NOT FOR PUBLICATION

INSTITUTE OF CURRENT WORLD AFFAIRS

93 Grantchester Meadows
Cambridge, England

16 May 1960

JT-8

Antarctic Air-Drop

Mr. Richard H. Nolte
Institute of Current World Affairs
366 Madison Avenue
New York 17, N. Y.

Dear Dick,

Since this article for the Polar Record was written the second phase of the air supply operations of the 1959-60 Antarctic summer season came and went. Or, more simply, the C-130's came and went.

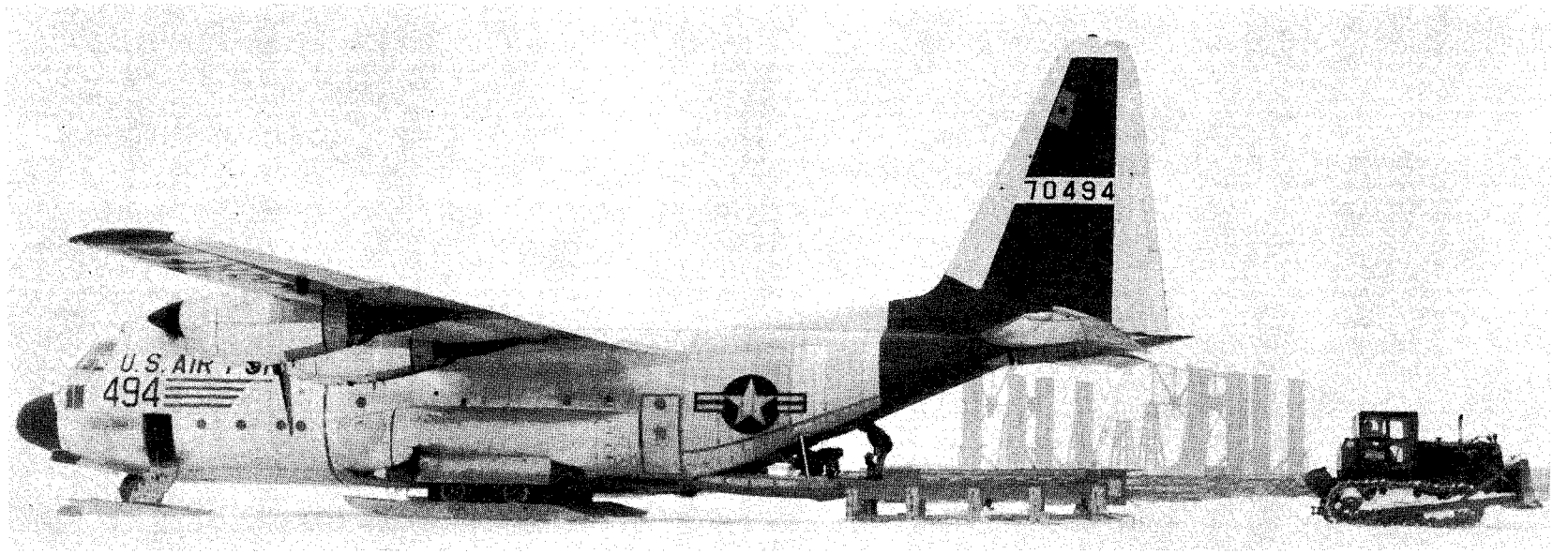
The Lockheed C-130 Hercules is the first four-engined ski plane ever built, and it is also the largest. Its ski-wheel landing gear incorporates main skis which are each 20.7 feet long by 5.5 feet wide, with a nose ski of equal width but only half the length. On its skis, at its maximum gross weight of some 62 tons, the plane has a bearing pressure of 5.5 psi. The cargo compartment is 9 feet high, 10 feet wide, and 41½ feet long. The plane is stated to have a range of 1500 statute miles with a payload of 15½ tons, cruising at 335 mph.

The first major task assigned to the Ski-130's was the delivery of about 10,000 tons of materiel for the construction of two radar stations on the Greenland ice cap in the summer of 1959. These operations, involving landings on unprepared snow surfaces at elevations between seven and nine thousand feet, pointed the way for a similar enterprise in Antarctica. The 61st Troop Carrier Squadron of the 9th Air Force, which had done the Greenland flying, assigned seven Ski-130's to the Antarctic project, named Operation Iceflow. The first of these aircraft flew from Christchurch, New Zealand, to McMurdo Sound on 23 January 1960.

Two days later the first landing was made at Byrd Station, with the South Pole Station receiving its first Hercules landing on the 28th. In the period from 25 January to 5 February 58 sorties were flown, delivering 160 tons of cargo to Byrd and 250 tons to the Pole. Although the two stations are about the same distance from McMurdo, the average net load was but 5.3 tons per flight to Byrd Station as contrasted with 8.9 tons per flight to the Pole.

The advantages of delivering cargo by landing an aircraft rather than by air drop are obvious. Parachutes and drop rigging have cost nearly a million dollars a year, some materiel is inevitably lost or damaged, and the task of recovering drops is one that must be experienced to be appreciated.

In a letter he wrote to me just before the last C-130 flight to the South Pole, Ed Flowers, the present Scientific Leader, made a few comments about the operation. Ed was senior meteorologist at the Pole in 1957, the station's inaugural year, and is more than well acquainted with air drops and their recovery. (He's also the only man I know of who has been hit by an airdrop -



FOR USE PMS WEDNESDAY, OCT. 28, 1959

SKI-130s SHOW MASS AIRLIFT TO ICECAP FEASIBLE --- Men building bases for America's Distant Early Warning Line are seen unloading heavy steel structures from the U.S. Air Force's new Ski-130 parked atop Greenland's Icecap. Flying through temperatures as low as 40 below zero, snow clouds, and fog, and landing on snow-covered ice, the prop-jet Lockheed ski planes in their first operational assignment delivered 23 million pounds of material from Sondrestrom, Greenland, to the DEW Line sites. Now safely home at Sewart Air Force Base, Tenn., the Tactical Air Command crews and planes soon will leave for the Antarctic to support a Navy expedition.

#

News Bureau. LOCKHEED - Georgia Division. Marietta, Georgia. 202469.
Photo No. RF 3208-1

a felt crash pad which came loose from an extremely poorly rigged load hit him squarely on the head, luckily doing no worse damage than a broken tooth.) Of the Ski-130 operations Ed had this to say:

> The 130's have made about 25 landings here and at Byrd in the past week in some of the worst weather imaginable, but without incident. We here are all convinced that this is the way to deliver things. At times they have come in 10 to 15 minutes behind each other, and seldom do they have to wait for the preceding one to be off-loaded. Depending on the cargo, the off-loading requires about fifteen minutes on the average.

The Globemasters did a mammoth job in establishing and resupplying the South Pole Station entirely, and Byrd Station partially, by air drop, but with the advent now of the Ski-130 it's to be hoped that the parachute will be a thing of the past in the delivery of cargo to the inland stations.

Very sincerely,

Jack Tuck

Jack Tuck

Reprinted from THE POLAR RECORD, Volume 10, Number 64, Jannary 1960

UNITED STATES AIR-DROP OPERATIONS IN ANTARCTICA, 1956–59[1]

BY JOHN TUCK JR.

[*MS. received* 24 *October* 1959]

CONTENTS

Introduction

The establishment of the United States IGY stations at the South Pole and in Marie Byrd Land, with their subsequent annual re-supply, has involved the delivery of men and matériel by air on a scale previously unknown to Antarctic operations. "Amundsen–Scott" station at the South Pole was planned and executed entirely by air, with C-124 Globemasters of the United States Air Force air-dropping the great bulk of the required cargo tonnage, and Navy ski-equipped R4D and P2V aircraft delivering personnel and non-drop cargo. In the case of "Byrd" station, the bulk of the cargo was planned for delivery from "Little America V" by tractor train, assisted by ski-equipped aircraft carrying personnel and some cargo to the station, and giving logistic support to the tractor trains. A considerable amount of matériel was also air-dropped by the C-124's, both cargo for the station and fuel for the tractor trains. In addition, a small amount of cargo was air-dropped for the setting up of the small summer station on the South Pole route (formerly "Liv Camp", now the "Naval Auxiliary Air Facility, Beardmore Glacier").

"Little America V" was closed in January 1959 and, except for one tractor train in 1960, the entire "Byrd" station resupply devolves upon the aircraft operating from McMurdo Sound.

"N.A.F. McMurdo"

The "Naval Air Facility",[2] McMurdo Sound, was built during "Deep Freeze I", 1955–56, and serves as the Antarctic operating base for heavy wheeled aircraft. These are mainly the 90-ton Globemasters of the 53rd Troop Carrier Squadron, eight to ten of which fly to the Antarctic from New Zealand

[1] In this article, examples are drawn primarily from the "Deep Freeze II" operations at the South Pole station, with which the author had personal contact. Opinions expressed are his own.

[2] Formerly "Williams Air Operation Facility".

every summer. There is frequent rotation of aircraft between McMurdo and New Zealand, and there are usually four on the ice at a time.

Among the facilities provided by "N.A.F. McMurdo" are those for the berthing and messing of air crews and support personnel, the handling and rigging of drop cargo, the storage and handling of aviation fuel, communications, radar and homing equipment, and a limited maintenance and repair potential. The runway itself, on the bay ice, is equipped with ground controlled approach gear, air control tower, and ancillary runway facilities. The deterioration of the runway surface during the height of the summer, and the possibility of the bay ice breaking out, has led to scheduling wheeled aircraft operations between about 1 October and mid-December. During "Deep Freeze II", the first C-124 arrived at "N.A.F. McMurdo" on 20 October 1956 and the first drop in the area of the South Pole was made on the 26th, over three weeks prior to the arrival of the Advance Construction Party. The drop, of 24 barrels of diesel fuel, was never located. Full-scale drop operations began after the landing of the Advance Party at the South Pole on 20 November, by two Navy R4D's. They continued until mid-December, when depleting stocks of aviation fuel at "N.A.F. McMurdo" and the rapid deterioration of the runway surface, forced suspension of wheeled aircraft operations, and the planes returned to New Zealand. Repairs to the runway were carried out under the supervision of Dr Andrew Assur of SIPRE, and with these and later colder temperatures, Globemaster operations were able to be resumed on 9 February 1957, and the drop missions to the South Pole and "Byrd" stations completed.

The following season, the first Globemaster arrived at "N.A.F. McMurdo" on 4 October 1957. Air drops were begun on the 17th, and ended on 4 December. Five missions were scheduled for February 1958, but were not carried out due to the late arrival of the C-124's at "N.A.F. McMurdo", and the breakout of the bay ice, which carried most of the runway out to sea.

During "Deep Freeze IV", 1958–59, the Globemasters began to arrive at "N.A.F. McMurdo" on 4 October 1958, drop missions began on the 8th, and were completed on 12 November. During "Deep Freeze 60" drop missions took place between 16 October and 12 November 1959. Such early completion of the air-drop programme, highly desirable operationally, entails the shipment to "N.A.F. McMurdo" of the bulk of the South Pole and "Byrd" station cargo during the preceding season. Supplementary items can be flown in from New Zealand; during "Deep Freeze 60", for example, a total of 446 tons of cargo were airlifted to "N.A.F. MacMurdo".

The following summary shows the size and scope of air-drop operations during Operations "Deep Freeze II, III, IV and 60":

	Net tons air-dropped			
	South Pole station	"Byrd" station	Other	Total
"Deep Freeze II"	650	209	23	882
"Deep Freeze III"	271	428	15	714
"Deep Freeze IV"	410	478	—	888
"Deep Freeze 60"	538	769	24	1331

	Drop sorties flown			
	South Pole	"Byrd"	Other	Total
"Deep Freeze II"	64	18	2	84
"Deep Freeze III"	22	32	1	55
"Deep Freeze IV"	30	33	—	63
"Deep Freeze 60"	41	56	2	99
	Average net tons per sortie			
"Deep Freeze II"	10·2	11·6		
"Deep Freeze III"	12·3	13·4		
"Deep Freeze IV"	13·7	14·5		
"Deep Freeze 60"	13·1	13·8		

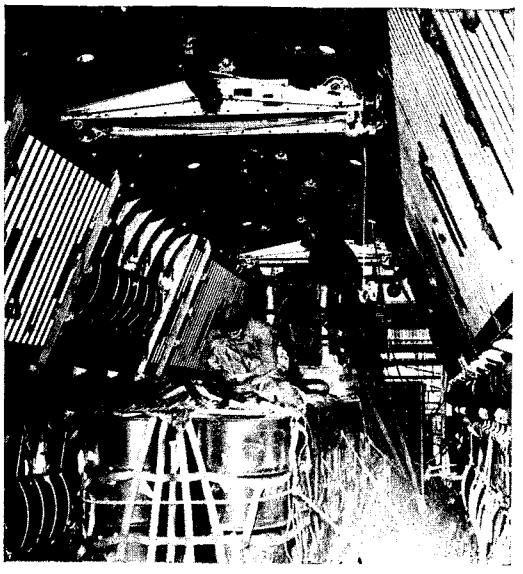
Cargo preparation

The construction material and first year's supplies for the South Pole station were packed and rigged for drop at "N.A.F. McMurdo"; the same was true of the cargo air-dropped at "Byrd" station and to the tractor trains. Subsequently, many items have been pre-packed for air-drop, some being actually rigged in New Zealand, others at McMurdo Sound. This work is carried out by personnel of U.S.A.F. Aerial Port Squadron.

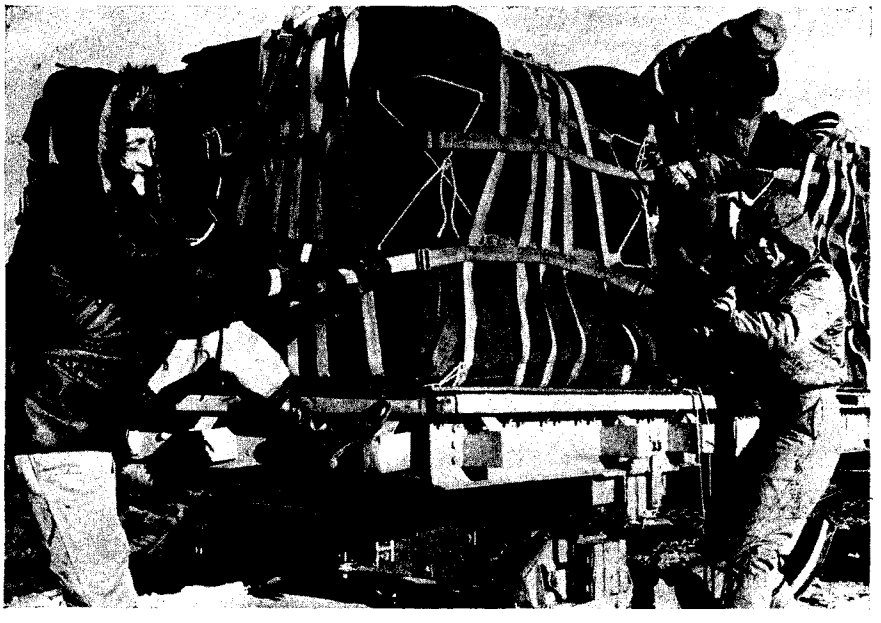
The C-124 drops cargo through a well in the belly of the aircraft, which limits the size of material that can be dropped to 144 in. long, 80 in. wide, and 106 in. high. This necessitated cutting all floor and roof trusses for the South Pole station buildings into two, and making splice plates for their reassembly. A few over-length items which did not lend themselves to being cut and spliced were delivered by ski-equipped aircraft. These maximum dimensions, however, still permit the dropping of such substantial items as D-4 Caterpillar tractors (with bulldozer blade, trunnions and low ground pressure tracks removed), and Weasels (with pontoons removed). These, and other heavy machinery and cargo, are dropped on metal platforms, which are carried in the drop well of the aircraft. The 4 ft. by 8 ft. building panels were dropped in bundles of ten, in a special harness to which the parachute is attached. General cargo is most frequently packed in felt-lined canvas A-22 drop containers, each of about 64 cu.ft. capacity, with some items being crated in 64 cu.ft. boxes which are dropped in a harness. Light, small loads can be dropped in any of several small canvas containers, or by special slings.

Cargo in the above categories is delivered by standard parachute drop, utilizing parachutes of 24 ft., 64 ft. and 100 ft. diameters, which have load capacities of 300 lb., 2200 lb. and 3500 lb. respectively. The 24 ft. parachute is used for the small containers, the 64 ft. primarily with the A-22 container, and the 100 ft. (costing about $1200) with the metal drop platforms. Up to five 100 ft. parachutes may be used for heavy items, such as the 9-ton D-4 tractor. As it has not been feasible to airlift the parachutes out from the South Pole by R4D or P2V, because of load limitations, they have been used but once, making the operation a costly one.

POL (petroleum, oil, and lubricants), in 55-gallon drums, was first delivered using the metal drop platforms, 24 barrels to a platform, with two or three 100 ft. parachutes attached. This method was abandoned, largely because of



Connecting parachutes to four-barrel harnesses of POL in aircraft

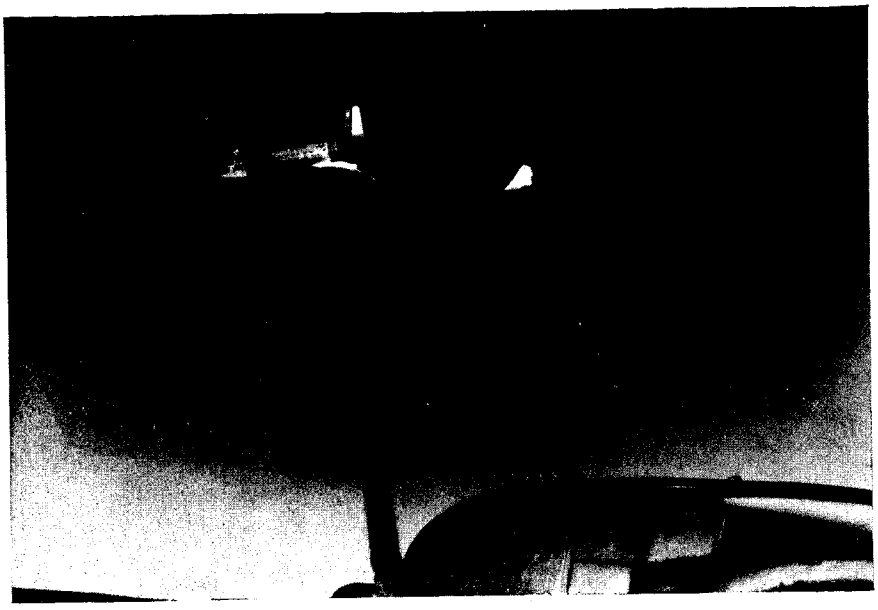


Strapping up an A-22 drop container. Preparing matériel at "N.A.F. McMurdo" for air-dropping by U.S.A.F. Globemaster aircraft

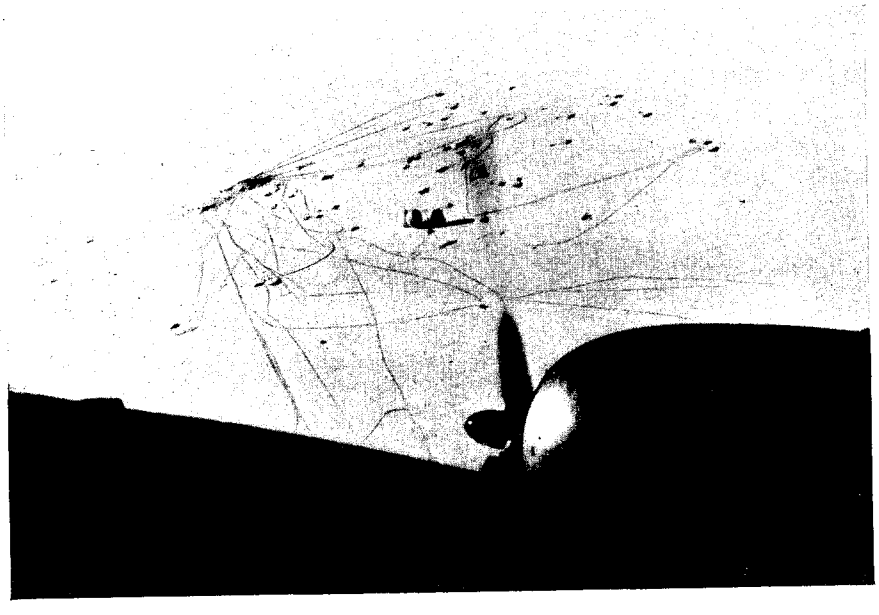
United States air-drop operations in Antarctica, 1956–59

Official U.S. Air Force photographs

(*Facing p.* 24)



Tractor just after leaving aircraft. One pair of 100 ft. parachutes are about to inflate, the second pair are still deploying from the aircraft



Tractor after landing safely. The tracks seen are from the recovery of earlier drops.
Air-drop of a 7-ton D-2 Caterpillar tractor at the South Pole station

Official U.S. Air Force photographs

the high percentage of failures, and four barrel harnesses were dropped on 64 ft. parachutes. A trial free-drop of six barrels of diesel fuel had resulted in four of the six rupturing, so no further attempts were made to free-drop POL. Somewhat later, stabilized free fall of fuel was tried, and as it proved successful this method was adopted for all POL drops. For this method, a small "ribbon" parachute is used, which slightly slows the rate of descent and ensures that the cargo will land upright. These are attached to four-barrel harnesses, with padding on the bottom and, though the barrels land fairly hard and generally nearly bury themselves in the snow, there is seldom any damage.

The free-drop method has been used primarily for lumber, which is dropped from a low altitude in bundles strapped together with metal bands. Upon impact, the bands break and the lumber scatters. Although there is some breakage, the loss is small and more than made up for by the saving in drop equipment.

During the early drop operations at the South Pole, "quick-disconnects" were used, which were designed to release the parachute when the bundle landed, and thus prevent its being dragged by the wind. These did not prove reliable, however, frequently not operating at all and occasionally doing so in mid-air, so their use was discontinued.

Drop zone layout

At the South Pole station, the drop zone is to the grid south[1] of the base, with the drop "T", a target of fluorescent cloth, placed about 500 yd. south of the camp. The ski runway, oriented approximately grid north-south, with its mid-point roughly 500 yd. to the grid west of the station, serves as a timing point for the aircraft on their drop runs, normally made from grid west to east. Drops seldom land much short of the "T", but they have been known to land a considerable distance beyond. Trail flags, set out at known distances from the "T", have been used as range markers to aid in the location of streamers or free-falls,[2] and to assist the ground drop controller in more accurately advising the aircraft of where the drops land.

Ground control

During the major part of the construction period, November to December 1956, an experienced Air Force drop controller was at the South Pole station; subsequently, this function was fulfilled by the Military Leader. Radio communication with the aircraft was at first maintained with either a hand, battery-powered, V.H.F. transceiver, or with the normal station high-frequency radio, and later by means of an aircraft type V.H.F. transmitter set up in the visual observation dome of the aurora tower. Use of the aurora tower, begun in October 1957, offered the great advantages of protection from wind and

[1] As all true directions at the geographic South Pole are north, the grid system of directions is used. Grid north is in the direction of the 0° meridian; grid south 180°; grid east 90° east; and grid west 90° west.

[2] See p. 28.

cold, and a 25 ft. height-of-eye, giving much greater perspective over the drop zone and its environs. It was also equipped with a separate radio for communication with the station Weasel.

The primary functions of the drop controller are keeping a record of the drops, noting the location of streamers and free-falls, which might otherwise become lost, and informing the pilot of drop accuracy and any malfunctions. He can also give a "negative drop" order if the aircraft is manifestly off the mark, or if ground personnel are not ready to receive a drop. Decisions with regard to the course, speed and altitude of the aircraft, and the timing of drops, are the responsibility of the aircraft commander.

Drop procedure

The number of aircraft dropping during a 24-hour period ranged as high as four at the South Pole station, though three was the normal maximum. Because of the limited number of personnel and amount of equipment available to handle the incoming matériel, present Task Force recommendations are for a maximum of two aircraft a day at the South Pole and three at "Byrd" station.

A flight advisory message is usually received prior to the departure of aircraft from "N.A.F. McMurdo", and communication with the aircraft established well before arrival. The aircraft are equipped with radar, and the stations have homing equipment, though that at the South Pole station was not always reliable; however, aircraft seldom have any real difficulty in locating the station.

Drop runs are normally made from grid west to east, parallel with the line of buildings, and slightly downwind from them. With the prevailing wind at the South Pole being from the grid north-east quadrant, the drops are therefore being made somewhat cross-wind. The drop altitude varies from about 1500 to 2000 ft., hence drops may drift well to the downwind side of the drop zone.

After the discontinuance of the use of "quick-disconnects", whenever the surface wind was sufficient to cause dragging (i.e. over 10 knots), the Weasel was stationed downwind from the drop zone with a crew who chased the drops as soon as they landed, and cut the parachute risers. This method proved quite satisfactory. Only one known drop got away, and that because the Weasel was temporarily out of commission and the "negative drop" was not given. It was later recovered 25 miles away. At "Byrd" station, where winds are considerably higher than at the South Pole, the problem has been more acute, and reports cite cargo recovered as much as 94 miles away, while a number of drops were completely lost.

The number of bundles dropped each pass varied from one to ten or more, mainly according to the type of cargo. Four bundles appeared to be the most satisfactory number to prevent too great spread on the ground, and to facilitate the task of the Weasel crew when there was a dragging wind. Upon completion of a drop run, the aircraft circles while the next group of bundles is being

prepared for release. When two or more aircraft are overhead at the same time, they may alternate on drop runs. After each pass, the ground controller informs the aircraft of the results.

Drop accuracy varied from excellent to highly disappointing. Wind, particularly when a parachute is carrying less than its rated load, and occasional delays in releasing cargo, were the main causes of inaccuracy. A high degree of accuracy was, however, common.

Recovery

At the South Pole station, recovery of drop cargo is effected by Weasel and D-2 tractor; "Byrd" station has in addition D-8's and Sno-Cats. At the South Pole, the 9200 ft. altitude causes a reduction in vehicle engine power, but the Weasel is still capable of hauling in one or two loaded A-22 containers, and the D-2 much heavier loads. After cutting the parachute loose from an A-22 container, the shackle to which it was attached can be hooked directly to the Weasel, and the D-2 can hitch on to fuel harnesses in the same manner. Small items are hauled in by sled, as is free-fall lumber. The only drops which the D-2 could not drag in were the 24-barrel platforms of fuel, weighing about 6 tons, which had to be broken down into two loads.

Cargo which has streamed in or free-fallen (other than the intentionally free-dropped lumber) must first be dug out, either by hand or by tractor, the latter method being preferred for obvious reasons. Then, if the container is not too badly disrupted, it can be dragged out of the hole and on into the station, otherwise it must be unloaded piecemeal and put on a sled.

Malfunctions

Of the various types of malfunction which may be encountered in parachute drops, two are of particular concern to the recipients of the cargo: streamers and free-falls. In the former case, the parachute deploys, but the canopy does not inflate. Instead, it simply streams behind the load. The drag of the uninflated canopy slows the descent slightly, but the load lands very hard and sinks several feet into the snow. The extent of damage depends upon the type of material and how it is packed; many durable items will be wholly or partly salvageable, fragile material will almost certainly be damaged beyond use or repair.

Free-falls occur when the parachute does not deploy, when the load tears loose from the parachute upon opening of the canopy, or when individual items break free from a container.

Damage varies according to the nature of the material and its attitude at impact. Bundles of building panels which free-fell but landed on end were recovered with relatively minor damage, others which landed flat were badly smashed, with perhaps only four of the ten panels being repairable. The most spectacular free-fall was a D-2 tractor which tore loose from its rigging, plummeted about 2000 ft., and buried itself over 30 ft. in the snow, a total loss.

Other malfunctions include canopies which tear or blow a panel, and "Mae Wests", the latter occurring when some of the shroud lines pass over the top of the canopy, giving it when inflated the distinctive shape which evoked the name. In both cases the rate of descent is faster than normal, but well-packed cargo generally suffers little or no damage.

The Air Force's figures for the results of the "Deep Freeze II" air drops are as follows:

Type of delivery	Net tons	Percentage recovered
Stabilized free fall	184	97
A-22 container, 64 ft. parachute	306	95
Metal drop platform	246	89
Special slings	82	91
Free fall [lumber]	64	98
	882 tons	94

The last column represents all material which could be used after recovery, including that salvaged from stream-ins and free-falls. During the February 1957 drops at the South Pole, just over 13 per cent of the total number of individual drops were streamers or free-falls. The number of malfunctions during these operations was less than had been generally expected, and most of the items so lost could be replaced.

During "Deep Freeze 60" the U.S.A.F. plans to make use of C-130 Hercules aircraft, a four-engine prop-jet aircraft with a cargo-carrying capacity similar to that of the Globemaster. If these prove suitable for the landing of cargo at the South Pole and "Byrd" stations, a great saving will be effected through the elimination of drop rigging, parachutes, and lost or damaged matériel.

Bibliography

United States Air Force, Wright Air Development Centre. *United States Air Force Parachute Handbook*, WADC Technical Report, p. 55–265, 1956. Wright–Patteson Air Force Base, Ohio.

United States Air Force. *Narrative Summary Report, Deep Freeze, II*, 1957.

United States Naval Mobile Construction Battalion (Special) Detachment One, *Operation Deep Freeze I and II, Final Report*, Vol. VI, 1957.

United States Navy Task Force 43. *Report of Operation Deep Freeze II*, 1956–57.

United States Navy Task Force 43. *Report of Operation Deep Freeze III*, 1957–58.

United States Navy Task Force 43. *Report of Operation Deep Freeze IV*, 1958–59.