(a) Modification of equipment to permit its accurate use over long periods of time under extremely rugged conditions, and
(b) Centralized processing of film which has been exposed to predetermined standards.

The Future. Survey photography in Canada is shifting rapidly to the completely vertical phase of the operation, as the tri-camera coverage is nearly complete. The RCAF is withdrawing steadily from large participation in survey, and civilian companies are assuming an increasingly larger share. It is encouraging to report that the companies concerned are most interested in developing techniques and equipment to meet the requirements to higher precision and economical operation. One concern is experimenting with air conditioned camera magazines. We feel that this is indicative of the general trend in all the companies concerned.

Arctic Air Photography

Arctic Mapping

Lt. Col. Paul E. Gremmler, Aircraft and Guided Missile Branch, Strategic Air Division, U. S. Air Force

The United States Air Force became interested in the Arctic and Sub-Arctic in 1941, when it was realized that aeronautical charts far more accurate than those in existence were needed in maintaining a flow of Lend Lease equipment to our allies.

Of first concern were the natural avenues over which the air traffic would flow.

Armed with the best charts available, the First Photo Mapping Group sent a Squadron to Alaska to complete this task as quickly as possible. Each year during the periods of best weather, a Squadron was sent to Alaska until the charting was completed in 1943. Ground survey parties were also working their way through the areas at the same time.

There were many problems to solve and the task became one of trial and error. For example, it was found early in the project that the oil used in lubricating the cameras congealed at the low temperatures encountered and had to be removed. There was much to learn about the operation of the planes and aerial photography in this area. Equipment failure hampered progress on many a mission and on some occasions kept a plane grounded for as long as a month.

By far the most interesting problem for the units in those days was personnel. Colonel Eldon D. Sewell of WADC, Dayton, Ohio, in his presentation at the 1952 Annual Meeting of the American Society of Photogrammetry, touched on several points of improvement methods for Aerial Mapping Photography. One concerns the flying or operational phase of mapping. Col. Sewell stated, "Photogrammetric flying requires more than a careful conscientious pilot." He couldn't be more correct. I should like to go a step further and say that the crew member should be a person who understands the need for the end result—"the maps." He must be burning with the desire to do his job as economically as possible, and to keep to the minimum the number of reflights due to his errors.

Col. Sewell also stated "the pilot must be trained for this type of flying and he must be provided with proper flying instruments."

The first crews sent to the Arctic had many navigational problems to solve because with unreliable magnetic compasses and poor charts, they relied on a system of pilotage, directional gyro, astro compass and drift correction to fly a fairly straight line. It is amazing, with the little amount of training they had, that so much was accomplished. In spite of the fact that F-2 and F-10 aircraft were used during the initial years for this project, the aeronautical charting photography of Alaska was for all practical purposes completed in 1943. Mapping photography was usually limited to small missions of certain small specific areas.

With the conclusion of World War II, the Arctic was considered in a new and more important light. Accurate maps were required with the result that organizations were stationed at Ladd AF Base, Alaska to do the job. Improved equipment in the

form of the F-13 appeared on the scene. Crews received more training and the results improved proportionately. There still was a long way to go however. With the arrival of Shoran, many felt that tremendous progress had been made in the right direction.

It is evident that we are moving toward the goal outlined by Col. Sewell when he said "Precision automatic flying would be highly desirable, since automatic equipment is generally more sensitive and reliable than human reaction."

The straight line computer with the airborne Shoran sets keep the planes on a straight line in this difficult navigational area.

Shoran provides the most economical, accurate and rapid means of providing aerial photographs for mapping purposes today. To conduct a successful operation requires tons of equipment of all kinds, cargo aircraft, helicopters, photo-mapping planes and outstanding electronic specialists. This is why we do not see many of these units in existence today. But in the long run it is cheaper in cost since the number of re-flights are reduced, and the insurance on the chances of carrying out the missions correctly the first time are increased 100 per cent.

The specifications for our mapping require staying within a 53 to 65 per cent forward overlap, the desired being 60 per cent and an average of not greater than 56 per cent; a sidelap of between 15 and 30 per cent; a tilt of not greater than 3 degrees in any case and an average of not exceeding one degree; and a crab of not over 5 degrees. With such specifications and considering the limited mapping experience of the crews, it is a wonder that any of the photography was considered acceptable.

Automatic equipment is one answer; another is intensive training of the crews. The photo school at Lowry Field is considering expanding its present course to satisfy this requirement.

With regard to those involved in a mapping program I mentioned that they must understand the need for the maps. They must also have an individual interest in the program.

A specialized mapping Squadron is once more being formed. The recent concept that a Reconnaissance Unit could do this work as part of its training is changing. A survey of personnel recently taken in one of our major commands indicated a considerable interest in joining the unit. The objective is to select the personnel with the most experience for this unit. We are headed in the right direction in this respect, for personnel with little or no interest in this work will result in considerable unnecessary cost in both time and money.

There are also new types of automatic equipment to be provided these units eventually. This will permit staying within our specifications easily and require only the surveillance of the crews for it to function properly. We should soon see the time when aircraft, operating automatically and unmanned, will be dispatched on a mapping mission and return to a predesignated base.

Perhaps we shall see the day when nuclear powered aircraft capable of staying aloft for days and limited only by the endurance of its crew, will search out areas of good weather and thereby achieve the now very ambitious goal "complete accurate mapping of the earth's surface."

Control for Arctic Mapping

C. H. Ney, Assistant Dominion Geodesist, Department of Mines and Technical Surveys, Ottawa, Canada

SYNOPSIS

Possible methods are classified under two headings—astronomic and electronic.

Astronomic Methods:

(a) Precise astronomical telescope
(b) Astrolabe
(c) Zenith camera
Inherent errors of the methods

Electronic Methods:

(a) Shoran
(b) Decca
(c) Raydist
Use of methods and inherent errors

Vertical Control

Barometric and trigonometric levelling supplemented by radar altimetry