(g) *Uses for Analysis of Extra Terrestrial Surfaces*—representatives in engineering, earth science and astro physics.

(h) *Training and Personnel Selection*—representatives of military training programs, university or college academic programs, and representatives of human systems engineering pursuits.

Each group will solicit ideas from their colleagues representing the various fields of endeavor keeping in mind that items to be covered are *State of the Art*, Statement of *Needs*, and *Relationship* and Inter-Dependency *Between* the *Component Parts*. The data submitted will be screened, analyzed and the best ideas incorporated into a technical expression covering various aspects of the problem. By working in groups of three, the possibility of "Personality Writing" will be minimized and there will be better assurance that all ideas will be considered. Thus, a group of three (or more) will consider ideas, discuss them, select the best and/or the most informative, and develop a report which will find an outlet at the next Annual Meeting of the Society and become a part of the technical literature.

Contributors will be acknowledged and the ideas selected will be identified with the originator either in footnote form or as part of an appended bibliography. The report or paper thus prepared will carry threeway (or more) committee authorship and one of the group will be chosen to make the formal presentation. It must be remembered that many researchers, users, and teachers have developed excellent ideas, but have hesitated to prepare a technical paper; thus, the profession has been denied benefit of such thoughts. It is hoped that the Society acting thusly can assist in bringing out needed information. Obviously, papers which are submitted containing detailed, carefully thought out and expressed ideas, which are well written and which contain much useful information will be referred to the Editor and/or Program Committee for special consideration at the Annual Meeting or for publication in the Journal.

In the above way it is believed that the following will be accomplished:

1. An excellent cross-section of opinions, facts, methods and ideas will be obtained.
2. The technical literature so developed will contain a good appraisal of the situation and will thereby provide a source of information for all to use.
3. Communication between all those working in any or all of the aspects of aerial imagery will be established and encouraged.
4. A basis for the 1963 contribution to photo interpretation will be provided by setting aside one day of the series of eight papers and possibly having sufficient information papers for additional session presentation.
5. The way will be paved for proposing that the committee be formalized and remain active by meeting at least once between Annual Meetings to act as a clearing house for ideas in all or any of the related fields. This will make certain that the best information and new developments are made known for all to use.

SUMMARY

With presentation of this paper comes an appeal. The Society of Photogrammetry has initiated such an undertaking, and it is requested that members and other interested people submit thoughts and ideas on any or all of the above. In doing so it is hoped to perpetuate continued interest in all activities by a free exchange of ideas, concepts, and information. By sponsoring this, the Society automatically becomes a storehouse of information bringing together people, organizations and ideas. Should the above succeed, much will have been done toward betterment of mankind in utilization of his inherited earth.

Administrative Problems in High-Level Photo/A.P.R. in the Canadian Arctic

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IN THE last decade interest has been focussed on developing the large land masses in the Canadian Arctic—a vast area, scarred by ice age glaciers, and the world's least-known rock pile.

It has been said that the whole history of

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the Canadian North can be divided into two periods, before and after the aeroplane. And it is certainly the latter period which has set the stage for writing a new chapter in Canada's economic growth.

Canada, faced with the problem of locating and measuring its natural resources over an area largely uninhabited, and second only in size to Russia, has had to develop techniques for aerial survey of large areas. It is believed to be the largest country in the world entirely covered by aerial photography. Any one can examine and purchase this photography from the National Print Library in the Department of Mines and Technical Surveys, Ottawa.

Since World War II the R.C.A.F. and commercial air survey firms in Canada have been systematically covering Canada. As experience was gained and new techniques perfected, the photo coverage was spread northwards to the Arctic regions.

In 1957 the Federal Government initiated a $6.3 million plan for obtaining photographic coverage of the Canadian Arctic Archipelago which, when obtained, would give complete basic reconnaissance photo coverage of the entire country of approximately three and a half million square miles.

Under this Federal plan a total of some 493,300 square miles, all north of the Arctic Circle, was put out on contract among the larger aerial survey companies in Canada. The area was divided into three main sections for operational purposes. Hunting Survey Corporation was responsible for obtaining photo/A.P.R. coverage of 272,770 square miles in the Eastern and Western Arctic. The A.P.R. (Airborne Profile Recorder) record was to be produced simultaneously with the aerial photography to provide vertical control for future mapping.

Due to the uncertainty of weather conditions and the complexities of the operation, it was estimated that this ambitious project would take six years to complete. The total cover was actually obtained in three years and it is expected that one more season will complete the few reflights necessary to replace some photography of marginal quality due to snow conditions.

The planning and carrying of out this operation and the necessary logistic support is the subject of this paper.

The area for which the photographic /A.P.R. coverage was required, lies north of the Arctic Circle and is snow covered except for a few brief periods from late June to August. Photographic scale was 1/60,000 with Wild RC5A 6″ focal-length cameras. In this short season, only a few days are suitable for obtaining high-level photography, though, during this time the high latitudes and consequent long hours of daylight make possible taking photographs during up to 20 of the 24 hours.

Due to the very short season, careful preplanning was necessary in order to take full advantage of the limited photographic time available. The aircraft selected for the operation were two B-17 Flying Fortresses, equipped with long-range fuel tanks, which enabled them to remain airborne for as much as 15 hours at a time. The aircraft were operated by Kenting Aviation Limited, the aircraft operating company of the Canadian Hunting Group. The use of three crews, working in rotation, permitted making maximum use of both aircraft and photographic hours.

The remoteness of the area from the base in Toronto is indicated by Foxe, one of the main bases used, being 2,000 miles north of Toronto, and Alert being an additional 1,000 miles further north of Foxe.

Bases are few and far between, and radio and navigational facilities virtually non-existent. The problems of navigation in this region at high altitudes are further complicated by the proximity of the magnetic pole, which is situated on Prince of Wales Island, and lies in the southern section of our area.

Acting for the author, Mr. Albert Brown, of Hunting Survey Corp., presented this paper at the 28th Annual Meeting of the Society, The Shoreham Hotel, Washington, D. C., March 14–17, 1962. The Abstract will be found on page 345 of the 1962 Yearbook.

Six bases were used for the operation: Frobisher Bay, on the southern end of Baffin Island; Foxe on the East coast of the Melville Peninsula; Cambridge Bay on Victoria Island; Resolute on Cornwallis Island; Alert on the most northern tip of Ellesmere Island, and the U.S.A.F. base at Thule, Greenland.

Large areas of the Arctic are, not without reason, called the "barrens." Due to the lack of facilities we were required to provide complete logistic support for the entire operation, which included accommodation of crews, aircraft servicing and refuelling, etc.

Pre-planning for the operation took place during 1957. The greater part of the Arctic Islands is now known to be accessible by sea, but only for a very short period of a few weeks in August, when ice conditions permit passage through the waters. One supply convoy makes the trip each year from Montreal. The bulk of the heavy supplies, such as fuel, transport trucks, stove oil and automotive gasoline had to be assembled to catch the trip scheduled for the fall of 1957, so that they would be ready on location for the start of the 1958 flying season. Personnel, aircraft spares and food were all flown in.

The first shipment, consisting of 145,000 gallons of aviation fuel, was deposited by this convoy at the main base at Foxe. This fuel was stored in drums in the vicinity of the single gravel airstrip, after having been brought ashore in landing craft, which are now playing a peaceful and useful role in the development of the north. It is interesting to note that the responsibility of the sea-carrier ceases once a consignment is off-loaded above the high-water mark, and therefore we had to make our own arrangements to move all supplies from the beach areas to safe storage areas. The following year an additional cache was established at Resolute Bay with a sea shipment of 50,000 gallons of gasoline from Montreal in the 1958 convoy. This made possible aircraft operation as far north as Alert, on the north coast of Ellesmere Island, and the most northerly point of the survey, about 600 miles from the North Pole.

To date, in excess of 350,000 gallons of gasoline have been used on this project, all of which was delivered by sea to the operating bases, excepting one shipment of 10,000 gallons. This shipment encountered unusually severe ice conditions at Sachs Harbour, some 650 miles from its intended destination of Cambridge Bay; it has remained there frozen in the ice on its sea-going barge. The non-arrival of this shipment made necessary operating from an alternate base and additional cost for extra flying time.

In addition to the fuel, the sea shipment included the necessary supplies of oil, stove-oil and automotive gasoline and two half-ton trucks which were used for transporting personnel and supplies at bases. These trucks had to be stored in the open, due to lack of facilities; in each successive season they have had to be dug out from vast snow drifts by the aircrew, and made serviceable before the season's operation was started.

Due to the lack of adequate civil radio facilities in the Arctic, it was found necessary to establish our own network of communication for the duration of the operation. A single sideband radio equipment was set up which provided two-way voice communication on a 24 hour basis between the head office in Toronto and all the bases. The system was set up primarily so that special weather forecasts, originating in Montreal, could be relayed to the crews at any base at which they might land at the end of a sortie. This weather information enabled the aircraft captains to plan the next sortie and to follow favourable weather conditions as they moved across the Arctic Islands. This network proved invaluable and provided a vital link for all other aspects of the operation. Crews were able to report daily progress and serviceability, replacement spares were expedited, and supplies were replenished with the minimum of delay. Above all it was possible, by direct communication, to co-ordinate all phases of the work, which added greatly to efficiency. Without this facility, photo production under such difficult conditions would undoubtedly have been far less than what was actually achieved with a minimum of equipment and manpower.

The Kenting detachment assigned to this operation consisted of 25 to 30 men, ranging in qualification from cooks, radio operators and engineers to pilots holding airline transport licenses, and veterans of many thousands of flying hours. This detachment constituted the actual working force in the field, and of course, was backed by staff at headquarters in Toronto, and was kept supplied during the operating season by air.

In the field the detachment is entirely self-supporting, with semi-permanent quarters at Foxe and tent facilities at other bases. The R.C.A.F. provides limited assistance at the Resolute Bay base.

High-level photography such as this requires flying with oxygen for long periods at a height of 30,000 feet, with resulting fatigue to crews. After the maximum operating time

for one crew, a relief crew was always available to take off on a second sortie immediately after the aircraft had landed, had been refuelled and had been checked by the engineers. Thus full advantage was taken of the good photographic weather during the very short season.

During the 1958 season, due to exceptionally good flying weather, Kenting Aviation crews achieved remarkably high production by flying 40,000 line miles of photography and simultaneous A.P.R., covering some 115,000 square miles, an area equal to about half the size of France. During the next three years the remainder of the area was completed; this included reflights over some areas where excessive snow conditions made the quality of the photography unacceptable. Only a very small line mileage of these reflights now remains to be completed.

To date, mapping the Canadian Arctic has been attempted only on a reconnaissance scale. This new vertical photography is part of the second step in the Federal Government's plan for providing the necessary base maps, essential to the planned development of the Canadian north.

Preliminary surveys carried out by the Geological Survey of Canada in the Queen Elizabeth Islands in 1955, showed favourable structures which pointed to the possibility of an accumulation of oil and gas as well as coal and gypsum. A Shoran/A.P.R. control network, also initiated by the Federal Government, has been built up during the last decade, over much of the area as the first step in the vast program for recording the natural resources. Hunting also contributed to this phase by establishing Shoran control stations over an area of 40,000 square miles of Baffin Island in 1957. The resulting grid of control points together with the latest photography plus the A.P.R. coverage means that the various elements needed for proceeding with mapping the Arctic now exist and the large job of compilation can now be carried on.

Position Determination of Artificial Clouds in the Upper Atmosphere

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(*Abstract is on next page*)

Introduction

Artificial clouds formed by rocket-borne chemical releases have proven to be an important tool in the study of the upper atmosphere. The position, as a function of time, of a set of recognizable points on the cloud is of fundamental importance in these endeavors. This information yields the size, growth, spatial orientation, and drift of the cloud, and these data provide a basis for the study of winds, turbulence, and diffusion in the upper atmosphere. The positions of these cloud-points are found by a method of triangulation based on photographic data. For the sake of clarity this paper will first delineate the various coordinate systems employed, the transformations among them, and the spatial intersection of lines necessary for triangulation, and lastly discuss the corrections that arise when this formal procedure is applied to the physical situation.

Coordinate Systems

Terrestrial coordinates

The position of a point near the surface of the earth may be specified in any of several