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# TEMPERATURE PROFILES OF AIR TRANSPORTED MATERIAL (U)

by  
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ABSTRACT. Winter flights of MAC aircraft were instrumented to determine the temperatures and temperature profiles to be expected in material during air transport. Flights in 21st Air Force C-141, C-124, and C-133 aircraft from the United States to Greenland and Europe during January are reported herein.

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# NAVAL WEAPONS CENTER AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

M. R. Etheridge, CAPT, USN ..... Commander  
H. G. Wilson ..... Technical Director

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## FOREWORD

This final report covers work conducted during the winter of 1968-69 to determine typical cold weather temperatures experienced by air transported ordnance.

The work was performed under Work Request WR 1-6025 in support of AIRTASK F19.332.301.

This report has been reviewed for technical accuracy by Warren W. Oshel.

Released by  
CRILL MAPLES, *Head*  
*Quality Assurance Division*  
1 October 1970

Under authority of  
G. W. LEONARD, *Head*  
*Propulsion Development Department*

NWC Technical Publication 4828

Published by ..... Propulsion Development Department  
Collation ..... Cover, 25 leaves, DD Form 1473, abstract cards  
First printing ..... 455 numbered copies  
Security classification ..... UNCLASSIFIED

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| DDC                             | DIFF SECTION <input checked="" type="checkbox"/> |
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## ACKNOWLEDGMENT

The authors wish to extend thanks and appreciation to the Headquarters' personnel of the Military Airlift Command at Scott Air Force Base, Illinois; Command Post personnel of the 21st Air Force at McGuire Air Force Base, New Jersey; and the officers and men of the 438 Military Airlift Wing (MAW). Special mention should be made of the efforts of COL Krantz of the 438 MAW. His efforts and attitude contributed significantly toward successful completion of the project. Mention should also be made of CAPT Ballard of 21st Air Force Headquarters. He was assigned this unusual request from MAC Headquarters and got the project off on a successful track. His drive and ability are a credit to the Air Force.

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## INTRODUCTION

Due to the controversy which presently exists over predictions of temperature profiles for air-transported materials, the Quality Assurance Division at the Naval Weapons Center (NWC), China Lake, Calif., was assigned the task of measuring maximum and minimum material temperatures during actual air transportation conditions. The purpose was to provide empirical data which would serve as a basis for more accurate predictions.

It was decided to weigh the measurements as heavily as possible to the cold extreme during the normal routine flights of the Military Airlift Command (MAC).

A request was made to headquarters personnel at Scott Air Force Base, Illinois for NWC personnel to measure cargo temperatures on the most northern flights scheduled during the winter of 1968-69. It was learned that they had an Army-Air Force Readiness Exercise scheduled for the period when NWC personnel would be available. These twin exercises, "Reforger" and "Crested Cap", would require the 21st Air Force, McGuire Air Force Base, New Jersey, to make many flights between the United States and Northern and North Central Europe. It was indicated that flights would be on a catch as catch can basis. The Air Force extended full cooperation to NWC personnel to see that a representative assortment of flights was made available.

Figures 1, 2, and 3 are examples of the aircraft used in this measurement sequence. Figure 1 is indicative of the MAC transport aircraft presently in use that will be used in the future. The other two are used on less than a first line basis.

## MEASUREMENT PROCEDURE

The procedures used to measure cargo temperatures on the in-service Air Force MAC cargo aircraft were such that the NWC test personnel would not disturb the 21st Air Force mission schedule in any way. The program was arranged with MAC Headquarters so that the greatest share of the work load would be Navy responsibility. The NWC personnel were assigned to the cargo aircraft by MAC, Air Command Post (ACP) as air crew members to fly with the NWC instrumentation during the particular mission. The flight engineer was requested to record indicated outside air temperature, altitude, speed and position obtained from cockpit instruments every 30 minutes throughout the flight. The conversion of indicated outside air temperature to true outside air temperature is given in Appendix A.



FIG. 1. C-141.

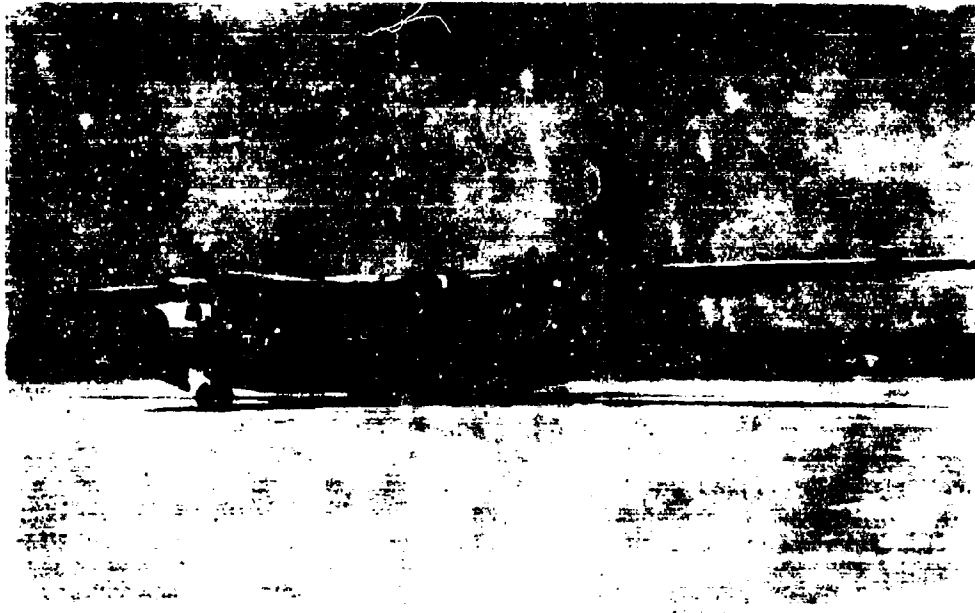


FIG. 2. C-133.

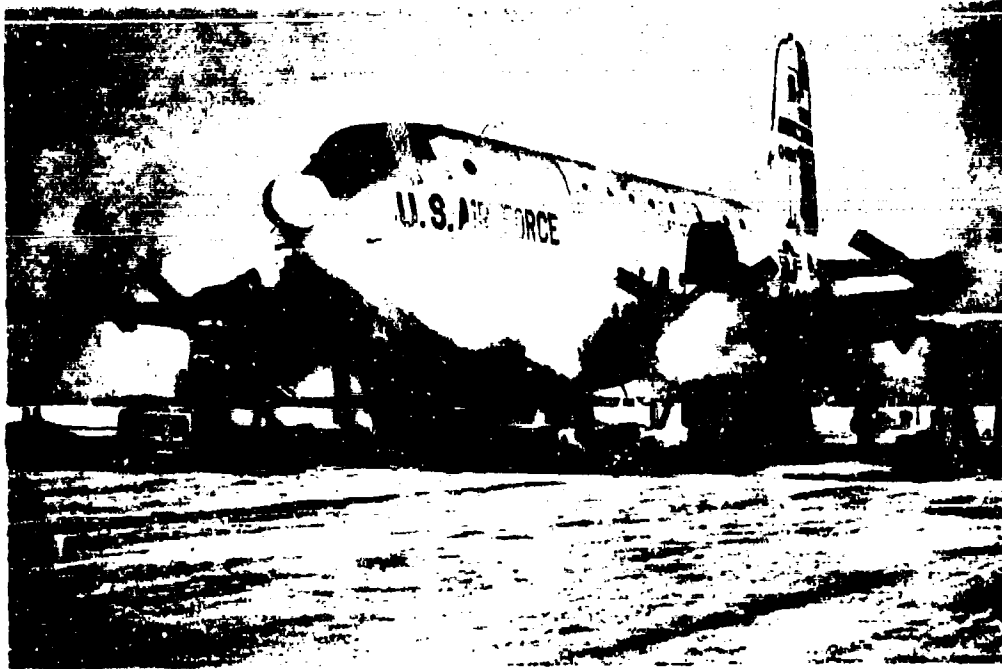


FIG. 3. C-124.

After the aircraft was loaded with cargo and ready for flight, the NWC personnel installed up to 12 thermocouple probes at various depths into the conglomeration of cargo so as to get a better idea of the thermal response of a cross section of that cargo. The probes were connected to the temperature recorder with the thermocouple extension wire. The temperature recorder periodically sampled the data during the entire time power was on the aircraft, both on the ground and during the flight.

The location of the thermocouple probes varied with each flight due to the change in cargo configuration requirements of each mission. The description of the cargo can be generalized as wooden crates, metal or cardboard boxes, or bulk filled sacks tied down to 88 x 108 inch metal pallets.

Figures 4 through 9 show the usual cargo configurations. Where possible, it was intended to send an unattended recorder on a flight between two bases where NWC technicians were located (i.e., McGuire AFB and Rein-Main, Germany). However, in actuality, only one flight turned out that way. The remainder were all accompanied.



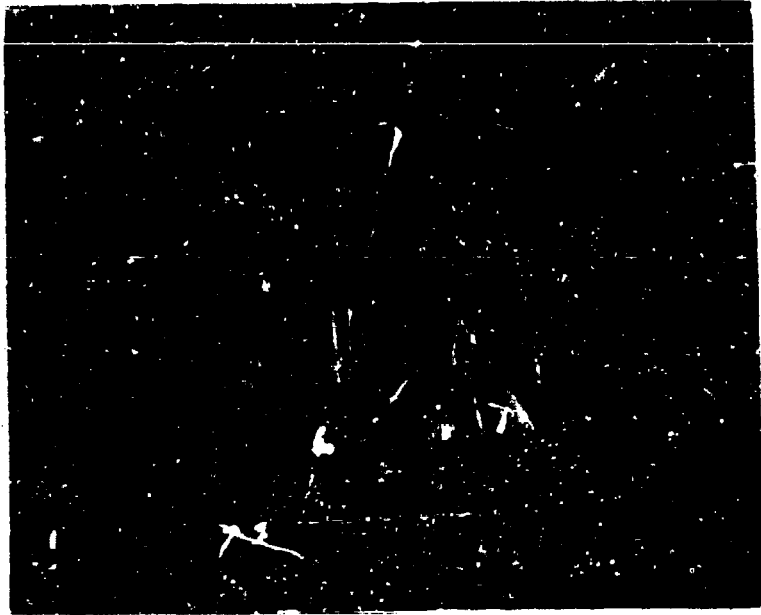


FIG. 4. Bullpup Missile Sections.

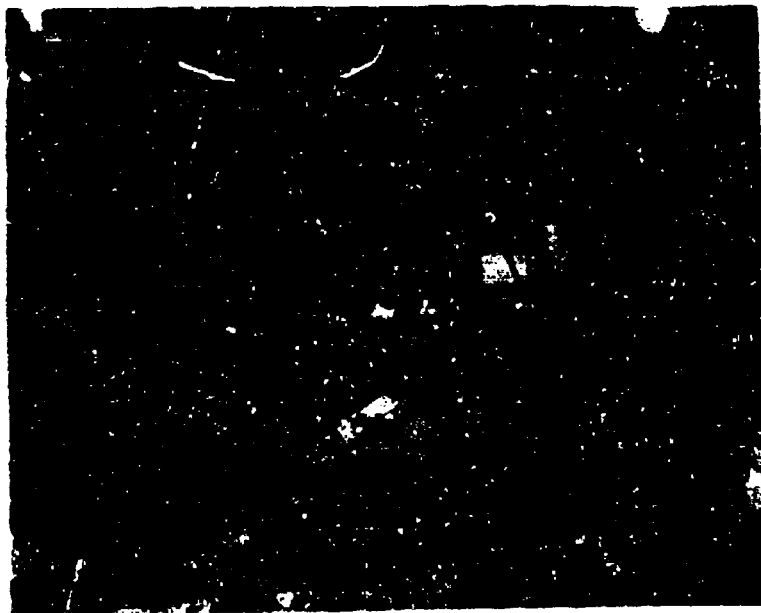


FIG. 5. General Bulk Cargo.



FIG. 6. Liquid Bulk Cargo.

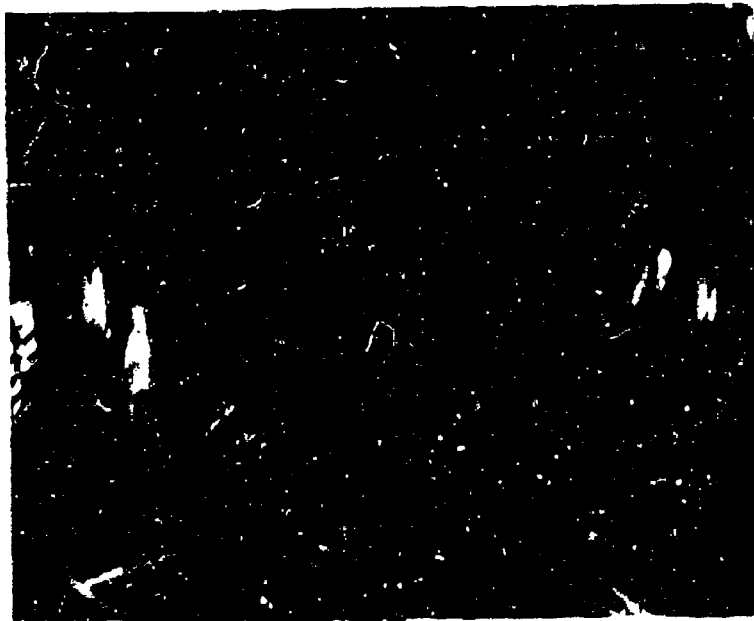


FIG. 7. Mixed Size Miscellaneous Cargo.

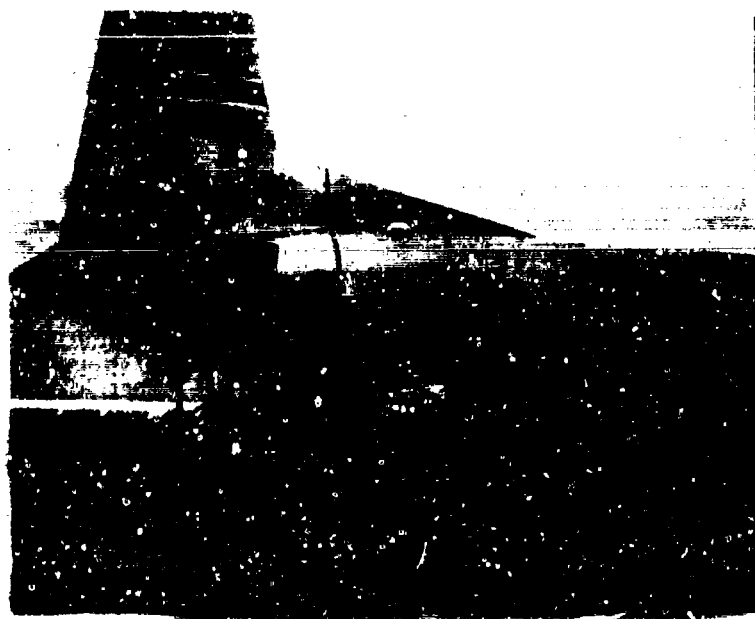


FIG. 8. Cargo on Pallets Awaiting Loading.

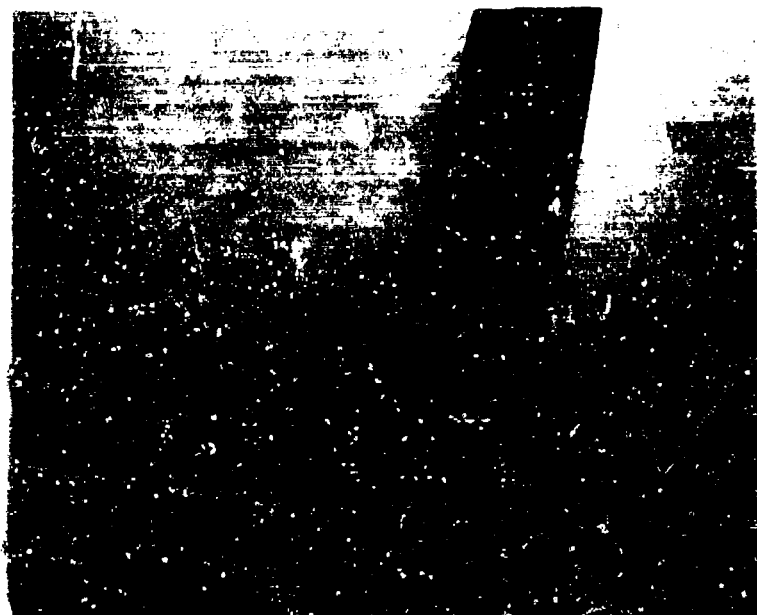


FIG. 9. Cargo Loader in Mating Position.

## INSTRUMENTATION

The equipment, used to measure the cargo temperature during the flights, consisted of a 12 channel multipoint strip chart type recorder, temperature probes and copper-constantan thermocouple extension wire. The temperature probes were a copper-constantan bimetal type thermocouple element, ceramic insulated and encased in a 1/8-inch-diameter metal sheath giving the probe sufficient rigidity to penetrate the cargo bulk.

The recorder was a potentiometer type temperature measuring instrument converted and rebuilt at NWC. The basic instrument is comprised of parts from the Honeywell Model 15 and 16 instruments. The rearranging of the various parts, along with potting of electronic circuitry and conversion to aircraft power result in an instrument that has been successfully used in tactical missiles at velocities above Mach 2.0. The recorder environment on the transport type aircraft was extremely mild compared to the environmental parameters for the recorder design.

The recorder required a power source of 115 volt 60 cycle AC. Modifications including an ERA Transpac IT 2106 inverter were necessary to accommodate the variety of power sources that were conveniently accessible in the cargo compartment of the aircraft. The power sources available on the Air Force C-141, C-133, and C-124 aircraft were 115 VAC 400 cycle, 28 VAC 400 cycle, and 28 VDC. Adapting the recorder to accommodate the different power sources did not in any way degrade the operation or calibration of the measuring equipment, however, as per good measurement practice, the recorder calibration was checked before and after each flight as part of the routine.

The thermocouple extension cable was regular solid conductor copper-constantan 20 gauge lead wire. The insulation was polyvinyl chloride over each conductor. The bundle of six each was covered by a Faraday shield of aluminized Mylar which was grounded to the recorder. The shielded bundle was encased in another thick sheath of polyvinyl chloride. This combination could have given trouble, since it is well known that solid conductor wire will fatigue harden and break when exposed to aircraft vibration. Also, polyvinyl chloride will get hard and brittle at low temperatures. However, this cable was used because prior NWC experience when riding long distances in MAC cargo aircraft had indicated that the cargo compartment would not reach extreme low temperatures. Also, this cable is extremely resistant to rough handling as can be the case during loading and unloading of palletized and unpalletized cargo.

## RESULTS

The cargo temperature data were accumulated on the MAC aircraft from 18 January 1968 to 1 September 1969. During that time, five complete aircraft round trip missions were flown with 13 separate flights or legs where the cargo was either off-loaded or on-loaded at each stop. Table 1 gives a brief flight log. Each leg of the mission may have had a different type of cargo such as boxes or crates on pallets, vehicles, missile motors in shipping containers, mail, aircraft engines, 55-gallon drums containing flammables, etc. During the five round trip missions a total of 93 hours, 55 minutes of flying time was logged, resulting in cargo temperature data on three different types of MAC aircraft. The aircraft used were the C-133, a relatively slow, medium altitude Turbojet aircraft flying at about 260 knots at altitudes of 17,000 to 20,000 feet. A piston-engine-powered C-124 provided data at lower altitudes of 8,000 to 11,000 feet and 200 knots. The C-141, the newest heavy cargo aircraft in the MAC squadrons, provided cargo temperatures for jet aircraft at high altitudes of 35,000 feet or more and speeds of 450 knots.

Figures 10 through 17 give a good idea as to the thermal exposure of general cargo during air transport. Figures 10, 11, and 12 are indicative of the C-141 induced situation while Fig. 13 and 14 show the C-133 and Fig. 15, 16, and 17 the C-124 situations. The shaded areas on the figures are the material temperature-envelopes measured. Notice in Fig. 10, 11, and 12 that the cargo space is held at nominal room temperature. Discussions with Air Force personnel disclosed that the chance of pressure loss, which is related to temperature in the C-141, is extremely remote if line service can be the basis for judgment. This relationship between pressure loss and temperature is discussed later. Only in three instances in the history of the C-141 flights were pressure losses reported. In each case, the regulation emergency procedure of crew going on pressure oxygen until the pilot could get the craft down to a lower altitude was carried out. This being the case the cargo was no longer exposed to the low temperatures of the high altitudes.

Figures 13 and 14 show that for reasons of fuel economy and the flight characteristics, the C-133 does not very often attain even the high altitudes specified in the flight manuals. Notice in Fig. 14, even on an over-ocean flight, the altitude averaged only 19,000 feet.

The low, slow Air Force Reserve C-124 situation is shown in Fig. 15, 16, and 17. Notice that the flight altitude for these situations is between 9,000 and 11,000 feet. This in itself will negate extremes of cold being imposed on the carried material.

Appendix B gives a complete log of flying data hours and a breakdown of the aircraft, its mission, and time in the air during each leg of the mission.

TABLE 1. Flight Log.

| Aircraft          | Flight S/N | Destination   | Flight time   | Total time   |
|-------------------|------------|---|---|--------------|
| C-133             | 2010       | McGuire to Argentina, Newfoundland<br>Argentina to Prestwick, Scotland  | 4 hr 50 min<br>6 hr   | 10 hr 50 min |
| C-124             | 10092      | McGuire to Goose Bay, Labrador<br>Goose Bay to Sonderstrom, Greenland<br>Sonderstrom to Kulusuk, Greenland                                      | 6 hr 20 min<br>5 hr 35 min<br>2 hr 45 min                                 | 14 hr 40 min |
| C-141             | 21036      | McGuire to Goose Bay, Labrador<br>Goose Bay to Rein-Main, Germany<br>Rein-Main to Prestwick, Scotland<br>Prestwick to Azores<br>Azores to Dover | 6 hr 10 min<br>12 hr 10 min<br>5 hr 30 min<br>7 hr 15 min<br>12 hr 15 min | 43 hr 10 min |
| C-141             | 8083       | McGuire to Rein-Main, Germany<br>Rein-Main to McGuire   | 6 hr 55 min<br>10 hr  | 16 hr 55 min |
| C-141             | 40642      | Rein-Main to McGuire  | 8 hr 20 min   | 8 hr 20 min  |
| Total flying time |            |   |   | 93 hr 55 min |

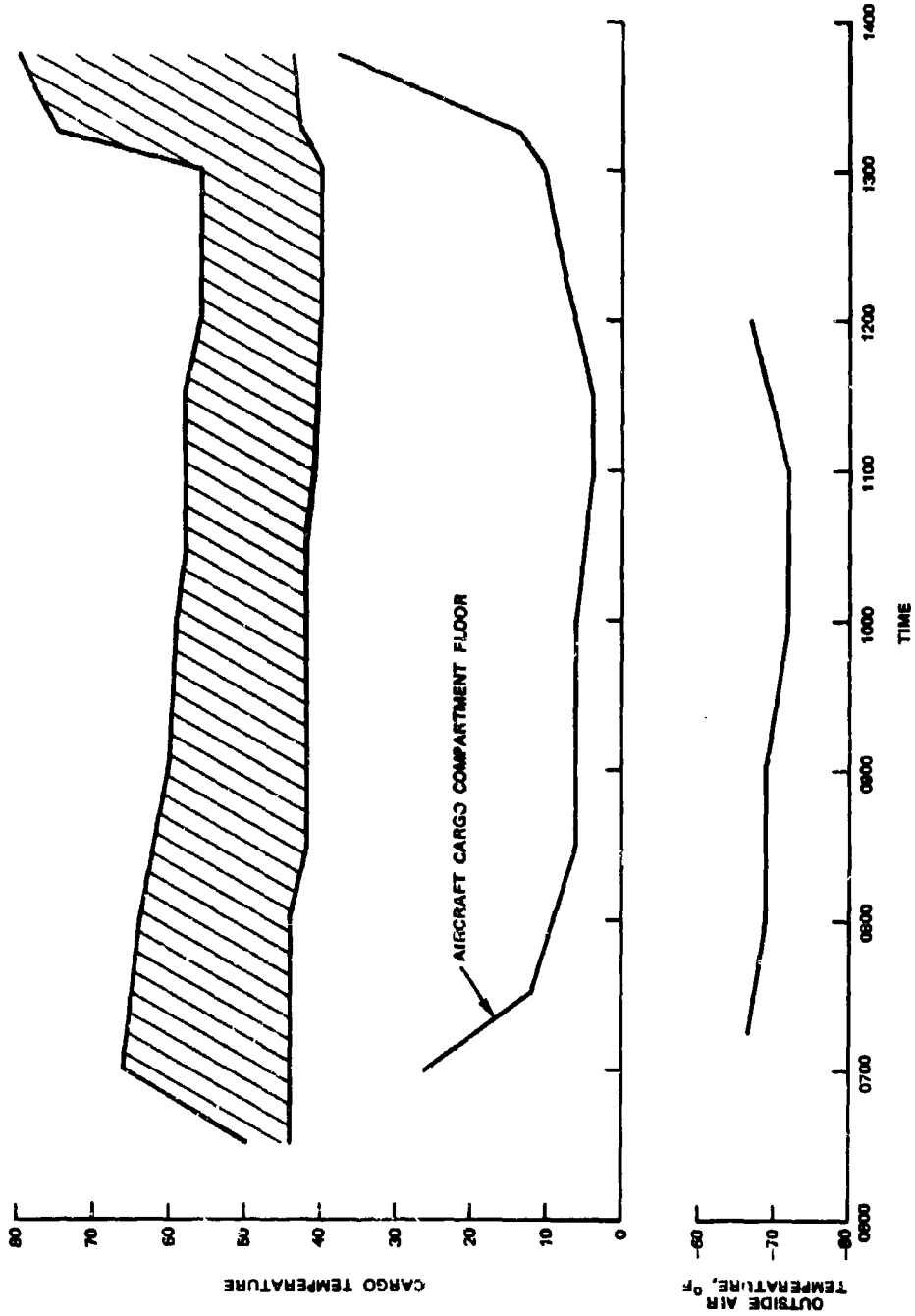


FIG 10. C-141 Flight 08083, McGuire AFB to Rein-Main, Germany (1/18/69).

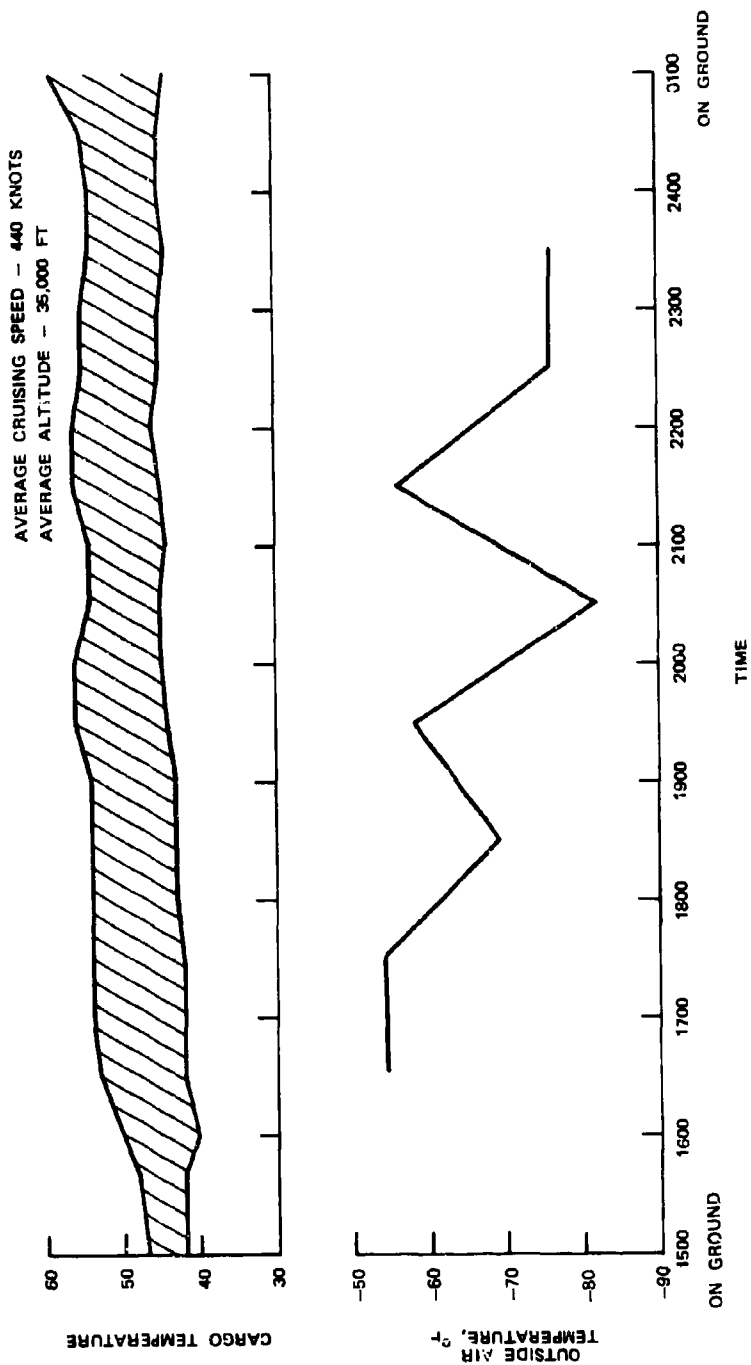


FIG. 11. C-141 Flight 08083, Rein-Main, Germany to McGuire AFB (1/18/69).



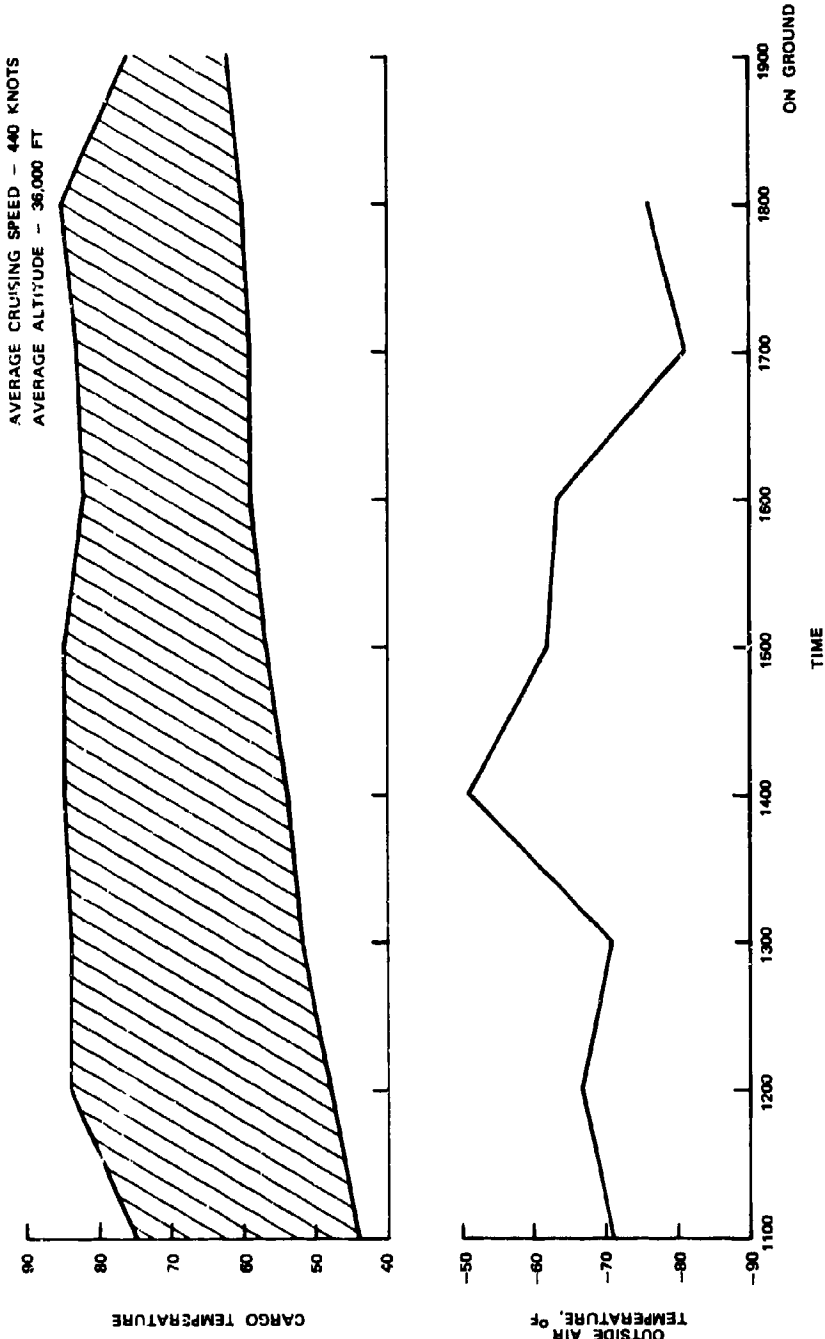


FIG. 12. C-141 Flight 40642; Rein-Main, Germany to McGuire AFB (1/22/69).

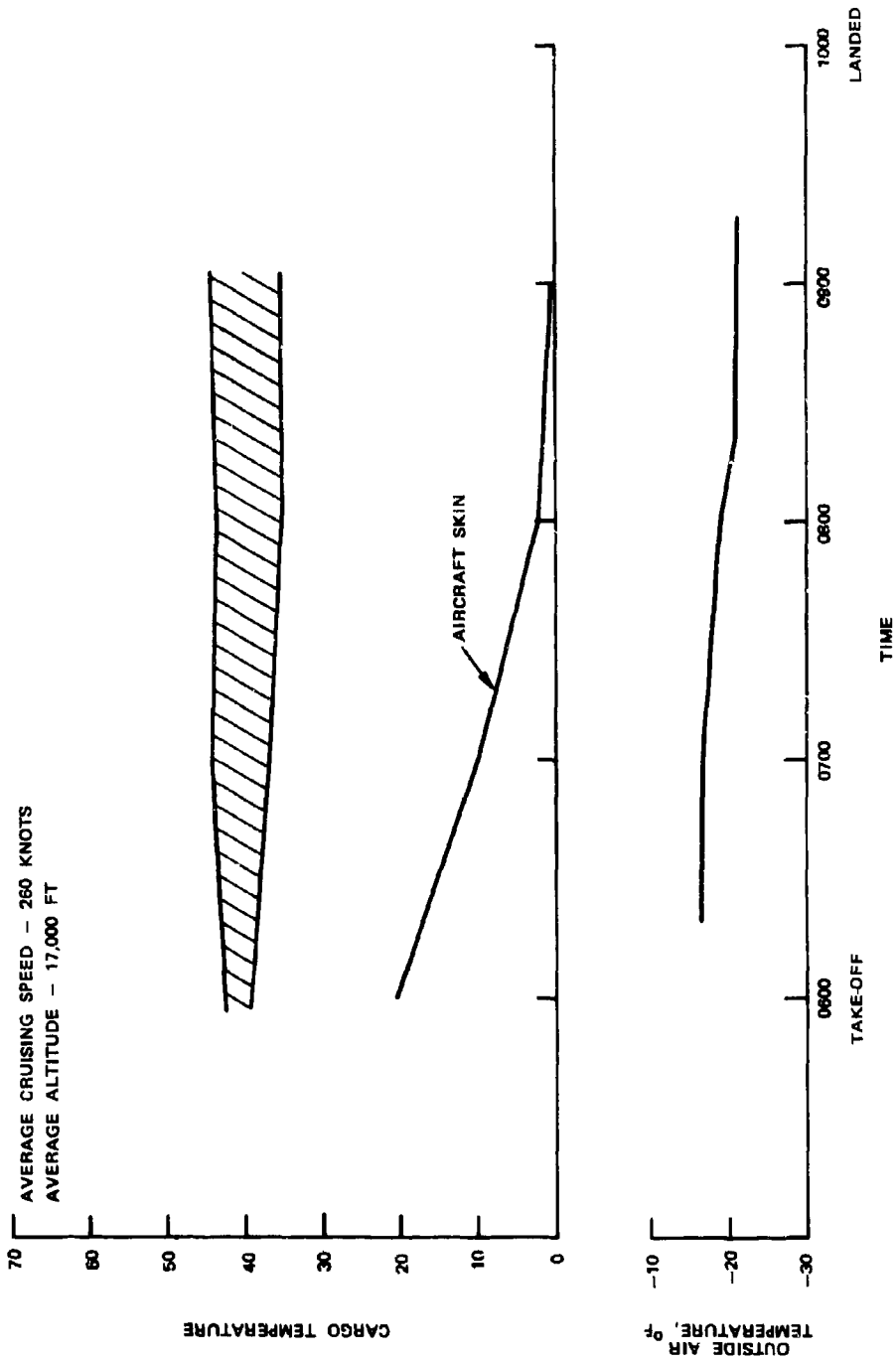


FIG. 13. C-133 Flight 2010, McGuire AFB to Argentina, Newfoundland (1/15/69).

13  
 11  
 143  
 153

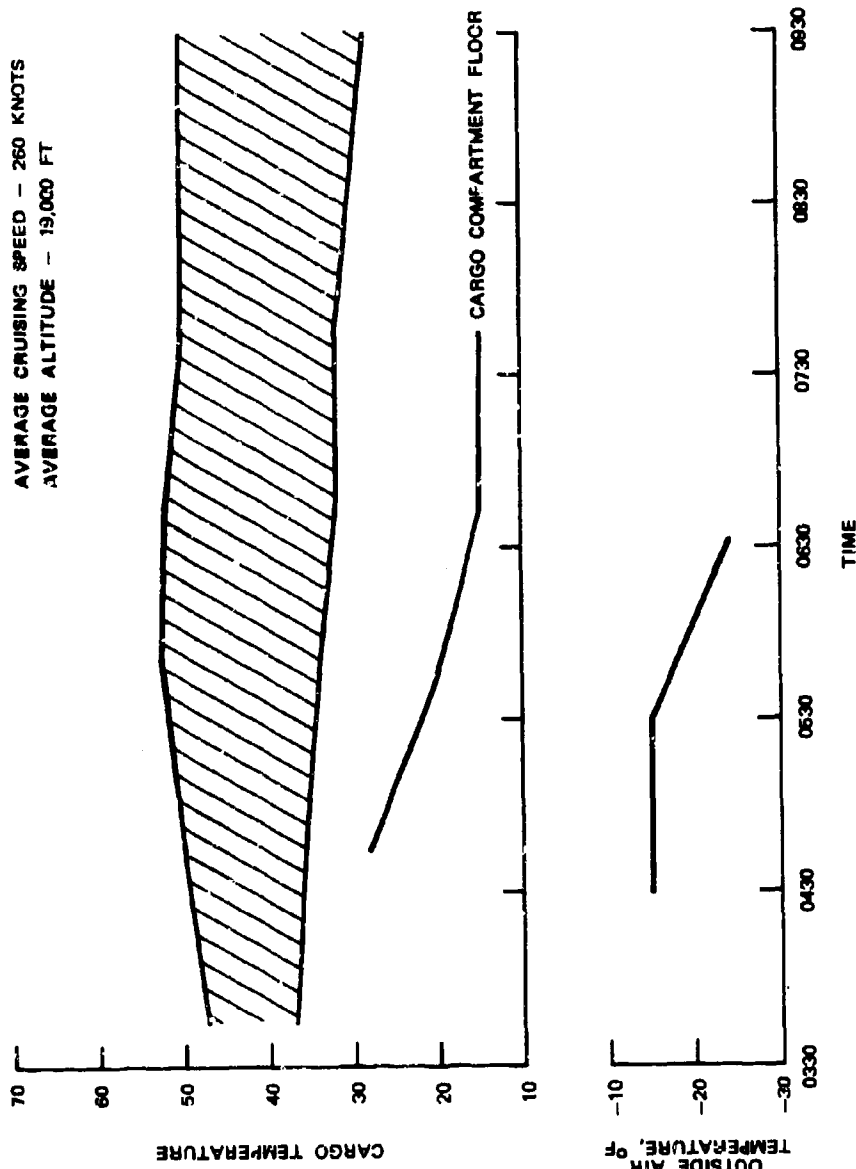


FIG. 14. C-133 Flight 2010, Argentina, Newfoundland to Prestwick, Scotland (1/16/69).

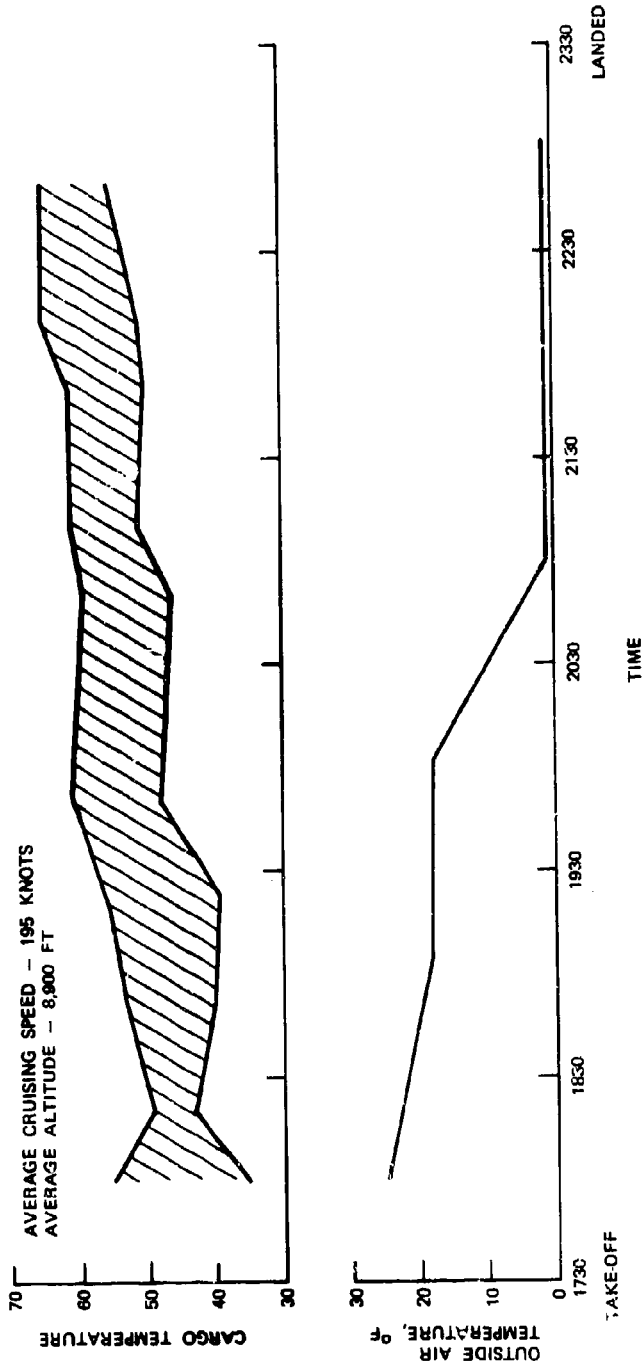


FIG. 15. C-124 Flight 10092, McGuire AFB to Goose Bay, Labrador (1/28/69).

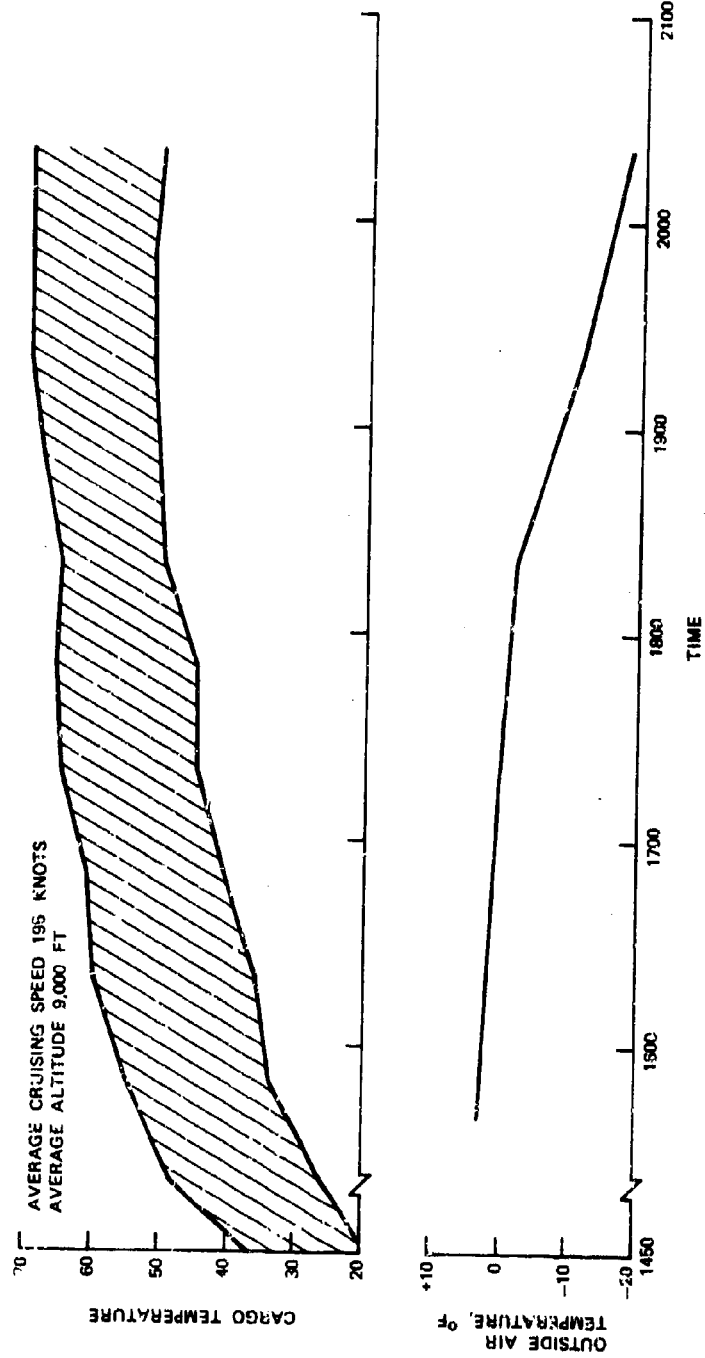


FIG. 16. C-124 Flight 10992, Goose Bay, Labrador to Sonderstrom, Greenland (1/29/69).

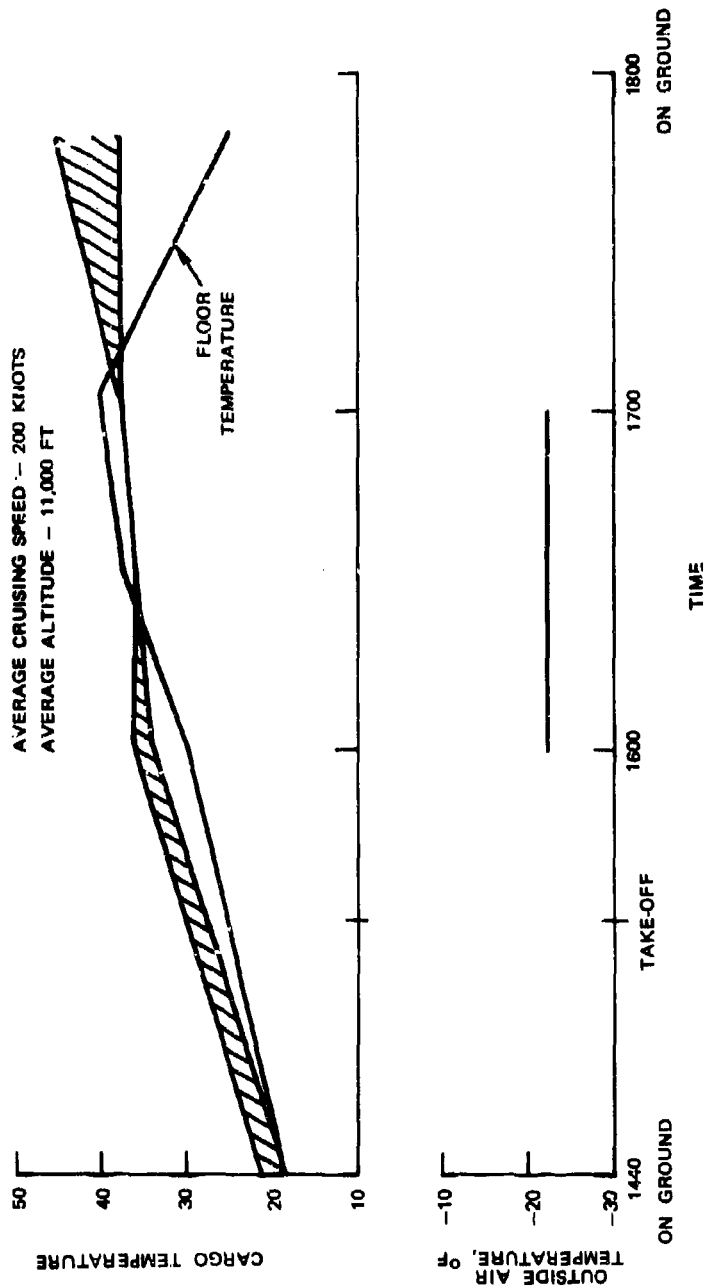


FIG. 17. C-124 Flight 10092, Sonderstrom, Greenland to Kulusuk, Greenland (1/31/69).

The C-124 flight from McGuire AFB to Greenland was interesting in that each leg of the flight had an entirely different cargo configuration. The aircraft was fully loaded to maximum weight while flying the McGuire to Goose Bay leg, and for the other extreme, the Goose Bay to Sonderstrom flight carried a minimal weight load of 5,000 pounds. The Sonderstrom to Kulusuk flight carried a volume loaded cargo of structural antenna parts. The 8,200 pounds of antenna parts were so large they could not be loaded as is normally done through the elevator so the clam shell doors in the nose were opened and the crates of antennas were manhandled on and off the aircraft. Figure 18 shows the C-124 being off-loaded at the remote landing strip in Kulusuk, Greenland.

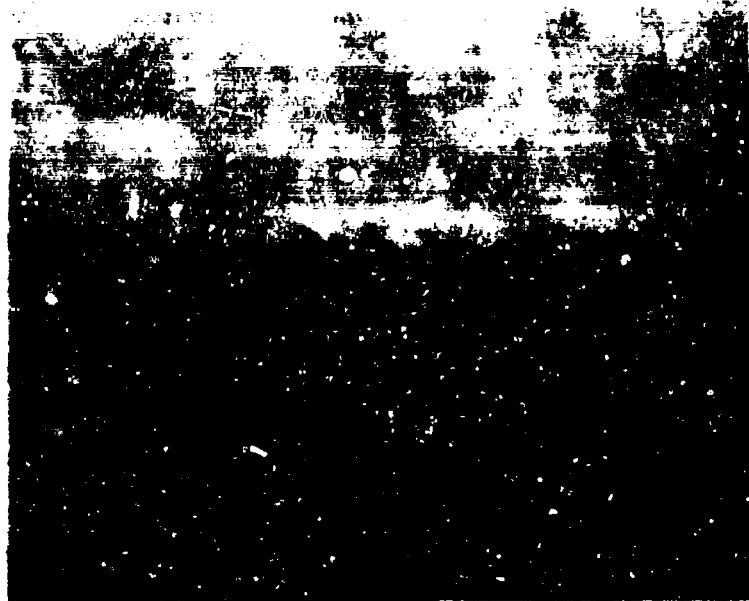


FIG. 18. C-124 Being Off-Loaded in Greenland.

The antenna parts were loaded on the C-124 one day prior to the scheduled takeoff. The aircraft remained on the flight line parking ramp exposed to sub-zero weather conditions. Twelve hours prior to the scheduled takeoff, Herman Nelson heaters were connected by means of 12-inch ducts to each engine and one placed inside the forward hatch of the aircraft. Figure 3 shows the heater hookup to the aircraft.

Arrangements were made between the NWC personnel and the aircraft Commander to shut the heater off or set the temperature control to a minimum in the cargo compartment during two of the flights. One of the flights mentioned was the C-141 S/N 08083 going from McGuire AFB to Rein-Main, Germany. One heater pack was shut off while the other was set to its lowest temperature setting. This condition was maintained for almost the entire flight.

A fact of interest and note in conjunction with extreme high altitude flight of cargos in C-141 aircraft is as follows: The aircraft has two heater-pressure packs. One is for the crew flight deck (2/3) and the cargo compartment (1/3). The other is totally for the cargo compartment. If one heater-pressure pack is lost due to malfunction, then the other is pressed into service to supply pressurization and heat to the crew flight deck and cargo compartment. However, even in this emergency situation, the cargo is still subjected to heating. If both packs are put out of commission, it is emergency procedure to abandon the high altitude situation and fly at an altitude conducive to crew comfort and breathing. Therefore, the cargo will not be subjected to the high altitude cold soak under these circumstances. The NWC personnel made arrangements with the 438 MAC Air Wing to disable one of the two packs and turn the thermostat in the cargo compartment off during a McGuire AFB to Rein-Main, Germany C-141 flight. The results are shown in Fig. 10. Notice that the cargo compartment temperature is still quite mild. On the return flight of the same aircraft that same day, the new crew was given no instructions. Notice the difference in cargo temperature for the return flight as shown in Fig. 11.

The point should be made that much inferred information can be obtained from the pilots' handbooks for the given aircraft. However, this information cannot be treated out of context and accurate cargo soak temperatures theoretically derived. Such interacting relationships as fuel consumption to achieve altitude with a given load, crew comfort, physical relations of flight, modes of heat transfer, and other extenuating circumstances must be placed in proper context.

Also notice that the outside air temperature during the flights are in close approximation to the extreme values specified for the altitude by MIL-STD-210.

The flight with the C-133 from McGuire to Argentia, Newfoundland was also made with the heater off in the cargo compartment. It is interesting to note that even though the heater was off, the cargo temperature did not drop drastically. The inside skin of the aircraft measured on channel 7 dropped from 20 to 0°F in 3 hours. This illustrates the obvious fact that the large mass of cargo will not readily change from its ambient temperature state and drop to some value approaching the outside air temperature.



### CONCLUSIONS

It is indicated in Fig. 10 through 17 that the minimum temperature design situation for air carried cargo is in the neighborhood of 20°F or greater. The inside aluminum skin temperature of the aircraft is indicated to be about 0°F minimum. Therefore, the design minimum temperature for air transported material should be in the range between 0 and 20°F.

It is also concluded that extenuating circumstances dictate that neither the low, slow aircraft or the high flying jet will surpass this envelope enough of the time to be engineeringly significant.

During this measurement series the lowest cargo temperature measured was 19°F even though true outside air temperatures of -82°F were recorded.

Appendix A  
INDICATED VERSUS TRUE OUTSIDE AIR TEMPERATURE

Indicated outside air temperature (OAT) is always higher than true OAT during flight because of the temperature rise associated with ram effects on the indicating system. All reference to OAT in this report is in the corrected or true OAT format. This was accomplished by using the plot of Fig. 19 which is a direct copy from the Air Force Flight Manual. This figure, Pg A1-7 of Appendix I of Air Force T.O. 1C-141A-1-1, gives the relationship of indicated OAT versus the true OAT such as would be measured by a man in a balloon with a thermometer.

**DATA BASIS: FLIGHT TEST**

JUNE 1965  
C-141A  
TF33-P-7

**EXAMPLE:**

**GIVEN:**  
TRUE MACH NO. = 0.70  
INDICATED OAT READING = 54°C

**FIND:**  
TRUE OAT

**SOLUTION:**  
TRUE OAT = 26°C

**CONDITIONS:**

TEMP. RECOVERY FACTOR = 0.965

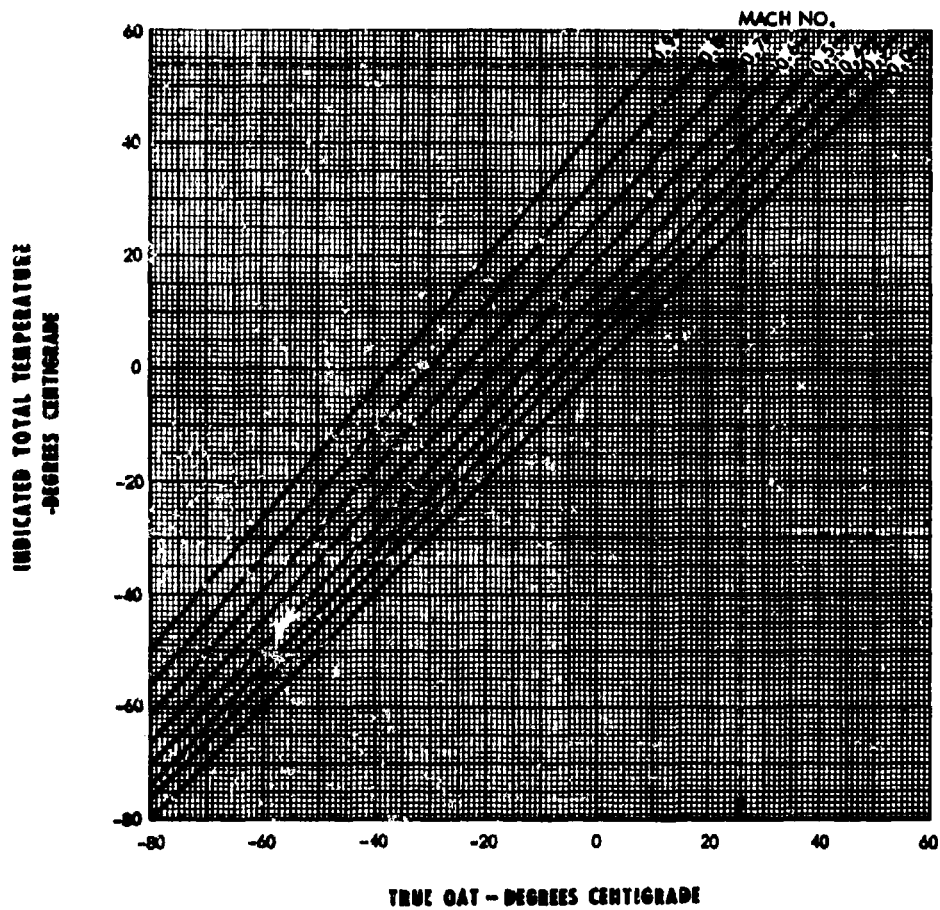


FIG. 19. Indicated Total Temperature Versus True Outside Air Temperature (OAT).

Appendix B  
COMPLETE TEMPERATURE LOG OF INSTRUMENTED FLIGHTS

TABLE 2. C-141 Flight 08083, McGuire AFB to Rein-Main,

| Time<br>(GMT) | Recorder channels/°F |    |    |    |    |    |    |    |    |    |    |    |
|---------------|----------------------|----|----|----|----|----|----|----|----|----|----|----|
|               | 1                    | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |
| 0635          | ..                   | .. | .. | .. | 50 | 46 | .. | 48 | 45 | 45 | 45 | 44 |
| 0700          | 66                   | 52 | 48 | 50 | 52 | 46 | 26 | 50 | 44 | 44 | 44 | 44 |
| 0715          | 65                   | 51 | 48 | 51 | 52 | 48 | 14 | 50 | 44 | 44 | 44 | 44 |
| 0730          | 65                   | 52 | 48 | 51 | 52 | 49 | 12 | 50 | 44 | 45 | 45 | 45 |
| 0745          | 64                   | 52 | 48 | 51 | 51 | 50 | 10 | 50 | 44 | 45 | 45 | 45 |
| 0800          | 64                   | 52 | 48 | 50 | 50 | 50 | 9  | 50 | 44 | 45 | 45 | 45 |
| 0815          | 63                   | 51 | 49 | 50 | 50 | 50 | 7  | 50 | 43 | 45 | 46 | 46 |
| 0830          | 62                   | 51 | 49 | 50 | 50 | 50 | 4  | 50 | 42 | 46 | 46 | 46 |
| 0845          | 61                   | 52 | 50 | 51 | 51 | 50 | 6  | 50 | 42 | 45 | 46 | 46 |
| 0900          | 60                   | 52 | 50 | 51 | 51 | 50 | 6  | 50 | 42 | 46 | 46 | 46 |
| 0915          | 60                   | 52 | 50 | 51 | 51 | 51 | 7  | 50 | 42 | 45 | 46 | 46 |
| 0930          | 60                   | 52 | 50 | 51 | 50 | 50 | 7  | 50 | 42 | 45 | 46 | 46 |
| 0945          | 59                   | 51 | 50 | 50 | 50 | 50 | 6  | 50 | 43 | 46 | 47 | 47 |
| 1000          | 59                   | 51 | 50 | 51 | 50 | 50 | 6  | 49 | 42 | 44 | 46 | 46 |
| 1030          | 58                   | 50 | 50 | 50 | 49 | 50 | 5  | 49 | 42 | 44 | 46 | 46 |
| 1100          | 58                   | 50 | 50 | 50 | 49 | 50 | 4  | 49 | 41 | 44 | 46 | 46 |
| 1130          | 58                   | 50 | 49 | 50 | 48 | 50 | 4  | 48 | 41 | 44 | 46 | 46 |
| 1200          | 56                   | 48 | 48 | 48 | 46 | 48 | 6  | 47 | 40 | 44 | 46 | 46 |
| 1235          | 56                   | 48 | 48 | 48 | 46 | 48 | 8  | 47 | 40 | 44 | 46 | 46 |
| 1300*         | 56                   | 49 | 49 | 50 | 57 | 48 | 10 | 52 | 40 | 43 | 44 | 44 |
| 1315          | 58                   | 67 | 53 | 62 | 75 | 54 | 14 | 63 | 47 | 43 | 44 | 44 |
| 1330          | 66                   | 75 | 54 | 65 | 80 | 61 | 38 | 68 | 56 | 50 | 44 | 44 |

NOTE: Total flight time: 6 hr 55 min.

Recorder channels 1 through 6 and 8 through 12: Palletized cargo.

Recorder channel 7: Cargo compartment floor.

\*Heaters turned on.

A

C-141 Flight 08083, McGuire AFB to Rein-Main, Germany (1/18/69).

| Recorder channels/°F |    |    |    |    |    |    | Outside<br>air temp.<br>°F | Position         | Speed,<br>knots | Altitude,<br>ft |
|----------------------|----|----|----|----|----|----|----------------------------|------------------|-----------------|-----------------|
| 6                    | 7  | 8  | 9  | 10 | 11 | 12 |                            |                  |                 |                 |
| 46                   | .. | 48 | 45 | 45 | 45 | 44 | ..                         | ..               | ..              | Take off        |
| 46                   | 26 | 50 | 44 | 44 | 44 | 44 | ..                         | ..               | ..              | Climbing        |
| 48                   | 14 | 50 | 44 | 44 | 44 | 44 | -67                        | 4522 N<br>6208 W | 447             | 33,800          |
| 49                   | 12 | 50 | 44 | 45 | 45 | 45 | ..                         | ..               | ..              | ..              |
| 50                   | 10 | 50 | 44 | 45 | 45 | 45 | ..                         | ..               | ..              | ..              |
| 50                   | 9  | 50 | 44 | 45 | 45 | 45 | ..                         | 4648 N<br>5632 W | ..              | ..              |
| 50                   | 7  | 50 | 43 | 45 | 46 | 46 | ..                         | ..               | ..              | ..              |
| 50                   | 4  | 50 | 42 | 46 | 46 | 46 | ..                         | ..               | ..              | ..              |
| 50                   | 6  | 50 | 42 | 45 | 46 | 46 | ..                         | ..               | ..              | ..              |
| 50                   | 6  | 50 | 42 | 46 | 46 | 46 | -69                        | ..               | 435             | 37,000          |
| 51                   | 7  | 50 | 42 | 45 | 46 | 46 | ..                         | ..               | ..              | ..              |
| 50                   | 7  | 50 | 42 | 45 | 46 | 46 | ..                         | ..               | ..              | ..              |
| 50                   | 6  | 50 | 43 | 46 | 47 | 47 | ..                         | ..               | ..              | ..              |
| 50                   | 6  | 49 | 42 | 44 | 46 | 46 | -72                        | 4832 N<br>3549 W | 440             | 37,000          |
| 50                   | 5  | 49 | 42 | 44 | 46 | 46 | ..                         | ..               | ..              | ..              |
| 50                   | 4  | 49 | 41 | 44 | 46 | 46 | -72                        | 4902 N<br>1756 W | 440             | 36,700          |
| 50                   | 4  | 48 | 41 | 44 | 46 | 46 | ..                         | ..               | ..              | ..              |
| 48                   | 6  | 47 | 40 | 44 | 46 | 46 | -67                        | 4901 N<br>0041 W | 448             | 37,000          |
| 48                   | 8  | 47 | 40 | 44 | 46 | 46 | ..                         | Over Paris       | ..              | ..              |
| 48                   | 10 | 52 | 40 | 43 | 44 | 44 | ..                         | ..               | ..              | ..              |
| 54                   | 14 | 63 | 47 | 43 | 44 | 44 | ..                         | ..               | ..              | ..              |
| 61                   | 38 | 68 | 56 | 50 | 44 | 44 | ..                         | ..               | ..              | On ground       |

nd 8 through 12: Palletized cargo.  
artment floor.

TABLE 3. C-141 Flight 08083, Rein-Mein, Germany to McGuire AFB (1/18/69).

| Time (GMT) | Recorder channels/°F |    |    |    |    |    | Outside air temp, °F | Position         | Speed, knots | Altitude, ft |
|------------|----------------------|----|----|----|----|----|----------------------|------------------|--------------|--------------|
|            | 1                    | 2  | 3  | 4  | 5  | 6  |                      |                  |              |              |
| 1500       | 47                   | 45 | 47 | 42 | 44 | 45 | ..                   | ..               | ..           | ..           |
| 1545       | 47                   | 45 | 48 | 42 | 45 | 46 | ..                   | ..               | ..           | ..           |
| 1600       | 48                   | 43 | 50 | 40 | 44 | 47 | ..                   | ..               | ..           | ..           |
| 1630       | 50                   | 44 | 53 | 42 | 46 | 48 | -54                  | 5242 N<br>0415 E | 443          | ..           |
| 1700       | 50                   | 45 | 54 | 42 | 47 | 48 | ..                   | ..               | ..           | ..           |
| 1730       | 52                   | 46 | 54 | 42 | 48 | 48 | -54                  | 5626 N<br>0602 W | 447          | 35,000       |
| 1800       | 53                   | 47 | 54 | 43 | 48 | 48 | ..                   | ..               | ..           | ..           |
| 1830       | 54                   | 48 | 54 | 43 | 48 | 48 | -69                  | 6038 N<br>1745 W | 447          | 35,000       |
| 1900       | 54                   | 48 | 54 | 43 | 48 | 48 | ..                   | ..               | ..           | ..           |
| 1930       | 56                   | 50 | 56 | 44 | 49 | 50 | ..                   | ..               | ..           | ..           |
| 2000       | 56                   | 50 | 56 | 45 | 49 | 51 | -58                  | 6048 N<br>3242 W | 447          | 35,000       |
| 2030       | 54                   | 51 | 53 | 45 | 48 | 48 | ..                   | ..               | ..           | ..           |
| 2100       | 54                   | 51 | 52 | 44 | 47 | 48 | -82                  | 5240 N<br>4700 W | 435          | 35,000       |
| 2130       | 56                   | 51 | 54 | 45 | 48 | 50 | ..                   | ..               | ..           | ..           |
| 2200       | 56                   | 52 | 55 | 46 | 48 | 50 | -56                  | 5525 N<br>5730 W | 443          | 35,000       |
| 2230       | 55                   | 52 | 54 | 45 | 48 | 49 | ..                   | ..               | ..           | ..           |
| 2300       | 55                   | 52 | 53 | 45 | 47 | 49 | -76                  | 5100 N<br>6432 W | 444          | 35,000       |
| 2330       | 54                   | 52 | 52 | 44 | 47 | 48 | ..                   | ..               | ..           | ..           |
| 2400       | 54                   | 52 | 53 | 45 | 47 | 48 | -76                  | 4638 N<br>7032 W | 442          | 35,000       |
| 0030       | 55                   | 53 | 54 | 45 | 48 | 50 | ..                   | ..               | ..           | ..           |
| 0100       | 59                   | 52 | 59 | 44 | 48 | 52 | ..                   | ..               | ..           | On ground    |

NOTE: Total flight time: 10 hr.  
Recorder channels 1 through 6: Palletized cargo.

TABLE 4. C-141 Flight 40642, Rein-Main, Germany to McGuire AFB (1/22/69).

| Time (GMT) | Recorder channels/°F |    |    |    |    | Outside air temp, °F | Position         | Speed, knots | Altitude, ft |
|------------|----------------------|----|----|----|----|----------------------|------------------|--------------|--------------|
|            | 1                    | 2  | 3  | 4  | 5  |                      |                  |              |              |
| 1035       | ..                   | .. | .. | .. | .. | ..                   | ..               | ..           | Take off     |
| 1100       | 50                   | 59 | 74 | 75 | 44 | -71                  | 5129 N<br>0025 E | 440          | 35,000       |
| 1200       | 70                   | 67 | 76 | 84 | 48 | -67                  | 5200 N<br>0450 W | 443          | 35,000       |
| 1300       | 74                   | 68 | 78 | 84 | 52 | -71                  | 5300 N<br>1520 W | 435          | 37,000       |
| 1400       | 74                   | 70 | 78 | 85 | 54 | -51                  | 5300 N<br>2745 W | 450          | ..           |
| 1500       | 74                   | 71 | 80 | 85 | 57 | -62                  | 5218 N<br>3752 W | 448          | ..           |
| 1600       | 74                   | 72 | 80 | 82 | 59 | -63                  | 5045 N<br>5100 W | 440          | ..           |
| 1700       | 71                   | 70 | 79 | 83 | 59 | -81                  | 4700 N<br>6100 W | 440          | ..           |
| 1800       | 72                   | 69 | 79 | 85 | 60 | -76                  | 4315 N<br>6700 W | 435          | ..           |
| 1920       | 70                   | 72 | 78 | 76 | 62 | ..                   | ..               | ..           | On ground    |

NOTE: Total flight time: 8 hr 20 min.  
Recorder channels 1 through 5: BullTup motor shipping containers.



TABLE 5. C-133 Flight 2010, McGuire AFB to  
Argentina, Newfoundland (1/15/69).

| Time<br>(GMT) | Recorder channels/°F |    |    |    |    |    |    | Outside<br>air temp,<br>°F | Position         | Speed,<br>knots | Altitude,<br>ft |
|---------------|----------------------|----|----|----|----|----|----|----------------------------|------------------|-----------------|-----------------|
|               | 1                    | 2  | 3  | 4  | 5  | 6  | 7  |                            |                  |                 |                 |
| 0510          | ..                   | .. | .. | .. | .. | .. | .. | ..                         | ..               | ..              | Take off        |
| 0500          | 42                   | 40 | 41 | 39 | 39 | 38 | 20 | ..                         | ..               | ..              | ..              |
| 0700          | 43                   | 44 | 43 | 39 | 37 | 36 | 10 | -16                        | 4110 N<br>7000 W | 260             | 17,000          |
| 0800          | 42                   | 42 | 43 | 37 | 36 | 35 | 2  | -18                        | 4350 N<br>6605 W | 260             | 17,000          |
| 0900          | 44                   | 44 | 44 | 38 | 37 | 35 | 0  | -20                        | 4525 N<br>6260 W | 260             | 17,000          |
| 0914          | ..                   | .. | .. | .. | .. | .. | .. | -20                        | 4645 N<br>5710 W | 260             | 17,000          |
| 1000          | ..                   | .. | .. | .. | .. | .. | .. | ..                         | ..               | ..              | On ground       |

NOTE: Total flight time: 4 hr 50 min.  
Recorder channels 1 through 6: Palletized cargo.  
Recorder channel 7: Aircraft skin in cargo compartment.

TABLE 6. C-133 Flight 2010, Argentina, Newfoundland to Prestwick, Scotland (1/16/69).

| Time (GMT) | Recorder channels, °F |    |    |    |    |    |    | Outside air temp, °F | Position         | Speed, knots | Altitude, ft |
|------------|-----------------------|----|----|----|----|----|----|----------------------|------------------|--------------|--------------|
|            | 1                     | 2  | 3  | 4  | 5  | 6  | 7  |                      |                  |              |              |
| 0330       | ..                    | .. | .. | .. | .. | .. | .. | ..                   | ..               | ..           | Take off     |
| 0340       | 40                    | 47 | 47 | 40 | 37 | 43 | .. | ..                   | ..               | ..           | ..           |
| 0440       | 43                    | 48 | 50 | 40 | 36 | 43 | 28 | -15                  | 5000 N<br>4800 W | 260          | 17,000       |
| 0540       | 43                    | 51 | 52 | 40 | 34 | 41 | 20 | -15                  | 5100 N<br>4300 W | 260          | 17,000       |
| 0640       | 44                    | 50 | 52 | 39 | 32 | 41 | 15 | -22                  | ..               | 260          | 19,000       |
| 0740       | 43                    | 49 | 50 | 37 | 32 | 40 | 15 | ..                   | ..               | ..           | ..           |
| 0932       | 43                    | 48 | 50 | 37 | 28 | 38 | .. | ..                   | ..               | ..           | On ground    |

NOTE: Total flight time: 6 hr.  
 Recorder channels 1 through 6: Palletized cargo.  
 Recorder channel 7: Aircraft skin in cargo compartment.

TABLE 7. C-124 Flight S/N 21036, McGuire AFB to Goose Bay, Labrador (1/25/69).

| Time (GMT) | Recorder channels/°F |    |    |    |    |    |    |    |    |    |    |    | Outside air temp, °F | Position | Speed, knots | Altitude, ft |                  |     |           |
|------------|----------------------|----|----|----|----|----|----|----|----|----|----|----|----------------------|----------|--------------|--------------|------------------|-----|-----------|
|            | 1                    | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |                      |          |              |              |                  |     |           |
| 0029       | ..                   | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | ..                   | ..       | ..           | ..           | Take off         | ..  | ..        |
| 0100       | 45                   | 40 | 40 | 40 | 43 | 40 | 53 | 52 | .. | 50 | 44 | 42 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0115       | 48                   | 42 | 42 | 41 | 46 | 42 | 66 | 56 | .. | 56 | 50 | 55 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0130       | 50                   | 44 | 42 | 42 | 49 | 42 | 68 | 61 | .. | 60 | 54 | 60 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0200       | 52                   | 45 | 43 | 43 | 50 | 48 | 70 | 64 | .. | 64 | 56 | 62 | ..                   | ..       | ..           | ..           | 4221 N<br>7100 W | 237 | 9,000     |
| 0215       | 54                   | 46 | 44 | 44 | 52 | 44 | 74 | 66 | 58 | 66 | 60 | 64 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0245       | 56                   | 49 | 46 | 47 | 54 | 46 | 77 | 70 | 72 | 70 | 64 | 68 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0300       | 58                   | 50 | 46 | 48 | 54 | 47 | 78 | 70 | 62 | 70 | 64 | 68 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0315       | 58                   | 50 | 46 | 48 | 54 | 47 | 78 | 71 | 63 | 71 | 66 | 69 | ..                   | ..       | ..           | ..           | 4542 N<br>6841 W | 243 | 9,000     |
| 0330       | 59                   | 52 | 47 | 50 | 54 | 48 | 79 | 72 | 64 | 72 | 66 | 70 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0345       | 60                   | 53 | 48 | 50 | 54 | 48 | 80 | 73 | 64 | 73 | 68 | 71 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0400       | 62                   | 54 | 49 | 52 | 55 | 50 | 81 | 74 | 66 | 72 | 70 | 73 | ..                   | ..       | ..           | ..           | ..               | 245 | 9,100     |
| 0415       | 63                   | 55 | 50 | 54 | 56 | 50 | 81 | 75 | 66 | 74 | 70 | 74 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0430       | 64                   | 56 | 50 | 55 | 56 | 51 | 81 | 76 | 66 | 75 | 71 | 74 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0445       | 64                   | 56 | 50 | 56 | 56 | 52 | 81 | 76 | 67 | 76 | 71 | 74 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0500       | 64                   | 57 | 51 | 56 | 56 | 52 | 82 | 76 | 67 | 76 | 72 | 75 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0515       | 66                   | 58 | 52 | 56 | 56 | 52 | 82 | 76 | 68 | 76 | 72 | 76 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0530       | 66                   | 58 | 52 | 58 | 57 | 53 | 83 | 78 | 68 | 77 | 73 | 76 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0545       | 68                   | 59 | 52 | 58 | 58 | 55 | 84 | 80 | 71 | 80 | 74 | 80 | ..                   | ..       | ..           | ..           | ..               | ..  | ..        |
| 0600       | 69                   | 61 | 54 | 60 | 60 | 56 | 82 | 77 | 69 | 79 | 74 | 77 | ..                   | ..       | ..           | ..           | ..               | ..  | On ground |

NOTE: Total flight time: 6 hr.  
Recorder channels 1 through 12: Placed in various locations in cargo compartment.

TABLE 8. C-124 Flight S/N 21036, Goose Bay, Labrador to Rein-Main, Germany (1/27/69 - 1/28/69).

| Time (GMT) | Recorder channels/°F |    |    |    |    |    |    |    |    |    |    |    | Outside air temp, °F | Position | Speed, knots     | Altitude, ft |          |
|------------|----------------------|----|----|----|----|----|----|----|----|----|----|----|----------------------|----------|------------------|--------------|----------|
|            | 1                    | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |                      |          |                  |              |          |
| 2035       | 44                   | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44                   | ..       | ..               | ..           | Climbing |
| 2100       | 50                   | 48 | 52 | 57 | 50 | 55 | .. | 60 | 66 | 70 | 68 | 68 | 68                   | ..       | ..               | ..           | ..       |
| 2115       | 54                   | 52 | 58 | 64 | 56 | 62 | .. | 71 | 68 | 61 | 69 | 70 | 78                   | ..       | ..               | ..           | ..       |
| 2130       | 58                   | 52 | 63 | 79 | 59 | 64 | 81 | 79 | 78 | 81 | 78 | 78 | 78                   | ..       | ..               | ..           | ..       |
| 2145       | 64                   | 54 | 69 | 76 | 64 | 70 | 86 | 85 | 82 | 86 | 81 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 2200       | 64                   | 55 | 70 | 78 | 64 | 69 | 86 | 86 | 82 | 86 | 83 | 86 | 86                   | +23      | 5350 N<br>5670 W | 235          | 9,100    |
| 2215       | 65                   | 56 | 72 | 78 | 64 | 70 | 87 | 87 | 83 | 87 | 83 | 86 | 86                   | ..       | ..               | ..           | ..       |
| 2230       | 68                   | 58 | 73 | 80 | 66 | 71 | 88 | 87 | 85 | 89 | 86 | 89 | 86                   | ..       | ..               | ..           | ..       |
| 2245       | 70                   | 59 | 74 | 82 | 70 | 72 | 88 | 87 | 84 | 86 | 83 | 86 | 86                   | ..       | ..               | ..           | ..       |
| 2300       | 72                   | 60 | 75 | 81 | 67 | 72 | 85 | 84 | 82 | 84 | 82 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 2315       | 71                   | 60 | 74 | 81 | 67 | 71 | 85 | 83 | 82 | 84 | 82 | 85 | 85                   | +24      | 5415 W<br>4800 N | 230          | 9,140    |
| 2330       | 72                   | 62 | 75 | 82 | 68 | 72 | 86 | 84 | 82 | 85 | 82 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 2345       | 72                   | 62 | 76 | 81 | 68 | 70 | 85 | 84 | 82 | 84 | 82 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 2400       | 72                   | 63 | 76 | 82 | 68 | 71 | 85 | 84 | 82 | 84 | 82 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 0015       | 73                   | 64 | 76 | 82 | 68 | 71 | 85 | 84 | 82 | 84 | 82 | 84 | 84                   | ..       | ..               | ..           | ..       |
| 0030       | 72                   | 64 | 75 | 82 | 68 | 70 | 85 | 84 | 82 | 85 | 84 | 85 | 85                   | +23      | 4000 W<br>5500 N | 232          | 9,140    |
| 0045       | 73                   | 64 | 76 | 82 | 68 | 72 | 84 | 84 | 82 | 85 | 83 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 0100       | 74                   | 65 | 76 | 82 | 70 | 71 | 85 | 84 | 82 | 84 | 83 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 0115       | 73                   | 64 | 76 | 81 | 70 | 70 | 84 | 84 | 82 | 84 | 82 | 84 | 84                   | ..       | ..               | ..           | ..       |
| 0130       | 73                   | 64 | 76 | 80 | 72 | 69 | 83 | 83 | 82 | 84 | 82 | 85 | 85                   | +16      | 3400 W<br>5430 N | 210          | 9,140    |
| 0145       | 77                   | 68 | 78 | 82 | 69 | 70 | 84 | 85 | 82 | 84 | 83 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 0200       | 77                   | 67 | 77 | 82 | 68 | 70 | 85 | 85 | 83 | 84 | 83 | 86 | 86                   | ..       | ..               | ..           | ..       |
| 0215       | 77                   | 68 | 77 | 82 | 68 | 71 | 84 | 86 | 83 | 84 | 83 | 86 | 86                   | ..       | ..               | ..           | ..       |
| 0230       | 78                   | 70 | 78 | 83 | 68 | 71 | 85 | 86 | 84 | 85 | 84 | 85 | 85                   | ..       | ..               | ..           | ..       |
| 0245       | 78                   | 70 | 78 | 83 | 68 | 71 | 86 | 86 | 84 | 85 | 84 | 85 | 85                   | +10      | 2600 W<br>5350 N | 200          | 9,150    |
| 0300       | 77                   | 70 | 77 | 82 | 68 | 70 | 85 | 86 | 84 | 85 | 84 | 86 | 86                   | ..       | ..               | ..           | ..       |
| 0315       | 76                   | 70 | 77 | 81 | 71 | 70 | 85 | 86 | 84 | 85 | 84 | 86 | 86                   | ..       | ..               | ..           | ..       |
| 0330       | 75                   | 70 | 77 | 80 | 71 | 70 | 86 | 85 | 84 | 86 | 84 | 86 | 86                   | ..       | ..               | ..           | ..       |

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|      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |      |                  |     |           |    |    |
|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|------|------------------|-----|-----------|----|----|
| 0015 | 73 | 64 | 76 | 82 | 88 | 71 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 0000 | 4000 W<br>5500 N | 232 | 9,140     |    |    |
| 0030 | 72 | 64 | 75 | 82 | 88 | 70 | 85 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 0030 | 4000 W<br>5500 N | 232 | 9,140     |    |    |
| 0045 | 73 | 64 | 76 | 82 | 88 | 72 | 84 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 0045 | ..               | ..  | ..        | .. |    |
| 0100 | 74 | 65 | 76 | 82 | 70 | 71 | 85 | 84 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0100 | ..               | ..  | ..        | .. | .. |
| 0115 | 73 | 64 | 76 | 81 | 70 | 70 | 84 | 84 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0115 | 3400 W<br>5430 N | 210 | 9,140     |    |    |
| 0130 | 73 | 64 | 76 | 80 | 72 | 69 | 83 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0130 | 3400 W<br>5430 N | 210 | 9,140     |    |    |
| 0145 | 77 | 68 | 78 | 82 | 69 | 70 | 84 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 0145 | ..               | ..  | ..        | .. | .. |
| 0200 | 77 | 67 | 77 | 82 | 68 | 70 | 85 | 85 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 0200 | ..               | ..  | ..        | .. | .. |
| 0215 | 77 | 68 | 77 | 82 | 68 | 71 | 84 | 86 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0215 | ..               | ..  | ..        | .. | .. |
| 0230 | 78 | 70 | 78 | 83 | 68 | 71 | 85 | 86 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0230 | 2600 W<br>5350 N | 200 | 9,150     |    |    |
| 0245 | 78 | 70 | 78 | 83 | 68 | 71 | 86 | 86 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0245 | 2600 W<br>5350 N | 200 | 9,150     |    |    |
| 0300 | 77 | 70 | 77 | 82 | 68 | 70 | 85 | 86 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0300 | ..               | ..  | ..        | .. | .. |
| 0315 | 76 | 70 | 77 | 81 | 71 | 70 | 85 | 86 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0315 | ..               | ..  | ..        | .. | .. |
| 0330 | 75 | 70 | 77 | 80 | 71 | 70 | 86 | 85 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0330 | ..               | ..  | ..        | .. | .. |
| 0345 | 75 | 72 | 78 | 80 | 70 | 71 | 86 | 86 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0345 | ..               | ..  | ..        | .. | .. |
| 0400 | 74 | 71 | 78 | 78 | 68 | 70 | 84 | 84 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0400 | 1930 W           | 210 | 9,140     |    |    |
| 0415 | 74 | 71 | 76 | 78 | 71 | 70 | 84 | 84 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0415 | ..               | ..  | ..        | .. | .. |
| 0430 | 73 | 71 | 76 | 78 | 70 | 70 | 84 | 84 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0430 | ..               | ..  | ..        | .. | .. |
| 0445 | 73 | 71 | 76 | 79 | 70 | 70 | 85 | 85 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0445 | ..               | ..  | ..        | .. | .. |
| 0500 | 76 | 72 | 77 | 79 | 71 | 70 | 84 | 84 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0500 | ..               | 200 | 9,150     | .. | .. |
| 0515 | 74 | 72 | 77 | 78 | 73 | 69 | 86 | 84 | 82 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0515 | ..               | ..  | ..        | .. | .. |
| 0530 | 73 | 71 | 76 | 78 | 74 | 69 | 84 | 84 | 82 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0530 | ..               | ..  | ..        | .. | .. |
| 0545 | 74 | 72 | 77 | 78 | 73 | 70 | 84 | 84 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0545 | ..               | ..  | ..        | .. | .. |
| 0600 | 74 | 72 | 77 | 78 | 73 | 70 | 84 | 84 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0600 | ..               | ..  | ..        | .. | .. |
| 0615 | 74 | 72 | 78 | 79 | 69 | 70 | 85 | 85 | 83 | 86 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0615 | ..               | ..  | ..        | .. | .. |
| 0630 | 74 | 72 | 78 | 78 | 68 | 70 | 84 | 84 | 82 | 86 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0630 | ..               | ..  | ..        | .. | .. |
| 0645 | 74 | 73 | 77 | 78 | 68 | 70 | 84 | 84 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0645 | ..               | ..  | ..        | .. | .. |
| 0700 | 73 | 72 | 77 | 78 | 58 | 70 | 84 | 84 | 82 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0700 | ..               | ..  | ..        | .. | .. |
| 0715 | 72 | 72 | 77 | 78 | 68 | 70 | 85 | 85 | 82 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0715 | ..               | ..  | ..        | .. | .. |
| 0730 | 73 | 72 | 77 | 78 | 69 | 71 | 85 | 84 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0730 | ..               | ..  | ..        | .. | .. |
| 0745 | 72 | 72 | 76 | 78 | 69 | 70 | 84 | 84 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0745 | ..               | ..  | ..        | .. | .. |
| 0800 | 72 | 72 | 76 | 78 | 68 | 71 | 84 | 84 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 0800 | ..               | ..  | ..        | .. | .. |
| 0815 | 74 | 74 | 76 | 78 | 70 | 72 | 85 | 84 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0815 | ..               | ..  | ..        | .. | .. |
| 0830 | 74 | 74 | 76 | 78 | 70 | 71 | 84 | 83 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0830 | ..               | ..  | ..        | .. | .. |
| 0845 | 72 | 72 | 75 | 75 | 77 | 82 | 94 | 78 | 80 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 0845 | Rein-Main        | ..  | On ground |    |    |

NOTE: Total flight time: 12 hr 10 min.  
Recorder channels 1 through 12: Placed in various locations in cargo compartment.

TABLE 9. C-124 Flight S/N 21036, Rein-Main, Germany to  
Prestwick, Scotland (1/30/69).

| Time<br>(GMT) | Recorder channels/°F |    |    |    |    |    |    |    |    |    |    |    | Outside<br>air temp,<br>°F | Position | Speed,<br>knots | Altitude,<br>ft |
|---------------|----------------------|----|----|----|----|----|----|----|----|----|----|----|----------------------------|----------|-----------------|-----------------|
|               | 1                    | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |                            |          |                 |                 |
| 0600          | 45                   | 40 | 42 | 46 | 50 | 47 | 43 | 43 | 47 | 50 | 50 | 50 | 50                         | ..       | ..              | On ground       |
| 0700          | 50                   | 44 | 48 | 52 | 66 | 52 | 48 | 61 | 56 | 61 | 58 | 58 | 59                         | ..       | ..              | ..              |
| 0715          | 52                   | 43 | 50 | 54 | 68 | 54 | 49 | 64 | 58 | 64 | 61 | 61 | 61                         | ..       | ..              | ..              |
| 0730          | 53                   | 42 | 51 | 54 | 68 | 55 | 50 | 66 | 60 | 66 | 63 | 64 | 64                         | ..       | ..              | ..              |
| 0745          | 55                   | 42 | 53 | 56 | 70 | 57 | 52 | 68 | 63 | 70 | 66 | 66 | 66                         | ..       | ..              | ..              |
| 0900          | 56                   | 43 | 54 | 58 | 74 | 58 | 54 | 70 | 65 | 71 | 68 | 68 | 68                         | ..       | ..              | ..              |
| 0815          | 58                   | 45 | 57 | 60 | 77 | 61 | 57 | 74 | 68 | 74 | 70 | 71 | 71                         | ..       | ..              | ..              |
| 0830          | 58                   | 45 | 57 | 60 | 78 | 61 | 57 | 74 | 68 | 74 | 70 | 71 | 71                         | ..       | ..              | ..              |
| 0845          | 61                   | 48 | 60 | 63 | 80 | 63 | 57 | 76 | 71 | 78 | 74 | 74 | 74                         | ..       | ..              | ..              |
| 0900          | 63                   | 50 | 63 | 64 | 65 | 66 | 52 | 70 | 66 | 74 | 69 | 71 | 71                         | ..       | ..              | ..              |
| 0915          | 64                   | 50 | 64 | 64 | 76 | 64 | 63 | 63 | 70 | 74 | 73 | 73 | 73                         | ..       | ..              | ..              |
| 0930          | 64                   | 51 | 64 | 65 | 82 | 66 | 64 | 66 | 79 | 81 | 78 | 78 | 78                         | ..       | ..              | ..              |
| 0945          | 65                   | 52 | 66 | 66 | 73 | 68 | 66 | 78 | 74 | 79 | 76 | 76 | 76                         | ..       | ..              | ..              |
| 1000          | 66                   | 53 | 67 | 67 | 75 | 68 | 65 | 78 | 74 | 80 | 77 | 77 | 77                         | ..       | ..              | ..              |
| 1015          | 64                   | 48 | 62 | 63 | 74 | 63 | 62 | 66 | 71 | 76 | 74 | 73 | 73                         | ..       | ..              | ..              |
| 1030          | 62                   | 49 | 64 | 64 | 67 | 65 | 64 | 70 | 71 | 76 | 74 | 72 | 72                         | ..       | ..              | ..              |
| 1045          | 62                   | 48 | 64 | 64 | 72 | 64 | 64 | 73 | 72 | 76 | 75 | 74 | 74                         | ..       | ..              | ..              |
| 1100          | 62                   | 46 | 64 | 64 | 72 | 64 | 65 | 74 | 73 | 78 | 76 | 75 | 75                         | ..       | ..              | ..              |
| 1115          | 64                   | 48 | 65 | 66 | 68 | 68 | 66 | 72 | 74 | 75 | 70 | 72 | 72                         | ..       | ..              | ..              |
| 1130          | 69                   | 66 | 60 | 66 | 82 | 66 | 66 | 65 | 65 | 66 | 66 | 68 | 68                         | ..       | ..              | On ground       |

NOTE: Total flight time: 5 hr 30 min.  
Recorder channels 1 through 12: Placed in various locations in cargo compartment.

TABLE 10. C-124 Flight S/N 21036, Prestwick, I

| Time<br>(GMT) | Recorder channels/°F |    |    |    |    |    |    |     |    |    |
|---------------|----------------------|----|----|----|----|----|----|-----|----|----|
|               | 1                    | 2  | 3  | 4  | 5  | 6  | 7  | 8   | 9  | 10 |
| 1450          | 46                   | 48 | 44 | 47 | 54 | 51 | 64 | ..  | 55 | 53 |
| 1515          | 44                   | 51 | 46 | 50 | 57 | 54 | 50 | ..  | 57 | 57 |
| 1530          | 44                   | 53 | 46 | 52 | 59 | 56 | 51 | 66  | 61 | 62 |
| 1545          | 44                   | 54 | 46 | 53 | 60 | 57 | 52 | 67  | 64 | 65 |
| 1600          | 44                   | 55 | 47 | 54 | 61 | 58 | 53 | 70  | 67 | 67 |
| 1615          | 44                   | 56 | 48 | 55 | 61 | 59 | 53 | 70  | 69 | 69 |
| 1630          | 45                   | 56 | 48 | 56 | 62 | 60 | 54 | 72  | 70 | 70 |
| 1645          | 46                   | 59 | 49 | 58 | 64 | 64 | 56 | 74  | 74 | 73 |
| 1700          | 47                   | 60 | 50 | 58 | 64 | 64 | 58 | 75  | 75 | 75 |
| 1715          | 48                   | 61 | 51 | 67 | 64 | 63 | 58 | 74  | 76 | 76 |
| 1730          | 48                   | 61 | 52 | 64 | 64 | 63 | 59 | 74  | 76 | 76 |
| 1745          | 50                   | 61 | 52 | 64 | 64 | 62 | 59 | 72  | 75 | 74 |
| 1800          | 49                   | 60 | 52 | 64 | 64 | 62 | 59 | 70  | 74 | 73 |
| 1815          | 50                   | 60 | 53 | 63 | 64 | 62 | 58 | 70  | 73 | 72 |
| 1830          | 50                   | 60 | 54 | 60 | 64 | 62 | 58 | 67  | 74 | 73 |
| 1845          | 51                   | 59 | 54 | 62 | 62 | 60 | 58 | 68  | 72 | 70 |
| 1900          | 50                   | 60 | 54 | 62 | 66 | 60 | 60 | 73  | 74 | 72 |
| 1915          | 52                   | 62 | 54 | 78 | 92 | 64 | 68 | 102 | 86 | 82 |
| 1930          | 56                   | 65 | 54 | 62 | 78 | 63 | 64 | 75  | 87 | 83 |
| 1945          | 56                   | 67 | 54 | 77 | 98 | 64 | 70 | 107 | 94 | 88 |
| 2000          | 60                   | 72 | 56 | 66 | 86 | 67 | 70 | 82  | 96 | 92 |
| 2015          | 56                   | 70 | 56 | 74 | 82 | 68 | 68 | 84  | 92 | 89 |
| 2030          | 56                   | 71 | 57 | 75 | 81 | 69 | 68 | 85  | 90 | 88 |
| 2045          | 56                   | 71 | 58 | 72 | 80 | 70 | 69 | 83  | 88 | 86 |
| 2100          | 56                   | 70 | 58 | 72 | 87 | 69 | 69 | 92  | 89 | 86 |
| 2115          | 57                   | 72 | 58 | 74 | 96 | 68 | 72 | 106 | 94 | 90 |
| 2130          | 58                   | 72 | 60 | 69 | 82 | 70 | 68 | 82  | 91 | 88 |
| 2205          | 59                   | 72 | 61 | 78 | 83 | 79 | 91 | 90  | 84 | 92 |

NOTE: Total flight time: 7 hr 15 min.  
 Recorder channels 1 through 12: Placed in various locations in ca

A

## D. C-124 Flight S/N 21036, Prestwick, Scotland to Azores (1/30/69).

| Recorder channels/°F |    |    |     |    |    |     |     | Outside<br>air temp.<br>°F | Position | Speed,<br>knots | Altitude,<br>ft |
|----------------------|----|----|-----|----|----|-----|-----|----------------------------|----------|-----------------|-----------------|
| 5                    | 6  | 7  | 8   | 9  | 10 | 11  | 12  |                            |          |                 |                 |
| 4                    | 51 | 64 | ..  | 55 | 53 | 58  | 56  | ..                         | ..       | ..              | ..              |
| 7                    | 54 | 50 | ..  | 57 | 57 | 62  | 61  | ..                         | ..       | ..              | ..              |
| 9                    | 56 | 51 | 66  | 61 | 62 | 66  | 66  | ..                         | ..       | ..              | ..              |
| 0                    | 57 | 52 | 67  | 64 | 65 | 69  | 70  | ..                         | ..       | ..              | ..              |
| 1                    | 58 | 53 | 70  | 67 | 67 | 72  | 72  | +23                        | ..       | 170             | 8,100           |
| 1                    | 59 | 53 | 70  | 69 | 69 | 74  | 75  | ..                         | ..       | ..              | ..              |
| 2                    | 60 | 54 | 72  | 70 | 70 | 75  | 76  | ..                         | ..       | ..              | ..              |
| 4                    | 64 | 56 | 74  | 74 | 73 | 79  | 80  | ..                         | ..       | ..              | ..              |
| 4                    | 64 | 58 | 75  | 75 | 75 | 80  | 81  | ..                         | ..       | ..              | ..              |
| 4                    | 63 | 58 | 74  | 76 | 76 | 80  | 82  | ..                         | ..       | ..              | ..              |
| 4                    | 63 | 59 | 74  | 76 | 76 | 80  | 81  | ..                         | ..       | ..              | ..              |
| 4                    | 62 | 59 | 72  | 75 | 74 | 79  | 80  | ..                         | ..       | ..              | ..              |
| 4                    | 62 | 59 | 70  | 74 | 73 | 77  | 78  | ..                         | ..       | ..              | ..              |
| 4                    | 62 | 58 | 70  | 73 | 72 | 76  | 77  | ..                         | ..       | ..              | ..              |
| 4                    | 62 | 58 | 67  | 74 | 73 | 76  | 76  | ..                         | ..       | ..              | ..              |
| 12                   | 60 | 58 | 68  | 72 | 70 | 75  | 76  | ..                         | ..       | ..              | ..              |
| 16                   | 60 | 60 | 73  | 74 | 72 | 79  | 90  | +27                        | ..       | 195             | 8,100           |
| 12                   | 64 | 68 | 102 | 86 | 82 | 93  | 106 | ..                         | ..       | ..              | ..              |
| 18                   | 63 | 64 | 75  | 87 | 83 | 92  | 98  | ..                         | ..       | ..              | ..              |
| 18                   | 64 | 70 | 107 | 94 | 88 | 100 | 119 | ..                         | ..       | ..              | ..              |
| 16                   | 67 | 70 | 82  | 96 | 92 | 100 | 97  | ..                         | ..       | ..              | ..              |
| 12                   | 68 | 68 | 84  | 92 | 89 | 96  | 92  | ..                         | ..       | ..              | ..              |
| 11                   | 69 | 68 | 85  | 90 | 88 | 95  | 92  | ..                         | ..       | ..              | ..              |
| 10                   | 70 | 69 | 83  | 88 | 86 | 92  | 90  | ..                         | ..       | ..              | ..              |
| 137                  | 69 | 69 | 92  | 89 | 86 | 94  | 102 | ..                         | ..       | ..              | ..              |
| 16                   | 68 | 72 | 106 | 94 | 90 | 100 | 108 | ..                         | ..       | ..              | ..              |
| 12                   | 70 | 68 | 82  | 91 | 88 | 96  | 91  | ..                         | ..       | ..              | ..              |
| 133                  | 79 | 91 | 90  | 84 | 92 | 106 | 98  | ..                         | ..       | ..              | End flight      |

15 min.

ph 12: Placed in various locations in cargo compartment.



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TABLE 11. C-124 Flight S/N 21036, Azores to Dover, Delaware (2/1/69).

| Time<br>(GMT) | Recorder channels/°F |    |    |    |    |    |    |    |    |    |    |    | Outside<br>air temp,<br>°F | Position         | Speed,<br>knots | Altitude,<br>ft    |
|---------------|----------------------|----|----|----|----|----|----|----|----|----|----|----|----------------------------|------------------|-----------------|--------------------|
|               | Recorder channels/°F |    |    |    |    |    |    |    |    |    |    |    |                            |                  |                 |                    |
|               | 1                    | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |                            |                  |                 |                    |
| 1130          | 58                   | 58 | 58 | 57 | 58 | 58 | 58 | 58 | 58 | 58 | 60 | 58 | 58                         | ..               | ..              | On ground          |
| 1215          | 60                   | 61 | 58 | 59 | 59 | 59 | 75 | 63 | 60 | 60 | 64 | 67 | 67                         | ..               | ..              | Start en-<br>gines |
| 1245          | 59                   | 62 | 59 | 59 | 60 | 60 | 59 | 62 | 62 | 60 | 64 | 62 | 62                         | ..               | ..              | Airborne           |
| 1300          | 58                   | 63 | 60 | 59 | 60 | 60 | 60 | 65 | 63 | 64 | 64 | 62 | 62                         | ..               | ..              | ..                 |
| 1315          | 59                   | 64 | 60 | 58 | 61 | 60 | 60 | 66 | 70 | 66 | 64 | 63 | 63                         | 39 N<br>28 W     | 213             | 8,150              |
| 1330          | 60                   | 68 | 62 | 60 | 62 | 62 | 62 | 70 | 71 | 70 | 64 | 65 | 65                         | ..               | ..              | ..                 |
| 1345          | 60                   | 68 | 62 | 60 | 63 | 62 | 62 | 71 | 72 | 70 | 64 | 65 | 65                         | ..               | ..              | ..                 |
| 1400          | 61                   | 70 | 62 | 60 | 64 | 62 | 63 | 72 | 67 | 72 | 65 | 66 | 66                         | ..               | ..              | ..                 |
| 1415          | 62                   | 71 | 62 | 61 | 64 | 64 | 64 | 72 | 68 | 72 | 64 | 67 | 67                         | 4130 N<br>3300 W | 218             | 8,100              |
| 1430          | 63                   | 73 | 64 | 62 | 66 | 64 | 65 | 74 | 69 | 74 | 66 | 68 | 68                         | ..               | ..              | ..                 |
| 1445          | 64                   | 74 | 64 | 62 | 66 | 66 | 66 | 76 | 71 | 75 | 66 | 69 | 69                         | ..               | ..              | ..                 |
| 1500          | 64                   | 74 | 64 | 63 | 67 | 66 | 66 | 74 | 70 | 74 | 65 | 68 | 68                         | ..               | ..              | ..                 |
| 1515          | 64                   | 74 | 63 | 63 | 68 | 66 | 66 | 76 | 73 | 75 | 66 | 70 | 70                         | ..               | ..              | ..                 |
| 1530          | 65                   | 75 | 63 | 63 | 68 | 67 | 67 | 77 | 73 | 76 | 66 | 70 | 70                         | 4215 N<br>3800 W | 212             | 8,100              |
| 1545          | 66                   | 76 | 64 | 64 | 69 | 68 | 88 | 78 | 74 | 76 | 67 | 71 | 71                         | ..               | ..              | ..                 |
| 1600          | 67                   | 76 | 63 | 64 | 69 | 67 | 68 | 77 | 73 | 76 | 66 | 70 | 70                         | ..               | ..              | ..                 |
| 1615          | 68                   | 77 | 64 | 64 | 70 | 68 | 68 | 78 | 75 | 77 | 67 | 82 | 82                         | ..               | ..              | ..                 |
| 1630          | 68                   | 77 | 64 | 65 | 71 | 69 | 69 | 78 | 75 | 78 | 68 | 72 | 72                         | 4250 N<br>4330 W | 200             | 8,100              |
| 1645          | 68                   | 77 | 64 | 65 | 70 | 68 | 69 | 78 | 76 | 78 | 68 | 72 | 72                         | ..               | ..              | ..                 |
| 1700          | 67                   | 76 | 64 | 65 | 70 | 69 | 70 | 78 | 75 | 77 | 68 | 72 | 72                         | ..               | ..              | ..                 |
| 1715          | 67                   | 76 | 63 | 65 | 70 | 68 | 70 | 78 | 76 | 78 | 68 | 72 | 72                         | ..               | ..              | ..                 |
| 1730          | 67                   | 76 | 62 | 65 | 70 | 69 | 70 | 78 | 75 | 77 | 68 | 72 | 72                         | 4300 N<br>4330 W | 196             | 8,100              |
| 1745          | 67                   | 76 | 62 | 64 | 70 | 68 | 69 | 78 | 74 | 76 | 67 | 72 | 72                         | ..               | ..              | ..                 |

|      |    |    |    |    |    |    |    |    |    |    |    |    |     |    |    |    |    |    |    |       |
|------|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|----|----|----|----|-------|
| 1545 | 66 | 76 | 64 | 64 | 69 | 68 | 88 | 78 | 74 | 76 | 67 | 71 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1600 | 67 | 76 | 63 | 64 | 69 | 67 | 68 | 77 | 73 | 76 | 66 | 70 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1615 | 68 | 77 | 64 | 64 | 70 | 68 | 68 | 78 | 75 | 77 | 67 | 82 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1630 | 68 | 77 | 64 | 65 | 71 | 69 | 69 | 78 | 75 | 78 | 68 | 72 | +25 | .. | .. | .. | .. | .. | .. | 8,100 |
| 1645 | 68 | 77 | 64 | 65 | 70 | 68 | 69 | 78 | 76 | 78 | 68 | 72 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1700 | 67 | 76 | 64 | 65 | 70 | 69 | 70 | 78 | 75 | 77 | 68 | 72 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1715 | 67 | 76 | 63 | 65 | 70 | 68 | 70 | 78 | 76 | 78 | 68 | 72 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1730 | 67 | 76 | 62 | 65 | 70 | 69 | 70 | 78 | 75 | 77 | 68 | 72 | +26 | .. | .. | .. | .. | .. | .. | 8,100 |
| 1745 | 67 | 76 | 62 | 64 | 70 | 68 | 69 | 78 | 74 | 76 | 67 | 72 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1800 | 67 | 76 | 62 | 64 | 69 | 69 | 69 | 77 | 74 | 76 | 67 | 72 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1815 | 68 | 77 | 63 | 65 | 69 | 70 | 70 | 78 | 75 | 77 | 68 | 73 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1830 | 68 | 76 | 62 | 64 | 70 | 69 | 69 | 78 | 75 | 77 | 67 | 72 | +25 | .. | .. | .. | .. | .. | .. | 8,000 |
| 1845 | 68 | 76 | 62 | 64 | 70 | 68 | 69 | 78 | 75 | 77 | 68 | 73 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1900 | 68 | 77 | 62 | 65 | 70 | 70 | 70 | 78 | 75 | 77 | 68 | 73 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1915 | 67 | 76 | 60 | 64 | 68 | 68 | 68 | 78 | 75 | 77 | 67 | 72 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 1930 | 68 | 78 | 61 | 65 | 70 | 70 | 70 | 79 | 76 | 78 | 68 | 73 | +25 | .. | .. | .. | .. | .. | .. | 8,000 |
| 1945 | 68 | 78 | 61 | 65 | 70 | 70 | 70 | 79 | 76 | 78 | 68 | 74 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2000 | 69 | 78 | 60 | 66 | 71 | 70 | 70 | 79 | 76 | 78 | 78 | 74 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2015 | 70 | 79 | 60 | 64 | 72 | 70 | 70 | 79 | 77 | 78 | 68 | 74 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2030 | 68 | 78 | 60 | 66 | 72 | 70 | 70 | 79 | 76 | 78 | 68 | 74 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2045 | 68 | 78 | 61 | 66 | 72 | 70 | 71 | 80 | 77 | 79 | 69 | 74 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2100 | 69 | 79 | 61 | 66 | 71 | 70 | 71 | 78 | 77 | 78 | 68 | 75 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2115 | 68 | 78 | 61 | 67 | 72 | 71 | 72 | 79 | 78 | 79 | 69 | 75 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2130 | 70 | 80 | 62 | 68 | 73 | 71 | 73 | 80 | 79 | 80 | 70 | 76 | +23 | .. | .. | .. | .. | .. | .. | 8,000 |
| 2145 | 68 | 77 | 60 | 66 | 71 | 70 | 71 | 78 | 76 | 77 | 68 | 75 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2200 | 68 | 77 | 61 | 66 | 71 | 70 | 72 | 78 | 77 | 78 | 69 | 75 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2215 | 68 | 78 | 61 | 66 | 71 | 70 | 72 | 79 | 77 | 79 | 69 | 75 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2230 | 68 | 78 | 61 | 66 | 72 | 70 | 74 | 79 | 77 | 78 | 70 | 76 | +25 | .. | .. | .. | .. | .. | .. | 8,000 |
| 2245 | 69 | 78 | 61 | 66 | 71 | 70 | 74 | 78 | 78 | 78 | 69 | 75 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2300 | 69 | 78 | 62 | 66 | 71 | 71 | 74 | 80 | 78 | 79 | 70 | 76 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2315 | 69 | 78 | 63 | 66 | 71 | 71 | 75 | 80 | 78 | 80 | 70 | 76 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2330 | 69 | 78 | 62 | 66 | 71 | 71 | 74 | 80 | 78 | 79 | 69 | 75 | ..  | .. | .. | .. | .. | .. | .. | ..    |
| 2345 | 69 | 78 | 60 | 66 | 71 | 70 | 74 | 80 | 78 | 79 | 70 | 76 | ..  | .. | .. | .. | .. | .. | .. | ..    |

NOTE: Total flight time: 12 hr 15 min.  
 Recorder channels 1 through 12: Placed in various locations in cargo compartment.

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TABLE 12. C-124 Flight 10092, McGuire AFB to  
Goose Bay, Labrador (1/28/69).

| Time<br>(GMT) | Recorder channels, °F |    |    |    |    |    | Outside<br>air temp,<br>°F | Position         | Speed,<br>knots | Altitude,<br>ft |
|---------------|-----------------------|----|----|----|----|----|----------------------------|------------------|-----------------|-----------------|
|               | 1                     | 2  | 3  | 4  | 5  | 6  |                            |                  |                 |                 |
| 1730          | ..                    | .. | .. | .. | .. | .. | ..                         | ..               | ..              | Take off        |
| 1750          | 35                    | 55 | 35 | 35 | 50 | 40 | ..                         | ..               | 150             | ..              |
| 1815          | 43                    | 49 | 45 | 44 | 48 | 43 | 25                         | 4055 N<br>7219 W | 195             | ..              |
| 1845          | 40                    | 53 | 40 | 40 | 50 | 45 | ..                         | ..               | ..              | ..              |
| 1915          | 41                    | 40 | 45 | 45 | 55 | 49 | 18                         | 4362 N<br>7037 W | 195             | 9,000           |
| 1945          | 48                    | 61 | 48 | 48 | 55 | 51 | ..                         | ..               | ..              | ..              |
| 2015          | 49                    | 60 | 47 | 47 | 56 | 54 | 18                         | 4515 N<br>6830 W | 195             | 8,900           |
| 2045          | 46                    | 59 | 50 | 48 | 56 | 53 | ..                         | ..               | ..              | ..              |
| 2115          | 51                    | 61 | 52 | 50 | 60 | 50 | 2                          | ..               | 190             | 9,000           |
| 2145          | 50                    | 61 | 54 | 50 | 59 | 49 | 3                          | ..               | ..              | ..              |
| 2215          | 55                    | 65 | 55 | 52 | 61 | 51 | ..                         | 5210 N<br>6315 W | 195             | 9,000           |
| 2245          | 55                    | 65 | 58 | 55 | 64 | 55 | 2                          | 5220 N<br>6315 W | 195             | 8,800           |
| 2350          | ..                    | .. | .. | .. | .. | .. | ..                         | ..               | ..              | On ground       |

NOTE: Total flight time: 6 hr 20 min.  
Recorder channels 1 through 6: Palletized cargo.

TABLE 13. C-124 Flight 10092, Goose Bay, Labrador to  
Sonderstrom, Greenland (1/29/69).

| Time<br>(GMT) | Recorder channels/°F |    |    |    |    |    | Outside<br>air temp,<br>°F | Position         | Speed,<br>knots | Altitude,<br>ft |
|---------------|----------------------|----|----|----|----|----|----------------------------|------------------|-----------------|-----------------|
|               | 1                    | 2  | 3  | 4  | 5  | 6  |                            |                  |                 |                 |
| 1450          | 19                   | 25 | 21 | 35 | 19 | 37 | ..                         | ..               | ..              | Take off        |
| 1520          | 26                   | 36 | 30 | 38 | 31 | 48 | ..                         | ..               | ..              | ..              |
| 1550          | 36                   | 40 | 39 | 50 | 34 | 55 | 3                          | 5510 N<br>6010 W | 195             | ..              |
| 1620          | 40                   | 46 | 45 | 54 | 36 | 60 | ..                         | ..               | ..              | ..              |
| 1650          | 45                   | 49 | 47 | 58 | 41 | 61 | ..                         | ..               | ..              | ..              |
| 1720          | 50                   | 50 | 50 | 60 | 45 | 65 | 0                          | 5880 N<br>5880 W | 197             | 9,000           |
| 1750          | 54                   | 55 | 51 | 62 | 45 | 66 | ..                         | ..               | ..              | ..              |
| 1820          | 55                   | 55 | 55 | 63 | 50 | 65 | -2                         | 6140 N<br>5630 W | 197             | 9,000           |
| 1850          | 55                   | 55 | 55 | 63 | 51 | 69 | ..                         | ..               | ..              | ..              |
| 1920          | 54                   | 55 | 54 | 55 | 52 | 70 | -11                        | 6500 N<br>5505 W | 191             | 9,000           |
| 1950          | 60                   | 55 | 56 | 65 | 52 | 70 | -18                        | ..               | ..              | ..              |
| 2015          | 61                   | 56 | 58 | 65 | 51 | 70 | ..                         | ..               | 190             | ..              |
| 2025          | ..                   | .. | .. | .. | .. | .. | ..                         | ..               | ..              | On ground       |

NOTE: Total flight time: 5 hr 35 min.  
Recorder channels 1 through 6: Palletized cargo.

TABLE 14. C-124 Flight 10092, Sonderstrom, Greenland to Kulusuk, Greenland (1/31/69).

| Time (GMT) | Recorder channels/°F |    |    |    | Outside air temp, °F | Position | Speed, knots | Altitude, ft |
|------------|----------------------|----|----|----|----------------------|----------|--------------|--------------|
|            | 1                    | 2  | 3  | 4  |                      |          |              |              |
| 1440       | 21                   | 19 | 25 | 19 | ..                   | ..       | ..           | On ground    |
| 1510       | ..                   | .. | .. | .. | ..                   | ..       | ..           | Take off     |
| 1600       | 33                   | 35 | 30 | 36 | -22                  | ..       | 200          | ..           |
| 1630       | 35                   | 35 | 36 | 36 | -22                  | ..       | 200          | 11,000       |
| 1700       | 36                   | 36 | 39 | 40 | -22                  | ..       | 195          | 11,000       |
| 1755       | 44                   | 36 | 24 | 40 | ..                   | ..       | ..           | On ground    |

NOTE: Aircraft loaded 24 hours before takeoff and remained outside on flight line in -20°F weather. Heater was placed in forward hatch 12 hours prior to takeoff.  
 Recorder channels 1 and 2: Skin measurements of structural antenna parts.  
 Recorder channel 3: Compartment floor temperature.  
 Recorder channel 4: Compartment air temperature.

UNCLASSIFIED

Security Classification

| DOCUMENT CONTROL DATA - R & D   |  |   |
|---|--|---|
| <i>Security Classification of title, body of abstract and indexing annotation must be entered when the overall report is classified</i>   |  |   |
| 1. ORIGINATOR'S REPORT (If separate author)<br>Naval Weapons Center<br>China Lake, California 93555   |  | 4a. REPORT SECURITY CLASSIFICATION<br><b>UNCLASSIFIED</b> |
|   |  | 7b. GROUP   |
| 2. REPORT TITLE<br><b>TEMPERATURE PROFILES OF AIR TRANSPORTED MATERIAL</b>  |  |   |
| 4. DESCRIPTIVE NOTES (Type of report and inclusive dates)   |  |   |
| 5. AUTHOR(S) (First name, middle initial, last name)<br><b>H. C. Schafer and R. A. Dickus</b>   |  |   |
| 6. REPORT DATE<br><b>October 1970</b>   | 7a. TOTAL NO. OF PAGES<br><b>48</b>  | 7b. NO. OF REFS   |
| 8a. CONTRACT OR GRANT NO.<br><b>Work Request WR 1-6025</b>  | 9a. ORIGINATOR'S REPORT NUMBER(S)<br><b>NWC TP 4828</b>  |   |
| b. PROJECT NO.<br><b>AIRTASK F19.332.301</b>  | 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)  |   |
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| 13. ABSTRACT<br><br>Winter flights of <b>MAC</b> aircraft were instrumented to determine the temperatures and temperature profiles to be expected in material during air transport. Flights in 21st Air Force C-141, C-124, and C-133 aircraft from the United States to Greenland and Europe during January are reported herein. |  |   |

| 14<br>KEY WORDS   | LINK A |    | LINK B |    | LINK C |    |
|---|--------|----|--------|----|--------|----|
|   | ROLE   | WT | ROLE   | WT | ROLE   | WT |
| Environmental Criteria Determination<br>Temperature Measurement Techniques<br>Aircraft Cargo Temperatures |        |    |        |    |        |    |

ABSTRACT CARD

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