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U. S. DEPARTMENT OF COMMERCE
HENRY A. WALLACE, Secretary
WEATHER BUREAU
F. W. REICHELDERFER, Chief

Instructions
for
Arctic Meteorological Service
(Preliminary)



Washington 25, D. C.
July 1946

ARCTIC METEOROLOGICAL SERVICE

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UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
Washington 25, D. C.
July 10, 1946

Arctic Operations Order - Statement of Weather Bureau Policy

By Public Law 296, 79th Congress, approved February 12, 1946, and Second Deficiency Act, Public Law 384, approved May 18, 1946, the Weather Bureau is directed to organize through international cooperation a meteorological network in the Arctic for the purpose of weather reporting and for research and development in the forecasting of weather and climatic changes. The Weather Bureau program for this purpose is known as the Weather Bureau Arctic Meteorological Service. The plan for 1946 aims to establish Arctic weather stations within the Western Hemisphere Sector in accordance with international understanding among the nations directly concerned and within the limitations of appropriations authorized by Congress. The tentative plan for subsequent years is to develop the international basis meteorological reporting network in the Arctic Region of the Western Hemisphere in cooperation with other departments and other nations interested in this development with the eventual view of maintaining, through international cooperation, the meteorological organization necessary to meet public requirements.

During the first year the primary objective is the collection and transmission of meteorological information. In addition to their regular work of weather observing and reporting, the technical and scientific staffs will be expected to carry out special observations of arctic phenomena to the fullest extent practicable under the circumstances. In subsequent years it is expected that the meteorological bases will also be utilized by scientists for observations and research in other geophysical sciences.

The Weather Bureau Arctic Meteorological Service as defined in this statement is a civil operation under the United States Weather Bureau of the Department of Commerce insofar as United States participation is concerned. In accordance with long established policy of international cooperation in weather service, and as specifically provided in Public Law 296, the Weather Bureau Arctic Meteorological Service will function in close cooperation with, or with active participation of, the meteorological services of other nations having territorial rights at locations on which these Arctic stations are situated.

The initial operation in the Arctic will be the establishment of a principal meteorological station at Thule, Greenland, with the participation of the Danish Government and local Greenland authorities with respect to sites and personnel. In connection therewith

it is planned to establish a depot of supplies from which a satellite station may be equipped, if and when it is found practicable by the Chief of the Weather Bureau to establish such station subsequently.

For purposes of coordination and economy in operation, and in order to carry the plans as far as possible on funds now available, it is the policy of the Weather Bureau Arctic Meteorological Service to utilize the assistance of other interested departments and Governments wherever practicable. In connection with previous plans of the United States Army and Navy for training exercises in cold climate operations, these departments have offered transportation and supporting facilities to the Weather Bureau. In utilizing these facilities it is understood between the Army, Navy, and Weather Bureau that the Weather Bureau Arctic Meteorological Service operates independently as a separate organization under the Weather Bureau, and that the respective plans and activities of the military organizations and the Weather Bureau will operate independently. Military commanders will, of course, exercise operational control over Naval and Military activities. The Weather Bureau official in charge will exercise full control over the establishment and operation of an authorized meteorological station under this program. In their relations to the personnel of other departments and agencies the Weather Bureau staff should endeavor to promote harmonious working arrangements in order that the maximum possible benefits may be derived from the assistance and facilities provided by cooperating agencies.

In view of the international nature of this undertaking it shall be the firm policy for Weather Bureau officials, employees, and others under Weather Bureau jurisdiction in this program to exercise good judgment, tact and discretion in their international contacts; for example, in their relationships at Thule and vicinity under the jurisdiction of Greenland administration of the Danish Government all concerned should make every effort to respect the interests and conform to the regulations of the local Government and its representatives. The Danish Government has a well established and successful practice of safeguarding the Eskimos and other residents in their relationships with foreign visitors. Special regulations have been established to protect the population from influenza and other contagious diseases to which they may be unusually susceptible and to preserve local customs, the violation of which would lead to unpleasant results. It shall be the duty of every member of the Weather Bureau Arctic Meteorological Service, individually and collectively, to comply with the territorial policies and regulations referred to in this paragraph and to promote good will and cooperation with the authorities and representatives of other nations with whom they have to work. The official in charge of each station or sub-station is responsible for establishing, for the personnel under his supervision, clear and specific instructions suitable to the circumstances of the locality concerned, and for enforcement of these instructions within the limits of his authority.

The official in charge of a principal station shall exercise administrative control over all personnel assigned to the base for subsistence, quarters, or regular duty whether permanently or as transients. There are no exceptions whatever to this provision for administrative control over personnel assigned to the station. In the absence of the regular official in charge the duly authorized first assistant is responsible for administrative functions and for carrying out Weather Bureau policy.

The official in charge of a principal station is also responsible for the general supervision of a satellite station established and operating under the jurisdiction of the principal station. Notwithstanding this provision any duly authorized official in charge of a satellite unit shall have the responsibility and authority for taking whatever reasonable action he considers necessary under unusual circumstances to safeguard life and property and to carry out the approved plans and policies of the Weather Bureau Arctic Meteorological Service.

The general meteorological program shall be conducted in accordance with detailed instructions presented elsewhere in this manual and in communications to officials concerned. It shall be the policy to maintain the highest standards in technical and scientific work and insofar as possible to obtain and record all scientific information of probable value. The collection and preservation of proper records in as complete a form as practicable is one of the primary objectives of the plan. Necessary action must be taken by the official in charge to maintain files and journals for permanent record of data collected and duties performed. All material, notes, photography and other records made by employees during their assignment to the Weather Bureau Arctic Meteorological Service shall be available to the Weather Bureau for official use. Such material shall not be released by an employee as public information without prior approval in writing from the Chief of the Weather Bureau, Washington, D. C. Private diaries and private photographs are included in such material; these will be returned to the owners for their use as soon as practicable by the Chief of the Weather Bureau with a decision as to the propriety of any proposed public release.

Members of the organization should look for opportunities for enlargement and increase in the value of the Arctic program, and should recommend consideration by the appropriate authority when they believe that action is desirable. Questions for which no definite authority or policy has been established should be communicated promptly to the Weather Bureau, Washington, for decision.



F. W. Reichelderfer
Chief of Bureau

The purpose of the following instructions is not to impose restrictions on employees but rather to expand the basic policies mentioned previously which will assist in the proper functioning of the Arctic network now being established. It is realized that the Official in Charge and many others on the staff are new in the Weather Bureau and that they will welcome guidance in policy and procedures in order to accomplish their assignments successfully. On questions of policy which may arise, the Official in Charge should, if time permits, obtain a ruling from either a senior Central Office official, who may be at the place or station or by radio from the Central Office, Washington, D. C. However, if time does not permit, the Official in Charge is authorized to use his own judgment and discretion but he should advise the Central Office of the facts at the first opportunity.

I ARCTIC STATION FACILITIES

The Arctic program is a permanent one. Every opportunity to improve and conserve the permanency of the physical facilities must be taken. If need for improvements becomes apparent, but cannot be done with materials and personnel on hand, recommendations in detail should be forwarded to the Central Office. The Official in Charge is authorized to take such action as construction of walks and fences, painting, and reinforcement of buildings, improvements in physical layout, etc., on his own initiative. However, the Central Office should be kept informed by descriptive and photographic presentation for record purposes. It is important that the station's appearance at all times be a credit to the United States.

II CHANNELS OF RESPONSIBILITY

(a) Central Office representatives: The Chief, Arctic Section has been designated by the Chief of the U. S. Weather Bureau to supervise and conduct the program. His authority, when he visits a station shall take precedence over the Official in Charge and other members of the Arctic station staffs. Orders and instructions decided on will be in writing and, in most cases, issued only after consultation with the Chief of Bureau, Central Office Project Leaders and/or officials in the field.

The Chief of the Arctic Section may delegate authority to others of his Central Office staff, but unless this is done in writing other Central Office officials of the Arctic Section staff, who may be present at Arctic stations, have only the authority to consult with and advise the Official in Charge of the Main Base in whom the authority to issue necessary orders and instructions to the station staffs will continue to rest.

When inspectors visit the stations, the scope of their authority to initiate action will be issued in writing before departure from the United States with a copy furnished to the Official in Charge.

(b) Main Base: The Official in Charge of the base station at Thule, Greenland has direct responsibility and authority for the conduct of the program at his station. He has authority to make any decisions as may be required for such matters as distribution of the work load, quartering of personnel, consumption of fuel and food, and others necessary to the successful accomplishment of the program objectives. It will be understood however, that

personal conveniences of a particular individual cannot always be accommodated.

The Official in Charge is authorized to maintain order first by suggestion; second by direct order or by institution of prescribed disciplinary measures, if necessary, as a last resort. To carry out this purpose, as soon as possible after arrival at the main base, the Official in Charge shall convene all station personnel to establish a code of station discipline and to procure majority agreement on penalties which could be invoked in case of infractions.

The forecaster assigned to the station will act as first assistant and will be in charge during absences or incapacitations of the Official in Charge. If, however, the Official in Charge considers this procedure to be undesirable he may recommend to the Central Office another member of the staff to act for him, giving his reasons for the change. If the recommendation is approved, the individual nominated to act for the Official in Charge will continue in this status until notified in writing otherwise. An Acting Official in Charge has the same authority as the Official in Charge.

(c) Advance Station: The Official in Charge of the main base station will have general administrative supervision of the advance station after it is established and may issue orders and instructions which will be binding upon the Official in Charge and staff at the advance station. The main base station Official in Charge will be responsible to the Chief of the Arctic Section, Washington, D. C., for administration of the network.

While wintering at the main base, the Official in Charge of an advance base will be subject to the jurisdiction of the main base Official in Charge.

it is planned that the Official in Charge of the advance station, while wintering at the main base, will be engaged primarily in making plans and preparations for establishing the advance station and the movement of supplies therefor. The main base Official in Charge shall make provisions for this activity within the limits of the main base program and its personnel complement.

In addition to the responsibility for preparation for advance station activities, the advance station Official in Charge shall assume such administrative and operational duties as may be determined by the main base Official in Charge.

Personnel for future assignment to an advance station will not be finally designated while in winter quarters at the main base. Selection of personnel therefor will be made by the Chief, Arctic Section, Washington, D. C., on recommendations by the Official in Charge of the main base and the Official in Charge of the advance station.

The network of meteorological stations will consist of one main base station at Thule, Greenland. In the spring of 1947, an advance station may be established by air at a position to be later determined by the Central Office.

III. PERSONNEL STATUS

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(A) PAY: All arctic project employees will be paid from the Central Office

1. Before embarkation.

(a) The employee will prepare Time and Attendance Reports S.F. 1130 from the time he is appointed until his embarkation.

- .1 On this report will be entered the date of entry on duty and duty status.
- .2 Also report of the time of departure and arrival in travel status at Boston.
- .3 Upon arrival at Boston he will report to the Official in Charge at Boston for certification of duty status at Boston.

(b) The Official in Charge at Boston will:

- .1 Enter in "Memorandum" portion of the Time and Attendance Report the duty status and certification of the appointment station and traveler.
- .2 Forward the Time and Attendance Reports to the Central Office Arctic Section for final certification.
- .3 Submit them promptly as they are used in the preparation of the payroll.
- .4 Continue to submit Time and Attendance Reports for every period till the employee embarks for his arctic post.

2. After embarkation.

(a) Any change in the employee's status after embarkation will be sent by radio direct from the Official in Charge to the Chief of the Arctic Section, Central Office.

3. Each employee of the arctic project should make arrangements for the disposition of his salary and reimbursement checks. A Power of Attorney should be executed and given to his bank or to an individual, and a memorandum, signed by the employee, should be forwarded to the Fiscal Section, Central Office, indicating the address to which his checks should be mailed.

(B) LEAVE: All arctic personnel will accrue annual leave at the rate of 26 days per year. Sick leave will accrue at the rate of 15 days per year.

- (C) DIFFERENTIAL: Each employee will be paid a stated annual salary from July 1, 1946 and will not receive differential for serving outside the continental limits of the United States.
- (D) OVERTIME: The salaries are per annum and will be the total payment made to the employees regardless of the number or periods of hours worked in any day, or days worked during any week.
- (E) CIVIL SERVICE STATUS: All field jobs in the arctic project are exempt from the Civil Service classification.

Any employee who holds a temporary appointment will not acquire a classified (competitive) Civil Service status, unless he remains in the government service until he takes and passes a regularly given Civil Service examination. Probational appointment is offered when his name is reached on the register of eligibles. Appropriate limitations appear on original appointment papers of the temporary appointee and also on any subsequent personnel action papers issued.

Employees which were originally given probational appointment in the government service and who have remained on the rolls continuously, have a permanent Civil Service status. In such cases no limiting statements will appear on personnel action papers.

- (F) COMPENSATION INSURANCE: Under the United States Employee's Compensation Act of September 7, 1916, as Amended, a civil employee of the United States who sustains an injury while in the performance of his duty is entitled to medical, surgical, and hospital service and supplies, and transportation to secure them if necessary. He is also entitled to monetary compensation while disabled for work beginning on the fourth day after pay stops, and continuing through the entire period of disability.

All injuries will be treated at the main base and first aid will be rendered at the advanced base. However, it is important that a record be kept and reported to the Compensation Commission of even minor injuries. In case complications should result later, a record of the injuries will then be on file with the Commission.

Procedures to be followed in keeping records of injuries.

When any injury is sustained by an employee he shall give written notice to his official superior. Forms are provided by the Commission for such purposes:

- Form CA-1 Notice of Injury (Made out by the employee)
- Form CA-2 Report of Injury (Made out by the employee's superior and should accompany Form CA-1)

For additional information on the Compensation Act a booklet is published entitled "Regulations Governing the Administration of the United States Employees' Compensation Act of September 7, 1916, as Amended, Relating

to the "Civil Employees and Others" which is included in the station library.

- (G) FUTURE STATUS OF EMPLOYEES: Employments in the Arctic service are of temporary indefinite nature. Upon termination of service at a particular Arctic station an effort will be made to reassign all employees to positions elsewhere in the Weather Bureau if suitable vacancies are available.

IV WORK AND RECREATIONAL SCHEDULES

A schedule of duty should be prepared by the Official in Charge in order to distribute the workload equally among all Weather Bureau station personnel. The work should be equally distributed as related to the construction of facilities, performing regular assigned duties as facilities are completed, KP duties, camp and building maintenance and other chores. Under conditions of operation of isolated stations it is expected that continuous operation of the station will be required but it should be possible to arrange for a weekly "time off" period for each employee. If it is impossible to allow personnel time off each week because of essential work which must be done, such time off credit shall accumulate and may be taken by an employee later on if possible.

While the value of this project will be measured to a large degree on the execution of functions related to regular assigned duties, group recreation and sport competitions are recommended for mental and physical exercise. Time has not permitted the planning of a recreational program other than providing equipment therefor, but it is believed that Arctic station personnel should make such plans after arrival at the base. Consideration will be given to the question of providing additional recreational facilities in the future and suggestions by Arctic station personnel are encouraged.

V RELATIONS WITH NON-WEATHER BUREAU PERSONNEL

Weather Bureau personnel will be transported in Navy ships to the base station. While travelling on Navy ships, Weather Bureau personnel will be under the orders of the commanding officer of the vessel or his representative and it is essential that Bureau employees comply with all rules and regulations issued by him while on board. It is expected that Weather Bureau personnel will eat in the general mess and be assigned to available quarters on the vessel as determined by the captain.

Civilians of other agencies and members of the Army and Marine Corps will also be on board and Weather Bureau personnel should make every effort to maintain cordial relations with these people.

On arrival at base stations, the activities of unloading and landing material will be under direction of the Navy commanding officer. Shore operations such as transportation and storage of supplies and equipment, inauguration of building program, and other constructional and meteorological matters will be under the direction of the Weather Bureau Official in Charge, who will of course maintain liaison with the military officers in charge of the various groups of military personnel assisting.

If there is any local population, every effort will be made by all Weather Bureau personnel to maintain cordial relations and to conform with the rules and regulations of the local administration. If a trading post is maintained, officials in charge are authorized to arrange with the local factor for purchases of small supplies, contract for personal labor of local natives, with payment to be effected on vouchers submitted by the official in charge to Washington. However, personal purchases should be made by cash.

VI ADMINISTRATION OF METEOROLOGICAL PROGRAM

(1) The meteorological program is the basic reason for establishment of the Arctic stations, and after the security of the station is established, it must be given first attention. The plans for the program are outlined in other sections of the manual and will be followed as written unless amended.

(2) The meteorological program of each base station will be conducted under the general supervision of the Official in Charge and under the direct supervision of the forecaster. This latter official will be responsible for inauguration and maintenance of the basic observational program and for institution of special observations as time and assistance permit in accordance with the instructions for the program given in the "Plans" section of this manual. He will also be responsible for conduct of the forecast program, outlined in the forecast "Plans" section. In addition, he will supervise the training of other members of the station personnel in meteorological work and bring the need for such training of individuals to the attention of the Official in Charge.

(3) The meteorological programs at the advance stations will be under the overall direction of the Official in Charge of the base station to which the advance station is attached. The forecaster at the base station will be responsible for immediate supervision of the program and will pass any instructions for meteorological work at the advance station through his Official in Charge.

and two observers are

(4) Since only one forecaster ~~is~~ assigned to the main base station and only one observer to advance stations, it is evident that these personnel are not sufficient to cover the full meteorological program. Hence, other members of the station staffs must be trained to participate in the meteorological work. The Official in Charge will designate individuals to assist in this work based on recommendation from the forecaster.

(5) The forecaster at the base station will lead the scientific program at that station and at the advance station which may be attached thereto. This program will include special meteorological observations as attached in the "Plans" section, special studies of data, investigations of geophysical phenomena having a bearing on the program, and other projects as time and assistance permit. It is suggested that group discussions of particularly interesting weather observations, phenomena and situations or of other phases of scientific work be held.

VII ADMINISTRATION OF COMMUNICATIONS

There is already at Thule a radio station operated by Danish personnel. This station is equipped with a U. S. Army owned transmitter of SCR 188 type. The call sign is OZZ. The station now operates in the Danish network southward along the coast of Greenland.

For the United States station at Thule there has been authorized the call sign KCWG 5 and certain frequencies (see later instructions) which have been coordinated to avoid conflict with Canadian radio communications.

It is the policy of the Weather Bureau that these two radio facilities

should eventually be amalgamated into one, both as regards to personnel and equipment. However, no prior arrangements for such amalgamations have been possible and whatever action is initiated in this direction should take into consideration the position of the Danes. The identity of the Danish radio should not be overridden if this endangers harmonious relations in any way. Discretion in this matter will rest with the Weather Bureau Official in Charge.

The Official in Charge will have general supervision over all United States communications. The radio communicators and radio technician will direct the technical phases of communications, with considerable latitude for initiative and use of individual judgment especially in cases of emergency.

The major radio equipment will be operated only by the communicators or technician or by other selected personnel when close supervision is maintained. (Except in cases of emergency.) Standard U. S. Army and Civil Aeronautics Administration procedures, will be used wherever pertinent.

Radio equipment will not be used for amateur contacts.

A log of communications activity will be maintained listing all point-to-point contacts, aircraft contacts, and such other material as may be determined by the Official in Charge. An orderly file of messages shall be maintained.

The communicators, under supervision of the Official in Charge, shall be responsible for the fulfillment of the propagation research plans as described elsewhere and submitted by the United States Bureau of Standards. This will include guarding of test frequencies, measurement of signal strength, etc. The extent to which this activity may be carried within a reasonable workload on the communicators, and without detriment to the main weather schedules, will be determined by the Official in Charge. All records of this aspect of communications shall be accurately prepared in duplicate. One set should be mailed to the Chief, U. S. Weather Bureau, Attention Arctic Section, whenever opportunity presents.

Personal and administration messages will be transmitted only with authorization of the Official in Charge, or acting official.

Attention is directed to a subsequent section of this manual dealing with communications operating instructions.

VIII MISCELLANEOUS RECORDS AND REPORTS

(1) The Official in Charge will maintain an official station diary of significant events occurring each day. A general running account of the weather, camp happenings, progress of the work, and other interesting subjects will be very helpful in organizing future expansions of the Arctic service. The Official in Charge should endeavor to make the diary as complete as possible.

(2) If unusual circumstances arise requiring changes in plans involving the failure of equipment, serious accidents, or for other reasons, the Official in Charge will immediately inform the Chief of the Arctic Section, U. S. Weather Bureau, Washington, D. C., by radio. All administrative messages

of this nature and others, when intended for the Central Office of the Weather Bureau, should be addressed to Arctic Section, U. S. Weather Bureau, Washington, D. C.

(3) The Official in Charge will report once each month concerning the state of supplies on hand, as required under the "Plans" sections of this Manual. Such reports will also include a statement concerning the conditions of the general physical establishment of the station.

(4) Other miscellaneous reports may be required and the Official in Charge will be so informed when the need for them develops.

(5) Beginning with the pay period ending on the second Saturday in July 1946, the Official in Charge will report on each second Saturday thereafter whether all personnel have been on duty for the complete pay period. In making these reports it will be satisfactory to consider that all personnel are on duty whether they are actually on or off duty at the station. In the event of death of any employee, the Central Office should be notified promptly by radio. These reports will be used to prepare the pay rolls in the Central Office in Washington.

(6) Additional budgetary reports may be required and the Official in Charge will be requested to furnish them as required.

(7) The Official in Charge will note carefully the conduct and attitude of each man assigned and at the completion of his tour of duty in the Arctic or sooner if requested, render report to the Central Office regarding these matters. It is especially important for the Official in Charge to note the psychological reaction of personnel to camp and work conditions. Such records will, of course, be confidential and for the information of Central Office officials only. Reports should be made on plain paper and no copies thereof should be filed at Arctic stations.

(8) At the end of his tour of duty, the Official in Charge will also be required to prepare a final report on the physical state of the establishment and the value of the work, including recommendations for improvements in the project based on his administration of the station. He will be directed specifically concerning material to be included in his final report on his return to the Central Office in Washington.

Note: All personnel assigned to Arctic stations are paid according to fixed annual salary rates and such employees accumulate annual and sick leave. Owing to the nature of the assignments, no employee will be charged for leave, either annual or sick, while in the Arctic if he is too ill to perform his duties or is granted time off for recreational activities.

IX. Accountability for Property:

- a. All property, expendable and non-expendable is invoiced to the Arctic Division at the Central Office.
- b. Responsibility therefor will rest with the Arctic Field Project (see Circular Letter 93-45 dated December 5, 1945).
- c. Inventories will be maintained by the Arctic Field Project and rendered to the Central Office as of the close of business December 31 of each calendar year. Inventory Form No. 2007 and 2007a should be forwarded to the Central Office by January 20 or as soon as mail facilities permit.
- d. Classification of property: Arctic Division, Central Office, will furnish the list of all non-expendable (z) property, with corresponding property numbers.
- e. Forms and records: Forms 2001, 2002, 2004, 2005, 2006, 2007, 2007a, and Stock Forms No. 3, cover all phases of property records that are or may be involved in the Arctic Project. (See Circular Letters herewith covering the use of these forms, No. 12-44, dated February 2, 1944, No. 92-45, dated December 5, 1945, Multiple Address Letter dated January 1, 1944, and Circular Letter No. 34-46, dated May 6, 1946.

X. Issuance of Property:

Requests for supplies, materials, equipment and forms will be submitted upon the following forms:

- a. Stores Requisition Form 2044 for items carried in Central Office Stock. (See Field Stock Catalog, Materiel Section, July 1945 edition).
- b. Stores Requisition Form 2044 for Forms. (See Forms Catalog, Materiel Section, April 1946).
- c. Emergency supplies of equipment, material, and forms should be made by radio.
- d. Recurring requirements for stock supplies and forms should be made on annual Stores Requisition Form 2044 so as to reach the Central Office by June 15 of each calendar year or at a date 30 days in advance of the sailing date of a vessel for the Arctic.
- e. Purchase Requisition Form 2046. (See Fiscal Manual for instructions for procurements.)

The Circulars and Multiple Address Letters mentioned above have been included in the appendix of this manual.

XI. Maintenance of Station.

Since the stations are permanent, the Official in Charge will direct the work in such a way as to preserve the establishment for future use. Buildings should be kept painted and in good repair. Necessary improvements for living facilities, such as water supply, permanent installation of instruments, and other changes should be considered and recommended to the Central Office for approval. All machinery, mobile equipment, supplies and materials should be kept in appropriate storage and in the best possible condition. Appropriations for the Arctic project is a continuing one and any amount saved from operational expenses in any fiscal year may be expended in following years. Hence, the Official in Charge should exercise constant vigilance in order to prevent any waste or deterioration of the equipment, buildings, supplies and instruments.

Cleanliness of surroundings is a morale and health builder of the highest order. The Official in Charge will therefore exert every effort to maintain the station, buildings and surroundings in a clean and orderly state. Each man shall be given responsibility for keeping himself and also his assigned living quarters clean. The Official in Charge will also issue instructions for regular cleaning periods of general quarters, washing of clothing, and such other necessary actions which will insure a clean and livable atmosphere at the station.

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MAIN BASE --BUILDINGS

The buildings provided at this time should not be considered as the final goal along this line but more as a means to an end. With the present critical housing and lumber situation, it was impossible to plan the buildings as they should be but instead plans had to be made so as to use available material.

Extra material has been included so that any alterations, in addition to those listed herein, which will add to personnel comfort and convenience, may be made as directed by the Official in Charge.

It should be kept in mind that some day these buildings may all be used for storage. Any additional reinforcements needed when the buildings are converted to that purpose, should be contemplated if possible during construction and inserted at that time.

LIVING QUARTERS

Two engineers barracks, 20' x 56', are to be used for living quarters, galley and mess. Identical alterations and additions will be made to each building. One is intended for use by the permanent personnel, the other as living quarters for transient Army Officers and general transient mess. Separate instructions have been written on the erection and alteration of these barracks.

One Quonset Hut will be erected according to regular instructions except that additional flooring will be laid. The floor will be identical to the one for the other Quonset Hut and detailed instructions written for its construction will apply. Install electrical equipment which is supplied with the hut. This building is to be used as living quarters for the transient personnel.

OFFICE SPACE

One Quonset Hut will be modified for use as an operational building, housing the radio and meteorological equipment. Separate instructions have been written on the erection and alteration of this building. Two James Houses will be attached to this building for sheltering the generators.

MISCELLANEOUS AND STORAGE

Two James Houses will be isolated for housing air to ground and emergency radio equipment, including one 15 KW generator. The generator should be placed in one of the James Houses on a foundation independent of the floor so as to provide an adequate foundation for the generator. Four extra 8" x 8" beams should be placed under the other building to reinforce the floor which will have to support the radio equipment.

One James House will be erected as a balloon inflation shed. It will be to the leeward of all other buildings so as to make balloon releases as easy as possible. In the end of the building to the leeward of the prevailing winds a large garage door is to be installed.

Two James Houses are to be erected and heated for use by the Army Air Forces.

In addition to the 5 James Houses mentioned above the main base will have 9 more James Houses to be erected and used as necessity demands.

BARRACKS

Twenty-one 6" x 6" posts are furnished as part of the barracks for foundation posts and under normal conditions are adequate, but to overcome any unevenness which might make some of these posts too short each building has been provided with 18 pieces 6" x 6" x 8' which may be used for foundation posts if necessary. One additional "B" unit goes in the building so foundation should be 56' long.

Upon completion of the operation shown in Figure 9, page 4, of the TM (placing floor joists) and before placing floor panels on foundation posts (Figure 10), the following operation is necessary:

Turn the floor panel over so that the underside is up. Nail two strips of 1" x 3" x 10' across the joists. These strips are to support insulating board which will be inserted between the joist later (see diagram 1). Floor panels are then turned right side up and installed according to instructions in the TM.

After all panels are bolted together and properly strapped, another special operation is necessary before laying of plywood flooring:

From the supply of 4' x 8' x $\frac{1}{2}$ " insulating board cut 70 pieces 1'10 $\frac{1}{2}$ " x 7'9". These are to be forced between the floor joist and pushed down so that they rest on the same 2" x 2" as the floor joist. It is suggested that as each piece is cut it be installed so that the best possible fit will be obtained. A warmer floor will be obtained if this insulating board is properly cut and inserted. It is hoped that the insulating board will be tight enough to support its own weight but in case of sagging the 1" x 3" nailed to the under side of the joists will prevent its falling.

Plywood floor can now be laid as directed in the TM.

The trusses, end walls, end side wall units and regular side wall units should be assembled according to the TM.

Do not apply exterior wall finish as instructed in the TM but proceed to erect the forming and trusses. Sufficient temporary bracing should be done to make this frame solid so that sheathing may be applied to the outside.

Apply 3/4" matched boards to exterior of the building altering end joints at various wall studs so as to make the wall as strong as possible. Do not put the top board of side wall on at this time. The end which is not to be used as a doorway should be boarded over and only openings left for the windows. Apply similar lumber on the roof after putting roof ledger, RL-1 in place. After the fascia board, FB-3, has been nailed in place the side wall sheathing may be completed. The 3/4" sidewall board can butt against the FB-3 (see Diagram 3) and need not be inserted as shown in the blue prints. Nail the fascia board FB-1 along the end walls. Apply the roofing paper as instructed in the TM. In cold weather tar paper should be warmed before unrolling.

The doors, windows and louvres can now be installed according to instructions in the TM. Sufficient glass has been shipped to replace all the substitute glass and to remove the insert screen and insert glass. It is suggested that this job be left for a later date when the initial work is over. Using pieces of 1" x 3", nail facings to each side of corners after a piece of tar paper has been tacked around the corners.

The outside wall should be covered with the 30# tar paper, being held in place by a few tacks until the lap siding is nailed on. Tack one strip of tar paper along the lower edge of the wall and start nailing the siding over it. The siding ordered was to have 6" exposed to the weather. When the first strip of tar paper is about covered tack another above it with about a 3" overlap. Work the lap siding upward again, etc.

The building will have three chimney flues which have been ordered as complete units. One will be 10' from the doorless end, another 30' from the doorless end, the third should be 10' from the end with the door. (Note approximate location of stove on Diagram A).

Before any further work on the interior, the floor should be completed. 15# felt saturated lining should be cemented with linoleum cement, to the plywood floor. Edges to be butted together. On top of this the linoleum should be cemented.

The interior wall panel can be applied to the studs after the rockwool has been inserted. The material originally intended for the exterior of the walls (3/8" plywood or 1/4" masonite) should be nailed over the celotex wall up to the height of the window sills. The interior roof panels may be nailed to the rafters with rockwool inserted in the void at least to fill solidly in the lower portion to the eaves.

The partition separating the vestibule from the rest of the building and the one dividing the washroom from the rest of the vestibule, are solid partitions extending to the roof. All other partitions are up 6" from the floor and are about 6" from the ceiling. This is to provide circulation and permit more even distribution of heat. Partitions with the exception of the one dividing the vestibule are shown in Diagram A. Sufficient 2" x 4" x 8' have been provided for studs which can be 4' o.c. or less if partition is not in exact multiples of 4' increments. The solid partition across the building should have a single 2" x 4" sill and 2" x 4" plate. Two pieces of 2" x 4" x 10' and 2 pieces of 2" x 4" x 8' (sills) have been supplied for this purpose. The studs will be placed 4' and 8' from each side of the building. The stud 8' from the wall will consist of two 2" x 4" and should then be the proper distance apart to receive the door casing. A double header should be placed above the door casing. The partitions should have plywood on both sides with rockwool between.

Sufficient 3/4" quarter round has been provided so that it can be nailed at the junction of the ceiling and the wall and in all other corners.

Other partitions should have a 2" x 4" plate next to the ceiling but no sill is necessary. The bottom end of the studs to be toe-nailed directly to the floor. Sufficient 2" x 2" lumber is provided to be placed between all studs, near top and bottom, where a plywood partition is to be made. The

lower 2" x 2" should be nailed so that the bottom edge is 6" from the floor and the top edge of the upper 2" x 2" should be 6' above the bottom of the lower 2" x 2" (see Diagram 5).

No wooden doors are provided for the individual rooms but instead curtains and curtain rods have been provided. The curtain rod holders can be attached to the studs which border all doorways.

In the vestibule a washstand should be constructed by using the 6 pieces 2" x 4" x 8' to make the support and placing two 2" x 10" x 8' for the top. The top should be covered by a piece of linoleum remaining from the material used on the floor.

The louvres at each end of the building will be nailed shut a large portion of the year but should not be omitted when erecting the building. During the nine cold months, rockwool should be put between the louvres and a piece of plywood nailed over the entire unit. During the summer, it should be opened to permit free air circulation for drying.

Several gallons of paint have been furnished. The outside of the wooden buildings should be painted red with a white trim. The interior may be painted or papered as desired.

Since making the drawings, some changes have been made in the living quarters plans:

1. Move the washroom and toilet to the other side of the vestibule and exchange the kitchen stove and table so that the stove will be along the wall which will have the washroom on the other side.
2. Build a solid partition across the vestibule 8' from the outside wall so that the washroom and toilet are separated from the rest of the vestibule. (Outside door and door into living quarters will both open into the vestibule portion).
3. Instructions for construction of a ceiling have been deleted but if it appears advisable, plan a suitable ceiling in accordance with material and facilities on hand.
4. Beveling of bottom roofing board may be disregarded.
5. Omit the layer of tar paper on the inner wall.
6. An additional James House to shelter the 15 kw generator for air to ground communications is to be erected near the transmitter building.

Summary of material furnished
(additional to regular barrack material)

Foundation:

- 18 pieces 6" x 6" x 8', posts
- 40 pieces 1" x 3" x 10', to be nailed under floor joists
- 35 pieces 4' x 8' x $\frac{1}{2}$ " insulating board, to be placed between floor joists.

Flooring:

8 rolls 15# asphalt saturated felt lining
 1140 sq. ft. linoleum
 30 gallons linoleum cement (use for felt lining and linoleum)

Sidewalls:**Exterior:**

131 pieces $3/4$ " x 6" x 12', for sheathing
 28 pieces $3/4$ " x 6" x 8', for sheathing
 80 pieces $3/4$ " x 6" x 8', for sheathing ends
 112 pieces lap siding, 12' long, 6" exposed
 28 pieces lap siding, 8' long, 6" exposed
 80 pieces lap siding, 10' long, 6" exposed for end walls
 3 rolls 30# tar paper
 14 pieces 1" x 3" x 10' for vertical corner boards

Interior:

3 rolls 30# tar paper
 10 pieces $3/4$ " quarter round 10' long
 38 pieces 1" x 2" x 8' to be used as battens over joints in
 plywood if necessary
 300 cu. ft. rockwool, 3" thick, for walls and ends
 60 double rolls light colored wallpaper, preglued

Roof:

180 pieces $3/4$ " x 6" x 12', for sheathing roof
 44 pieces $3/4$ " x 6" x 8', for sheathing roof
 320 cu. ft. rockwool, 3" thick

Partitions:

62 pieces 2" x 4" x 8' for studs, plates and headers
 4 pieces 2" x 4" x 10' for sills and plates
 12 pieces 2" x 2" x 12' for headers
 20 pieces 4' x 6' x $1/4$ ", 3 ply, plywood, for partitions
 7 pieces 4' x 7' x $1/2$ ", 5 ply, plywood, for partitions
 1 door 3' x 6'6", complete, with casing, hardware, and sill

Wash Stand:

6 pieces 2" x 4" x 8'
 3 pieces 2" x 10" x 8'

Extra:

12 pieces 4' x 8' x $1/2$ ", 5 ply plywood
 12 pieces 4" x 4" x 12'
 12 pieces 6" x 6" x 12'
 12 pieces 8" x 8" x 10'
 12 pieces 2" x 6" x 10'
 12 pieces 2" x 8" x 10'
 7 pieces 2" x 10" x 10'
 20 pieces 2" x 4" x 14'
 20 pieces 2" x 4" x 10'
 40 pieces lap siding, 10'
 20 pieces 1" x 4" x 10'
 10 pieces quarter round 10'
 230 pieces $3/4$ " x 6" x 12'
 15 pieces 4' x 8' x $1/2$ " insulating board

5 rolls 30# tar paper
 100 cu. ft. rock wool
 44 pieces 1" x 2" x 10' battens
 for ceiling joints
 260 cu. ft. rockwool, 3" thick

BASE STATION

OPERATIONS BUILDING

This building is a Quonset Hut with two side door entrances.

8" x 8" timbers have been provided to be used as a foundation upon which the steel beams can be placed.

The building should be erected according to usual instructions except for a few alterations explained below:

At the ends, no entrances are to be provided. Close the doorways with a sheet of $\frac{1}{2}$ " plywood and inside with a piece of $\frac{1}{2}$ " insulating board if necessary. The doors should be used for the side entry ways.

The side entries should be placed between the steel ribs 24' and 28' from the office end of the building. Instructions for making a side entry doorway are given in the instruction manual.

Before the quarter round is placed around the floor additional layers of flooring are to be laid.

Cover the floor with 30# tar paper overlapping it about 3" and tack it in place so it will remain while putting down a layer of plywood. Cover the floor with $\frac{1}{2}$ " plywood, altering the pattern used on the first layer so that a minimum number of joints occur at the same place as on the first layer. To this glue a layer of felt lining butting the edges together, then glue the linoleum down. While completing the floor, as mentioned above, a stove or two should be put in operation temporarily and moved about so that it is not necessary to cut either the felt lining or the linoleum.

On the 6th and 9th steel rib from office end of the hut door, a solid partition, with door, is to be built. A wooden batten 1" x 2" should be used all the way around on the inside wall in place of a masonite strip.

For the partition separating the radio and meteorological office 3 pieces, 2" x 4" x 10' should be cut to fit, 4' o.c., being toe-nailed to the floor and to the steel ribs. A 2" x 2" x 6' can be used for a stud along the wall.

Pieces of 2" x 2" should be used for headers between the studs, the lower edge of the bottom one 6" above the floor, the top edge of the upper one 6'6" above the floor. The partitions will be $\frac{1}{2}$ " plywood, 4' x 6'.

The solid partitions should have a 2" x 4" plate, the studs being nailed to it and to the 1" x 2" battens (8d common nail may even reach into the steel rib). Use double studs and headers around the doors. The doors will be from the James Houses which are later to be erected as generator sheds. The office side of the partition should be $\frac{1}{2}$ " plywood. The partition between the living quarters and the storage space should have plywood on the living room side and insulating board on the other. Rookwool is provided for this partition.

The partition between the office space and the adjoining room should have the studs 2' o.c. since the panel boards are to be supported by it. The other

partition studs may be 4' o.c.

30# tar paper has been provided for placing over the Kimsel before the corrugated metal roof is applied. This should help keep the Kimsel from getting wet and giving off a strong odor.

The generator sheds will be James Houses set next to the side entries. Exact method of sealing connection between Quonset Hut and James House can be worked out with spare supplies provided. The exterior of the door leading to large generators should be covered with asbestos board and tin for fire protection.

A large portion of the floor should be left out of the building and the generators set directly on timbers on the ground. It will prove advantageous from several points of view if the generators are placed on their foundations before the building is erected.

A battery rack should be built along the office wall using 2" x 4" for supports and 2" x 10" for the shelf.

Wallpaper and paint have been provided and may be used according to desires of the Official in Charge. The paper is preglued and needs only to be wet before applying.

Summary of Materials Furnished

Foundation:

20 pieces 4" x 4" x 10' posts

Flooring:

30 pieces 4' x 8' x $\frac{1}{2}$ " 5-ply
 5 rolls 30# tar paper
 970 sq. ft. linoleum
 7 rolls asphalt saturated felt lining
 25 gallons linoleum cement

Partitions:

4 pieces 1" x 4" x 10' battens (should be ripped to make 1" x 2" x 10')
 6 pieces 1" x 2" x 8' battens
 20 pieces 2" x 4" x 10' plates, studs
 4 pieces 2" x 4" x 8' studs
 3 pieces 2" x 4" x 12'
 12 pieces 2" x 2" x 8' headers
 16 pieces 4' x 8' x $\frac{1}{4}$ " plywood
 10 pieces 4' x 8' x $\frac{1}{2}$ " plywood
 10 pieces 4' x 8' x $\frac{1}{2}$ " insulating board
 50 cu. ft. rockwool

Miscellaneous:

5 rolls 30# tar paper to be placed under metal roof
 20 rolls wallpaper, preglued

Extra:

8 pieces 2" x 4" x 10' 4 pieces 2" x 6" x 10'
 8 pieces 1" x 4" x 10' 6 pieces 4' x 8' x $\frac{1}{2}$ " plywood
 6 pieces 4' x 8' x $\frac{1}{2}$ " insulating board

MAIN BASE

TRANSMITTER BUILDING

This building will be isolated so that it can serve as a storage space for emergency equipment as well as housing facilities for the air-ground communication equipment, including one 15 KW generator.

The building will be constructed as usual except for reinforcement of the floor.

The generator should be placed directly on a ground foundation with the floor being built around it. Avoid having any direct solid contact between generator foundation and the building in order to minimize vibration of the building. The space of $\frac{1}{4}$ " to $\frac{1}{2}$ " between the floor and the generator foundation should be sealed with tar paper or rockwool.

The remainder of the floor should be reinforced by running additional 8" x 8" timbers midway between the regular floor joists.

One of the spare space heaters may be installed in this building to be used when necessary.

TRANSIENT QUARTERS

A second Quonset Hut has been supplied for the main base to be used as living quarters for transient personnel. This hut will be constructed according to usual plans except that the floor will have additional material and tar paper has been furnished to cover the Kimsel before placing the metal roof in place.

After laying the regular floor, cover it with 30# tar paper using a few tacks to hold it in place. Lay the second layer of plywood so that a minimum number of joints are directly above joints of the first layer. Glue the felt lining to the plywood butting the edges together and finish off the job by gluing down the linoleum.

The wiring equipment furnished with the hut should be installed and whether it is connected to the 110 volt or 32 volt power supply depends upon distance it is from the batteries and amount of time the A.C. generators are actually in operation.

When all other construction is completed some form of vestibule should be built from surplus lumber. The door of the James House inflation shed which was replaced by the larger doors can be used on the vestibule.

INFLATION SHED

The main base will require an additional building for inflation of the 350 gm balloons. This will be a James House with garage doors built into one end. In selecting the site for this building give due consideration to prevailing wind direction and to obstructions for releasing in high winds.

Construct the house according to usual instructions but do not complete the end to the leeward of prevailing winds. When the rest of the building is

complete cut an opening in this end large enough to receive the garage door casing. On each side of this opening put two 2" x 4" studs and above the opening put a double header adequately braced.

If the end with the large door gives indications of being insecure additional inner braces should be installed and possibly some exterior guy wires attached. Insert the casing and hang the doors. Since this building will be used only at short intervals of time no heat is necessary.

Electric lights have been planned and unless it is too far from the source of power #10 single wire can be used. An outside light has also been provided for illumination while taking the balloon out of the shed and making the release.

LIGHTING

The main base has been provided with a 32 volt lighting system including 18 cells of 2 volts each, two 2 KW gasoline generators and one $\frac{1}{2}$ KX wind-driven generator. An extra blade has been provided for the windcharger.

Under ordinary conditions 16 cells of 2 volts each are sufficient but cold temperatures may decrease the voltage so that it will take the 18 cells to total 32 volts. A voltage between 30 and 32 volts will operate the lights satisfactorily. Special booklets on maintenance and care of the batteries has been shipped for each station. No. 00 wire has been provided and should be used for connecting generators and batteries to the switch board.

Both gasoline generators should be installed and ready for operation. A DPDT switch has been provided so that either generator may be put in use on a moment's notice. The spare generator should be used an hour or two about every two weeks to keep it in running condition but should not be used more than that except in emergency.

The wind-driven charger has a 40-foot tower with it which should be erected away from obstructions but not too far from the batteries. No. 8 single wire has been provided for this purpose and there may be some No. 6 surplus that could be used. Whenever possible the windcharger should be used and the gasoline supply conserved.

After living at the station for a few weeks there undoubtedly will be discovered that some spots are not adequately illuminated. To meet this condition a few extra outlets and additional wire have been provided. Care should be taken in running wires as voltage drop is a noticeable item in 32 volt systems. Each station has been supplied with a circular slide rule for determining wire sizes needed to carry a certain load. All circuits should be properly fused at all times.

In addition to the 32 volt lighting system some buildings are to have a 110 volt lighting system which may be used during the time the generators are in operation to supply power for other equipment. The larger 15 KW generators should not be run for the sole purpose of furnishing illumination.

When placing the sills, it is suggested that a small trench under them be made so that armored cables running from the generators in the James House

to the panel board may be laid, entering the hut by coming up through the floor.

Three outside lighting fixtures have been provided for installation, where ever they will prove most helpful. At least one of them should be 32 volt so that it is always ready for use.

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Since writing the above the people supplying the electrical equipment have reported many items are not available. Substitutes have been ordered and in some cases they are poor substitutes but are the best available.

It appears that DPDT switches will not be available, it may be possible to locate three pole double throw as a substitute or it may be that nothing will be located. There are relays on the generators and switches are not absolutely essential but it would facilitate periodic checking of the spare generator.

Similar obstacles were confronted in purchasing other electrical materials so it is suggested that all class 12(electrical) equipment be unpacked and inventoried before starting to wire the buildings.

Plan the lights, switches and receptacles for convenience and comfort but be sure wire of adequate size is used and be absolutely sure that all equipment and circuits are properly fused.

Equipment in class 12(electrical) for 110 volt lights is from the panel board to the lights, all cable and transformers between the panel board and generators have been included with the radio equipment.

HEATING

Each Quonset Hut is provided with two oil-burning heaters which should be installed in the huts as indicated on the drawings. In addition to these there are 8 oil-burning space heaters being provided. Two will go into each of the two wooden barracks, two James Houses are to have one each leaving two for replacement or spare parts.

Fuel used for heating and cooking should be recorded so that in future planning exact consumption figures will be available. Any changes made to equipment, buildings, or its surroundings, which reflects in change of fuel consumption should be included as remarks to the fuel consumption report.

It will be the responsibility of the Official in Charge to keep records on fuel consumption and if necessary inaugurate plans for fuel rationing.

ADVANCE STATION -- BUILDINGS

The main building at these stations is a Quonset Hut with a James House attached at each end. A second Quonset Hut is furnished for storage and for transient quarters. The only other building is a James House which will be isolated for storage of supplies and emergency equipment.

LIVING QUARTERS AND OFFICE SPACE

Separate instructions have been written on the erection and alteration of the Quonset Hut to be used for living quarters and office space.

STORAGE SPACE

The second Quonset Hut should be erected according to instructions but a partition 16' from one end should be erected in order to divide the building into two rooms. The smaller room will be available for use as transient quarters and will include a stove. The storage space can also be used as a vestibule for entry into the transient quarter. By attaching the James Houses to the main Quonset Hut will result in two doors being surplus, one of which can be used in constructing the partition suggested.

The partition should have a 2" x 4" sill and a curved plate of 1" x 4" which can be nailed to the steel rib. 2" x 4" studs, 4' o.c. and sufficient 2" x 2" headers will be placed so the pieces of 4' x 8' plywood can be used to wall the partition.

Sufficient 3-plywood has been included for the inner wall of the transient room. $\frac{1}{2}$ " insulating board should be used to finish off the storage room side of the partition. In case any rockwool is left over from the other buildings it can be used in this partition as insulation.

The wiring material for lights as furnished with this Hut should be installed with the master switch and fuse box mounted on the end wall nearest the 32 volt batteries. Adequate No. 8 single wire and essential insulators have been provided for connecting to the power supply in the main building.

The individual James House should be built according to usual instructions and at a distance of at least 30 feet from the other buildings as a safety measure in case of fire or other emergencies. No lighting or heating is intended for this building.

Where rawinsondes will be taken at an advance station, an additional building is necessary for inflation of the 350 gm balloons. This will be a James House with garage doors built into one end. In selecting the site for this building, prevailing wind direction and other obstructions should first be considered since balloons will be released in high winds on occasions.

Construct the house according to usual instructions but do not complete the leeward end of the building. When the rest of the building is complete cut an opening in the leeward end large enough to receive the garage door casing. On each side of this opening put two 2" x 4" studs and above the opening put a double header adequately braced.

If the end with the large door gives indications of being weakened additional inner braces should be installed and possibly some exterior guy wires for support. Insert the casing and hang the doors.

Electric lights have been planned for this building and unless the distance is too far from the source of power, No. 10 single wire can be used. An outside light has also been provided for illumination while taking the balloon out of the shed and making the release.

Since this building will be used infrequently and only at short intervals of time, no heat is necessary.

(Living Quarters and Office Space)

Sufficient 8" x 8" timbers are supplied to construct a sub-foundation upon which is placed the iron sills that come with the Quonset Hut (see picture, page 3 of manual). In case it is impossible to find adequate level surface, 20 pieces of 4" x 4" x 10' are provided to be used for posts. The ideal location, for warmth and stability would be similar to the picture on page 3 of the manual. However, the fewer posts used because of uneven ground, the better. Great care should be taken to see that the floor frame is level, otherwise subsequent construction is more difficult and the building becomes less weatherproof.

Lay the plywood floor and erect the interior walls according to manual of instructions but do not install the masonite batten strips at this time.

At points on the ceiling 13' and 23' from the end with the washroom and midway between the center of hut and exterior edge of floor on radio side and 14' from galley end of hut on washroom side, attach 4" outlet boxes. No holes are to be put in the masonite except for the screws which should go through the masonite into a piece of 1" board. This board may be an available scrap but should not be less than 3" wide or 12" long.

At a point 18' from washroom end of hut and on that same side, a batten must be fastened to the masonite wall in order to permit anchorage of a partition later. Batten should start 8" from floor and extend until 6'4" above floor. Use 2" screws 12" o.c., going through the masonite and into any 1" scrap of lumber which may be available. It will perhaps be best to have an individual piece of scrap lumber for each screw. The batten should be a piece of 1" x 2" furnished for this purpose.

Between the steel ribs 4' and 8' from the washroom end of the hut on the office side of the building, 4 pieces of 2" x 6" are to be installed. The lower edge of the bottom one should be 3' above the floor. Holes should be drilled in the steel rib so that lag screws or spikes can be driven into the ends of the 2" x 6". Between the 4th and 5th rib from the washroom end of the hut and in the exact center of the hut fasten one 2" x 6" x 4' so that it will be available to nail to latter when erecting the partitions.

The Kimsel may be laid according to regular instructions.

Sufficient 30# tarpaper is provided to put a layer of it over the Kimsel before attaching the metal roofing.

Building may now be completed according to manual of instructions.

Plastic glazing furnished in windows should be replaced by double strength glass which has been furnished. The middle strip which divides the window into two panes may be removed and the glass furnished will fit the sash properly. Past experience in frigid climates indicates that further insulation of windows is not necessary but there will be ample material, lumber and glass, to make wooden sash which can be used to replace the screen sash if deemed advisable. It is suggested that this work on the windows be delayed until the other construction work is completed and the initial work has subsided. The smokestack units should go in the 6th, 16th and 21st 2-foot roof section counting from the washroom end. An additional N-2 unit of two smokestacks has been included since only two smokestacks are provided with each hut.

As soon as the shell of the building is completed enough to retain some heat one of the heaters can be temporarily installed. It should not be permanently installed as additional flooring is to be laid.

With the completion of the exterior of the building, all attention should be given to the floor and no partitions erected until later.

Cover floor with 30# tarpaper using carpet tacks to hold it in place, use about 2" lap. Place the second layer of $\frac{1}{2}$ " plywood so that wherever possible, the joints occur at a different point than they did on the first layer.

6d common nails 8" o.c. can be used to nail plywood to the subfloor. Care should be taken to have plywood tight against the masonite wall. A layer of asphalt saturated felt lining should be glued to the plywood with linoleum cement. Butt the edges together instead of overlapping. After this has dried apply another coat of cement and lay the linoleum. It is suggested that the Hut be kept quite warm during this process in order that the linoleum will be easier to handle. It will be necessary to move the stoves during these operations in order that no breaks occur in either the felt lining or the linoleum.

After the floor is completed it will be necessary to cut two 3" strips of 12 gauge metal from the sheet provided and nail it to the floor in each doorway, to act as door sill. This is to protect the exposed linoleum and also act as a seal across the bottom of the door.

A James House is to be placed at each end of this building. The one at the washroom end of the building to be used for electrical generators and such storage as space will permit, the other for storage and use as a vestibule. It is suggested that the generators be placed on their foundation before the James House is built. Avoid having any direct solid contact between generator foundations and buildings in order to minimize vibration of the building. The space of $\frac{1}{4}$ " to $\frac{1}{2}$ " between the floor and the generator foundation should be sealed with tarpaper or rockwool.

A portion of the floor in the generator house should be omitted so that the generators foundation can be directly on the ground. Extra 8" x 8" and 2" x 6" lumber is provided so that a solid foundation can be built. A series of 8" x 8" x 8' covered crosswise with 2" x 6" 's and sunk about 6" in the ground should be solid and stable.

Since the end of the Quonset Hut is plywood, no difficulty should be experienced in nailing the James Hut to the Quonset Hut. Several extra pieces of 2" x 4" and 1" x 4" are included in case they might prove helpful for this purpose.

To erect the partitions 2" x 4" studs should be cut proper lengths and nailed in place as shown on diagram A. No sills are to be used so studs will be toe-nailed directly to the floor. Where possible stud should be toe-nailed into the steel rib at the ceiling. If no steel rib is available, stud should be held to masonite by screws or toggle bolts. The stud in center of hut and 18' from washroom end should be securely nailed into the 2" x 6" previously placed between the ribs. This stud will have to furnish most of the rigidity for this section since the studs on each side will not be fastened to a steel rib. Wherever the partition comes against the wall (which is at steel ribs except for the place where the batten has already been fastened to the masonite) wooden 1" x 2" battens should be nailed to the steel ribs. This batten will then act as a stud to which plywood partition board can be nailed. In bending these battens it will be greatly simplified if it is sawed one-half way through about every 3 inches. When partitions come against the end walls 2" x 2" have been furnished for use as studs. Between all studs which are to have plywood partitions 2" x 2" headers should be nailed. The bottom edge of the lower one should be 6" above the floor and the top edge of the upper one 6'6" above the floor. The section of plywood which goes against the wall will have to be curved to fit. One way of getting the proper curvature would be to take a piece of stiff wire and after bending it to fit, use its shape as a guide in marking the plywood.

There are 2 pieces of 2" x 4" x 10' and 2 pieces of 2" x 10" x 6' to be used in making the wash stand. Two 2" x 10" put side by side can be used for the top and the 2" x 4" used for supports. The top should be covered with a piece of the linoleum left over from covering the floor.

Two 2" x 4" x 10' and one 2" x 10" x 6' have been included to construct a rack for the batteries used in the 32 volt lighting system. One row of trays can be placed on the floor and the remaining trays on the 2" x 10" which should be fixed about 22" above the floor. The lower tier of batteries should not be directly on the linoleum but placed on a layer of surplus lumber, 2" x 4" preferred.

Sufficient preglued wallpaper has been furnished and may be put on as desired. White paint has also been furnished to be used as desired.

Summary of Materials Furnished

Foundation:

20 pieces 4" x 4" x 10' (additional posts)

Flooring:

30 pieces 4' x 8' x $\frac{1}{2}$ ", 5-ply, plywood

4 rolls 30# tarpaper

970 sq. ft. linoleum

7 rolls felt lining

25 gallons linoleum cement

Partitions:

24 pieces 4' x 8' x $\frac{1}{4}$ " plywood
 23 pieces 2" x 4" x 8' studs
 5 pieces 1" x 2" x 8' battens
 4 pieces 2" x 2" x 6' studs
 21 pieces 2" x 2" x 8' headers
 6 pieces 2" x 2" x 10' plates

Wash Stand:

2 pieces 2" x 4" x 10'
 2 pieces 2" x 10" x 6'

Battery Rack:

2 pieces 2" x 4" x 10'
 1 piece 2" x 10" x 6'

Extra, and for partition in other Quonset Hut:

29 pieces 2" x 4" x 10'
 14 pieces 4' x 8' x $\frac{1}{4}$ " plywood
 12 pieces 1" x 4" x 10'
 12 pieces 2" x 6" x 10'
 16 pieces 4' x 8' x $\frac{1}{4}$ " plywood
 6 pieces 1" x 4" x 8'
 8 pieces 2" x 4" x 8'
 8 pieces 4' x 8' x $\frac{1}{8}$ " insulating board
 7 rolls 30# tarpaper
 1 door 3' x 6'6" complete
 55 double rolls wall paper, preglued.
 3 gallons white paint

For installation in James House: (~~Grant Land only~~, inflation shed)
 1 two-door garage set 4' x 6'6"

LIGHTING

All three stations have been provided with a 32 volt lighting system, including 18 cells of 2 volts each, two 2 KW gasoline generators and one $\frac{1}{2}$ KW wind-driven generator. An extra blade has been provided for the wind charger.

Under ordinary conditions 16 cells of 2 volts each are sufficient but cold temperatures may decrease the voltage so that it will take the 18 cells to total 32 volts. A voltage of between 30 and 32 volts will operate the lights satisfactorily. Special booklets on maintenance and care of the batteries has been shipped for each station. No. 00 wire has been provided and should be used for connecting generators and batteries to the switch board.

Both gasoline generators should be installed and ready for operation. A DPDT switch has been provided so that either generator may be put in use on a moment's notice. The spare generator should be used an hour or two about every two weeks to keep it in running condition but should not be used for more than that except in emergency.

The windcharger has a 40-foot tower with it which should be erected away from obstructions but not too far from the batteries. No. 8 single wire has

been provided for this purpose and there may be some No. 6 surplus that could be used. Whenever possible the windcharger should be used and the gasoline supply conserved.

After living at the station for a few weeks there undoubtedly will be located some spots which are not adequately lighted. A few extra outlets and additional wire have been provided to remedy such conditions. Care should be taken in running wires as voltage drop is a noticeable item in 32 volt systems. Each station has been supplied with a circular slide rule for determining wire sizes needed to carry a certain load.

The radio equipment operates on 12 volts and is to use a portion of the cells from the 32 volt lighting system. Power clips can be used to tap off 12 volts from the wet cells, after about 1 week operation the power clips should be altered and 6 other cells be used about a week. This changing of cells for radio power supply should be done so that over a period of time all cells have had about the same use.

~~XXXXXXXXXX~~ and a 115 volt, 1 1/2 kw. generator has been provided for rawinsonde observations. The BX cable should run directly from the generator to a safety switch near the raob equipment. From this switch box the BX cable should be run to two or three duplex outlets fastened along the base board (2 outlets in the meteorological room and one in the living room). These outlets are provided since it frequently is necessary to put a few lights on the circuit to load the generator properly.

An outside lighting fixture has been provided for each station to be installed where it will prove most helpful and still be fairly close to the batteries. It may be most advantageous on one of the James Houses or on a cross member of the wind generator tower.

In order that future operations may be advisably planned it is requested that a record of all fuel used for the 32 volt generators be recorded as well as a fair estimate of hours per day that the generator was in operation.

(Further details given under fuel consumption reporting)

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Since writing the above the people supplying the electrical equipment have reported that many items ordered are not available. Substitutes have been ordered and in some cases they are poor substitutes but are the best available.

It appears that double pole, double throw switches will not be available, it may be possible to locate three pole double throw as a substitute or it may be that nothing will be located. There are relays on the generator and switches are not absolutely essential but it would facilitate periodic checking of the spare generator. Similar obstacles were confronted in purchasing other electrical materials so it is suggested that all class 12 (electrical) equipment be unpacked and inventoried before starting to wire the main building.

Plan the lights, switches and receptacles for convenience and comfort but be sure wire of adequate size is used and be absolutely sure that all equipment and circuits are properly fused.

Each Quonset Hut is provided with two oil burning space heaters which should be placed about as shown on the drawing. Changes in location for comfort and convenience may be made if desired.

The heater in the transient quarters is not to be in operation except during time when actually needed for additional personnel. The second stove for the extra Quonset Hut can be used for replacement or spare in case of necessity.

Fuel used for heating and cooking should be recorded so that future planning will have exact consumption figures available. Any changes made to equipment, buildings, or its surroundings, which reflects in change of fuel consumption should be included as remarks to the fuel consumption report.

It will be the responsibility of the Official in Charge to keep records on fuel consumption and if necessary inaugurate plans for fuel rationing.

ALL STATIONS

Fuel and Lubricants

Lubricating oil being supplied was computed on an average of 5% of the motor fuel and should normally be consumed at about that rate.

However, the other items listed under fuels have only been estimated and since they are in such small quantities no difficulties should be experienced in establishing a satisfactory ration system.

The following material has been furnished for heating, mobile equipment generators, and miscellaneous:

	<u>Advance Station</u>	<u>Thule</u>	<u>Total</u>
Radio Generator fuel (#1) drums		200	200
Mobile engine fuel (#1) drums		200	200
Lub. oil, drums		20	20
Engine gasoline, drums	150	150	300
Lub. oil, drums	6	9	15
White gas, drums	1	1	2
Kerosene, drums	6	10	16
Heating (#1) drums	250	550	800
Alemite, lbs.	5	10	15
Gear lubricant, lbs.	20	80	100
Coal, hard, tons	6	19	25

Gasoline

	<u>Drums</u>	<u>Sub Total</u>
Thule, 32 Volt generator, 4 gallon/da, 450 days	36	
Thule, 1½ KW generator, 2 gallon/da, 450 days	18	
Thule, light tractor, 2½ gallons/hr, 12 hrs/da, 60 days in fall, 100 days in spring	96	150
Advance Station, 32 volt generator, 4 gallons/da, 450 days	36	
" " 1½ KW generator, 2 gallons/da, 100 days	4	
" " light tractor, 2½ gallons/hr, 18 hrs/da, 100 days	90	
" " contingencies	10	140
Total		290

Coal

	<u>Tons</u>	
Thule, 1 stove, permanent, barracks, 60 lbs/da, 450 days	13½	
Thule, 1 stove, transient, 90 lbs/da, 100 days	4½	
Thule contingencies	1	19
Advance Station, 30 lbs/da, 400 days	6	6
Total		25

Fuel Oil

	<u>Drums</u>	
Thule, 1-15 KW, regular communications, 1 drum every 3 days, 450 days	150	
Thule, 1-15 KW, air-ground communications, 1 drum every 1½ days, 75 days	50	200
Thule, 1946, Tractor, D-7, 1 drum/da, 60 days	60	

(continued)

Fuel Oil (cont'd)

	<u>Drums</u>	Sub <u>Total</u>
Thule, 1947, Tractor, D-7, 1 drum/da, 100 days	100	
Thule, 1946-47, snow removal	40	
		<u>200</u>
Total		<u>400</u>

Heating

Thule, permanent, 4 stoves, 10 gal/da, 450 days	360	
Thule, transient, 4 stoves, 10 gal/da, each, 100 days	80	
		<u>440</u>
Advance Station, 2 stoves, 10 gal/da each, 600 days		240
" " contingencies		120
Total		<u>1200</u>

Record of Fuel Consumption

The official in charge at each station will be responsible for maintaining a complete record of all fuel consumption.

It is ~~very~~ ^{el} desired that accurate records be maintained in order that the information can be used for future planning. Fuel used for various purposes should not be grouped together but kept entirely separate. Extra WB Forms 1078 have been provided for this purpose if desired.

Maintain a running record of dates when a drum is opened and the purpose for which the fuel is to be used. In cases of engine fuel, a record should be made of hours of operation in order that consumption per hour may be determined. Similarly, a record of date when coal bags are opened is desirable. However, it is not necessary to record the opening of each bag, but only the date when, for example, three or four bags are opened to fill the coal box. An accurate figure as to pounds of coal consumed each week is the record desired.

At the close of each month a summary is desired indicating the total fuel consumption for each activity, i.e., radio generators, mobile equipment, gasoline generators, heating, etc.

FOODS -- PROVISION AND USE

Among the foods supplied will be found those items which are customarily provided by U. S. Government services and also some luxury items not generally included. The luxury items are supplied mainly for birthday, holiday celebrations, and other special occasions.

Staple items have been furnished over and above regular Army proportions as an insurance against:

- (a) The possibility that vessels will be unable to reach the main base next season on schedule.
- (b) The event of convoy ships being caught in the ice and forced to remain with constructional and other crews on board for a considerable period.
- (c) To assure adequate supplies in case fresh and perishable foods may spoil.

There is appended hereto a variety of suggested menus selected by Army and Navy dieticians. It is expected that the cook at each station will exercise individual ingenuity in providing and preparing the food in the best manner which will cater to the taste of station employees of the group to which he is attached. While it will not be possible to follow the wishes of any single individual of the staff in regard to meals, it will be advantageous if personal tastes are consulted and an effort made to provide, at least once a week, and also on special occasions, some particular food and/or its preparation for which each individual expresses a keen desire.

There should be no fixed routine for various menus. However, the supply officer and cook should note the quantities consumed and, in general, determine the limitations in regard to weekly presentation of any particular food which is specially favored. For example, eggs, if not used too liberally by transients, may be served as often as four times weekly.

SUPPLY

General foods, cased and crated, in every class have been provided slightly in excess of proportions considered adequate by Army dieticians. Food provided at meals is expected to be generous but an abundance of food in store should not encourage its waste.

CHECK ON CONSUMPTION AND QUALITY

The supply officer is expected to keep careful check on consumption of and expenditures of food and make such report to the Central Office monthly by Air-Mail pickup if possible, or by radio. The report should include comments on quality and acceptability of the various foods both before cooking and after preparation for serving.

The storage qualities of products will soon be learned by experience and when there is evidence of deterioration of any item in store, such food should be placed on a priority list for early consumption.

PRESERVATION OF FOODS

Certain foods such as pickles, canned whole tomatoes, canned asparagus, and certain canned meats and fruits, indicated by a double asterisk (**) on the food lists, should be stored in quarters where above-freezing temperatures can be maintained in order to preserve their best appearance when served. The items marked with a single asterisk (*) on the food lists should be stored, preferably in a cool place where temperatures are also above freezing. A portion of the Operations Building has been suggested as a suitable storage place for these items.

WARM STORAGE

Supplies to be kept above freezing should remain on shipboard until storage facilities are available ashore. Stowage on ship should be arranged according to this principle.

FOODS -- ARMY PROCUREMENT

Army Ten-in-one Rations: (Quantity: Thule, 2000; Advance Station, 1000.

These rations have been provided for emergency use; that is, for example, during periods when the stations are being established, and they should be reserved for such purpose.

Foods which are packed especially for long-period storage should not be used when other boxed and crated foods are conveniently available for use. Ten-in-one ration cases should not be broken open for the sole purpose of obtaining particular items which may be personally desired.

Army K and D Rations: (Quantity, 600 rations at the base station)

These are provided for extreme emergency and should be stored in special shelters erected at a sufficient distance from the main building, to protect them from fires which may occur in the main buildings.

FOODS -- TREASURY PROCUREMENT

Beverages:

Coffee, roasted, vacuum packed, is provided in abundance.

Coffee, soluble, is also provided in generous quantity, but it should be reserved for use between meals and possible trail activities.

Juices, fruit; fruit crystals and vegetable juices supplied are more than adequate for the issue of one 10-ounce tumbler, the usual daily ration, to each man daily. It may be served at breakfast or at any other meal.

Milk, malted and Ovaltine will provide a warm or cold drink at mealtime or for between-meal snacks.

Milk, powdered, whole has been provided for use occasionally as a beverage, as well as for other purposes.

Tea and cocoa are supplied in excess of normal Army proportions in order to provide for between meal refreshment, night watches or possible trail activities.

Bread and Pies:

Provision has been made largely for base-cooked bread and pies. Pies should be prepared more often than starch puddings since it is believed that the former will be preferred by American observers and also those of other countries.

Candy:

Candy bars and sweet chocolate are provided for use mainly on special occasions. Sweet chocolate may, on occasions, also be issued for use on short leave excursions.

Candy, Hard, is supplied in sufficient quantities to allow a consumption at the rate of 4 ounces each week per man in addition to that which might be reserved for special occasions.

Marshmallows may be used for flavoring, but are mainly intended for use on special occasions.

Fruits:

Fruits, canned or evaporated are supplied in sufficient quantities for a daily use. Fancy fruits, such as figs, dates and special raisins should be used for holiday and birthday celebrations and reserved for such occasions.

Meats:

In an attempt to provide fresh meats for a considerable period, a quantity of beef, veal, pork loin, ham, turkey, and chicken has been supplied together with mechanically operated cool storage boxes or so-called reefer boxes having 150 cubic feet storage capacity as used by the U. S. Navy. Care should be given to the operation of this cool storage apparatus, especially when fresh foods are being transferred from Naval Transport lockers to shore storage. If possible, fresh foods should be transferred from the ships' cold storage to the reefer boxes while on shipboard and the filled boxes hauled ashore. Careful handling is essential during this operation. If the meat is subjected to any considerable change in the temperature, the quality and storage potentialities of such food will deteriorate. The machinery of the reefer boxes should be kept in operation continually until the local temperatures remain well below freezing. If this procedure is followed, there should be no wastage of meat through spoilage at the main base and the supply will be sufficient to allow 500 lbs. or more for use at each satellite station which will be established in the Spring. However, no reefer boxes will be supplied to advance stations and attention should be paid in choosing sites for cold storage purposes, which

should consist of permanently frozen ground cellars, underground ice, snow banks or glaciers.

Meat and vegetable spreads have been supplied in small quantities and they are primarily for use as between-meal snacks, including night watch duty.

Shrimp and lobster, canned, are provided for special occasions and should be reserved therefor.

Nuts:

Nuts, if kept fresh by preservation provided by special cans, have been found to be of value in circumstances when fresh fruits and vegetables are scarce. A quantity sufficient for at least one issue weekly to each employee has been provided in addition to the amount to be reserved for holiday occasions.

Soups:

Soups consisting of several varieties, dehydrated and canned, are provided sufficient for a serving of more than one ration per man per day and may be used on the menu for dinner and/or supper at the discretion of the supply officer. Ample use of soups will provide the amount of liquid intake required for good health and which otherwise might be neglected under arctic conditions of living.

Vegetables and Berries:

Vegetables and berries, both dehydrated and canned, are provided in sufficient quantities for liberal servings.

FOOD REQUIREMENTS
Basis of estimate as originally planned

Thule

<u>Personnel</u>	<u>Period</u>	<u>No. of men</u>	<u>No. of days</u>	<u>Man days</u>	<u>Subtotal man days</u>
<u>Permanent staff</u>	1 Sept. 46 - 6 Dec. 47	10	462	4620	
Danish observers	" "	2	462	924	
WB Forward Station Staff	" 12 Apr. 47	1	224	224	
Air Corps Bush Plane Crew	1 Mar. 47 - 6 Dec. 47	2	280	560	6328
<u>Transient</u>					
Air Corps ground crew	1 Mar. 47 - 16 May 47	20	77	1540	
Air Corps flight crew	" "	10	77	770	
WB Grant Station Staff	" 28 Mar. 47	4	28	112	
WB Construction crew	" "	4	28	112	
OA-10 Amphibian aircraft	Intermittent	9	14	126	<u>2660</u>
<u>Total man days</u>					<u>8988</u>

Advance Station

Permanent staff	1 Apr. 47 - 30 Nov. 48	5	609	3045	
Construction crew	" 22 May 47	4	52.5	210	
Air Corps flight crew	" Intermittent	5	49	245	
<u>Total man days</u>					<u>3500</u>

FOOD ORDERED

Thule

<u>Estimated absolute requirement</u>	<u>Rations 8,988</u>
<u>Ordered</u>	
Standard foods, boxed and crated	Rations 7000
Army foods... Ten-in-one	" 2000
Emergency foods... K and D	" 600
<u>Total rations</u>	
	<u>9,600</u>

Advance Station

<u>Estimated absolute requirement</u>	<u>Rations 3,500</u>
<u>Ordered</u>	
Standard foods, boxed and crated	Rations 3000
Army foods... Ten-in-one	" 1000
Emergency foods... K and D	" 600
<u>Total rations</u>	
	<u>4,600</u>

(continued)

FOOD ORDERED (continued)

The overall provision, including emergency foods, is probably adequate for a period of 18 months at Thule, and for 2 years at the Advance Station.

Comparative analysis of food proportions
Based on quantities ordered and rations to be provided.

Product	Massachusetts Institute of Technology	as provided by
	suggestion	Weather Bureau
	<u>Average lbs. per diem</u>	<u>Average lbs. per diem</u>
Meat		
Meat/vegetable mix	1.3	1.35
Fish		
Meats are in just proportion since these can be provided in extreme emergencies by hunting.		
Eggs, dried, whole	.035	.066
Experience has shown that eggs are much desired by men on outpost duty and for this reason the proportion has been increased.		
Milk, dried whole		
dried, skimmed	.18	.24
condensed, canned		
Milk is an item greatly desired and used as a beverage by men on Arctic outpost duty; hence, the increased proportion.		
Butter	.096	.091
Since butter is difficult to obtain at this time, lards and oils have been increased to substitute somewhat for this deficiency.		

(continued)

Comparative analysis of food proportions--etc. cont'd.

Product	Massachusetts Institute of Technology	as provided by
	suggestion	Weather Bureau
	<u>Average lbs. per diem</u>	<u>Average lbs. per diem</u>
Lards and oils	.038	.072
A considerable quantity is supplied in the form of shortening for use in making bread and pastry.		
Sugar, granulated and sweets	.385	.454
Raw sugar provided is less than the Mass. Institute of Technology suggestion owing to existing difficulties of procurement. However, additional sweets have been added which will more than make up the slight deficiency in raw sugar.		
Legumes	.78	1.0
Additional legumes in form of dried beans have been added as insurance in emergencies and to provide for possible dog food and trail requirements.		
Cereals, Flour, Breakfast foods, Biscuits, 1/3	.663	.80
Cereals, especially flour have been slightly increased to provide for extreme emergencies and may be used with meats obtained by hunting.		
Vegetables, dehydrated, canned	.5	.6
Some extra vegetables are provided in order to allow for any spoilage.		
Potatoes, dehydrated, canned, fresh	.138	.15
Fruits, dried, canned	.455	.52
Fruits in excess of normal Army issue are likely to be consumed at Arctic bases.		

MENU SUGGESTIONS

Using Ten-in-one rations, to which soups, dehydrated or canned vegetables and/or fruits may be added for dinner or supper. There are five different menus, each packed in separate cases.

Menu No. 1

Breakfast

Biscuits
Cereal, premixed
Coffee
Ham and eggs
Jam
Milk, evaporated
Sugar

Dinner

Biscuits
Coffee
Fruit pudding
Grape beverage crystals
Hamburgers
Starch Jelly
Sugar

Supper

Biscuits
Butter, Army spread
Caramel nouget
Cocoa
Meat and rice or
corned beef hash
Tomatoes

Menu No. 2

Bacon, canned
Biscuits
Cereal, premixed
Coffee
Jam
Milk, evaporated
Sugar

Biscuits
Caramel custard
Fruit cake
Lemon powder
Pork tenderloin or
beef stew
Sugar

Biscuits
Butter
Coffee
Corn, canned
Meat balls, spaghetti
Peanuts
Sugar

Menu No. 3

Cereal, premixed
Coffee
Jam
Milk, evaporated
Pork sausage meat
Sugar

Biscuits
Meat and corn
Orange juice powder
Plum pudding
Sugar
Sweet chocolate bar

Biscuits, square
Butter
Cocoa
Corned beef
Fruit bar stew
Peas, canned

Menu No. 4

Bacon, canned
Biscuits
Cereal, premixed
Coffee
Jam
Milk, evaporated
Sugar

Biscuits
Chocolate cocoanut bar
Fig pudding
Lemon powder
Pork, apple sauce
Sugar

Beans, snap, canned
Biscuits
Butter
Caramel nouget
Coffee
Roast beef, canned
Sugar

Menu No. 5

Biscuits
Cereal, premixed
Coffee
Jam
Milk, evaporated
Pork sausage links
Sugar

Biscuits
Cheese and bacon
Orange juice
Pineapple rice pudding
Sugar
Vanilla fudge

Biscuits
Butter
Chocolate bar
Cocoa
Ham and raisins or
Ham and sweet potatoes
Lima beans

MENU SUGGESTIONSUsing Cased, general foods

Breakfast

Bacon, sliced, grilled	Bacon, sliced	Biscuits
Buttered toast	Biscuits	Butter
Coffee	Butter	Coffee
Hot cakes, syrup	Coffee	Grapefruit juice
Jam or jelly	Eggs, whole, dried	Milk, whole
Milk, whole, chilled	Jam or jelly	Oatmeal
Oatmeal cereal	Milk, whole, dry	Scrambled eggs
Pineapple juice	Rolled oats	Scrapple
Stewed prunes	Stewed fruit	Stewed peaches
Sugar	Sugar	Sugar
	Tomato juice	
Biscuits, hot	Bacon, sliced	Bacon
Butter	Butter	Biscuits
Coffee	Coffee	Butter
Eggs, scrambled	Eggs, scrambled	Coffee
Grapefruit, chilled	Fruit juice	Honey
Ham, sliced, grilled	Hot cakes	Hot cakes
Honey	Milk, whole, dried	Milk, whole
Jam	Rolled oats	Pineapple juice
Milk	Stewed fruit	Stewed prunes
Rice, cereal	Sugar	Syrup
Sugar	Syrup	Wheat cereal
Tomato juice		
Apples, stewed, cream	Biscuits, hot	Biscuits, hot
Butter	Butter	Butter
Coffee	Cheese omelet	Coffee
Corn beef hash, grilled	Coffee	Hot cakes
Cream of wheat	Jam or jelly	Marmalade
French toast	Milk, whole	Milk, whole, chilled
Grapefruit juice	Stewed fruit	Molasses
Jam	Sugar	Pineapple juice
Milk, whole, chilled	Tomato juice	Pork sausage
Sugar	Whole wheat cereal	Stewed apricots
Syrup		Sugar
Biscuits, hot	Biscuits, hot	Biscuits, hot
Butter	Butter	Butter
Coffee	Coffee	Cheese omelet
Figs, chilled	Eggs, whole	Coffee
Jam	Grapefruit juice	Jam
Milk, whole	Ham, sliced	Milk, whole
Potatoes, hashbrowned	Jam	Pineapple juice
Scrapple, grilled	Milk, whole	Stewed peaches
Sugar	Stewed fruit	Sugar
Tomato juice	Sugar	Wheat cereal
Wheat cereal	Wheat cereal	

MENU SUGGESTIONSUsing Cased, general foods (cont'd)

Breakfast

Butter	Bacon, sliced	Apple sauce
Chipped beef, creamed	Biscuits, hot	Bacon, sliced
Coffee	Butter	Biscuits
Corn niblets pan cakes	Coffee	Butter
Honey	Eggs, whole	Coffee
Milk, whole, chilled	Jam	Eggs
Oatmeal cereal	Milk, whole	Jam
Orange juice	Pineapple juice	Milk, whole
Stewed figs	Rolled oats	Oatmeal
Sugar	Stewed fruit	Sugar
	Sugar	Tomato juice
Bacon, sliced	Biscuits, hot	Biscuits, or hot cakes
Butter	Butter	Butter
Coffee	Cereal, whole wheat	Coffee
French toast	Coffee	Jelly
Jam	Marmalade	Milk, whole
Milk, whole, chilled	Milk, whole	Raisins and rice
Oatmeal cereal	Orange juice	Sugar
Pineapple juice	Potatoes, hashbrowned	Tomato juice
Sugar	Sausage, pork	Vienna sausage
Syrup	Sugar	
Biscuits, hot	Bacon, sliced	Bacon, sliced
Butter	Biscuits or hot cakes	Biscuits, hot
Cereal, whole wheat	Butter	Coffee
Coffee	Coffee	Eggs, whole
Marmalade	Fish roe, fried	Jelly
Minced beef, creamed	Jelly	Milk, whole
Milk, whole	Milk, whole	Oatmeal
Orange juice	Rice and raisins	Pineapple juice
Potatoes, hashbrowned	Sugar	Sugar
Sugar	Tomato juice	

MENU SUGGESTIONSUsing Cased, general foods

Dinner

Bread	Beef, roast	Biscuits/bread
Butter	Bread	Butter
Carrots, peas	Butter	Buttered beets
Coffee	Cabbage	Chicken noodle soup
Cream tomato soup	Coffee	Lemonade
Mushroom gravy	Cranberries	Mashed sweet potatoes
Onions	Peach pie	Sugar
Peaches, chilled	Pepperpot soup	Vienna sausage
Potatoes, baked, brown	Potatoes, mashed	Coffee
Steak, beef	Sugar	

Bread/biscuits	Bread	Bread
Butter	Butter	Butter
Coffee	Carrots, creamed	Butterscotch pudding
Fruit cocktail or pea soup	Coffee	Cabbage, Beets
Gravy	Fruit cocktail or	Coffee
Pork chops	Mushroom soup	Corned beef hash
Rice pudding, baked	Milk,	Fruit cocktail or
Sugar	Pork loin, roast	Clam chowder
Sweet potatoes, glazed	Potatoes, mashed	Macaroni and cheese
Tomatoes, stewed	Starch pudding, chocolate	
	Sugar	Sugar

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Apple pie, cheese	Apricots, canned	Bread
Beef, roast	Bean soup	Butter
Brown gravy	Beef, corned	Coffee
Bread	Bread,	Corn niblets
Butter	Butter	Ham, baked
Coffee	Cabbage	Peach pie
Corn niblets	Cake	Potatoes, sweet
Cream of mushroom soup	Coffee	Split pea soup
Mashed potatoes, buttered	Potatoes mashed	Sugar
Sugar	Sugar	

Asparagus, buttered	Bread	Biscuits
Bread	Butter	Butter
Butter	Cabbage	Cabbage
Coffee	Coffee	Cherry pie
Fruit cocktail or	Fruit cocktail or	Corned beef hash
Vegetable soup	Clam chowder	Fruit cocktail or
Pineapple fritters	Loganberry pie	bean soup
Pork roast	Meat/vegetable stew	Jam
Potatoes, sweet, glazed	Sugar	Macaroni and cheese
Sugar		Sugar

(continued)

Dinner suggestions (cont'd)

Asparagus	Bread	Beets
Beans	Butter	Bread
Beef steak	Carrots	Butter
Bread, apple, raisin pudding	Cocoa	Caramel nouget
Bread	Corn	Carrots
Butter	Fruit cocktail or	Coffee
Coffee	Onion soup	Fish, canned
Fruit cocktail or	Jam	Fruit cocktail or
Vegetable soup mix	Peach pie	Clam chowder
Potatoes, hashed brown	Pork roast	Potatoes, parsley
Sugar	Potatoes mashed	Sugar
Chicken Maryland	Bread	Bread
Chicken noodle soup	Butter	Butter
Coffee	Butterscotch pudding	Chicken roast, cranberries
Corn and lima beans	Carrots, peas	Coffee
Figs, canned	Coffee	Pea soup
Layer cake, iced	Mushroom soup	Peas, carrots
Mashed potatoes	Potatoes, roast	Plum pudding, sauce
Sugar	Sugar	Potatoes, mashed
	Turkey roast, cranberries	Sugar

MENU SUGGESTIONSUsing Cased, general foods

Supper

Apple compote	Bread	Biscuits
Biscuits, hot	Butter	Butter
Candy, hard	Cake	Boiled beans - bacon
Cocoa	Candy, hard	Candy, hard
Fruit cocktail or	Figs, canned	Coffee
Creamed tomato soup	Fruit cocktail or	Fruit cocktail or
Hamburger steak	Pepperpot soup	Chicken noodle soup
Jam	Peas, canned	Lemonade
Pickles, relish	Pork and gravy	Onions, fried
Potatoes, fried	Potatoes	Pineapple, canned
Spinach - bacon	Tea	Sugar cookies
Sugar		
Apricots, fruit jello	Apple-raisin sauce	Biscuits
Bread	Bread	Chicken noodle soup
Carrots, peas, creamed	Butter	Chocolate cracker pudding
Cheese omelet - bacon	Coffee	Cocoa
Cocoa	Cookies	Creamed chicken, cranberry sauce
Nuts	Corn	Nuts
Orange juice	Ham, canned	Potatoes, mashed
Potatoes, hashbrowned	Macaroni and cheese	
Sugar	Mushroom soup	
	Nuts	
	Pickles	
	Sugar	
Asparagus, buttered	Fruit cocktail or	Fruit cocktail or
Beef pot roast	Pea soup	Clam chowder
Biscuits, hot. Jam	Sausage, pork	Corned beef
Cake, layer. Prunes	Baked beans	Boiled rice
Cocoa, tea. Sugar	Carrots	Buillon gravy
Fruit cocktail or	Bread. Butter	Cabbage
Vegetable soup	Canned pears. Cookies	Biscuits. Butter
Macaroni and cheese, baked	Starch pudding	Cake, iced. Pineapple, can
Pickles	Coffee, tea	Cocoa
Cream of tomato soup	Chicken mix soup	Onion soup
Bread. Jam	Biscuits, fancy	Chile con carne
Luncheon meat grilled	Chicken Maryland	Rice, boiled
Beans and bacon baked	Potatoes, mashed	Beans, string
Potatoes, mashed	Beans, lima	Cherries, unsweetened
Beets, Harvard	Tomatoes, canned	Pumkin pie
Ice cream, chocolate	Stewed fruit	Cocoa, Sugar
Tea, Cocoa	Coffee	Candy, hard
Candy, hard	Candy, hard	

(continued)

Clam chowder	Pea soup	Vegetable soup
Biscuits, hot. Jam	Tuna fish	Biscuits. Butter
Salmonloaf	Macaroni and cheese	Cod fish cakes
Peas green, creamed	Spinach, creamed	Potatoes
Apple pie. Cheese	Peas, creamed	Beets
Cocoa, tea. Sugar	Cake. Apricots	Prunes. Cake
Pickles	Canned fruit	Cocoa, tea. Sugar
Nuts	Tea, cocoa. Sugar	Pickles
	Nuts	Nuts
Fruit cocktail or	Fruit cocktail or	Fruit cocktail or
Tomato juice	Pepperpot soup	Onion soup
Bread. Jam	Ham, baked	Beef brisket, sliced
Macaroni, hash style	Sauerkraut	Potatoes, parsley
Beef tips, braised	Potatoes, mashed	Cabbage, buttered
Corn niblets, buttered	Peas, mashed	Peas, mashed
Ice cream. Cookies	Pears, canned. Cookies	Apricot pie
Tea, cocoa	Coffee. Sugar	Cake
Candy, hard	Candy, hard	Coffee. Sugar
		Candy, hard
Tomato soup	Mushroom soup	Vegetable soup
Bread. Jam	Beef tongue sliced	Biscuits
Beef steak	Ham, sliced, brisket	Vienna sausage
Potatoes hashed brown	Fish, salmon, cold	Potatoes, mashed
Tomatoes, stewed	Potatoes, chipped	Cabbage, boiled
Egg-custard pudding	Pickles. Relish	Asparagus, buttered
Tea, cocoa	Cake, iced.	Ice cream, vanilla
Nuts, mixed	Peaches, canned	Cookies
	Cocoa, tea	Tea, cocoa. Sugar
	Nuts	Nuts

Special items such as shrimp, lobster, fancy figs, dates, raisins, candy bars, marshmallows, sweet chocolate and nuts are included for holiday and birthday celebrations.

Meat and vegetable spreads such as liver paste, ham spiced, veal, ham and tongue, tomato mix and Pabst cheese are included for between-meal snacks and early morning watches, together with bouillon, coffee, tea or cocoa.

General

The objective of this program is to secure the maximum amount of meteorological data consistent with the elements of personnel, time, instrumentation facilities, and the varying degrees of difficulty under which the work is conducted. These instructions presuppose the maintenance of a full observational program. At the discretion of the official in charge of each station they will be modified to accord with existing conditions and the availability of facilities.

So far as possible, standard surface and upper air observations will be taken in accordance with current instructions applicable to Weather Bureau stations. Notes will be made of deviations from these instructions and of all conditions likely to affect the accuracy of the observations. Complete notes will be made of conditions that might result in recording non-representative data, regardless of the nature of the conditions. Of course, it is anticipated that in many instances observing personnel will be obliged to resort to improvisation to secure meteorological data. Accordingly, a complete log of unusual situations encountered and of the devices or improvisation adopted to meet them should be kept at each station. This log will not only assist in evaluating the data with respect to accuracy and representativeness, but will be a valuable source of material when a basic manual on taking arctic meteorological observations is prepared.

An attempt has been made in these instructions to outline a basic observational program. It is believed that the list of special phenomena observations is relatively complete; however, the desirability of taking special phenomena observations in addition to those listed will probably occur to observing personnel. Every encouragement is given to taking additional observations, which will probably be added to those already listed. It is requested, therefore, that a full report of procedures adopted to take the observations be submitted with necessary recommendations regarding instrumentation which appear desirable. It is understood that complete use of the observational facilities at each station cannot be made immediately upon arrival. The observational programs will be inaugurated as soon as possible and in the following order of preference:

1. 6-hourly
2. Pibal
3. Rason
4. Special phenomena

In the following discussion of surface and upper air observational programs it should be understood that the instructions cited will be supplemented by such additional instructions as may accompany the instruments used, or as may later be furnished through established channels of communication.

Observational Program

Surface--General: Observations taken in accordance with the following instructions will be recorded so far as possible on standard observational forms. The official in charge at each station will make provision for recording

notes and extended comments that are too voluminous for entry on the form used for the observation proper. All basic observational forms will be prepared in duplicate and stored in separate buildings to guard against the complete loss of data in the event that one copy should be destroyed. The forms will be retained at the station until instructions regarding their disposition have been received. Standard instructions concerning the neat and legible preparation of the forms and the verification of them by an observer other than the one making the entries will be observed. Adherence to instructions is not required in cases where departure from them would enhance the value of the data or render them more amenable to interpretation.

Surface Observations

Schedules: 6-hourly observations will be taken *for transmission* at 0000, 0600, 1200, and 1800 GCT. These schedules are 30 minutes earlier than the time of taking synoptic observations in the United States in order to facilitate the collection. Transmission of the observations will be made in accordance with communication plans. Hourly and special airway observations will be taken as required for use by flights between stations. During these flights a continuous weather and radio watch will be maintained.

Forms: Form 1130A will be regarded as a basic observational form and prepared in duplicate. All 6-hourly observations will be entered on this form with extended notes and comments recorded as described above, and transcribed to Form 1001.

Instructions: "Instructions for Airway Meteorological Observers (Fifth edition, Circular N, as amended by C.L. NO. 32-46 and attachment)" and "Instructions for Preparing Meteorological Forms" will be observed in taking and recording 6-hourly observations.

Ice observations: A record will be kept of the break-up and freeze-up of the ocean ice and the movement of the ice flow in shore and off shore during the transitional open seasons. Similar data should be kept respecting streams or rivers in the vicinity of the station. The terminology used in describing visual ice observations will be taken from "Atlas of Sea Ice" by Maurstad.

Thickness of Ice: When the condition of the ice cover permits, a measurement will be made each Monday of the ice thickness. For this observation a hole will be made in the ice by means of an ice auger or ice ax. An ice caliper, which is an "L" shaped device, may be improvised for use as a measuring tool. The short limb of the "L" is placed under the ice cover. The long limb is graduated in one inch increments from which the thickness of the ice will be read on the ice caliper to the nearest unit inch.

Temperature of Ice: If the ice is more than 6 inches thick, drill a hole with the ice auger to a depth of 6 inches. Place a thermocouple or the bulb end of an armored thermometer in the hole and fill the hole to the surface of the ice with water. The first observation should not be taken until the water has been frozen for 24 hours. Ice temperature readings will be taken twice-daily 12 hours apart, preferably as close as possible to noon and midnight local time. The readings will be recorded on Form 1130A and a complete description of the exposure of the temperature element made in the station log

of meteorological observations. If the ice is 6 inches or less in thickness, the thermometer element will be exposed in the ice at a depth equal to that of the half its thickness. As the ice increases in thickness the thermometer elements should be placed progressively lower until they are exposed at a depth of 6 inches beneath the surface.

Temperature Profile: To establish a temperature profile the following temperature data will be secured at the time of measuring the ice temperature:

1. Temperature at the base of snow, either ground or solid ice.
2. Temperature at the surface of the snow (taken in accordance with instructions for snow surface temperature observations in Circular N).
3. Temperature of the air at approximately four feet above the surface of the snow.

If the point of observation is over the sea, the temperature of the sea at a depth of 10 feet below the surface and immediately below the surface, together with the direction of the ocean current, will be obtained.

All entries will be recorded on Form 1130A.

Snow Observations: At stations taking rason observations, snow depth and temperature measurements will be secured immediately prior to the time of the observations. Data will be recorded on Form 1130A.

At weekly intervals a circular sample will be cut from the packed snow and its liquid equivalent determined by melting the sample and measuring it in a standard rain gage. Notations will be made of the cubic content of the unmelted sample in order that the density of the packed snow may be computed. These observations will be in addition to those required daily of snowfall and amount on the ground.

Automatic rain and snow gage records will be annotated whenever it is believed that such records are inaccurate either because of a nonrepresentative catch or of drifting and blowing snow. Inaccurate records will be corrected before transcribing hourly, 6-hourly, and daily amounts of precipitation from them.

Solar Radiation: Solar radiation observations will be made three times daily by means of a radiation meter calibrated in terms of gram calories per square centimeter per minute. Instructions for its use are furnished with the meter. At the time of each observation the ceiling, sky, visibility, weather, obstructions to vision, temperature, dew point, and elevation angle of the upper limb of the sun's disk will be observed. All data will be recorded on Form 1130A.

Schedule of Observations: Observations will be taken at one-half hour after sunrise, solar noon, and at one-half hour before sunset. However, observations will not be attempted during seasons when the upper limb of the sun's disk does not appear above the horizon.

Illumination Observations: These observations will be taken by means of

an exposure meter at the time of the radiation observations. The reading of the exposure meter, which should be arranged vertically to obtain a measurement of the light intensity, will be entered on Form 1130A. Illumination observations will be taken with the exposure meter, regardless of whether the sun is below the horizon throughout the day. Under these conditions, when radiation observations will not be taken, illumination observations will be taken at true solar noon and three hours before and three hours after noon.

Sunrise and Sunset: To verify the accuracy of computed data a record of the time of sunrise and sunset will be made on Form 1130A. The records may be discontinued if the actual time of sunrise and sunset agrees with computed data. If observations cannot be made against a sea level horizon, the angular height of intervening obstruction will be entered in the station log, and the apparent time of sunrise and sunset recorded.

Luminous Meteoric and Geomagnetic Observations: Aurora, or other geomagnetic phenomena, and the occurrence of luminous meteors will be recorded with time of beginning and ending on Form 1130A. Detailed descriptions of aurora in accordance with "Aurora -- Geomagnetism" by C. W. Gratlein and pictures in color of brilliant displays will be secured and recorded whenever possible.

Frost: Observations of frost formation can be most expeditiously taken by use of a snow frost table. This consists of an aluminum table about 3 feet in diameter and 4 feet high. A 3-inch metal apron is suspended from the table top.

Frost formation varies with varying conditions of sky cover, humidity, and wind. Observations, therefore, cannot be taken at scheduled times. When a frost formation is observed to have occurred, a measurement of the thickness will be made and entered on Form 1130A, together with a description of the structure, orientation of feathers, and the direction and speed of the wind. Pictures of unusually heavy frost deposits will be made and a description of them entered on the back of the pictures. The data of occurrence and the condition under which the frost formed will also be recorded on the photos. All deposits of snow and frost will be removed immediately after the observations have been completed.

Upper Air Observations

Initially, one rason will be taken daily at Thule and the advance station at 1500 GCT. If the wind data pertaining to the rasons cannot be obtained for any reason, the data will be secured by means of a rabal or pibal observation, in that order of preference. The rasons at Thule may later be increased to two daily, i.e. at 0300 and 1500 GCT.

Forms: W.B. 1103 and 1110A are regarded as original observational forms and will, therefore, be prepared in duplicate and stored separately in accordance with the foregoing.

Rasons will be taken in accordance with Circular P, 5th Edition, "Instructions for Modulated Audio Frequency Radiosonde Observations", and following amendments and supplementary instructions:

- MAL 11-3-44, Subject: Table 20 of the Radiosonde Observation Computation Tables and Diagrams
- MAL 11-30-44, Subject: Correction to Radiosonde Observation Computation Tables and Diagrams
- MAL 2-12-45, Subject: Fifth Edition of Circular P
- MAL 8-23-45 and attachment, Subject: Tables and Instructions for Computing Heights of Constant Pressure Levels Below the Level of the Station
- MAL 9-24-45, Subject: Accuracy of Surface Values in Raobs
- MAL 10-9-45, Subject: Amendment to Circular P in Conformance with 1945 Radiosonde Code
- MAL 11-30-45, Subject: Raob Table 20
- MAL 12-14-45 and attachment, Subject: Enclosed Instructions for the Preparation of Constant Pressure Data
- MAL 2-8-46, Subject: Entry of Balloon Data on Recorder Records
- MAL 10-19-45, Subject: Radiosonde Observation Program
- MAL 11-26-45, Subject: Rawin Supplies
- MAL 12-28-45, Subject: Rawinsonde Observation Program
- MAL 2-14-46, Subject: Plotting Time Altitude Curve on Winds Aloft Graph
- MAL 3-15-46, Subject: Procedures in Rawinsonde Program
- MAL 5-17-46, Subject: Installation of Temperature and Humidity Elements in Friez Modulator ML 310B/AMT 1
- MAL 5-24-46, Subject: Comparative Winds Aloft Observations
- Rabal observations will be taken in accordance with Circular O and the following supplementary instructions:
- MAL 3-8-43, Subject: Upper Air Winds from Raob Balloons
- Circular Letter No. 109-43, Subject: Upper Air Winds from Raob Balloons
- Circular Letter No. 1-44, Subject: Coding and Transmission of Rabal Data
- Circular Letter No. 16-44, Subject: Upper Air Winds from Raob Balloons
- MAL 8-12-44, Subject: Rabals
- MAL 11-2-45, Subject: Rabals

Pibals: Observations will be taken daily at 0400 GCT at the advance stations. Pibals will be taken at 1600 GCT at the advance stations only when a rason observation is not taken. Pilot balloon observations initially will be taken daily at 0400 and 1000 GCT at Thule, but if a second daily rason is later inaugurated, the pibal schedule will be 1000 and 2200 GCT. Pilot balloon observations will be taken in accordance with Circular O, "Instructions for Making Pilot Balloon Observations", and the following supplementary instructions:

Circular Letter No. 172-41, Subject: Changes on Pibal Forms

MAL 4-3-42, Subject: Amendments to Circular O

MAL 10-12-42, Subject: New Procedure for Inflating 30-gram Pilot Balloons for Nighttime Observations

MAL 11-20-42, Subject: Instructions for Use of Pibal Inflation Nozzles

MAL 12-17-42, Subject: Discontinuance of Forms 1117A

MAL 5-24-43, Subject: Delayed Pilot Balloon Observations

Circular Letter No. 46-44, Subject: New 100-gram Pibal Procedure

MAL 8-2-44, Subject: Maximum Altitude Entry for 100-gram Pibals

MAL 12-3-44, Subject: Instructions for Use of New WBAN Pibal Forms

MAL 1-13-45, Subject: Time Entries on Pibal Forms

MAL 6-15-45, Subject: Computation of Wind Resultants

MAL 10-12-45, Subject: Revision of Form 1114

Circular Letter No. 14-46, Subject: Amendment to Pibal Code

MAL 3-15-46, Subject: Water-activated Electric Lighting Units

MAL 6-24-46, Subject: Water-activated Pibal Lighting Units

Special Observations Requested by Army Signal Corps

Special observations requested by Army Signal Corps will be undertaken in cooperation with their Engineering Laboratories for testing special Army meteorological equipment under arctic conditions. The following special equipment has been sent by the Army Signal Corps Laboratories for testing:

- 1 Barometer ML-102-D
- 3 Hydrogen Generators AN/TMQ
- 1 Wind Equipment AN/GMQ-1
- 1 Balloons and Sterilizer Unit
- 1 Thermograph ML-277
- 1 Psychrometer Set AN/TMQ-6
- 2 Thermometer ML-352/um
- 2 Mercury-thallium thermometers

A separate folder of instructions is being sent giving detailed information regarding tests to be made on the above equipment.

CLOTHING

XII (e)

Personnel should provide themselves with ordinary clothing such as they would wear on similar duty in average temperate climates, i.e., suits, sweaters, shirts, socks, underwear, shoes, hat, handkerchiefs, pajamas, and any old clothing that will serve for the rough work of installing the bases.

The Weather Bureau will issue clothing for special outdoor service. Such clothing shall remain the property of the Weather Bureau, to which Bureau personnel will be accountable for all items received and not returned.

Of course replacements will be made by the Weather Bureau in all legitimate circumstances such as deteriorations as a result of normal wear, accidents which occur during duty periods, and also losses by fire. Otherwise, personnel are responsible for all items made available to them and they must return all clothing and equipment issued, irrespective of its condition on completion of their assignments.

Suitable cold weather clothing is not warm in itself; it is merely a good insulator and a poor conductor of heat. The heat of the body is held in by the clothing and prevented from escaping into the atmosphere. Since still air is an excellent insulator, the best cold weather clothes are those which entrap a considerable amount of air. Several thin layers of cloth are better than one thick, heavy matted piece of material because air pockets can form between the layers. Cold weather clothing must also be roomy. If it is too tight, much of the insulating air will be squeezed out. Moreover, the pressure on the body will restrict circulation of the blood, which must move freely if frostbite or discomfort from cold is to be avoided. Keep clothes dry, when possible.

Moisture is a good conductor of heat. Since perspiration is the one factor most likely to cause damp clothing, shed clothes before getting really hot. Do not wear waterproof clothing in extremely cold weather as it will prevent perspiration from evaporating and cause inner clothing to become wet. Be careful to dry clothes after wearing; clothes which feel dry may contain a great deal of moisture.

Removal of Frost

Regardless of care taken some moisture will condense in clothing and boots in the form of frost in cold weather. Most of the frost (usually deposited on the inside of the outer layer) may be brushed or beaten off before it has a chance to melt. Before entering warm quarters (after a long term of duty outdoors) take off the outer clothing, turn it inside out, and remove as much of the frost as possible. Never take frosted outer clothing indoors unless there will be time to dry it thoroughly. Leave

frosted clothing outside if planning to return soon into the cold.

Drying Clothing

Hang up each piece separately. Never put articles close to a fire or hot pipes. Never try to warm a heavily dressed body or foot against a stove or to dry the clothes on the body. Remove the clothes, exposing the body to the warmth and dry clothes separately. Leather articles like boots and mukluk soles must be dried slowly since heat will ruin them. Clothes will dry if hung outdoors in the cold, in fine weather.

CLOTHING ISSUE

Wet weather clothing issued to Weather Bureau personnel will consist of:

No. issued

- 1 Coat, rain.
- 1 Poncho lightweight.
- 1 Parka, wet weather, which has a hood to cover the head.
- 1 Trousers, wet weather.
- 1 pr. Gloves, leather, heavy.
- 1 pr. Boots wader, knee.

Special Work Clothing issued for beach unloading, etc.

- 1 pr. Trousers duck, used with parka and trousers wet weather.
- 1 pr. Gloves, leather, heavy.
- 1 pr. Gloves shell, leather.
- 2 pr. Gloves mosquito; which are intended for light work gloves as well as for insect protection.
- 1 pr. Shoe pac 12", for use on wet and muddy surfaces.
- 1 pr. Boots wader, knee, for shallow wading.
- 1 pr. Waders, over the shoe, for wading in water up to the waist.

Clothing for use in moderate cold.

- 1 Cap, field cotton w/visor.
- 1 Cap, field pile.
- 2 Drawers, 50% wool 50% cotton.
- 1 pr. Gloves, insert wool, for use with Gloves Shell Leather.
- 1 pr. Gloves wool, leather palm.
- 1 Hood, jacket field. This may be attached to the jacket field 1943 and worn over the cap, field cotton or cap field pile.
- 1 Jacket Field 1943. This is a windproof, water repellent jacket which should fit over a shirt, sweater, jacket pile, Type B; Jacket Field, wool, or any combination of the four. Adjustability in its size and fit is made possible by the double set of buttons at wrists, and neck, and by the waist draw strings. By use of these adjustments it can be loosened to permit circulation of air about the body without need for opening the jacket and exposing the under clothing to the elements.

- 1 Jacket, Field Wool, an Eisenhower type of wool jacket suitable for mess purposes or moderately cold weather.
- 1 Jacket Field (pile) Type B. A smooth fitting jacket, pile lined and especially suitable for indoor wear and for underwear outdoors. This is not an outdoor outside garment and should never be worn as a top garment when outdoors.
- 1 Mitten Shell, Trigger Finger. May be worn separate in moderate weather but should be reserved for use with mitten, insert, in moderately cold weather.
- 2 pr. Socks, cushion sole, a wool sock to be worn next to the foot. These socks should not be washed in hot water.
- 4 pr. Socks, Ski, a combination of one or more ski socks worn over the sock cushion sole, will fit well in shoe pacs or mukluks of the size equivalent to a dress shoe size. Socks, ski, are of wool and should be washed in lukewarm water.
- 1 pr. Shoepac 12" 1944, with insoles. These shoepacs are made on a special last which gives them sufficient roominess about the instep and toes. To accomodate two, three or more pairs of socks as well as the insoles (which come with the shoe pacs) and which are an essential part of the assembly. The insoles should always be removed when the shoepac is not in use, and dried as often as they become frosted or damp.
- 1 pr. Trousers Field Wool. Wool trousers should be kept as clean as possible to avoid deterioration through washing. Use luke warm water for washing trousers and do not rub unnecessarily.
- 2 Undershirt, Winter 50% wool 50% cotton. Wearing of light cotton or rayon underwear beneath the wool underwear is recommended. Light underwear may be easily washed, whereas wool underwear is difficult to wash and deteriorates with each washing.

Cold Weather Clothing, to be worn in combination with other clothing issued, consists of:

- 1 pr. Boots Mukluk, with insoles. Great care should be taken, when putting on and tying mukluks, to see that the insoles (which are part of the mukluk assembly) are fitted centrally over the mukluk sole, and that the mukluk fits squarely on the foot; otherwise this footwear will assume an uncomfortable, lopsided position which once assumed is difficult to remedy. If the mukluk sole should become wet be sure to shape it carefully before placing it to be dried.
- 1 pr. Goggles M1943. Wear goggles always in fog or hazy weather to avoid becoming snowblind.
- 1 Mask, face, cold weather. In extremely low temperatures a face mask will afford protective service for relatively short periods. It should be dried thoroughly after each interval of use, no matter how short the interval.

- 1 Muffler, OD. The muffler will be found to be useful in many circumstances, not the least when used to cover the face and the edge of the sleeping bag opening, if sleeping in tents or in the cold, when frost from the breath will form. Much of the frost may be brushed from the muffler and it may be dried cold, in the open, if snow is not drifting.
- 1 pr. Mitten Arctic. The mitten arctic will be found useful even in moderately cold conditions, when it will serve for warming hands used bare when doing jobs requiring manual dexterity. Care should be taken to keep the inside of the mitten clean. They should be dry cleaned as often as necessary.
- 1 Overcoat Parka type, pile lined. The liner may be removed and used separately as a dressing gown, or otherwise.
- 1 pr. Overshoe Arctic. In emergency, or in some conditions of moderate dry cold, the overshoe arctic, with insoles, one or more pair of wool socks and a pair of felt socks, may be found the most comfortable and protective footwear.
- 1 Parka, field, pile. This garment should not be worn outside without the protective covering of the parka, field, cotton, or the parka white. If necessary it may be worn over all buttoned body clothing. The hoods of the parkas should, if necessary be tailored to fit each individual and so prevent irritation which may result from ruffs obscuring vision.
- 1 Parka Field, cotton OD. To be worn over parka field, pile.
- 1 Parka White, may be worn over the two other parkas or over the parka field pile alone.
- 2 pr. Socks Felt. The socks felt may be worn with convenience and comfort together with the shoepac, the overshoe, arctic, or the mukluk. Care should be taken to see that the felt sock is fitted and worn squarely on the foot, that it does not turn so that the heel fits on the ankle part. Rub the heel and sole of a worn felt sock lightly but sufficiently to refelt it while it is warm and damp. It should not be rubbed roughly even when dry.
- 1 pr. Shoes, Arctic felt Shoes arctic felt should be given considerable attention if they are to give maximum satisfaction. They should not be worn outdoors when the snow is melting. (The shoepac is the item for use in these circumstances). As much snow as possible should be brushed from the felt shoe before entering a warm building. They should be dried slowly as often as they are worn on snow or in low temperatures. They should never be permitted to become wet. Moisture may dry quickly from the interior and exterior of a felt shoe, but saturation and quick drying brings about rapid deterioration.
- 1 Sweater, High neck.
- 1 pr. Suspenders, Trouser. Even though a belt may be sufficient support for the trousers, suspenders are most useful when traveling or moving in and out of doors in cold climates. They permit adjustability of the belt, and circulation and exchange of air, which is necessary for cleanliness health, and comfort.

The clothing listed above is IF intelligently used; in layers when necessary, adequate for protection of men exposed to extremely low temperatures for periods of less than four hours, and when a certain amount of exercise is permissible. Use of the layer principle, that is, wearing item by item, one over the other, (even two pairs of drawers if engaged in sitting or standing in extreme cold) will provide protection if loose fitting clothing is worn.

The number of items issued should serve for general purposes. Items for special needs and for legitimate replacements may be obtained as extras or in exchange, from the supply officer.

Beds, Bed Clothing, Sleeping Bags and Miscellaneous Items.

Bedsteads double-decking are provided with the intention that the upper or lower bed, at will, may be used for storing personal equipment which may not be stored in lockers conveniently. However, it may be necessary to use the spare beds for transients, occasionally, and while permanent personnel will not be inconvenienced unless necessary, they should be prepared to share living quarters, if required.

Bed Clothing in the form of mattresses, blankets, sheets, pillows, pillow cases, and comforters are supplied in quantities sufficient to provide for the needs of each individual. The personal needs of each, rather than a fixed standard of issue, should guide the supply officer's distribution of bed clothing. Personnel will have to wash their own bed and other clothing when necessary.

Some of the blankets provided should be regarded as emergency; for use in hospital, or in case of accident.

Issue

- 1 Sleeping Bags, Arctic (which is a double bag) together with a water repellent case, are provided for use in such emergency as will be found during unloading and before permanent living quarters are ready for occupation. Also, for extreme emergency such as the evacuation of the permanent buildings, if such is necessary. As soon as other sleeping covers such as blankets can comfortably serve the purpose, bags sleeping, arctic should be stored with other emergency equipment.
- 1 Bags, Sleeping wool. These together with, or without the case, water repellent, for sleeping bag, will serve for use on ship-board or elsewhere when temperatures and other conditions are favorable. A Bag, Sleeping, wool, has been found equivalent to two blankets in providing warmth and comfort. Under certain conditions, they may be used in permanent quarters, and thus conserve blankets.

- 1 Box match waterproof w/compass. Waterproof match boxes are provided mainly as an item for use in emergency such as shipwreck, or forced trail journies over the ice. The boxes should be restocked as often as possible, or necessary.
- 1 Case, Water Repellent, for use with sleeping bags.
- 2 Handkerchiefs, O.D.
- 1 Headnet mosquito.
- 1 Kit sewing and darning.
- 1 Knife pocket general purpose.
- 1 Knife hunting, with sheath.
- 2 Towel bath.

XII (f)

COMMUNICATIONS PROCEDURES

Operators Instructions

Principal Circuit

The principal communication circuit from Thule will be to the USAAF base at BWS, Greenland. For this circuit there is provided one 3 KW low frequency transmitter with Beveridge type directional antenna to be directed on BWS. This circuit is authorized to transmit on a low frequency of 109.5 KC.

On this same circuit there will be four high frequencies available on 400 watts, namely:

3390.0	Winter	(night))Low Sun Spot
5597.0	Summer	(day))cycle
7560.0	Winter	(night))High Sun Spot
10645.0	Summer	(day))cycle

(Note - Sun Spot cycle is medium in 1946 and increasing to 1948).

It is presumed that the LF Channel will prove the most reliable and that initial contacts will be attempted on 109.5. If this contact is not successful that higher frequency will be next tried which is most appropriate to the particular time and season. However, it should be observed that so little is known of radio propagation in high latitudes that station experience may indicate a superior order of frequency use, or method of contact. In such case the necessary arrangements between Thule and BWS for most efficient operation of the circuit may be examined by the communicators. Changes of operating procedure should be reported to the Official in Charge for approval and entered on the records of the station.

It is presumed that the Army station at BWS (call sign WYTK) will use the same low frequency of 109.5 KC on the circuit to Thule. Other Army high frequencies may be available for cross band communications, and these can be determined in the field.

The Army station at BWS may be alerted to stand by for the opening of the Weather Bureau circuit by means of the operating Danish radio facility at Thule. In general, a guard will be initiated on Weather Bureau frequencies as of September 1.

Transmission Times and Schedules.

Thule will file initially one synoptic report (MT) every six hours, one rawinsonde (RS) observation, and two wind

aloft (PB) observations daily. After the station construction is completed the rawinsonde observations (RS) may be increased to two daily and ~~while~~ the synoptic reports (MT) may be increased to a three hourly schedule, subject to the advice of the senior meteorologist and approval of the Official in Charge who will take into consideration the increased work load on communications personnel, increased fuel consumption and other factors. Such changes in the observational schedules should be coordinated by dispatch with the Central Office before they are made effective.

Synoptic weather observations will be made sufficiently in advance to be filed with the communicators for transmission at 0000Z, 0600Z, 1200Z and 1800Z.

The precise times of transmission most convenient for reception by the Army at BWS are not yet known and must be determined by mutual agreement between stations in this field. To avoid confliction with other schedules in the Greenland network any timing for the Thule transmission will be acceptable which falls within one half hour of the principal observation hours listed above.

Routing of traffic from BWS to the United States will be accomplished through present Army circuits or through any circuits which may be developed to improve the radio contact into Greenland.

There will be a requirement for the reception at Thule of selected meteorological information from outside sources. This information will be prepared at Washington, D. C. in bulletin form, and will be forwarded via BWS (and possibly via Fairbanks, Alaska - see data on experimental circuit to Fairbanks). It will be transmitted to Thule by BWS, when available, on six-hourly schedules immediately following the completion of the Thule weather report. (see section on forecast program). Upon completion of all scheduled meteorological information stations will exchange administrative, personal, and service communications as necessary.

Communicators will keep records of signal strength and observe experimental propagation tests (see recommendations of Bureau of Standards) both in conjunction with regular schedules and at such special times as are established. Reliance is placed on the initiative and resourcefulness of the communicators to procure data of value to the future development of Arctic radio networks.

When not otherwise engaged communicators may scan the receiver for signals which may be identified and keep records of all stations which can be heard, together with time and signal strength.

Experimental Circuit to Fairbanks

It is intended that an experimental circuit be established with Fairbanks.

Initially this will consist of a high frequency test channel. Sloping "V" antenna (or Rhombic if circumstances permit) will be oriented on Fairbanks from Thule.

During the month of October 1946 signals will be transmitted between Fairbanks four times daily starting at 0200Z, 0800Z, 1400Z, 2000Z. This transmission will require 24 minutes according to the following procedure:

1st	3 min.	Thule	Transmits on	3390 KC
2nd	"	Fairbanks	" "	3390 "
3rd	"	Thule	" "	5597.5"
4th	"	Fairbanks	" "	5597.5"
5th	"	Thule	" "	7560.0"
6th	"	Fairbanks	" "	7560.0"
7th	"	Thule	" "	10645.0"
8th	"	Fairbanks	" "	10645.0"

To accommodate schedules at Fairbanks it may be desirable to change the starting times of the above test transmissions. Any changes should be coordinated with the Arctic Section, Weather Bureau, Central Office.

Records of reception on all four frequencies will be kept at both Fairbanks and Thule. These records will be forwarded to the Arctic Section, Central Office, Weather Bureau, as soon after the end of October as possible. Upon review of these records the future activity of this experimental circuit will be determined and field stations will be advised.

If it develops that at least one daily radio contact between Thule and Fairbanks can be established it is then contemplated that suitable antenna and equipment will be installed at Fairbanks to initiate a more substantial experimental circuit.

It is hoped that a circuit to Fairbanks may prove sufficiently reliable, at least for some favorable period of each day, to justify continuation of this circuit permanently within the limits of its capabilities. If some daily contact can be maintained with upwards of 75% reliability this channel will then be continued and used for administrative and personnel traffic, and for duplicate transmissions of weather traffic.

It should be noted that the establishment of a successful contact with BWS does not necessarily insure the receipt

of Thule weather data in Washington, D.C. And yet the value of the Thule reports can largely be measured by the reliability with which they reach the United States teletype circuit. Breakdowns in the relay from BW8, elsewhere in the radio chain, frequently occur. It is for this reason that the experimental circuit to Fairbanks (even if secured only one a day) may be of great value in the overall efficiency of the communications, since Fairbanks affords a direct contact with wire circuits to the United States.

The spare Beveridge LF antenna included in the Thule equipment is intended for a future development of the Arctic radio network, and is specifically for contact to a future station in the vicinity of Melville Island, Canada. It should be noticed that the bearing of Fairbanks and of Melville Island from Thule are closely similar. If, therefore, studies of radio propagation indicate the desirability of construction this Beveridge antenna for contact with Fairbanks at any time in advance of the establishment of a facility in Melville Island it will be reasonable to proceed with such construction using an orientation midway between the bearings of Fairbanks and Melville. Decision as to the construction of this second Beveridge antenna will be referred to the Arctic Section of the Central Office, with recommendation of the Thule Official in Charge.

Air Ground Channels.

Air ground communications will be guarded whenever aircraft are known to be in the vicinity, or upon request from BW8. Standard US Army air ground procedures will be used.

Air ground frequencies are authorized as follows:

3452.5 KC
6355.0 KC

Non direction Homing Beacon:

The homing beacon will be operated on 398 KC whenever aircraft are known to be in the vicinity, or upon request from BW8. The identification will be TL.

UHF Equipment:

Will be used as circumstances dictate for air ground contact with aircraft in the immediate vicinity.

Emergencies:

Standard US Army emergency communication procedures will be followed with respect to aircraft in distress, and under other emergency circumstances. Reference is made to Operating Instructions of the Strategic Air Command.

Satellite Stations:

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When the satellite stations under the administration of Thule is established communication schedules shall be revised to include reports from such satellite according to revisions of these instructions to be published later.

LF frequencies of 158.5 and 170.5 KC have been authorized for circuits to satellites.

Ciphers:

The Official in Charge shall determine any case in which the use of a cipher may be necessary. If circumstances permit he shall obtain instructions from the Weather Bureau Central Office, and in any event he shall advise the Central Office of such action at the earliest opportunity.

Personal Messages:

Each person assigned to the Thule station shall be allowed to file for transmission without cost personal telegrams to the average amount of 100 words per month. Such messages will be relayed through US Army circuits to the nearest commercial telegraph facility, from which point they will be forwarded collect to the addressee.

In case no aviation facilities can be maintained at Thule for outgoing airmail on a monthly (approximate) basis, then in addition to the above allowance for telegrams each person will be allowed to file for transmission to BWS, without cost, personal radio letters in the average amount of 150 words per month. A pool will be arranged for a supply of stamps at BWS and letters will be forwarded weekly by Army airplane at the first point of mailing in the U.S. postal system. These messages may be prepared in letter form by the US Army at BWS.

Air mail and telegrams incoming to Thule shall be routed through the Central Office, Arctic Section. It is anticipated that periodic mail service approximately monthly to Thule will be available and that no limit need be set on incoming mail. Parcel post deliveries may be limited to an average of 25 pounds per man per month.

Telegrams to Thule will be acceptable to the US Army circuits and will be limited to an average of 100 words per man per month. This instruction shall not apply in case of emergency messages. The acceptance of emergency messages beyond the normal limit shall be at the discretion of the Central Office, Arctic Section.

The above instructions are subject to acceptability by the US Army for transmission on Army circuits to BWS and Thule. If the experimental circuit to Fairbanks, Alaska, proves adequate this may be used for incoming and outgoing administrative and personal traffic. Facilities of CAA at Fairbanks will accept traffic within limitations as set forth above. Personal traffic will be turned over to the

Weather Bureau at Fairbanks for forwarding.

Categories of Acceptable Traffic:

- 1- Distress Messages
 - a. Concerning aircraft threatened by serious and imminent danger, and requiring immediate assistance.
- 2- Urgent Messages
 - a. Concerning safety of human life and the safety of air navigation.
- 3- Safety Messages
 - a. Urgent Notices to Airmen.
 - b. Important meteorological warnings.
- 4- Aircraft Movement and Control Messages.
 - a. Pre-flight warning messages.
 - b. Flight plans.
 - c. Departure messages.
 - d. Traffic control messages.
 - e. Delay notices.
 - f. Cancellation notices.
 - g. Arrival notices.
 - h. Instrument-approach messages.
 - i. Request information messages.
 - j. Flight release messages.
 - k. Position reports.
 - l. Any other communication relating to movement and control of aircraft not listed above.
- 5- Meteorological Communications.
 - a. Predeparture weather forecasts and terminal forecasts.
 - b. Landing weather.
 - c. Clearance weather observations.
 - d. Basic meteorological information.
 - e. Analyses.
 - f. Forecasts for route sections and amendments.
 - g. Synoptics.
 - h. Upper air reports.
 - i. Surface observations.
 - j. Collective meteorological data.
 - k. Messages exchanged between meteorological offices to insure their information services.
- 6- Operational Communications.
 - a. Aircraft operating schedules.
 - b. Servicing of aircraft.
 - c. Supplies for ground facilities, including the provisions and incidental requirements of personnel associated therewith.

- d. Provisions and incidental requirements for passenger or crew safety or comfort.
- e. Instructions to individual members of the crew regarding special in-flight procedures.
- f. Tests or experiments.
- g. Extra landings to be made by aircraft.
- h. Aircraft parts and materials.
- i. Hours of opening and closing facilities or services.
- j. Changes in circuit operating procedures and techniques.
- k. Changes in current schedules or additions thereto.
- l. Replacement parts for station equipment and adjuncts.
- m. Instructions to employees regarding procedures for restoring inoperative radio equipment and adjuncts.

7- Executive and Administrative Communications.

- a. Official communications pertaining to the Arctic Project.

8- Personal communications.

- a. As detailed above.

The unauthorized interception and divulging of the contents or the publication or any use whatever of radio communications not intended for the general use of the public, is prohibited. Communications addressed to a specific addressee shall be considered the private property of the official addressee and shall not be given any other distribution under any circumstances.

Basic procedures governing and regulating international radio communications have been set forth in "The Telecommunications Conferences" (Cairo 1938). These procedures are recognized internationally, are applicable generally to the aeronautical services and will be used to the extent to which they may be applied to the procedures outlined herein.

Operating Procedures-

Contacts with Army Facilities.

In all radio communications with US Army facilities, either ground stations or aircraft there shall be used Standard Army Operating procedures as set forth in the following manuals, or other pertinent manuals not listed. This material is specifically referred to and made a part of Weather Bureau instructions:

- TM 11-454 The Radio Operator.
- TM 24-10 Basic Field Manual-Combined Radiotelegraph (W/T) Procedure.
- CCBP2-2 Combined Operating Signals.

Inasmuch as no particular CAA manuals are available

for definition of proper procedure on the experimental circuit to Fairbanks reliance is placed on a familiarity with CAA procedure by radio operators employed for this project. The following CAA publications are referred to:

- "Q" Signal abbreviations of June 1, 1939.
 Contractions of Feb. 1, 1946.

Weather Transmission Procedures

(Note: Radio call letters and station index numbers shown in the examples which follow are for illustrative purposes only, and have been underscored. At the time of preparation of these instructions, final radio call and index number assignments for these stations have not been determined).

A station transmitting meteorological information shall send:

- (a) Its own radio call twice, followed by a double dash (BT) KEBJ KEBJ BT
- (b) The type of report (MT, PB or RS) MT
- (c) The time of observation. (Used rarely. Only sent if it is at variance with the usual filing time, or if a correction to previous material is being sent.) 011225Z
- (d) A double dash (BT) BT
- (e) The report, followed by a double dash 82050 03875 24415..etc
BT
- (f) Additional reports of the same type, each followed with a double dash. (Used when one station is transmitting another station's report, in addition to its own). 82050 03875 24415..etc
BT
82100 00690 26500..etc
BT
- (g) Repeat items (b) through (f), if separate types of data are sent during the same transmission. MT BT
82050 03875 24415..etc B'
PB BT
82016 02713 2718 22624
..etc..BT
- (h) Its own radio call once. KEBJ

Examples:

- (1) Transmission of an "MT" report by Thule:

KEBJ KEBJ BT

MT BT

82050 03875 24415 12580 60807 73775 75092 BT

KEBJ

Examples, Continued:

(2) Transmission of an "MT" and a "PB" report by Thule:

KEBJ KEBJ BT

MT BT

82050 13875 24415 12580 60807 73775 75092 BT

PB BT

82016 02713 2718 22624 2630 42732 2830 62731

2835 BT

KEBJ

(3) Transmission of Thule, advance station reports by Thule:

KEYZ KEYZ BT

MT BT

82500 00690 26500 13074 40304 61070 79980 BT

82050 03875 24415 12580 60807 73775 75092 BT

PB BT

82516 02412 2413 22516 2520 42632 2631 62835 2732
82730 BT

82016 02713 2718 22624 2630 42732 2830 62731 2835 BT

RS BT

82530 92224 23020 00018 85478 17345 02214 70005
02532 01913 50870 65411 02112 11690 01530
22400 76607 82553 30075 90904 02318 20972
94999 02320 33218 05999 44125 92999 BT

KEYZ

(4) Transmission of a corrected report by Thule:

KEBJ KEBJ BT

CQN MT 011800Z BT

82050 03875 24415 12580 60824 73775 75092 BT

KEBJ

Special Note:

In case of a regular meteorological report, and if no successful contact is established with the receiving station after two attempts, then the radio operator is

authorized to make a blind transmission. All such blind transmissions shall be logged and efforts made to determine whether reception was successful anywhere.

OUTLINE OF RADIO INSTALLATION

1. Grounds. Before the buildings of the camp site are erected a grounding system for radio should be buried in the earth. This will consist of a ring of bore #6 SD copper wire of about 12 inch diameter to which 18 100 foot radials have been soldered. The ring should be buried under the point to point operations building. The radials should be buried in the earth to a depth of about six inches. The ends of the radials should be connected to ground rods, driven into the ground, on a slant if necessary. All equipment grounds should be connected to this system. A similar ground system, except that the radials may be 100 feet, should be installed at each end of each beverage antenna. Under each flat top T antenna 200' radials should be installed.
2. The floors of the buildings that will house radio equipment should be reinforced to support the additional weight. Eight by eight timbers are being furnished for this purpose.
3. Power. Power for the radio equipment will be supplied from three 15 KVA diesel engine generators. Two of these units will be installed in a power shed adjacent to the main operations building. These will be the main and standby units. The third unit will be installed in a separate building located 20 feet from the main building for fire protection. This will be the emergency unit. The air ground transmitters will also be in this building. Power distribution will be through safety switches. For the main power supply these switches will be located on a mounting board in the point to point operations building. For the emergency supply, the switch mounting board will be in the emergency power-air ground transmitter building.
4. Point to Point Transmitters at the Main Station:
 - a. 1 each Wilcox 96-200c transmitter with a 36A rectifier. The frequency range of this transmitter is 125-525 K. The output is 3KW. The power required is 6-8 KW at 220 volts 3 phase. This transmitter will work into a beverage antenna at 118.5 kc.
 - b. 2 each T5/FRC transmitters, frequency range 150-550 kc, output 500 watts, single phase, 220 volts. These transmitters will work into a T antenna for communication with the advance station at 158 or 170.5 kc.
 - c. 5 each T4/FRC transmitters, frequency range 2-18 mc, output 400 watts, single phase 220 volts. These transmitters will work into doublet and sloping V antennas at the following frequencies:

3390
5597.5
7360
10645

One channel will be spare.

- 2 -

5. Air Ground Transmitter at the Main Station:

- a. One T5/FRC. This transmitter will work into a T antenna for providing a homing signal at 398 kc.
- b. Three T4/FRC. These transmitters will work into doublets and sloping V antennas at 3452.5 and 6355 kc.

One channel will be spare.

6. Receivers at the Main Station:

- a. Eight Hammarlund Super Pros having a tuning range of 100 to 400 kc and 2500-20,000 kc. These receivers will be used to guard the higher frequencies.
- b. Two Navy Type RBA, having a tuning range of 15-600 kc. These will be used to guard the lower frequencies. The receivers will be mounted in cabinet racks located in the Point to Point operations building. The two spare super pros will be mounted in the emergency power-air ground building for emergency use.

No separate receiving antennas will be installed, instead, change over relays to switch the antennas from receivers to transmitters will be used.

7. Antennas at the Main Station:

- a. ^{edges} Beverage^{edges}s. At Thule two beverage antennas, one wave length long, one on Fairbanks and one on BW 8 will be installed. These antennas will be supported on tripod masts made of pine 2 x 4's fastened together with an eight inch bolt. They will have two #8 stranded copper weld wires which will be fastened to pony insulators on brackets fastened to the ends of the 2 x 4's so as to give the wires about a 15 inch spread. The incoming ends will be ground through 150 watt resistors of about 300-400 ohms resistance. The other end will be connected by a transmission line through a change-over relay to a receiver or transmitter. The tripod masts will be guyed as necessary. These antennas will be for low frequency communications.
- b. Sloping V antennas at the Main Station. At Thule two sloping V's, one on Fairbanks and one on BW 8 will be installed. They will be constructed of #8 copperweld wire, and suspended from 85' steel masts. Design will be in accordance with CAA Drawing D 3212. Spacers on the exponential leadin will be of dry maple with porcelain or glass knobs on the ends. These antennas will be for high frequency communications. They will be used for receiving and transmitting, using a change over relay.
- c. Flat Top T Antennas. (non directional) Two flat top T antennas will be installed at the main station and one will be installed at the advance station. They will work on low frequencies for com-

munications in the local nets. They will be supported on 85 foot sectional steel towers at the main station, and on 73 foot sectional plywood towers at the advance station. Construction will be in accordance with drawings in Army LF antenna kit #2A299-GP7 or CAA drawings D 3595-1 and D 3595-2. The horizontal spans will have 3 number 8 stranded copperweld wires. The downloads and transmission line will be of #8 stranded hard drawn copper. Dimension A will be 240 feet, dimension B 100 feet, dimension C 20 feet. At the main station one of the flat tops will be used for transmitting a homing signal at 398 kc.

- d. Doublet Antennas. Five doublet antennas will be installed at the main station. Three will be installed at the advance station. They will be used for high frequency point to point and air-ground communications. At the main station they will be supported on 85 foot sectional steel masts. At the advance station they will be supported on 50 foot sectional plywood masts. The leadins will be of open wire transmission line type. (EO-1 transmission line is not available). Materials for these antennas are supplied in doublet kits. Two extra kits have been ordered for the advanced station, and five extra kits for the main station.
8. Advance Station. The advance station is being supplied with battery operated transmitters and receivers.

2 each VRC-1 Transmitters covering the frequency ranges

200	-	500 kc
400	-	800 kc
3000	-	4500 kc
4500	-	6200 kc
6200	-	7700 kc
7700	-	10000 kc
10000	-	12500 kc

2 each RBA Navy Type Receivers covering the frequency range

150	-	1500 kc
1500	-	18000 kc

2 each RBA Navy Type Receivers covering the frequency range

15	-	600 kc
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1 each TBK hand powered emergency transmitter-receiver.

SOME HINTS ON THE OPERATION AND MAINTENANCE OF MOBILE EQUIPMENT IN COLD REGIONS

Operation and maintenance of mobile equipment in cold regions is not easy. Cold alone is not the factor in preventing operation; it is a combination of cold, wind, snowdrift, icing and bad visibility. Operators and mechanics in cold regions soon learn what their own peculiar problems are, but it is well to know beforehand something about them and how to meet them. Failure of equipment to function in cold climates should not be blamed on some mystery introduced by the cold since it will be found that difficulties can be traced to something that careful preparation and maintenance can eliminate.

Three broad principles are the fundamentals of proper Arctic maintenance. First is a knowledge of the problems that exist; second, familiarity with devices and measures required to solve such problems; and third, the determination to take proper precautions. This last factor requires qualities of spirit and devotion to duty without which all knowledge is useless for the accomplishment of a difficult mission. However, the proper maintenance and procedures are equally important.

MODIFICATION OF EQUIPMENT

Modification of equipment for use in the Arctic is summarized in one word "Winterization". Winterization involves the need for keeping the oil in a fluid state, combating ice formation on equipment surfaces and also in the carburetor, preserving mobility of controls, arrangement and care of the batteries to meet the unusual electrical demands and at the same time, preserving efficiency and comfort of personnel.

PHYSICAL DISCOMFORTS

Work in cold weather takes longer. Physical discomfort, difficulty in manipulating tools, poor visibility because much of the maintenance work will have to be done in poor artificial light; frost nipped fingers, numbness of hands smeared with grease and oil, wrestling with tools held in bulky gloves are conditions which lead to discomfort, inconvenience and annoyance. But much of the annoyance can be eliminated if the job on hand is undertaken after careful planning and giving thought to the problems at hand.

It will also save time in the long run if time is taken to think how the job can be done without discomfort before the job is started. First, provide all tools that may be required for the job and select clothing which will give warmth without interfering with freedom of body movement. At the same time, consider ways to avoid soiling clothes because laundry facilities will be limited and the supply of clean clothes for frequent changes at small arctic outposts will not be great.

HAND GEAR

It has not yet been found possible to provide really adequate protection for the hands during mechanical operations in extremely low temperatures, especially when grease, gasoline and oil are involved. If overall temperature control, using tents, shelters or space heaters can not be provided, and they probably will not be in every circumstance, it is suggested that the best method of operation is to work quickly with bare hands, but with some source of

warm air nearby with which to warm the hands frequently. A blow torch in a can or a gasoline stove in a box will be handy in such cases. Taping the tools and, where possible, the parts of machinery which the bare hands may come into contact with, will prevent the cold metal from nipping the fingers.

Always remember that spilling gasoline on the hands is painful and may be dangerous if prolonged. However, some consolation may be had from the fact that gasoline cleans the hands; they dry quickly and then they may be thrust into the pockets or inside the belt for warmth without danger of soiling the clothes. Of course, oil smeared hands should be wiped as often as possible and a rag or waste should always be handy for this purpose.

HEADGEAR

Mechanics and others working on machinery in the open should pay particular attention to their hoods and headgear. The hood should fit snugly, but not so tight that it cannot be pushed back by using only your arms. A hood should either be loose enough about the neck to permit it to turn with the face, or it should be attached to the garment in the Eskimo fashion. In Eskimo style clothes, the Parka is not carried on the shoulders, but is carried on the head by means of the hood. In such cases, the hood is firm enough on the head to make sure that it turns when the head turns and it does not blindfold the wearer when he turns his face. Carrying the weight of a parka on the head is irksome at first. However, it should be remembered that many people of the world habitually carry great loads on their heads without apparent discomfort. Naturally, with a little persistent practice, this custom, as it applies to wearing a parka, can soon be acquired.

CARE OF EQUIPMENT AFTER OPERATION

Covers adequate to prevent snow from drifting under the motor hoods and other parts of vehicles should be provided. These can be made up from the canvas if other suitable shelter is not available. In regard to shelters or houses for vehicles, it is well to remember that a cold vehicle when brought into a warm shelter will "sweat"; moisture will condense on cold surfaces and in some parts of the equipment, it may cause trouble. In such cases, the vehicle should be left in the warm shelter until the snow or ice deposits melt and dry thoroughly; otherwise, when the vehicle is started and removed from the shelter, the condensation will soon freeze and cause trouble.

Doors and windows may freeze shut, glass instrument covers and windows will be difficult to clean. Even if the vehicle is to remain outdoors after operation, it is well, provided the weather is clear, to leave cab doors or windows slightly "cracked" in order that the circulation of air will prevent the formation of frost on the instruments and interior of the cab. Later on, however, when the vehicle has cooled, the doors and windows should be closed securely to prevent snow from shifting into the cab. Snow will sift even through a pinhole.

Outside parking of vehicles is often found desirable, even though hangar space is available. This is especially true if the hangar or shelter door is apt to become blocked with snow drift or if the temperature within the shelter is likely to vary from far above to below freezing.

SOME PRECAUTIONARY MEASURES

Fuel and Oil Tanks

To prevent condensation from forming within them, fuel and oil tanks should be filled to capacity after operation.

Tools

Tools and other small parts may sink out of sight if laid down on the snow. Always keep them in a belt kit, your tool box, or cover the snow with canvas on which to place the tools and parts.

While making emergency repairs on cold equipment, never use too much pressure in tightening nuts, bolts, and cables. Remember, they will expand on warming, freeze tight in the cold and snap when forced.

Starting Engines

When starting a cold engine use an external battery or a battery charger, if possible.

Spark Plugs

Spark plug fouling may be expected if a cold engine fails to start rapidly. Partial firing expands moisture laden air in the piston chambers which quickly condenses and leaves small beads of ice on the spark plug electrodes. Such ice accumulates with each unsuccessful start. Remember that your first attempt at starting will be the best; and if the engine fails to start after three or four attempts, it may be advisable to remove three or four of the plugs and dry the points. The time taken to do this is often much less than that used for repeated attempts to start a balky machine.

Oil Pressure

Oil pressure gages and other instruments may often be sluggish in operation immediately after starting the engine. If there is no sign of oil pressure after the engine has been running a few minutes, or the oil pressure drops after a few minutes of operation, these difficulties may be caused by blown oil lines, congealed ice in the line, ice in the oil reservoir drain or other parts of the oil system. When this occurs, the engine should be stopped and the trouble located and corrected.

GENERAL INFORMATION

The application of external heat should be resorted to with caution. If the vehicle is properly winterized, you should have no trouble in starting the motor, and any one of the heaters, - spot heaters, space heaters or others used for this purpose - should take care of the job.

However, if winterization has not been completely installed in the equipment, you may have to resort to "Bush" methods and use a blow torch or primus in starting the motor. But to use such methods, is an admission of failure. In cases when equipment has not been winterized, arrangements should be made

to cover the vehicle with some sort of insulation and place one, two, or a dozen ordinary lanterns beneath it provided nothing better is available. The heat from these lanterns will be sufficient to keep a tractor engine and lubrication system from getting so cold as to give trouble in starting. The foregoing does not, of course, apply to long lay-overs. In such events, the batteries should be removed and stored in some warm place after being fully charged. When the vehicle is to be used again, replace the batteries after the engine has been slowly warmed with whatever means which may be available. With a moderately warm engine, a fully charged battery together with some dexterity and determination, there should be little difficulty in getting the engine started. Operations at Arctic outposts, to which supplies are carried at great expense and difficulty, do not warrant the wasting of fuel and oil by running the engines continuously between working periods.

TROUBLE POINTS

Even though the machinery has been winterized it is well to remember the points at which trouble may be found. Control systems must have provision for differential expansion and contraction, and gear type pumps must have adequate clearance to compensate for case shrinkage. Before attempting to start a pump, care must be exercised to see that the pump is free from ice. Care should also be given to the operation of condensation traps and drains unless Methyl Hydrate is used to prevent the formation of frozen condensation.

In spite of the use of low pour point oil, oil lines should be installed to allow complete drainage and to prevent the lodgement of sludge in low bends and angles. Carburetor screens, if left on, should be carefully attended as they will doubtless accumulate snow and hoarfrost.

ELECTRICAL EQUIPMENT

The electrical load will be increased in starting cold machinery and provision should be made to use either a battery cart or a battery charger when starting engines which have not been used for some time. Care should be taken when using spot or space heaters to prevent any damage to the insulation of ignition wires.

HYDRAULIC PARTS AND HYDRAULIC FLUIDS

Hydraulic mechanisms will doubtless be serviced with suitable hydraulic fluids which have been diluted with Stoddard Solvent. However, hydraulic packings, connections, cups and seals must be given constant attention and provision should be made for readily servicing such parts.

MEDICAL ATTENTION

A doctor has been included with the regular base station complement. He shall be responsible for maintaining the health of advance and base station personnel, inspecting facilities in order that living quarters are kept in a sanitary condition, to advise personnel on health measures, to treat sickness and accident cases, as may be required. The doctor will also serve as a relief weather observer at the main base.

He will be responsible for maintaining surgical kits ready for use at all times, the prescribing of medicines required for treatment and the issuance of medical supplies.

The sick bay will be in the main living room and provided with one bed. This part of the living room will also serve as his office, the medical library and where medical and first aid shall be given to personnel.

In addition to the duties given above the base station doctor will be responsible for:

- (a) The issue of food and clothing supplies and maintaining records thereof.
- (b) Advising personnel on dressing for outdoor work.
- (c) To render medical and first-aid assistance to the local population when requested by them.
- (d) Surgical treatment of serious accidents or illness will be of a temporary nature provided evacuation of the patient is necessary and possible. However, evacuation of a patient, if possible, shall be left to the decision of the station doctor.
- (e) To maintain records of issuance of and accountability for medical supplies.

Note: In case of accidents, please see Chapter III, Personnel Status, relative to the execution of essential C.A. forms therefor, for each injury.

SOME HINTS ON ENVIRONMENTAL PROTECTION

Knowledge makes for confidence, but only through experience can one attain wisdom. In strange conditions it will be found, generally, that there is as much to unlearn as to learn. Usual and "common sense" methods are not always right in the Far North. What the inexperienced may decide to do for comfort in the Arctic Regions might well lead to inconvenience, if not to inability to perform well the duties for which one was hired. You may find in Stefansson's "Friendly Arctic" a precise and accurate description of conditions and a knowledge of how to deal with them. A knowledge of what others have done to protect themselves in the Arctic will not in itself give the novice protection but it will hasten the process of indoctrination and make easier the acquirement of such wisdom as may be gained by personal experience.

Even knowledge is of little use unless it can be applied at the right time and only experience can enable us to anticipate, develop a habit, and be prepared to meet best the unusual conditions encountered in the Arctic, or elsewhere.

Learning never stops. Even if you think you know it all, you have to keep reviewing what you know, so that you may be ready automatically to adjust yourself to some conditions and avoid others which may not be coped with.

Don't consider that your intelligence is being insulted if you read here what you already "know". There is a great difference in knowing something that you read and comprehending those things so well that you yourself could jot them down without stopping to search for them in your mind or rake them from memory.

THE ARCTIC DEFINED

Arctic conditions are not confined within the Arctic Circle, as one might imagine when remembering that The Circle is an imaginary line drawn about the world at Latitude 66°30'N. The Arctic is more accurately that area in which the temperature of the warmest month averages below 50°F; or, the area north of the timber line. Such conditions will be found in some places both in Siberia and Canada far above and far below the Arctic Circle. In some areas the timber line is 400 miles north of the Circle, while in some other areas it is 400 miles south.

ARCTIC CONDITIONS

Within limits, certain general statements can be made profitably about Arctic conditions, but at best they can be only broad summaries. Local conditions within very narrow limits vary as much in the Arctic as they do elsewhere. Seasonal and other conditions vary from year to year and those with long residence in the polar regions will rarely attempt to dogmatize. Of a few things it is certain. The Arctic is not an area of "dead ice" or ultra cold throughout the year. Only

on Greenland, some parts of Devon, Heiberg, Baffin and Grant Land will be found permanent icecaps. Terrific cold is not an incessant condition in the Arctic and extreme cold is not the most difficult condition to contend with. In summer, in much of the Arctic, the temperature is generally well above freezing and there is rain even at the North Pole. Extremely low temperatures together with high wind velocity is rare. Storms or blizzards in the Arctic occur with about the same relative frequency as storms in other parts of the world.

The darkness of an Arctic winter is not dismal to the healthy and active minded; in fact such intense darkness as sometimes experienced during an overcast night in temperate latitudes is seldom if ever experienced in the Arctic even in the depths of winter. There and then the snow on the ground and the crystals in the air reflect the light of the moon and the stars; the mere absence of the sun in the Arctic does not produce dark and dismal conditions. Dismalness in high latitudes is much more striking in the late spring and the fall when the sun spends part of the day above the horizon, and when the country is so fogbound, mistbound and damp that the cold penetrates sufficiently to render the conditions of the poorly dressed traveller, miserable.

However, yearly precipitation is small, most of it occurs between the months of April and November, although enough snow may be carried by the wind in winter as to make it appear as a snowfall.

There may be a snowstorm in the Arctic without the fall of new snow; the snow in the storm may be that which is caught up by the wind and which drifts from place to place and back again. Snowfall in the greatest amount in the Arctic is experienced in the spring and fall and this makes for discomfort and introduces a real danger to travel over the ice, especially in the fall. Freezing of the surface water on the sea and on lakes takes place rapidly in the fall, but contemporary or subsequent snowfalls may blanket the ice in a manner to render it unsafe for travel. The blanket of snow may permit the ice to warm and weaken and care should be taken when walking over new ice that is snow-covered.

The tides in the Arctic may not be considered of importance by the inexperienced arctic traveller, but while the daily and lunar tide levels do not vary greatly in much of the Arctic, except in its southeastern portion, there is generally enough rise and fall of the tide to develop cracks not far from shore and these cracks in the fall, or at any time, when snow covered, offer a danger it is well to remember. After a snowstorm or in dull light of winter the unwary might step into a crack in which the ice is not solid; the crack may be wide or so narrow as just to permit the foot to enter; the result of stepping into it may be a twisted ankle, a broken leg or at least, wetted foot gear.

If foot gear is wetted during cold weather when near to the base it may not be serious. If the distance is not too great it will be possible to hurry indoors and change socks. But if the distance to shelter is far more than an hour's travel - it would be well to stop, remove the boots and wring out the socks, being sure to get them back on before they freeze too stiff to permit this operation.

If such an accident happens when you are more than four hours travel from the base, you should in such circumstances be provided with spare, clean socks, carried for such and other emergencies.

If your excursion will take you more than four hours' travel away from your base you should carry spare socks and mitten liners, and in most cases, a bite to eat. There are several reasons for this.

We know from experience that the human body can stand terrific cold for very short periods, especially immediately following a meal, but we also know from experience that the metabolism of the human is such that if exercising throughout a four-hour period without food, the resistance to cold thereafter is much reduced. So, gauge the reinforcements in clothing required with regard to the peculiarities of the body.

We are apt to think of the body as being at one temperature, but this is not true of skin temperature. It is through the skin and its associated matter that you sense the feeling of discomfort from cold. A glance at the chart below will help you to comprehend that certain parts of the body will require certain percentages of reinforcement or additional protection, depending on the time limit of exposure. The most sensitive parts are the feet, the head and hands, in that order.

CHANGES OF SKIN TEMPERATURES OF VARIOUS PARTS OF THE BODY WHEN DRESSED IN CUSTOMARY WINTER CLOTHING AND EXPOSED TO STILL AIR TEMPERATURE OF 25°F. WITH THE BODY AT REST.

Body Segments	Normal skin temperature	Exposure in hours			
		$\frac{1}{2}$	1	$1\frac{1}{2}$	2
Head	92.2	83	78.5	72.8	67.2
Arms	92.5	91.8	89.6	89.1	88.1
Hands	92.0	85.6	80.0	75.5	69.0
Trunk	94.4	94.4	94.3	94.1	93.0
Legs	92.0	90.9	90.3	90.0	88.3
Feet	89.0	80.6	75.7	70.1	65.0

The human body at a temperature of 92.6 is comfortable.
 " " " 90.6 is cool.
 " " " 89.2 feels cool to cold.
 " " " 88.0 feels cold.
 " " " 85.8 almost shivering.
 " " " 69.0 slightly numb
 " " " 65.0 numb beyond ordinary tolerance.

The temperatures listed are skin temperatures, of course, not the surrounding air temperature. You may notice how quickly the skin temperature of the head, the hands, and the feet drop. This can, with care and preparation, be somewhat controlled by applying more insulation, but the proportion of insulation required for various parts differs largely in regard to the time exposure. Insulation is provided by means of space or thickness. To increase the thickness required over the hands to keep them warm under conditions of rest when the body condition is still tolerable, would mean a covering so thick as to prohibit all dexterity. However, a little exercise of the extremities such as wriggling the fingers and crinkling the toes can be of considerable help. And there is one

thing to remember . You can not wriggle the fingers or crinkle the toes well if your gloves and your boots are too tight fitting. WEAR THEM LOOSE.

SELECTION OF CLOTHING

The proper clothing for cold climate is that which will keep you warm when the body is at rest, but the proper use of such clothing is to adjust it, or remove it (and carry it with you) if called upon to exercise in a manner that will bring your body to the "good-and-warm" condition. To be warm means comfort, but "good and warm" is too hot in the Arctic. In fact it is better and important in the outdoors Arctic to feel at all times just cool; in this manner you can avoid subsequent discomfort.

Such comfortably-cool feeling under cold conditions can only be accomplished during exercise by the exchange of air about the body. The warm, vapor laden air from the body must be permitted to escape and condense on some outer layer of the protective clothing. The clothing must not be tight, it must permit the circulation of air. It is because of this you will find among the Arctic clothing provided, large sizes in both underwear and outer garments.

Under the circumstances in which Weather Bureau employees will be working normally, it might be advisable in the interest of comfort and cleanliness, to consider the wool underwear somewhat in the same category as the sweater - an auxilliary layer rather than a basic foundation, and to wear light cotton underwear which can be readily washed, next to the skin.

CARE AND WEAR OF ARCTIC CLOTHING

A formula in regard to Arctic behavior in respect to clothing, is short and worth memorizing; it is A COLD. A. C. O. L. D.

- A, stands for Apprehension and Anticipation. You must apprehend, and anticipate danger.
- C, stands for Cool, Confidence and Cleanliness.
- O, stands for don't overheat; don't over exercise. Earning your bread by the sweat of your brow means imperceptible sweat in the Arctic, not sticky, wet sweat.
- L, stands for Loose and this applies to clothing, not thinking.
- D, stands for Dry. Dry clothing affords the best insulation.

You might notice that three of the five symbols have to do with provision for coolness, not warmth. In fact one of the principal causes of discomfort and disaster in the Arctic is first overheating and then the unavoidable, consequential chilling.

No static condition of clothing will serve in the Arctic because exercises no matter how well planned are apt to be irregular. This calls for clothing that is adjustable and the knowledge of how to adjust it to advantage. Among the first lessons to be learned in regard to the Arctic is that it pays to take time to make adjustments to clothing in order to meet the various conditions and requirements. Sustained comfort can not

be achieved throughout long periods of exposure without making adjustments to clothing.

Adjustment does not mean only buttoning or unbuttoning the jacket. To open the jacket when it is snowing will permit the snow to enter and wet the underclothing. Adjustment means loosening in this case; that is, loosen the clothing in order that the air might circulate and dissipate the heat of the body. If loosening is not sufficient, then some of the underclothes should be removed. Under normal conditions and clear weather it is better to risk a little cold while removing a garment and putting back the outer layer, than to suffer the after effects of sweating profusely, or to expose the inner layers to the possibility of accumulating hoar frost or snow. Remember, the hoar frost formed from the body vapor will most likely congregate on the outer layer of clothing. If an inner layer of clothing after removal of an outer layer becomes an outer, then it too will accumulate hoar frost and when the outer layer is put back on, the frost in the then inner layer will melt and make the whole garment damp and unservicable for warmth.

It is not too difficult to change clothes if the weather is clear, but it may offer some difficulty during a storm. Under such conditions there are two modes of procedure; either reduce your exercise by slowing travel, or stop and improvise a shelter under which the clothing may be changed. It is in this connection that the A in the formulae becomes important. A. Apprehend the danger and difficulty; anticipate it and prepare for it. Make necessary adjustments before the acute need for them occurs. This applies to the protection of the body, the hands and feet.

CARE OF THE FEET

Proper care of the feet is extremely difficult in cold climate, for two reasons: All types of "civilized" footwear are as yet inadequate since they do not lend themselves readily to adjustment. The feet, because of the relatively large area of skin area in relation to mass involved, are more sensitive to temperature influences than other parts of the body, except the hands.

A common error is to have footwear too tight, thus hampering blood circulation and limiting air circulation. Snug fitting footwear such as might be required for comfort and protection when walking long distances while carrying heavy loads will not be a requirement for Weather Bureau employees on normal duty, and since there will be at base headquarters (at the western stations at least) an entire absence of "feminine appeal", the occupants at those bases need have no compunction to taking a shoe or a boot of a size larger than usual. Select a size not so large as to ruin socks through sloppiness nor snug enough to restrict circulation.

Free spread and exercise of the foot bones will not cause permanently enlarged feet. In fact many persons who have worn soft-soled, loose native footwear for years in the Arctic have, by developing flexibility and slenderness of the feet, worn smaller sizes in shoes on their return to civilisation.

The D part of the formulae should be emphasized in regard to the foot gear. KEEP IT DRY. This will necessitate the development of the habit of brushing all snow from the boots EVERY time you come in from out doors when there is snow on the ground. To the old Sourdough, the manners of a Cheechoka in regard to neglect in dusting the snow from the boots before entering a house is about as disgusting as neglecting to clean the teeth, or eating beans and bacon from the point of a knife, in "civilized" quarters. The consequence of such neglect when on the trail or even about camp are apt to be disastrous. Another important precaution: Clothing, from socks to parka and cap, loses warmth when dirty or greasy, so keep clothing, especially socks, clean.

CARE OF THE HANDS

There is no single specification to cover all requirements for the care and protection of the hands, and the requirement in regard to each individual is likely to differ. Hands, like the feet, carry many sweat glands and give off much vapor which must be allowed to escape if gloves and mittens are to be kept dry for protection. Any form of adequate hand protection in well below freezing temperatures is too bulky to permit acute dexterity in the manipulation of instruments. Light gloves worn inside loose fitting mittens have been advocated in some circumstances, especially when the exposure must take place in high wind. But the well experienced worker will find (if his position is sheltered from high wind as it will be in the case of the Weather Bureau employees) that the most satisfactory procedure is to work quickly and intermittently with bare hands for very short intervals, slipping the hands into warm mittens very frequently; that is, before the hands become chilled. In this manner the work can be accomplished with more speed, skill and accuracy than if attempted with chilled, numbed or gloved fingers. The covering of all metal parts of instruments likely to come in contact with the fingers with adhesive or friction tape will prevent the fingers from sticking or freezing to the cold metal.

The intermittent use of mittens calls for some convenience for holding the mittens close to the body in an accessible position and for this purpose the mittens should be fastened to a string, or tape (provided in the Mitten, Arctic,) which is slung about the neck and braced with a cross strap to keep the mittens from swinging too far from the body and from being lost in the snow or blown away by the wind. A lost mitten can mean the loss of a hand and a useless hand and in some circumstances may mean the loss of life.

HEAD GEAR

The ears are more sensitive to cold than they are to feeling and may become frostbitten without the knowledge of the owner. So, keep your ears covered when the temperature is low and the wind blows free. Hoods are available with both the Overcoat, Parka Type, ^{and} the Jacket, Field, in addition there are Caps, Pile, with ear coverings for use outdoors. But because of the great variability of shapes and sizes of heads, necks, and faces, it has not been possible to provide a standard hood that will fit all individuals snugly. A little effort with a needle and thread will enable each individual to shape the hood to his individual requirements and this will be found well worth while.

A fluffy fur fringe on a hood has a personal appeal but it is useful in only some circumstances. For base observations, when the term of exposure to cold is not expected to be of long duration and when clear and rapid reading of instruments is essential, the ruff which blows in front of the eyes and obstructs the vision is not advantageous, but may be a hindrance.

The exposure of the nose and cheeks of the newcomer to the Arctic, when the temperature is fifty or sixty below zero, may result in the blanching or frostbite of the skin. However, if the "bite" is not sustained for more than a few minutes no permanent injury will result and the skin and associated matter will gradually acquire an ability to withstand the cold to a certain extent, unless, of course, it is deeply frostbitten and develops a sunburn-like scab. This scab will eventually peel and expose a new tender layer of skin which must be given special attention and protection during the first few days of exposure to the cold.

Next to preventing frostbite, the important thing is to discover it as soon as possible. To do this you should soon develop a habit of wrinkling your nose and cheeks, but if they are too stiff to wrinkle they are frozen. However, this does not mean serious injury because you can thaw out a frostbitten nose and a cheek with the palm of your hand or by snuggling it in the crook of your arm where your breath will aid in raising the temperature. It is important to thaw a light frostbite as soon as it is noticed. The face never becomes immune to the tendency to freeze; although the skin will toughen somewhat, it will never out-toughen Jack Frost. NEVER RUB a frostbite. Rubbing with snow is particularly harmful when the temperature is far below freezing. In such cases, lay your bare hand on the frozen part for a few seconds at a time, taking care not to expose the hand until it too becomes cold and numb, or use the hand to direct your warm breath over your face. When the frostbite is thawed, dry the skin with a piece of soft cloth - a handkerchief or the back of the Arctic Mitten, whichever is handiest.

It is quite difficult to determine when a toe or a heel is frostbitten, but a warning of this is a fairly prolonged feeling of chill in the part. A rather quick twinge of pain and then a treacherous numbness is an indication. There is little feeling in a frozen toe or a frozen heel and serious damage to a foot has occurred when the owner didn't realize that it was frozen. If the above mentioned three conditions are sensed it would be well to seek some sort of shelter, remove the boots and socks and change your socks even though they are only turned inside out. If you feel like rubbing a frostbitten toe or heel, be sure that you have a sock on first and don't rub the sock or the injured part so hard as to injure the skin. It is far better not to rub at all. Either thaw the toe or heel with the hand or put on clean socks and warm up the part by smart but not too strenuous exercise. It is well to pay attention to the feet even if they feel only uncomfortably cold. The removal of a boot and turning the socks or a change of a sock's position will relieve pressure which is often the cause of the trouble. Relief from footwear, even for a few minutes (although in doing this the foot itself must be exposed to the cold) is always worth while if it eventually prevents the frostbite of a toe or a heel. A frozen toe is apt to lose its nail - a long and painful process, while a frozen heel may give trouble for the full length of the winter season.

TROUBLE DUE TO BREATHING COLD AIR

There need be no fear of freezing the lungs by normal breathing of the extremely cold air, if you are human. Dogs and horses, working extremely hard in low temperatures might through rapid breathing, chill their lungs, but the intelligence of the normal man will automatically encourage him to restrict the intake of cold air long before the lungs are likely to suffer, except in cases of extreme competitive effort such as skiing or snowshoe racing for large prizes.

SNOW BLINDNESS

Snow blindness is not a result of cold nor of strong sunlight. Most frequently it is the result of exposure to the diffused glare during dense or light foggy weather under which conditions there is a continuous effort to adjust the focus of the eyes on conditions and objects which fail to offer contrasts or shadows. Snowblindness is not real blindness in the sense that you will never see again, but when really snowblind you can not see and the pain of it is one of the most excruciating suffered by men in the polar regions. The prevention is just an ordinary pair of snowglasses, or goggles and a determination to wear them ALL THE TIME one is exposed to the foggy, hazy conditions experienced mainly in the spring of the year, and sometimes in the fall. Snow blindness is not prevalent in the winter, nor in summer, except in the permanently snow covered areas. Eye strain may be a result of exposure to bright sunlight reflected from snow in spring, summer and fall, but such eye strain is not real snow blindness, although it is often spoken of as such. The difference is the reaction of the eyes and the intensity of the pain. Eye strain is a pleasant sensation compared to snow blindness, during which the eyes exude a viscous matter, eyelids become paralyzed and the pain extends throughout the body.

GENERAL HEALTH

Loss of weight is experienced in some cases when men first live in the Arctic, but this is generally due to dehydration; that is, loss of water from the body. Under cool conditions there is no great desire to drink much water and this habit should be cultivated.

It is because of this tendency that it is suggested that soup be served frequently.

COLDS AND DISEASES

In general there is less likelihood of infection of common diseases and germs when living in the north. Some propogandist has spread a story that one can't get a cold in the Arctic. The fact is that colds occur with slightly greater frequency in camps and bases in the Arctic than elsewhere, due possibly to crowded conditions, restrictions in ventilation; the introduction and opening up of supplies which may be germ laden in the house, or, perhaps, because of the lack of certain vitamins and sunlight.

One of the common symptoms of a cold - a "running" nose - is common to most people who must go out in the cold in the Arctic. However, in

the Arctic a running nose is not necessarily a sign of a head cold or sinus trouble, but merely a method of dehydration or the result of slight irritation and stimulation, and the "run" consists mostly of water. Its loss is not harmful nor its presence indicative of disease or bacteria. It can be disposed of without unpardonable offense or danger by a flick of the finger, but snuffling into a handkerchief and nosewiping is likely to damage the tender skin of the nose and cause abrasion or irritation.

PRECAUTIONS AGAINST GETTING LOST DURING BLIZZARDS

There are many tricks in the experienced arctic travellers procedure, but the mention of more than a few is unnecessary in regard to the presumed potentialities of an Arctic meteorologist. The simplest way to prevent getting lost and for the provision of comfort and protection is to build a covered runway from the Operations Building almost to the weather instrument shelter, and also to the shelters used for the operation of pibal and rawinsonde equipment.

In cases where a covered runway is not feasible, a rope should be stretched along the entire route. Although this guide may be required not more than four or five times during a winter season, it provides a margin of safety to observers in extreme weather. Experienced white men and even Eskimos have been known to freeze to death within a few yards of their houses during severe blizzards.

If you are caught in a storm, or fog that is light and obscures visibility so that familiar objects cannot be recognized clearly at a distance, and you feel that it is necessary to make your way back to the base, don't try to hit it "on the nose". Your camp or base will, or should be, established on some part of a conspicuous, extending feature, like a coast, a river or a range. In trying to find your way home be sure that you will strike to one side of it and know which way to turn when you get there. Small details obscured by snowstorm or fog take on queer shapes and appearances. During periods of low visibility in the Arctic, you are apt to get confused and let yourself in for trouble. Always remember that it is easy to get lost in an Arctic storm and many good men have become confused so quickly that they have travelled in circles, lost all sense of control, discarded their clothes and eventually froze to death.

WHAT TO DO IF YOU ARE CAUGHT IN A BLIZZARD

If you can not see at all where you are going and have nothing substantial to guide you, stop, sit down and let the snow cover you or dig into a snow bank if one is handy and wait for better weather.

The only time it is dangerous to sleep in the snow is when you are so tired that your body and senses cannot respond to the warning of cold. Ordinarily, if you are sleeping in the snow, your body will feel the cold and you will waken long before you are in danger of freezing. When awakened and suffering from cold, you can move about within a narrow confine and exercise moderately to warm up before settling down to another quiet snooze. Under such circumstances and with such behavior there is little chance that you will oversleep or suffer frostbite. If you have

been well fed up to the time of exposure, well dressed and not tired out, you could, as have many others, spend several days without food while waiting in the snow for the blizzard to cease or the weather to clear and suffer no serious injury in consequence. Above all, do not wander in a blizzard; but if caught, stay where you are at least until the weather clears.

THIRST AND ITS RELIEF BY EATING SNOW

To try to eat snow as you would eat bread would soon cause freezing of the lips and exhaustion, but to eat snow as you would ice cream and to do so in the same manner, is safe and satisfying. It is necessary to go to some trouble to make ice cream and it is necessary to go to some trouble to prepare snow for eating, at least you have to mush it up in your hand until it is somewhat the consistency of ice cream before you begin to nibble it, or melt it in your mouth. There is one special precaution. If it seems likely that you will be exposed for long periods without means for melting snow by use of a stove and a pot, start thawing snow in your hand and eat it long before you have any feeling of thirst, especially if you are walking and must continue to walk. If you are just sitting, waiting for a blizzard to end, you should also start melting snow early and continue to use it slowly so that you may take enough of it to prevent trouble through dehydration and to keep yourself conditioned to complete the journey when the blizzard is over. Naturally, snow in such quantities as to deteriorate your body comfort or reduce your resistance to cold should not be eaten. It is assumed, however, that when waiting for a blizzard to end you will not be even in a semi-exhausted condition since you should have stopped and sought shelter long before you began to feel exhausted.

THE MAINTENANCE OF YOUR OWN MORALE IN CAMP THROUGHOUT LONG PERIODS

There is nothing more enervating than discontent, self-pity and idleness. A sure prevention from boredom is strenuous work and a variety of interests. An expression of a variety of interests does not necessarily mean that you should go to the other fellow and tell him all you know about his line of business. Rather it should be expressed by going to the other fellow and asking him to tell you what he knows. This might encourage him to ask you some day about your own work and you will find interest in telling about it.

An objective of each individual in a small group should be to be entertained by someone else's technical or scientific affairs, not personal affairs, because the repetition of personal affairs, likes and dislikes and favorite stories, soon becomes boring.

There are many outlets for moods of depression, or oppression, when one is in the Arctic. Drawing in color, no matter how poor the execution, is a good form of relief. Reading becomes, if too long sustained, monotonous, unprofitable and mind addling. The eyes see, but the mind does not record and one can soon get into a habit of scanning for the sheer false comfort of mental numbness. Much better than over-reading is the practical investigation of material things. Remember the myriad forms of life that are active during the summer months in the Arctic. Those forms do not become extinct in the winter for they are hibernating, waiting

for warmth. You can, by bringing them into the house, introduce the warmth necessary to awaken new life, and the life development of many forms of plants and small forms of animal and insects is fascinating. A knowledge of it is never a loss nor a burden, even if you do not intend to use it professionally. Many forms of life found in the Arctic can be thawed in the house in winter, developed a stage then put out to freeze again without permanent injury. Thus it becomes possible to take up a study when opportunity arises, to discontinue it temporarily if other matters intervene, and take it up again from where you left off if you so desire. In such ways you can occupy the winter season so that time simply "flies". There is less excuse for boredom under such circumstances than there is in urban or suburban centers.

TO SUMMARIZE

- A. Apprehend all dangers, anticipate difficulties.
- B. Keep busy.
- C. Keep cool, especially when exposed to the cold.
- D. Keep your clothing dry. Drink more water than you feel like drinking.
- E. Exercise, but not too strenuously.
- F. Feet should receive special attention even though such attention is troublesome.
- G. Keep well groomed. Living in the Arctic is no reason to tolerate uncleanliness.
- H. Handle things smartly, you can do this best with warm, bare hands.
- I. Individuality counts for much in the Arctic, but expression of individuality should not interfere with complete co-operation with your associates.
- J. Don't be a jerk and feel that your personal affairs and prowess as a story teller are going to impress favorably your associates for months on end.
- K. Keep a diary of all things worth recording and keep it orderly, so that in after years it may profit others in addition to yourself.
- L. Looseness is a good axiom in the Arctic, except as applied to loose-mouthed and loose-thinking.
- M. Mind your own business, but don't be unmindful of the other fellows' desires and privacy.
- N. Noses are the only objects that should be drips in the Arctic. They will be.

PHOTOGRAPHY

Photographic equipment is supplied for obtaining pictures of scientific interest showing observation techniques, landscape and activities which are peculiar to the Arctic. An important part of the observational program will be to take photographs of meteorological phenomena of all types, particularly aurora displays, ice formations, snow depths, rime formations, sun dogs, and others rarely seen anywhere else but in the Arctic.

The 4" x 5" camera should be used for general photographic work. In addition, an exposure meter has been provided to obtain correct exposures under varying lighting conditions. Tests of meter readings should be checked by developing and printing trial exposures. However, it is not expected that all photographs taken will be developed at the station.

Moving pictures covering the unloading of vessels, setting up stations and other related activities should be taken. It is especially desired that color moving pictures be obtained of aurora displays or other meteorological phenomena when the subjects show movement. This will add to the value of the photographic record. Of course, moving pictures should not be made of subjects which can be represented equally as well with still pictures.

The primary purpose of the 35 mm. camera is to prepare many series of color film strips for making lantern slides. Each series should be carefully planned as to continuity, completeness and correct exposure. Sequences of the following types are desired.

- (1) Meteorological phenomena (aurora, blizzard, etc.)
- (2) Observational techniques, showing in detail each step involved in taking an observation under arctic conditions.
- (3) Recreational activities in the Arctic.
- (4) Normal arctic living conditions.
- (5) Landscape scenes showing seasonal differences.
- (6) Physical arrangement and location of station in sequence.

Detailed records of all photographs should be kept, giving date, time, exposure, light conditions and any other pertinent information. Exposed film should be carefully marked for identification and the notes for each exposure included although the photos are known before development to be of poor quality.

Technical Bulletin SIG 189, entitled "Cold Weather Photography", is provided for guidance and other technical manuals have been included with each piece of equipment.

Personnel are reminded that all photographs taken by Weather Bureau personnel on the Arctic Project are property of the U. S. Government and that approval of the Chief, U. S. Weather Bureau must be obtained before their release for publication and public information.

INSTRUCTIONS FOR REPORTING RADIO RECEPTION CONDITIONS

Requested by U. S. Bureau of Standards.

NANOOK log sheet (Type 1) is intended for use in recording data on reception of one to four network stations using the frequencies listed in the first column. Spaces are provided for recording the intensity "S", the readability "R", and the fading characteristics "F" of each frequency at regular intervals during each day. Observations at hourly intervals are desirable, but not necessary if inconvenient. Whatever daily schedule is followed should be adhered to as faithfully as possible throughout any one calendar month.

Normally the stations observed will be those with which contacts are regularly scheduled. However, if other stations, not contacted, can be listened for, data for these may be recorded also.

Under "S" the reading of the "S-meter" on the receiver is recorded. If possible, the transmitting operator should hold his key down while the receiving operator reads his "S-meter". When the intensity is variable the average reading should be recorded.

The signal readability is rated according to the following scale and recorded under "R":

- 1 - unreadable
- 2 - barely readable, occasional words distinguishable
- 3 - readable with considerable difficulty
- 4 - readable with little difficulty
- 5 - perfectly readable.

The fading characteristics are rated as follows and the rating recorded under "F":

- 0 - steady
- 1 - shallow fades
- 2 - infrequent quick deep fades
- 3 - infrequent gradual deep fades
- 4 - frequent deep fades
- 5 - flutter fading

It is desirable that all stations make observations at approximately the same times; i.e., follow the same daily schedule.

INSTRUCTIONS FOR REPORTING AURORAL DATAOPERATION NANOOK

NANOOK log sheet (Type 2) is intended for recording hourly auroral data and reception characteristics of WWV and one or more other distant stations operating on regular known schedules.

Under "Aurora", the brightness, elevation position, direction, and activity of auroral displays are recorded in columns headed B, E, D, and A respectively. The code numbers for these characteristics are as follows:

<u>Code</u>	<u>Column 1-B Brightness</u>	<u>Column 2-E Elevation position</u>	<u>Column 3-D Compass direction of maximum intensity</u>	<u>Column 4-A Activity*</u>
0	No aurora			
1	Very faint	Small patch well above horizon	N	Slight
2	Faint	Barely above horizon	NE	Moderate
3	Moderate	Up to 30° above horizon	E	High
4	Bright	Up to 60° above horizon	SE	
5	Very bright	Up to 90° above horizon	S	
6		From horizon overhead to 120°	SW	
7		From horizon overhead to 150°	W	
8		From horizon overhead to horizon	NW	
9		Sky in all directions		
X	No observation possible during darkness due to seeing conditions.			
D	Daylight			

*By activity is meant the complexity and motion of the display. Slight activity means only a glow, luminous surface, or at most steady arcs and bands seen. Moderate activity means arcs or bands with ray structure, draperies, or corona seen. High activity means any and all forms seen pulsating, changing color, and moving.

Under remarks the form, color, and direction of motion (e.g. E-W) should be given if activity is reported as moderate or high.

The attached sheet gives a description of various types of auroral displays.

The column headed "Observers" is for recording the observers initials.

The intensity "S", fading characteristics "F" and background noise "N" are recorded for each of WWV's four frequencies.

Under "S" record the average "S-meter" reading.

Rate the fading characteristics on the same scale as that given for use with form type No. 1.

For the background noise rating, tune the receiver to an adjacent frequency where no carrier is heard and record the S-meter reading.

One or more other stations may be observed and rated like WWV in the remaining spaces on this form. A station in the standard broadcast band, 500 to 1500 kc, and a very low frequency, such as that used by NSS for time signals, are suggested.

Auroral Description

- G Glow: A faint glow near the horizon resembling the dawn, usually white or greenish color but sometimes red. This is often the upper part of an arc whose lower border is below the horizon.
- HA Homogeneous Arc: The arc is usually diffuse above and sharply defined below. It may be near the horizon or quite isolated high in the sky. Sometimes several parallel arcs occur and may be connected at one end by a sharp curve. The color is usually greenish-yellow or nearly white. The arc often gradually climbs up the sky and may later have a very luminous irregular lower border and soon after break into rays (type RA). The arc is usually set almost at right angles to the magnetic meridian. Often only parts of arcs are visible.
- HB Homogenous Band: This band has a more irregular form than the homogeneous arc. It may vary from narrow to very wide. The lower border is often irregular and sharply defined. It may sometimes consist of a segment of approximately semicircular shape which may move across the sky in the direction of the usual arcs HA. The band may have folds and resemble a large curtain. These usually change into bands with ray structure (type RB). The color is usually bluish-white.
- PA Pulsating Arc: Arcs, or parts of them, may flash up and disappear rhythmically with a period of 1 to 30 seconds. The color is usually bluish-green.
- DS Diffuse Surface: A diffuse veil or glow, often over large parts of the sky. It may resemble clouds and often appears after rays or curtains. The color may range from violet-white to an intense red.
- PS Pulsating Surface: A diffuse patch or surface which appears and disappears rhythmically. Near the zenith the boundary may be sharper. Often appears with or as part of a flaming aurora (type F).
- RA Rayed Arc: An arc with ray structure. A quiet homogenous arc often becomes very luminous and then breaks into rays. The rays may be short or long and may vary in brightness along their length.
- RB Rayed Band: A band with ray structure. Resembles the bands types HB but composed of rays. The rays may be close together or scattered along the band. Several parallel bands may appear. Near the magnetic zenith the bands may form a corona.
- D Draperies: When bundles of rays become long the band often assumes the form of a curtain or drapery. The lower border is often more luminous. Near the zenith they have a fanlike form or partial corona.
- R Rays: Rays resemble searchlight beams in a dusty atmosphere. The rays may appear isolated or in great bundles. They are usually greenish-yellow but may be red. Rays often appear with other auroral forms.
- C Corona: When rays approach the magnetic zenith they seem to converge to a point because of perspective. The corona may be formed by long or short rays, by bands or by draperies.

F Flaming Aurora: A quick-moving form consisting of waves of luminosity moving toward the zenith or of invisible waves which cause parts of arcs, bands, or patches to appear and disappear rhythmically. Often appears after strong displays of rays and curtains and is often followed by the formation of a corona.

FORECAST PLANS

Weather forecasting in the Northern Arctic is a comparatively new field in meteorology. It is anticipated that it will receive increasing emphasis by the meteorological services of the United States in the future. The Weather Bureau Arctic Project is a highly significant beginning in this new field.

While it is recognized that the very nature of the project will impose definite limitations on the amount that can be accomplished during the first year, it is also recognized that much can and should be done.

These forecasting objectives fall into two general categories. The base station forecaster should be in a position to prepare:

- a. General Forecasts for purposes of camp security, and
- b. Airway forecasts for periodic air operations.

The first objective (a) is, of course, primarily concerned with the tracking and/or development of intense storms in the area. For example, the camp should be alerted for approaching blizzard conditions in order to prevent hunting parties, etc. from being away from the base during the storm.

The airway forecasting program (b) will for the most part, be concerned with the flight operations to establish advanced stations in the spring, and for assistance to periodic flights for mail deliveries, etc.

To accomplish these forecast objectives, continuity of synoptic weather charts and reports must be maintained at the base station.

Communication channels will be established for transmitting the following data to the base station:

1. To be sent daily via CAA and/or AACS, through Greenland or Alaska
 - a. 1230Z surface analysis for the hemisphere north of 60°N.
 - b. 1230Z 700 mb. analysis northern hemisphere.
2. To be sent daily from Fairbanks, if possible, a selection of Alaskan, Canadian, and additional reports as available, north of 60°N for 1230Z surface and 1600Z upper air.
3. To be sent via the CAA and/or via AACS a sequence of stations N of 60° for 1230Z surface and 1600Z upper air not included in 2 above.
4. To be sent to BW1 to BW8 to the Arctic project daily a selection of Greenland, Iceland, and eastern Canadian 1230Z surface reports and 1600Z upper air reports.

From these data the following charts will be prepared:

- a. Surface maps.

- b. 700 mb. charts (analyses combined with available upper air data).
- c. Supplemental charts as needed.

The forecaster will maintain a daily journal of his forecast activities including, insofar as is practicable, the following items:

- a. Forecasts made--descriptive discussions of reasoning employed.
- b. Forecast verification--including "post-mortem" analysis.
- c. Any intuitive correlations noted.

This program will necessarily be subjected to some revision depending upon actual conditions at the stations.

The forecaster at the base weather station is the senior scientific representative and he is therefore responsible for the supervision of all scientific phases of the expedition. Upon completion of his assignment the forecaster will render a complete report of the various observational activities conducted during the preceding year.

WEATHER TRANSMISSION SCHEDULES

1800Z

1230Z surface reports (approximately 100 stations or 600 groups)

0000Z

1230Z Surface analysis (approximately 500 groups)

1230Z 700 millibar analysis (approximately 500 groups)

1230Z Surface reports (delayed reports)

1600Z Upper air reports (approximately 10 stations or 250 groups)

Note I - Contents of sequence groups of reports are attached in Appendix A.

Note II - It is anticipated that when Spring air operations commence it will be necessary to increase the data received by the Arctic base station to a minimum of two synoptic times daily.

Note III - The analyses listed in (I) above are now available from the Army only.

MOBILE EQUIPMENT

Mobile equipment has been provided for the following purposes:

- a) To form landing ramps for unloading purposes, if necessary.
- b) For the transportation of supplies and equipment from the beach to building sites, camps and supply depots.
- c) For the distribution and erection of radio supplies and antennae.
- d) For the preparation of landing strips either on ice, or on land, if possible.

The allotment of service for the various items of mobile equipment will be the prerogative of the Weather Bureau.

TABLE OF EQUIPMENT

In order that all mobile equipment may be in readiness for immediate operation on landing in the Arctic it is planned to have such equipment winterized and serviced before loading in Boston, Mass. Their first service on shore should be the preparation of a landing ramp, if necessary, followed by construction of a road from the beach to the building sites and supply dumps. The hauling of building supplies and shelters should then proceed, but with particular attention given to the radio antennae and equipment, in order that a communication system can be established and in working order before the supply ship leaves.

It is expected that sufficient drivers will be available during landing operations, to man the mobile equipment during 24 hours a day. Every effort should be made to keep the machinery in use constantly for whatever purpose required.

Fuel for these operations should be drawn from the supply ships' bunkers in order to conserve shore supplies as much as possible. After the departure of the ship, all mobile equipment should be used sparingly in order to conserve fuel.

It is not intended that Weather Bureau employees should maintain the temporary landing strip in perfect condition continuously, but rather to take such precautionary measures as may be required to permit the strip to be made servicable at any time at short notice.

D-7 Tractors, with blades. For use as a bulldozer and hauling.

To permit the towing of other equipment, D-7 tractors will not be equipped with winches. Separate power driven winches are to be provided. These winches are primarily for use at the satellite stations, but they

may be used at the main bases during the first season for such purposes as may be necessary.

Graders.

Mechanized graders will be used for preparing landing strips on the ice or on land. However, it should be remembered that snowdrifts are likely to accumulate in front and behind any obstruction and the snow removed by graders or bulldozers should not be banked beside the runway, but spread out to form a smooth-surfaced mound. It may also be disposed of in filling ravines or other depressions. To assist in doing this work scrapers, road, 8 cu. yd., Towed Type, are provided and which may be used together with other snow removal equipment, when necessary.

Road rollers, used as snow rollers.

Road rollers have not been provided for the sole purpose of impacting the snow on the overall surface of the strip, although they might be used for such purpose. Such rollers are primarily for use in impacting snow or hard slush in small depressions which may, if left unfilled, create a hazard on the strips, either on land or ice.

Airborne tractors, with blades.

Airborne tractors with blades are provided primarily for use at the satellite stations. However, one such tractor should be retained for main base station use; while the others should be reserved for delivery in good order at the forward stations. This does not mean, however, in unusual circumstances, such as during the unloading period, that some of this mobile equipment should lie idle if it can be used profitably.

M 29. Weasel. Not amphibious.

An M 29 at each main base, together with the airborne tractors, should provide ample equipment for hauling light, one-ton sleds for moving supplies, personnel and equipment. However, the use of the M 29's should not be extravagant since the life service of these vehicles is known to be limited and they will be needed during spring operations.

It is not intended that the M 29's or light tractors will be at the disposal of personnel for jaunts or excursions unrelated to the technical operation of official business. Short holiday trips, also those made to satisfy curiosity and gain exercise should be made by employees on foot.

Pumps, gasoline engine driven.

It is expected that the pumps will be found invaluable in many circumstances. The proximity of fresh water supply to buildings during the spring, summer and fall seasons is doubtful and hauling of water when there is no snow on the ground would involve the use of mechanical equipment and expenditure of precious fuel. In sub-zero temperature periods, when water

pumping is not practicable, the pumps may be used when necessary for the fueling of airplanes although the provision of two pumps at the station will permit one to be used exclusively for moving gasoline.

Pumps, Wobble.

On many occasions and when the use of mobile equipment is limited, the wobble pumps which are worked by hand, will meet the requirements and thus conserve the use of the power driven gasoline pump. A wobble pump may also be used to provide the bathroom with water from the galley or elsewhere.

Gasoline, winch, towing.

The gasoline winch, towing, light, including the steel cable, is semi-mobile equipment which is intended primarily for use at satellite stations, if necessary, where mobile equipment will be limited. It may also be used for hauling loaded sleds up steep grades; hauling supplies from an unloading point using an endless cable, the down haulage section of which may be rope.

It may also be used, for hauling fuel drums cast overboard from the supply ship to the shore, with the aid of a long sling, or net, and for hauling such drums from the water edge to higher levels on the beach. To facilitate this operation some drum slings should be made available.

Athey wagons, crawler fitted.

Athey wagons, crawler fitted, may prove invaluable in carting supplies from the beach to the building sites and supply dumps. They may be hauled by the D-7 Cats or, if the grade is not too steep, by the lighter mobile equipment.

MOBILE EQUIPMENT

AIR FORCE PROVISION

With the expectation that the provision of landing strips on the ground, is possible, the Air Force will provide and make available the following equipment.

Router, Road, cable operated, 3 teeth.

While primarily intended for use on earth surfaces, this machinery may also be found useful in preparing surfaces on ice for landing strips. The router especially is valuable for the removal of wind-packed snow drifts which may offer considerable resistance to the bulldozer carried on the D-7 tractors and to the graders and scrapers.

Scraper, Road, towed type, capacity 8 cubic yards.

This vehicle is also primarily intended for use in removing earth and its replacement. It may serve also in clearing snow from landing strips having ice foundations. The road scraper may also serve for transportation

of supplies from the beach to the building sites or supply dumps and may be towed by heavy or light tractors in cases where the grade is not steep.

Compressor, Air, Truck mounted. Gasoline engine driven.

Compressor, air, gasoline engine driven will be used primarily to supply air for pneumatic drills which may be required for the clearing of a ground landing strip. It will serve also when used together with associated machinery, to set dead-men, spikes, or pegs for guying radio antennae masts and houses. It may be an absolute necessity for use in pumping up hydraulic equipment and tires on aircraft and care should be taken to see that fittings are provided for such purpose.

Welding set, gasoline engine driven, trailer mounted.

These sets may be found valuable for the repair of tractor treads and other parts of the machinery as well as for repairing aircraft.

MOBILE EQUIPMENT

NAVY PROVISION

For various unloading operations the Navy expects to use certain mobile equipment which may be left on the beach for subsequent use. It is understood that the Weather Bureau will be permitted to use such equipment when necessary.

Crane, Crawler type, mobile

The Crane, Crawler type, will be found particularly useful for placing heavy generating sets and other heavy equipment in position.

Stone boats or sleds, heavy duty.

The Navy will have available two or more heavy duty stone boats. If suitable landing ramps are available, the stone boats may be loaded while inside the LCM's and hauled directly from the seagoing craft to the beach and thence to the building site or supply depots.

AUTOMATIC WEATHER STATION-TDN EQUIPMENT

TDN equipment is an automatic weather station which is designed under normal conditions to transmit weather observations on fixed radio schedules without attention over a period of three months. Its usefulness is unique because the equipment can be installed at remote places from which weather observations are highly important and essential to fill in gaps of the synoptic network.

Equipment for one complete automatic weather station will be provided for testing under arctic conditions and instructions for its installation and operation will be included with the TDN apparatus. Location of the automatic weather station will be left to the discretion of the Official in Charge of the Main Base.

So far TDN equipment has operated successfully in tropical and temperate climates but its usefulness under arctic conditions has not been determined. It is desired that the tests include the following:

(a) Effect of extreme temperatures on the mechanical functioning of instruments, generators and radio transmitters.

(b) Adequacy of range of meteorological instruments.

(c) Accuracy of meteorological instruments, i.e., comparison of transmitted with observed data.

(d) In order to obtain information relative to range and reliability of radio reception of TDN equipment, the Central Office should be advised of established radio transmission schedules and frequencies with recommendation for action to arrange reception of the signals by other Danish or Canadian outlying stations.

(e) Effect of snow and frost accumulations on radio and meteorological elements.

(f) Effect of geomagnetic disturbances on reliability of radio transmission of signals.

(g) Servicing needs of equipment with specific reference to mechanical reliability.

(h) Tests of antennas set up in true geographic direction between communication bases compared to antennae set up in other directions.

In view of potential use of automatic weather station equipment for future arctic meteorological research, it is desired that the final report on TDN apparatus should give a complete picture of its efficiency as now constructed and include recommendations concerning those features requiring further development for arctic use. The report may be prepared separately or kept in the station log.

MISCELLANEOUS NOTES ON CONSTRUCTION OF TEMPORARY AND PERMANENT
SUPPORTS FOR INSTRUMENTS

Part I: Instrumental Installations

Installation of the instruments in Arctic regions presents problems not usually encountered elsewhere and it will be necessary to make adjustments at the time of installation.

(a) Instrument Shelters

The advance station is being furnished a Cotton Region shelter which will serve to house exposed instruments, and also another similar shelter for raob purposes.

At the main station a large instrument shelter has been provided for exposure of all instruments except the raob equipment. A Cotton Regional shelter also has been furnished for use in making raob base-line check.

A prefabricated plywood shelter has been provided for the rawin equipment.

In some Arctic localities, difficulties have been encountered with snow accumulating in the shelter. By removing portions of the shelter floor is the best way to overcome this, although some stations have been successful by making the floor louvred.

When making the permanent shelter support, a separate 4" x 4" post should be installed extending through the shelter floor for attaching the Townsend Support. Leave at least a 1" space between this post and the shelter floor so as to prevent any vibration of the shelter being transferred to the maximum and minimum thermometers.

Temporary Installations

At the advance stations, it will be impossible to dig holes for erecting shelter supports except during the summer. Accordingly, a temporary shelter support must be provided until warmer weather permits the erection of a permanent support.

Before erecting a temporary shelter the ground should be cleared of snow and leveled in order that the support can rest on the ground. Obtain four 4" x 4" timbers at least 4 feet in length and brace the timbers to stand in an upright position to form the shelter support. Then anchor the support with guy wires to a couple of helium cylinders placed on the ground underneath the shelter.

(b) Surface Wind Instruments

Each station is provided with a 12' support which should be erected on the building housing the meteorological equipment. A platform about 3' x 4' should be built and placed on the Quonset Hut near the end. Having it 4' long will permit nailing it to two steel ribs and also provide adequate support. The 12' support should be well guyed as during the course of a year dozens of trips will be made to the wind vane and anemometer. Run the guys so they do not interfere with climbing the support. It is suggested that a permanent ladder to the platform be installed.

The wind vane contact box should be provided with a canvas shirt or a circular wooden block to prevent snow from clogging the contacts and rollers. The skirt, however, should be loose fitting around the support so that no drag is present.

All wind vane and anemometer contacts should be cleaned weekly with crocus paper. Unless the anemometer is subject to soot and dirt from local sources, it need not be cleaned monthly. Once every three months is sufficient.

(c) Pibal Instruments

The theodolite metal stand should be anchored at a distance far enough from all obstructions so that if possible the entire horizon is clear above an elevation angle of 6° . The best way to fasten the stand is to dig down two 8" x 8" posts and place a piece of 2" x 10" across the top. Use large lag screws to secure the stand to this foundation.

Permanent telephone connections between the office and the theodolite site should be made. This can be arranged by means of a plug system so that a telephone set may be kept indoors when not in use. The best lighting arrangement for the theodolite is the flashlight adaptation which can be kept in observer's pocket during the flight.

To determine true north one should use the stars as instructed in Circular O. Some local check point should be located so that the wind vane can be periodically checked and, of course, a daily check of the theodolite is necessary.

No particular pibal shelter has been planned but one should be made out of surplus lumber. It should be 6' square with a 2' opening on the leeward side for entrance into the shelter. Each side should be about 5' 6" high. A door may be built to close this entrance but past experiences indicate it will prove more bothersome than useful. A light plywood cover may be built to place over the shelter to keep the snow out.

If hydrogen is used storage space and inflation facilities should be remote from the living quarters.

(d) Precipitation Instruments

The weighing rain gage and the 8-inch gage should be placed far enough from all buildings and obstructions to be free from their influence. A Snow-Frost Table should be placed on a post about 4' high and used to determine depth of snowfall except when winds are blowing.

(e) Instrumentation in the Meteorological Office

Instrumentation in the meteorological office will compare with that in any other office and usual rules will be followed.

OBSERVATIONAL TECHNIQUES AND CARE OF INSTRUMENTS

(a) Psychometric Data and Maximum Temperature Readings.

In extremely cold temperatures, the observer should read the thermometers as rapidly as possible so as to prevent the heat radiating from the body effecting the temperature readings. When working on instruments in the shelter, this source of heat may raise the temperature around the instruments several degrees which should be compensated for, hence, readings should be taken before the work is begun and after it is completed.

Care should be exercised in wetting the wet bulb muslin or a thick layer of ice will be formed and erroneous readings will result. Once each day (oftener if ice entirely evaporates in less than 24 hours) the muslin should be submerged in warm water and permitted to remain until all ice is melted. When the water container is removed a uniform layer of ice will form on the wet bulb.

In extremely cold temperatures when 0.1° variation in reading thermometers makes a large difference in dew point and relative humidity, extreme care should be taken. A hair hygrometer element in good condition will give a more accurate reading of the moisture content than the wet and dry-bulb method. If the hair element appears to be working satisfactory, it may be used to determine the relative humidity. Using the current temperature, determine from the tables (or low temperature slide rule) the proper value for the depression. Subtract the depression from the current temperature thus determining the dew point temperature.

Once a week the hygrometer should be calibrated indoors. After the instrument has assumed room temperature, the relative humidity in the room should be obtained by psychrometer and the hygrometer reset at room humidity. If the humidity in the room is low, it should be raised by steam to approximately 50% before calibration is made.

To calibrate the hygrometer at higher humidities a tight box can be built which has a shelf for the hygrometer and a place for two thermometers which can be read outside the box. The hygrometer is placed on the shelf and hot wet rags are placed in the bottom of the box and the box closed. The wet-bulb thermometer should have wicking in a container of water so that it will give a wet bulb reading. When the temperatures reach equilibrium they will be noted along with the time. The relative humidity in the box can then be computed and compared with the hygrometer.

In these calibrations the exposed clock should be left outside and the calibration made with a spare clock, to overcome the possibility of the clock's being stopped by moisture absorbed indoors.

There will be days when the mercury in the maximum thermometer will not thaw out (the melting point of mercury is - 38°F) and no reading will be obtainable. If the thermograph is functioning properly, it may be used during these conditions but if there is doubt as to its accuracy, the highest temperature of the various alcohol thermometer readings recorded during the day will be used for the maximum temperature.

During times of rime icing, the louvers, in the shelter may close up completely. Erroneous temperature readings can result from such a condition which, of course, should not be tolerated any length of time. Sweeping off the shelter at 6 hour intervals will prevent large accumulations but during severe icing conditions it may be necessary to do this every hour. Care should be exercised in cleaning the shelter to avoid vibration of the instruments. In such cases they should be read before and after cleaning the shelter to determine if any errors were caused due to vibration.

(b) Thermograph Records and Care of Clocks.

Changing thermograph sheets is a trying ordeal in very cold temperatures and can be best done by wearing a pair of gloves. Always use care in handling the cylinder with bare hands or frost bite will result.

The oil in all clocks, for use outside, has been completely removed and none should ever be added. It is advisable to keep all outside clocks out of any heated rooms since the moisture picked up while indoors is likely to give trouble when the clocks are taken out into the colder temperatures.

Use caution in winding the clocks in cold weather as they do not stand the same treatment in the Arctic as they do in temperate climates.

(c) Snow-Frost Measurements.

The snow-frost table should be brushed clean at each 6 hourly observation. Brushing this board clean of snow and frost at each observation time will also permit using it to determine if any ice crystals have fallen. Good common sense should be used along with this board for observing the amount of snow fall. This instruction supplements but does not cancel instructions in Circular N.

(d) Rawinsonde Observations.

To compute the geodynamic heights for the radiosonde surface use the formula given on the reverse side of WB Form 1154-A.

The ground check for humidity should be made with the humidity value obtained from the hygrometer. Experience in the Arctic has shown that at low temperatures humidity measurements for a calibrated hair element are in general more accurate than those obtained from the psychrometer. Parachutes will not be used.

(e) Pibal Observations.

A hot water bottle is a practical aid in keeping the hands warm during a pibal run. One for the feet is also helpful if the shelter is free from snow or frost. Extreme caution should be taken to keep the feet dry.

To facilitate handling of the theodolite adjustments it is advisable to wrap several layers of friction tape around the control knobs. Candles and

- 3 -

lanterns will usually be used for lighting of the pibal. In cases of high winds the water activated cells may be used. At least a dozen runs should be made using the water activated cells so that information is available as to their practicability and performance. A parachute will not be used with the electric cells.