

For the Brock Gold Medal Award, on April 15, 1971, the Secretary-General sent a circular to all the Member Bodies asking for proposals, in the manner prescribed by the regulations of the Awards; further letters were sent urging a reply. Two proposals reached the Council, both perfectly valid, being supported by several National Societies or Honorary Members. The Council examined the documents received at the time during the Milano meeting; that is, before the period for presentation of the candidatures had expired. When the period stated by the regulations had terminated, since there weren't any more candidates, a vote by correspondence went ahead. This gave the following results: Dr. Uno Helava, 5 votes. A member of the Council, Mr. Tewinkel did not vote since he was not allowed to support a fellow citizen. Thence the Brock Award was assigned unanimously to Dr. Helava. I heartily congratulate the winner of the important award, which up to now has been given to only three very eminent persons: Dr. Bertele, Prof. Schermerhorn and Dr. Helmut Schimdt.

I ask the Secretary-General to present the award to Dr. Helava.

*Secretary-General:* Dr. Heleva, it is indeed a pleasure, a personal pleasure of mine, to award this Brock Medal to you on behalf of the International Society for Photogrammetry, for your part in developing the analytical plotter, for which you hold some patents, I understand. The plotter is recognized as being an outstanding contribution in the evolution of photogrammetry. This plotter involves a computer, on-line, which has two functions: (1) to solve in a very excellent way the geometric problem of photogrammetry in place of the former mechanical linkages; and (2) the computer serves to draw contours automatically, and to form an orthophoto. The analytical plotter is in serious production, and is in use in large areas of the world. It is indeed a pleasure for me to award to you these tokens of the Award, as well as this certificate which tells us about it.

*Dr. Helava:* Thank you, Mr. Tewinkel, thank you Mr. President, and through you the Council. I think I have to use this opportunity to say, first of all, that the Council committed a mistake, because I am not a citizen of the United States. I think, also, Mr. Tewinkel put it very perfectly when he said the Brock Medal is for my part in the development of the analytical stereoplotter. I think it is only fitting at this moment I acknowledge the very great contributions made by many individual people, many organizations, which have made my dream come true, if you wish. At the same time, I think I should also acknowledge my indebtedness to many contributors, maybe not so direct, but very important nevertheless. Starting from my native Finland for my education - and my professor is sitting right beside me here, Dr. Halonen; to Canada, who gave me the opportunity, not only to work, but to contribute in a scale and in a scope that was beyond my greatest dreams

at the time; also to Italy, in our position in a true international sense, to Italy for recognizing the potential of my ideas early, and giving me a lot of encouragement and help since then; also to the United States, for recognizing the potential of the principles of the analytical plotter, and for providing the ever-important financial support without which any development of this scope might not materialize. Last, but not least, my thanks to a person who actually forced me to write the initial patent application in 1956, - my wife. Thank you all.

*Prof. Solaini:* The second Award that the ISP has to assign is that named after Otto von Gruber, established by Prof. Schermerhorn and meant to recognize the best published paper of the last four years. The jury was formed, besides Prof. van der Weele, rector of the ITC, and myself, by Prof. Hofmann (West Germany) and by Mr. Proctor (United Kingdom). There were four competitors, some of whom presented various works. The first decision of the jury has been to consider not just a single paper, but the complex of the works which express a contribution to a determined subject. Furthermore, since all the competitors have presented valid papers, and during the past four years the prize has not been awarded, Prof. van der Weele, in agreement with Prof. Schermerhorn, has accepted to assign two Awards. With unanimous votes by the jury, they have been assigned to Dr. Heinrich Ebner of the University of Stuttgart, and to Dr. Joachim Höhle, collaborator in the scientific department of the Wild Company. Hearty congratulations to the two winners, and best wishes to other scientists for the next four years.

Since Prof. Schermerhorn is unfortunately absent, Prof. van der Weele is very happy to present the awards on his behalf. (Applause).

*Prof. van der Weele:* Thank you Mr. President. It is indeed a great pleasure for me to perform this task. I think both of the candidates have fulfilled the requirements of the jury completely, and this is particularly so for Dr. Ebner, who has continued, more or less, the work started about forty years ago by Professor von Gruber, who published, in the first instance, problems of aerotriangulation, the combination of studies with background and their applications, and this is in particular the contents of the last four or five papers of the work of Dr. Ebner. I am very glad to be able to present him here the Award, and, in addition, this certificate stating that you have been given this Award. (Applause).

*Dr. Ebner:* Thank you very much.

*Prof. van der Weele:* The second candidate, Dr. Höhle, has been chosen because he has presented a Paper of a rather fundamental nature about the multi-media photogrammetry. This is not a new subject; in fact, it has been treated before, but he has treated it now in such a general and fundamental way, as far as the jury could see, it could be the basis for future work for a number of special applications. Dr. Höhle, it is a pleasure for me to present to you these tokens. (Applause).

*Dr. Höhle:* Thank you very much.

*Dr. Ebner:* Professor van der Weele, Professor Solaini, as long as I have worked in photogrammetry, the Otto von Gruber Award, founded by Prof. Schermerhorn, was very desirous for me. In combination with my research activity, I want to point out the favourable conditions at our Institute - the Institute of Prof. Ackermann at Stuttgart - in particular, the very close collaboration with my friend, our mathematician, Mr. Klein. I want to thank Prof. Ackermann very much for his promotion. I hope I have learned from him not only photogrammetry but, in addition, something of his very general way of thinking. I want to point out, in conclusion, that this Otto von Gruber Award is a very great honour for me, and, at the same time, an incitement for further development and research activities. (Applause).

*Dr. Höhle:* The main thing I have done is to bring photogrammetry in as a method. Recently, I have devoted considerable time to the study of underwater photography, and I enjoyed the work very much. However, the important thing is that I wish to acknowledge the valuable assistance of many persons who contributed to my work, mainly the Institute for Photogrammetry and, in particular, Prof. Schwidefsky, for which I am very grateful.

*Prof. Solaini:* Je suis parvenue, peut-être penserez-vous, finalement, à la conclusion de mon rapport. Je m'excuse de vous avoir ennuyé, mais il était de mon devoir de vous renseigner sur l'activité du Conseil et sur la vie de notre Société. Le Docteur Doyle va dissiper l'actuelle monotonie par son brillant exposé sur la photogrammetrie dans l'espace.

Avant de terminer, permettez moi de vous dire deux mots sur les arguments principaux que nous aborderons au cours du Congrès. Cette fois il n'y a pas dans la photogrammétrie de nouveautés sensationnelles,

mais des progrès très considérables. Je me limite à vous citer quelques uns des arguments qui sont, à mon avis, les plus importants.

1. Les "remote sensing", dont l'étude du point de vue photogrammétrique a été commencée à Lausanne, occuperont d'une façon approfondie les Commissions I et IV et VII.
2. L'automatisation en photogrammétrie qui a bien progressé dans certains pays est, certainement, un des thèmes les plus séduisants de discussion, par suite de ses énormes possibilités et à cause des difficultés considérables qu'elle présente.
3. La triangulation aérienne a fait de grands progrès en ce qui concerne sa précision et son application à des grands blocs et aux grandes échelles.
4. L'économie des projets de levés photogrammétriques est attentivement étudiée par la Commission IV.
5. Les applications non topographiques de la photogrammétrie augmentent chaque jour en étendue et en importance.
6. La photointerprétation a atteint une dimension nouvelle grâce à l'emploi de satellites artificiels qui permettront aussi de dresser, dans un proche avenir, des cartes à petite et peut-être à moyenne échelle.
7. Finalement, je tiens à vous rappeler le projet d'une "Histoire de la Photogrammétrie", que le Général Löfström présentera à la Commission VI. Il s'agit d'une oeuvre très importante, à laquelle tous les Pays Membres sont appelés à collaborer.

Vous pouvez donc constater, que le matériel de travail et de discussion ne manquera pas au cours des séances des Commissions Techniques. Les Présidents de Commissions, que je remercie pour ce qu'ils ont fait jusqu'ici, et pour ce qu'il feront pendant les prochains jours, auront de la peine à contenir les discussions dans les limites imposées par le temps disponible.

A vous tous, j'adresse mes meilleurs voeux de bon travail et de séjour agréable à Ottawa.

*Dr. Gamble:* Thank you Mr. Speaker. Our keynote speaker is well known to most photogrammetrists, certainly in North America and I believe well beyond the seas. He has contributed to the advancement of photogrammetry in many ways as a teacher, research scientist and almost equally more important as an Ambassador of Goodwill. When it became my responsibility to select a keynote speaker for this Congress, I knew who I wanted, my difficulty was to try to persuade him to undertake the task knowing his busy schedule. I won't spend too much time enunciating his long and distinguished career but just mention a few things. He is presently a research scientist for Mapping Systems at the U.S. Geological Survey; Chairman, Apollo Orbital Science Photographic Team, responsible for the planning, development, operation and data reduction of camera systems in Apollo Lunar Programmes. Awarded the NASA medal for experimental scientific achievement for this work. Formerly Chairman of Geodesy and Cartography Panel of National Academy of Science - a study of peaceful applications of space - deliberations of that study won him a medal in deciding the need for and design of earth resources technology satellite which we heard about today. He is also a past President of the American Society of Photogrammetry. Ladies and Gentlemen, it is with great pleasure that I call upon Mr. Frederick J. Doyle for our keynote address.

## PHOTOGRAMMETRY AND THE FUTURE

Frederick J. Doyle  
U.S. Geological Survey

President Solaini, Chairman Gamble, distinguished guests, ladies and gentlemen. When Mr. Gamble first asked me to give this talk, I held off giving him an answer. As the man said when he was being ridden out of town on a rail, "If it weren't for the honour, I'd just as soon not go". Nevertheless, once having accepted the task, I will admit that the opportunity of pontificating before my peers developed a certain powerful attraction. In the intervening months I have thought seriously about what I might say to you, for to waste a half hour of the time of so large and prestigious a group ought to be a hanging offence. I would like to share with you some thoughts on "Photogrammetry and the Future".

Four years ago many of us attended the XIth Congress of this 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.

However, 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. Instantaneous voice and television communication around the world is an everyday occurrence. Automation makes us wonder how essential men 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 only be 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, 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 or 8 billion. It doesn't really make any difference what the number is--either one of them is more than the planet can support at present levels of consumption. The biblical injunction "Be fruitful and multiply" has apparently backfired. 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 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 per square kilometer, Japan 290, Britain 360. The real difficulty is that 75 per cent of the people have been concentrated on 2 per cent of the land. The attendant urban problems of 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, there are currently ten times as many students enrolled in astrology courses as in astro-physics 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. While 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.

Economic growth is not necessarily inimical to the better life, the natural surroundings, or the national environment. Through constructive accomplishment we must reassure those people who are wary of the effects of science and technology.

## 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 in streams and rivers since the beginning of the industrial revolution two hundred 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 efficiently 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 are 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 while we recognize our dependence upon 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, photo-chemical 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. There is legitimate cause to wonder if 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. Is that progress?

Nobody is against clean air--the biggest polluters run television commercials about oil refineries disguised as bird sanctuaries. But when corporations solve the problems of pollution, 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 per cent, production of nonreturnable bottles has gone up by 53,000 per cent, and production of synthetic fibers by 6,000 per cent. Nitrogen fertilizers (up 1000 per cent) 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. DDT has probably saved 1,000,000 lives, but is that good or bad? 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!

#### Natural 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 populations and standards of living increase elsewhere, where will all these materials come from? The reserves of most metallic minerals are such that at present rates of consumption they will be exhausted in decades; for aluminum and iron, in centuries. One can find all kinds of numbers--pessimistic or optimistic--depending upon the point one wishes to make. 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.

One of the bright spots in the resource picture is 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 per cent since 1945, but almost 250 per cent 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 per cent above 1950, and are expected to be 100 per cent by 2000. Though these increases are not found world-wide, drastic improvements are being initiated. Thus there is no fundamental reason why food supply cannot be tripled by the end of the century. What is lacking is the organizational and political capability to transport fertilizer, seed, food, and populations to better areas when necessary. Unless these adjustments are made widespread famines are nearly inevitable.

#### Energy

In 1850, coal, oil, and gas supplied 5 per cent of the world's energy, and the muscles of men and beasts 94 per cent. Today those figures are exactly reversed. With high standards of living goes high energy consumption. Machines furnish the average American industrial worker with energy equivalent to that of 244 men, and household appliances are equivalent to 33 men. While population has grown 70 per cent in the last 40 years, energy consumption has increased 310 per cent. Americans now use more than six times as much energy per capita as the world average. Consumption of electrical power has shown by far the greatest growth. The 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 once 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.

Gas production has not yet topped out, but proven reserves have fallen to their lowest level in 15 years. The United States now buys 27 percent of its oil from foreign suppliers, mostly Canada and Venezuela, but those countries face the same prospect of shortages in the next few years. The only foreseeable solution is based on imports from the Middle East. Foreign affairs aside, the price that will have to be paid for super-tankers and ports to handle them must inevitably be added to the consumer's bill.

Coal is our most abundant energy resource. It is also the easiest fuel to extract and use, but despite these advantages its use is decreasing. The main reason is that coal is dirty. Coal burning discharged 9 million tons of sulphur into the atmosphere last year. The pressures of environmental laws will simply not allow this in the future. Unless current research programmes in sulphur scrubbing and coal gasification are successfully beyond anyone's expectation, the use of coal must continue to decline. In order to provide economic supplies, coal industry leaders argue that they must rely on strip mining, the greatest destroyer of the American countryside. Ecologists and the public alike deplore this practice.

There are 52.3 million kilowatts of hydroelectric capacity in the United States, which is less than one third the country's 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 several decades. By that time the fast-breeder 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 hydroelectric dams, they become positively incoherent 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 most plans for 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 prestigious Club of Rome sponsored a computer study carried out by Massachusetts Institute of Technology, tracing the interaction of population, food supply, natural resources, industrial production, and pollution over long spans of time. The results showed that even when the hypothetical inputs were most conservative, 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 "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 is plagiarism. If you copy from many, that is research". This talk is based on research. These statistics have been published again and again and examined from every possible angle. 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 my earlier expressed concern 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, more than 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 only planetary engineering and management can restore the balance. The role of photogrammetry in that task is one that we must appreciate and accept with vigour. 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 me, 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 labour, 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 the type of information required for resource discovery, distribution, and management is most efficiently collected by the techniques of photogrammetry. The requirement for basic topographic mapping as a fundamental tool for planning does not need to be elaborated before this audience. Our first task is to continue to develop our mapping technology so that more information can be produced at less expense and in shorter time frames so that development need never be impeded by the lack of adequate data about the terrain.

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 is 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 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 when the world is saved by photogrammetry, the success 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 other scientists, whose personal ox has been gored by lack of funding, is the space programme. 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".

Surveys of the environment must be global. In the past we have tended to collect information which tells us *how to do* what we have already *decided to do*. What we need now is information that tells us *what to do*. 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 lifetimes 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, in the next two weeks we will hear 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 it 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 clamour 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 does give rise to questions of international legality and political sensitivity. We must believe 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 that secrecy and national welfare are not necessarily synonymous.

Because of my deep personal involvement in the programme, 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 1885, 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.

A few weeks ago, the United States Secretary of the Interior announced: "After great deliberation and reflection, I have determined that it is in the national interest to grant a right-of-way permit for the Trans-Alaska pipeline from the North Slope to the southern port of Valdez". You may well imagine that that decision was supported by volumes of facts. Now lay out any set of facts that would bear on the decision: the geologic structure, the distribution and thermal regime of permafrost, the migratory routes of caribou, the habits of other wildlife, salmon spawning patterns, characteristics of arctic vegetation, the cost of pipeline construction versus tankers, the population distribution, long-range and short-range climatological factors, etc., etc., etc. Say that every one of those factors is determined absolutely, then tell me how you are led inevitably to a single conclusion. It cannot be done. Clearly what is missing is the mathematical model - the science, if you will - that relates these facts.

The same deficiency applies to dam construction, highway construction, power plant siting, urban development, mineral excavation - any problem involving ecological, environmental, technological, social, and economic factors. The point is that decision results are very sensitive to particular assumptions about highly uncertain and ill-defined relationships, and this uncertainty increases as we attempt to extend the models into the future. We simply do not know the significance of the facts that we can collect. I suggest that the development of these scientific relationships is a worthy challenge for any photogrammetrist - one indeed that cannot be solved without his contribution. 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. For years scientists and engineers have taken the attitude that their role is simply to provide information or technological capability. Academicians in their ivory towers have been content to provide knowledge, and leave the decisions on what should be done with that knowledge to elected officials who decide on national priorities. We are grateful to be able to say that scientists did not make the decision to send a man to the Moon rather than put up an Earth observing space station. Science did not decide to develop nuclear weapons rather than nuclear power. Certainly no attitude is better calculated to infuriate the young and to justify their contempt. 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. Science and technology has provided the miracle of the loaves and fishes. Now we must make sure that that miracle extends to the proper use and distribution of the benefits.

Increasingly, scientists are being called upon to advise policy makers - particularly at the interface between environment and technology. We need to participate actively in those deliberations which will result

in the application of the knowledge we contribute. We need to look beyond the immediate application and judge the second- and third- order consequences for individual human beings and the implications for society as a whole. Advance assessment of projects, by showing the trade-offs between beneficial and harmful effects can have preventive significance. The role of advisor and policy maker is one which we should not just accept but actively seek out. 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".

At the same time we must be careful to differentiate between advising 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 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. Once we accept that responsibility there is no turning back, except for those who value surface over depth and impact over implication.

### *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".

*Dr. Gamble:* And now our immediate Past President, Dr. Hans Härry to thank Mr. Doyle.

*Dr. Härry:* Mr. Chairman, Ladies and Gentlemen. Mr. Doyle, you have given us a very interesting address. We heard new ideas from the new world and we got a view into the future of our fine techniques. Many of us will give verbal thoughts to the successes we have. We are much obliged to you Mr. Doyle and it is a great pleasure for me to express the thanks of your colleagues.

Nous, auditeurs, sommes très impressionnés par les idées, suggestions et projets que M. Doyle nous a développés. Au nom de vous tous, j'ai le devoir agréable d'exprimer au conférencier les sentiments de notre profonde gratitude. Le vieux photogrammètre qui a commencé, il y a cinquante ou soixante ans, à étudier et à pratiquer la photogrammétrie, est enthousiasmé des moyens techniques dont nous disposons aujourd'hui et que M. Doyle nous a montrés. Dans le temps, l'enthousiasme était plus grand que les moyens techniques.

Unserer Kollege Fred Doyle hat für uns anregende und zukunftsweisende Ideen entwickelt. Die Ausführungen werden den einen und anderen von uns noch einige Zeit beschäftigen. Der alte Photogrammeter der vor fünfzig oder sechzig Jahren Bekanntschaft mit der Theorie und der Praxis der Photogrammetrie machte, ist begeistert von den wissenschaftlichen und technischen Mitteln, die uns Fred Doyle gezeigt hat. Früher hatten wir nur die Begeisterung und wenig technische Mittel, aber es ist Kollegen weiterleben wird. Wir danken Fred Doyle für seinen interessante Vortrag.