A Report on the AIRLIFT

Berlin Mission

THE OPERATIONAL AND INTERNAL ASPECTS OF THE ADVANCE ELEMENT

DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE SECRETARY

JUN 27 1975

MEMORANDUM FOR EXECUTIVE, DCS OPERATIONS
EXECUTIVE, DCS PROGRAMS AND RESOURCES
EXECUTIVE, DCS SYSTEMS AND LOGISTICS
EXECUTIVE, OFFICE OF AIR FORCE HISTORY

SUBJECT: Report on the Airlift Berlin Mission

Recently, General Tunner appeared in a BBC documentary on the Berlin Airlift. He believed the Combined Airlift Task Force Report on the Berlin Airlift might be of interest to the Air Staff. The attached reports are forwarded for appropriate distribution. These copies are reproductions from General Tunner's personal copy. According to General Tunner, this report is the most factual and accurate of the Berlin Airlift Mission and is very scarce since few copies were reproduced.

Robert Hermann

ROBERT HERMANN, Colonel, USAF
Chief, Public Information Division
Office of Information

Attachments

PREPARED BY HEADQUARTERS
COMBINED AIRLIFT TASK FORCE

T H E   C O M B I N E D

F O R E W O R D

The Combined Airlift Task Force was a command subordinate both to the Headquarters United States Air Forces in Europe and the Headquarters British Air Forces of Occupation, containing United States Air Force, Royal Air Force, United States Navy air transport units and British Civil Charter Companies.

This report covers only those aspects of Airlift problems encountered by the Combined Airlift Task Force as the forward echelon of this combined operation. During its operation the Combined Airlift Task Force learned and re-learned many lessons in sustained mass air transport. In this analysis will be found discussion of these lessons, together with the problems which confronted the CALTF or were apparent to its commanders and their staffs.

Omitted from this analysis are the problems - and their solutions - of (1) those organizations in direct support of the Airlift, such as Burtonwood and Erding Air Depots, which were neither assigned nor attached to the Airlift; (2) those organizations outside the European Theater, such as MATS and the British bases handling heavy maintenance for the RAF aircraft; and (3) the echelons, both USAF and RAF, above this command.

The mission, the varied nationalities as well as services composing the CALTF, and the record daily tonnage hauled make the Berlin Airlift the most momentous mass air transport movement to date in history. This analysis has been prepared for use as source material in planning future mass airlifts in order that they may swing into full operation with minimum effort and cost but maximum speed and efficiency.

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INTRODUCTION . . .

On 1 August 1949, phase-out plans for the Berlin Airlift were put into effect, to terminate as rapidly as possible the world's largest mass air transport operation, known to the British as "Operation Plainfare," to the Americans as "Operation Vittles," to the Germans as "Die Luftbruecke" (Air Bridge), and labeled by the Russians as "Die Bluff-Bruecke."

This report, "Airlift — Berlin Mission," is an operational account of the British and American flying elements which, teamed together as the Combined Airlift Task Force, pursued to a decisive conclusion the joint mission of "Tons to Berlin." As the title implies, the report is strictly from the viewpoint of the operation. However, it is not a complete, logistical study of the Airlift operations. Months of research and study will be required to bring out of this intensive performance all of the valuable facts and conclusions. But the internal highlights can be mirrored quickly, as a broad reflection near at hand, to serve as a guide for future planning of similar operations.

During the 13 months from 26 June 1948 until 1 August 1949, more than 266,600 flights, carrying more than 2,223,000 tons of food, fuel and supplies, had been made into the peacetime blockaded city of Berlin, in aircraft bearing insignia of the Royal Air Force, British civil aviation, and the United States Air Force.

It is not within the province of the operational elements to discuss the external problems and accomplishments. Only the higher echelons in each participating government can describe those tremendous administrative and supporting agencies whose missions were concentrated and focused upon keeping the steady stream of loaded aircraft flowing through the air corridors to Berlin. Those organizations, of course, and, close at hand, USAFE and BAFO, ran the blood-bank, kept the Airlift alive -- made it possible.

The Combined Airlift Task Force, embracing air transport units of Great Britain and the United States, accomplished its joint mission more because of the implicit confidence and good will existing on both sides than by detailed regulations and directives. Actually, one of the greatest lessons learned was that such a thing could be done, and can be repeated. There are major organizational and operational differences in the Air Forces of the two nations but, in spite of these, it was possible to blend their efforts in successfully accomplishing the single objective.

Because of these differences, therefore, certain sections of this report deal exclusively with British operations and others with the American. Wherever possible, the treatment is joined. Every effort has been made to portray faithfully the separate and joint activities, and to record with impartiality the problems of each, the solutions, the accomplishments and the lessons learned.

In dealing with technical and administrative matters, this report goes into detail on the USAF side, but touches only of those aspects on the RAF side where they directly affected operations. This is done because Headquarters, CALTF, had only operational responsibilities for the RAF participation.

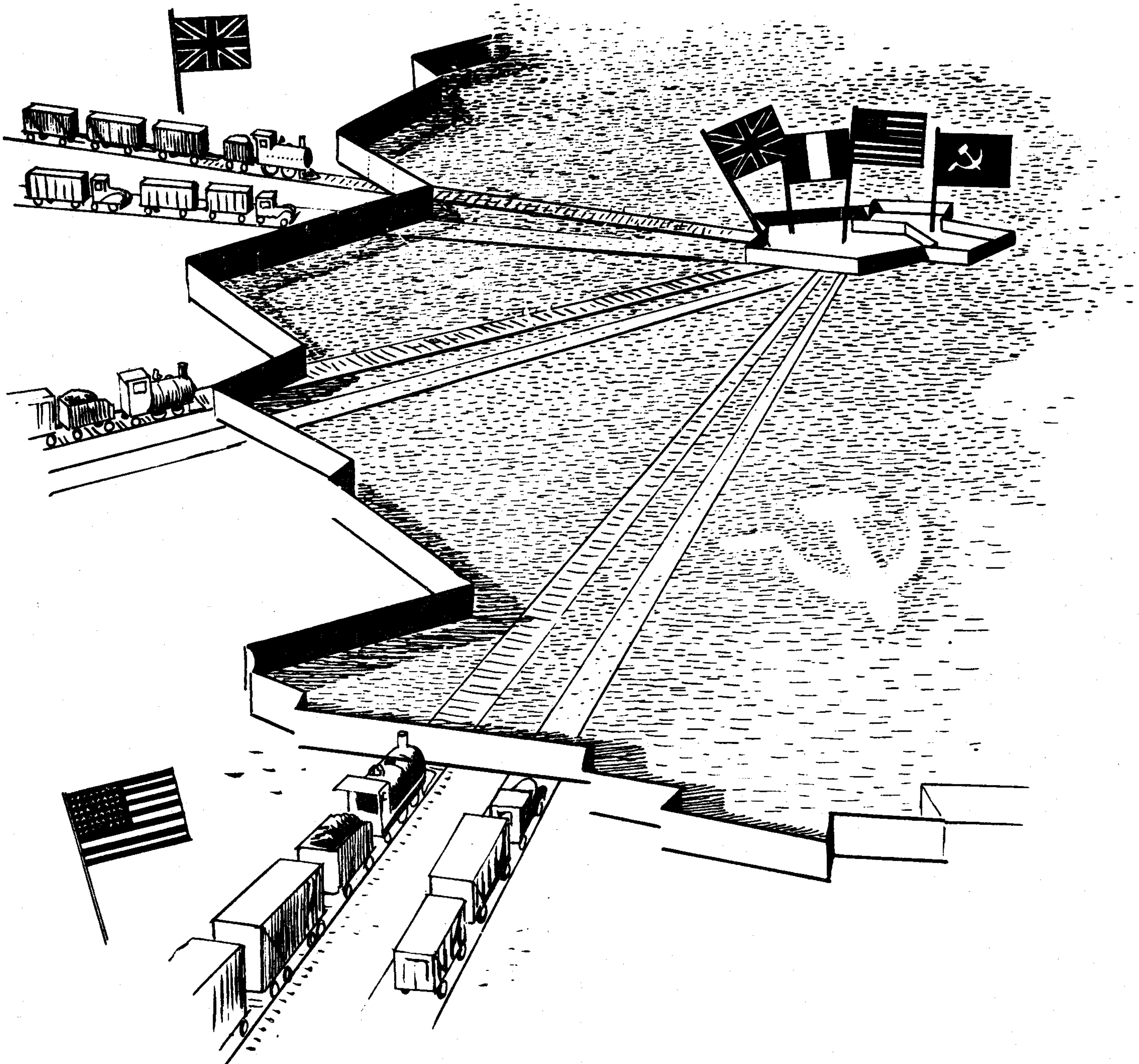
The operational units and the Headquarters staff have learned significant lessons in operating air transport aircraft on a production-line basis. It is their belief that, given the proper support, anything within reason can be transported anywhere in the world, at any time, by air, with minimum regard for geography or weather.

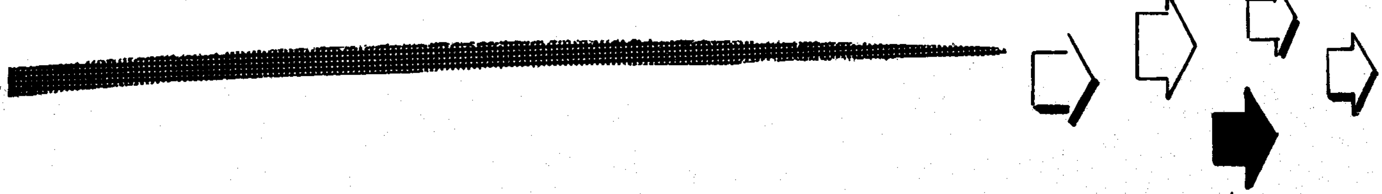
An Airlift Task Force can be appended to the organization of any theater commander. It can be operated entirely within that theater, or it can be based there and terminate its lift in another theater. It can traverse more than one theater. Such a Task Force also has the inherent ability to airlift itself, veritably by its own bootstraps, from one base of operations to any other base in the world.

1 The SITUATION...

On 24 June 1948, all rail traffic into Berlin from the Western Zones of Germany, amounting to 12 or 15 trains per day, was stopped by the Soviet government for "technical reasons," and the strangulation coils which had been slowly tightening about the city since the previous January, took their final hold. Berlin became virtually a besieged city, an island cut off from the rest of the world, entirely surrounded by the Soviet Zone. Official access was permitted only by air, through three 20-mile wide "corridors" extending on straight lines to Berlin from the three westerly cities of Hamburg and Buckeburg in the British Zone and Frankfurt am Main in the American Zone.

Three days earlier, according to official records, all military surface transportation between the three Western sectors of Berlin and the occupied zones of the United States, Great Britain and France, had been brought to an abrupt halt because of unreasonable Soviet restrictions. All means of incoming military transportation, except by air, were denied. This was followed on 23 June by Soviet inspections and investigations of all transport, extending to German trains, trucks and barges, as well as the military, which resulted in a





complete tie-up of surface transportation. For the first time in modern history, more than 2,250,000 people living in a city barely recovering from almost total devastation by war, faced starvation in peace or, in the words of General Lucius D. Clay, abandonment to totalitarian domination.

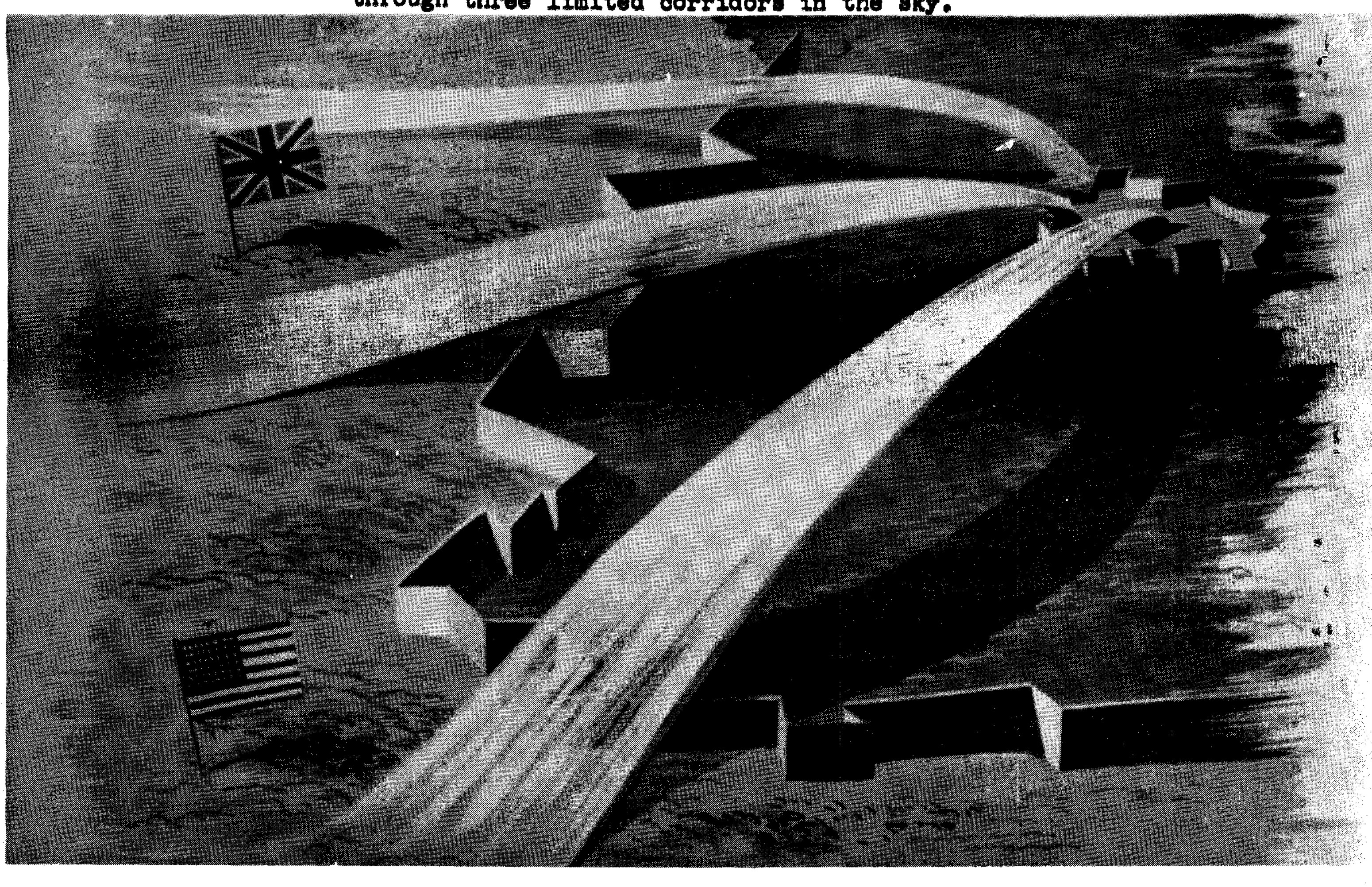
The Western Powers faced a situation calling for withdrawal of all forces and abandonment of position, or an attempt to supply a city as large as Philadelphia, U.S.A., with the necessities of life by the only remaining means of transportation — air — until some other solution could be found in the impasse. The decision was made to institute an airlift to Berlin from the Western sectors of Germany.

Already it had been necessary to resort to the airlifting of military supplies for a period of 11 days beginning on 1 April 1948, when the U.S. authorities refused to submit to Soviet search and investigation of military shipments by rail. During this time, 327 tons of Class 1 (food) and critical supplies had been flown in.

As the situation worsened after 11 April, movement by air of supply for the United States military was again initiated on 22 June, and the plans based upon the experience of the 11-day airlift were placed in effect by the Commanding General of the U.S. European Command, using the 60th and 61st Troop Carrier Groups of the United States Air Forces in Europe, based then at Kaufbeuren and Rhein Main. During the period 21-26 June, an average of 38 cargo flights were made each day, transporting approximately 130 tons of supplies.

Meanwhile, military supplies for British nationals were being flown in by their aircraft, but necessarily in smaller quantities. There were no comparable R.A.F. air transport units based on the continent when the total blockade was imposed. However, when the plans of the United States and Great Britain were made for a joint

● The "Blockaded Island" — Berlin — accessible only through three limited corridors in the sky.



airlift, immediately following the blockade, orders were given for the movement of R.A.F. Transport Command aircraft from England and the facilities of Tempelhof and Gatow airdromes were set up and augmented to receive the increasing amounts of supplies.

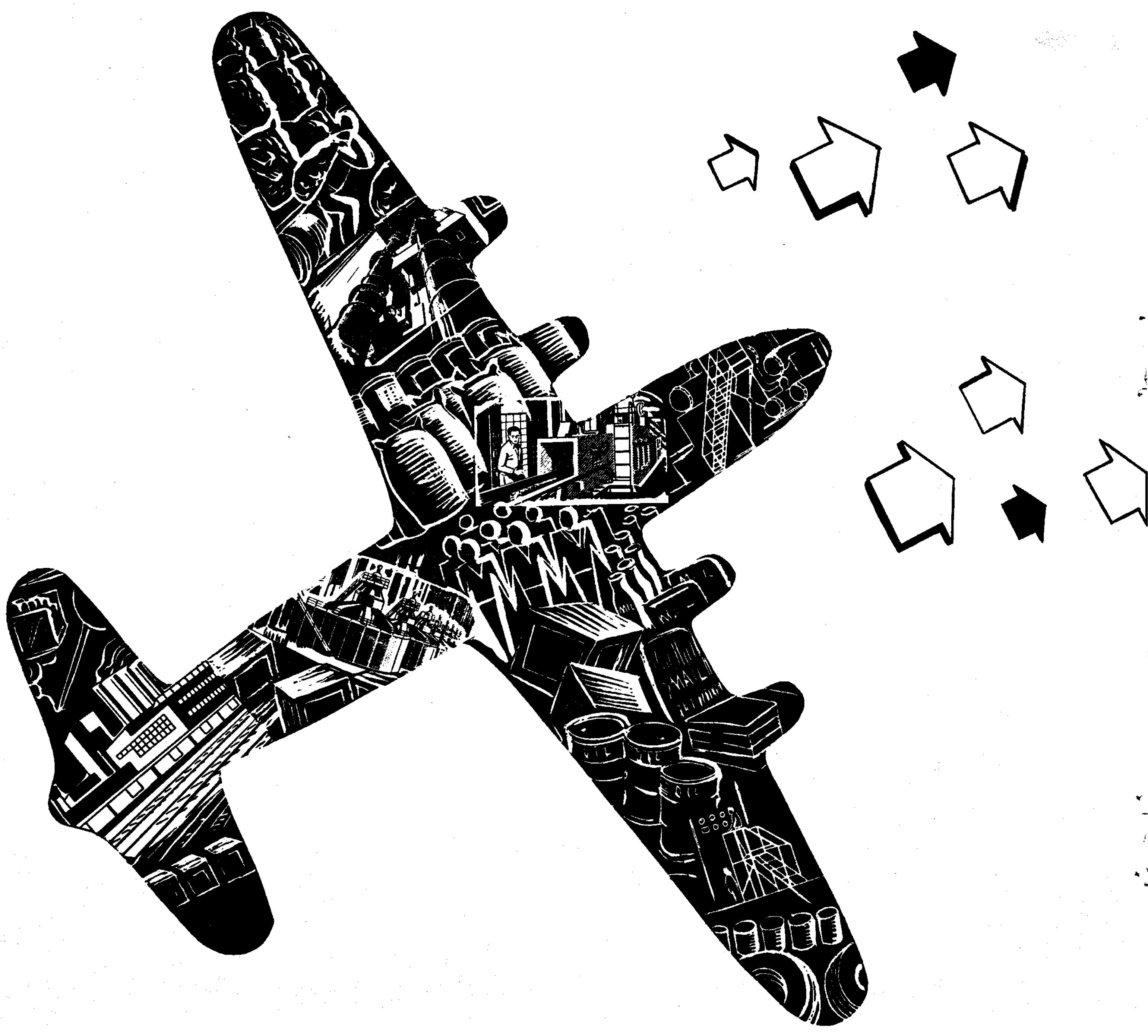
The Berlin Airlift, to supply the German population as well as the military, in the Western Sectors of Berlin, was actually begun on 26 June 1948.

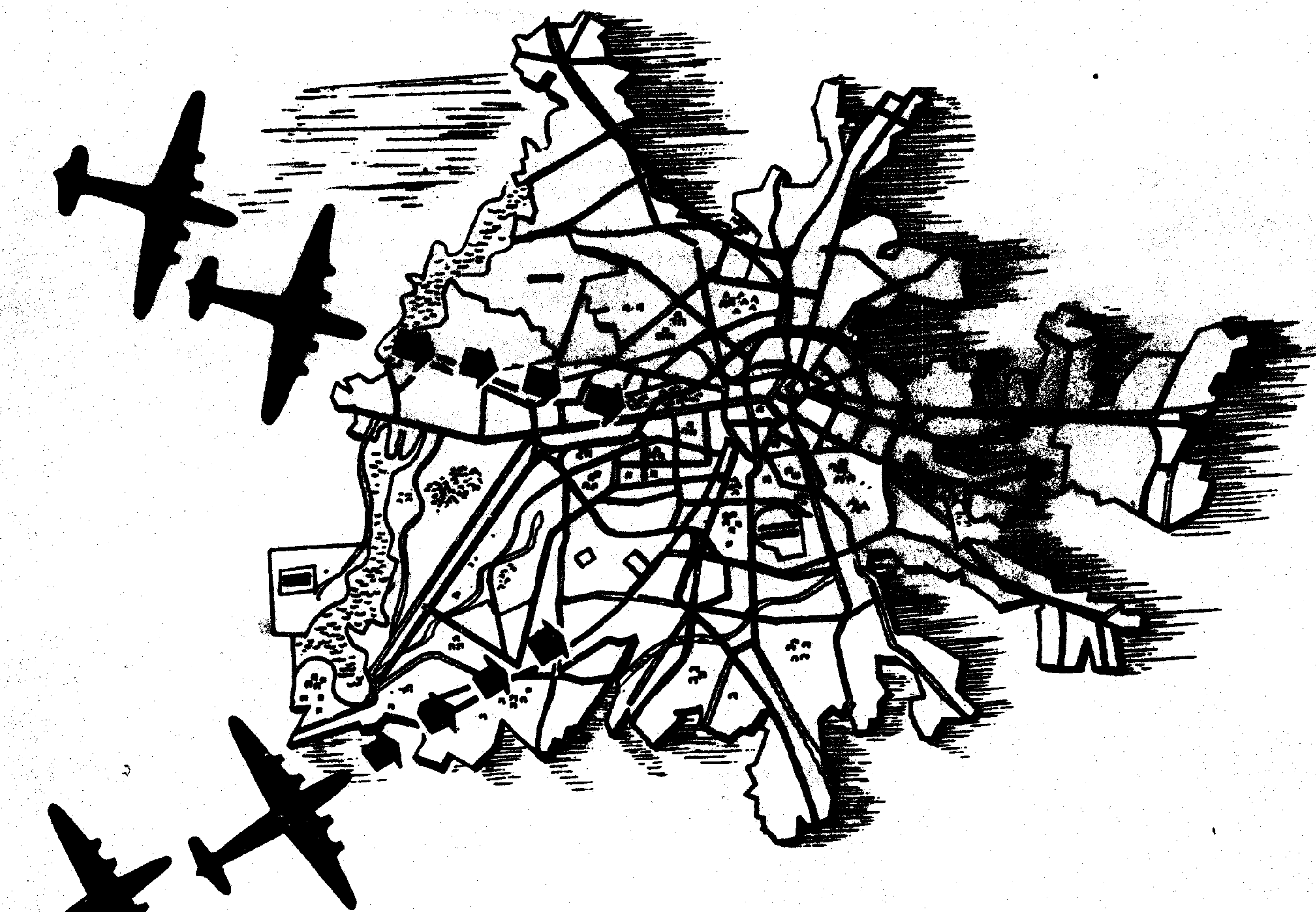
Prior to the blockade, approximately 12,000 tons of supplies were shipped daily to Berlin by rail, barge and trucks. The immediate situation on 25 June involved not only the problem of airlifting the bare necessities of life to Berlin, but also the establishment of far-reaching supply and support lines needed to accomplish the task.

German children (right) viewing arrival of an Airlift C-54 at Tempelhof Airfield.

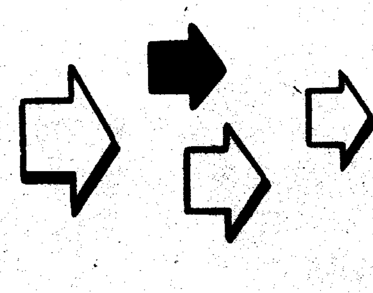
● Rail, barge and highway paths blockaded, thereby stopping the flow of supplies to the Western Sectors of Berlin.

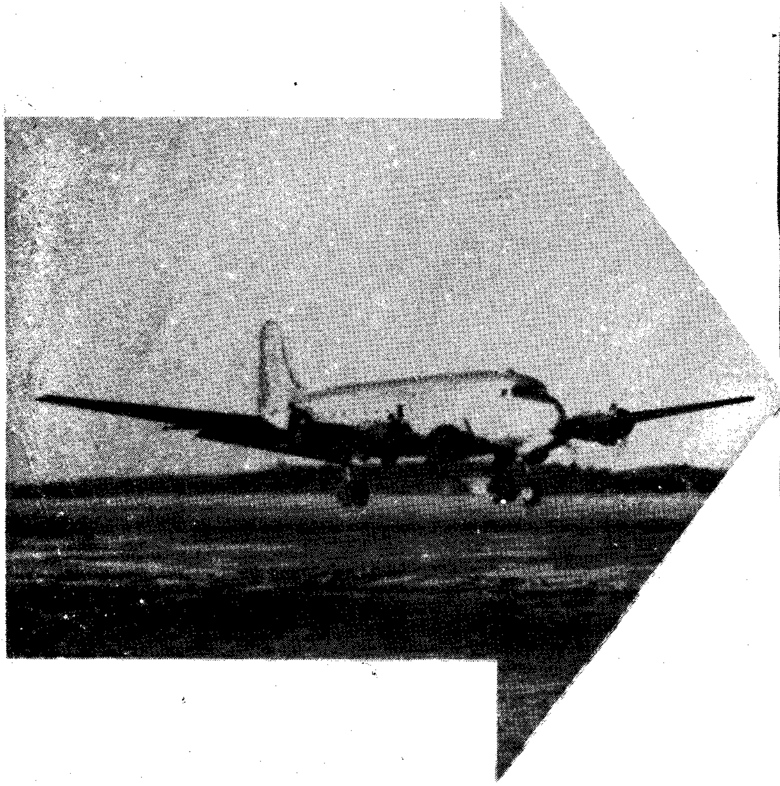
2 The MISSION





The Mission of the Berlin Airlift may be simply stated: "To supply the island of Berlin with the necessities of life by air." Although that sounds over-simplified, it states the Airlift goal completely. All achievement was measured by that yardstick. We considered Berlin an island, although entirely surrounded by land. It was unusable land. The access to Berlin was through the only free means left — guaranteed by a written agreement — the air.





The Mission ....

Based upon an estimate of the situation and a survey of the minimum needs to sustain all life in the Western Sectors of Berlin, the authorities representing Great Britain, the United States and France decided that 4,500 tons of varied supplies was the minimum daily requirement to be airlifted.

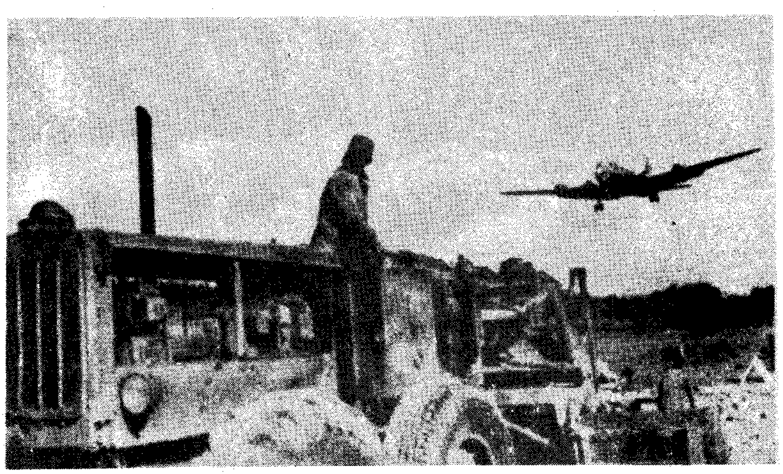
No allocation was made by the Joint Powers at that time establishing the amounts to be flown in by the British and United States units assigned to the Airlift mission. The units were instructed to transport the maximum amounts possible, within their capabilities.

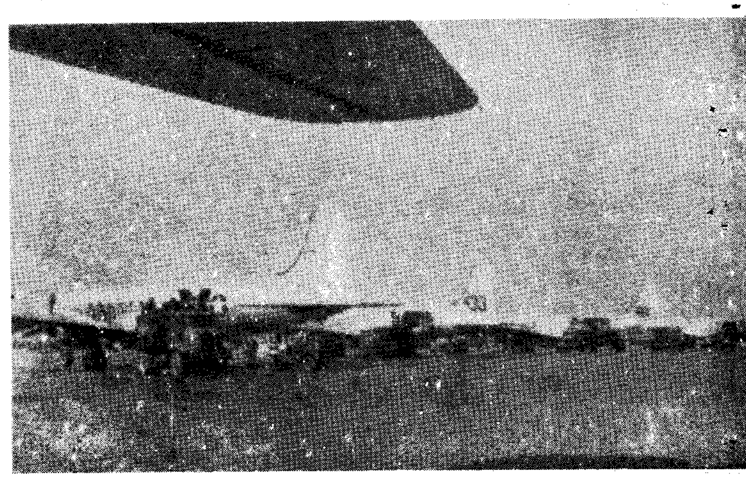
The first official mission for the United States elements was stated in an order dated 29 June 1948, from the Commanding General, USAFE, to the Project Commander of the USAFE Berlin Airlift Operation:

"Insure that the maximum number of missions are flown and that optimum over-all efficiency of operation is maintained..."

A similar mission was given the British elements by the British Air Forces of Occupation.

On 30 July 1948, the Commanding General, USAFE, ordered the formation of the Airlift Task Force (Provision-





al), appointing Major General William H. Tunner as its Commander. The order contained this statement:

"...The mission of the Airlift Task Force (Provisional) is to provide Airlift to Berlin and other places as may be directed by the Commanding General, USAFE..."

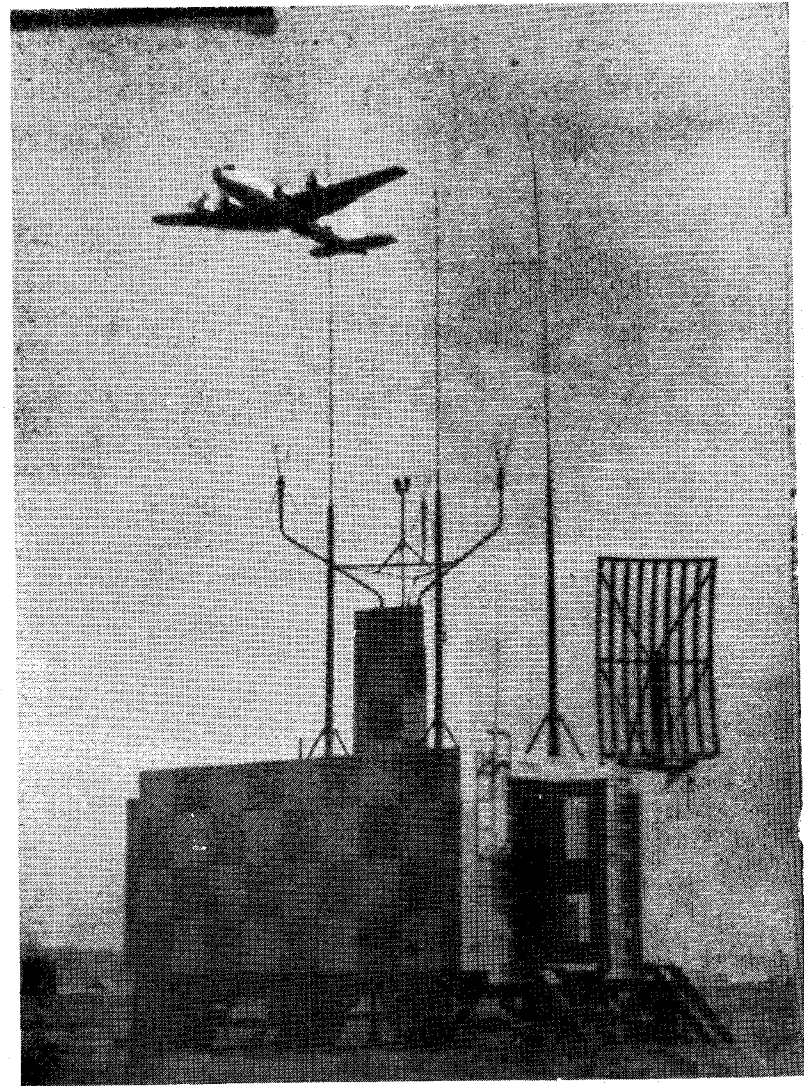
In September 1948, the British operational units were placed under the command of the No. 46 Group, Royal Air Force, at Buckeberg, with a mission similar to that of American units.

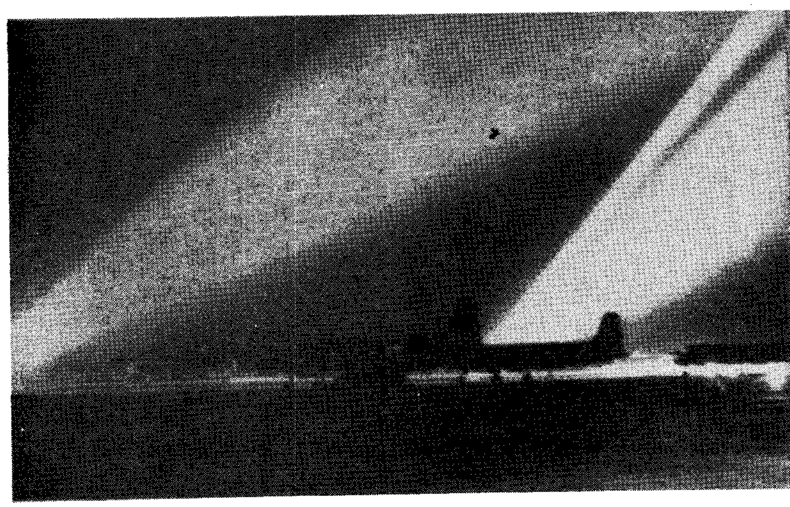
The original estimate of needs, translated into an official mission, was contained in a memo to the Commanding General, USAFE, dated 10 August 1948, subject: "Minutes of Meeting with Major General P. Hays, Deputy Chief, OMGUS." This established the definite tonnage goal of 4,500 tons per day by the combined efforts of the British and American units.

On 15 October 1948, in the joint letter which established the Combined Airlift Task Force, Headquarters USAFE and BAFO jointly set forth the mission in a letter directive to Major General Tunner which read in part:

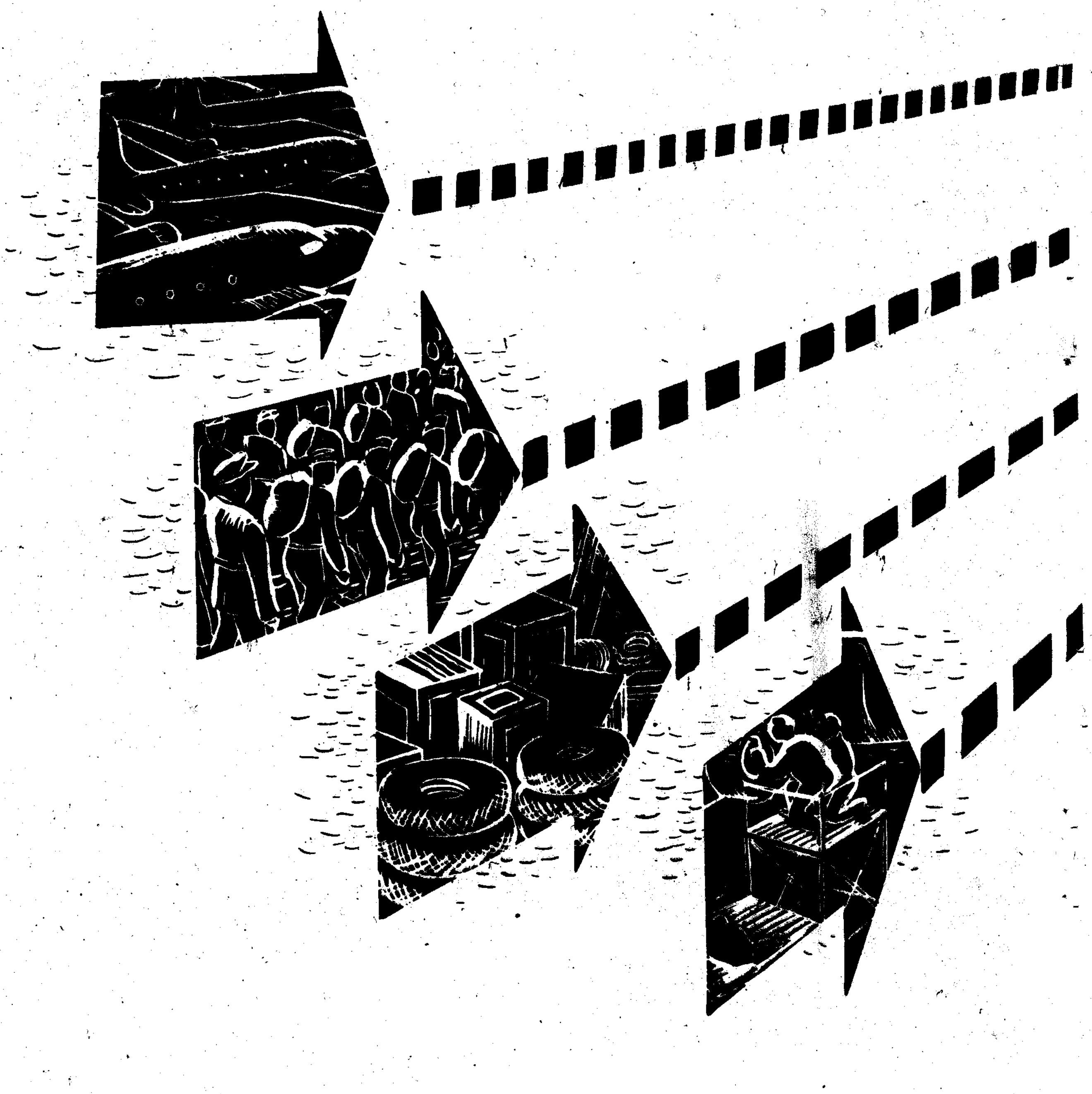
"To effect delivery to Berlin, in a safe and efficient manner, the maximum tonnage possible, consistent with the combined resources of equipment and personnel made available..."

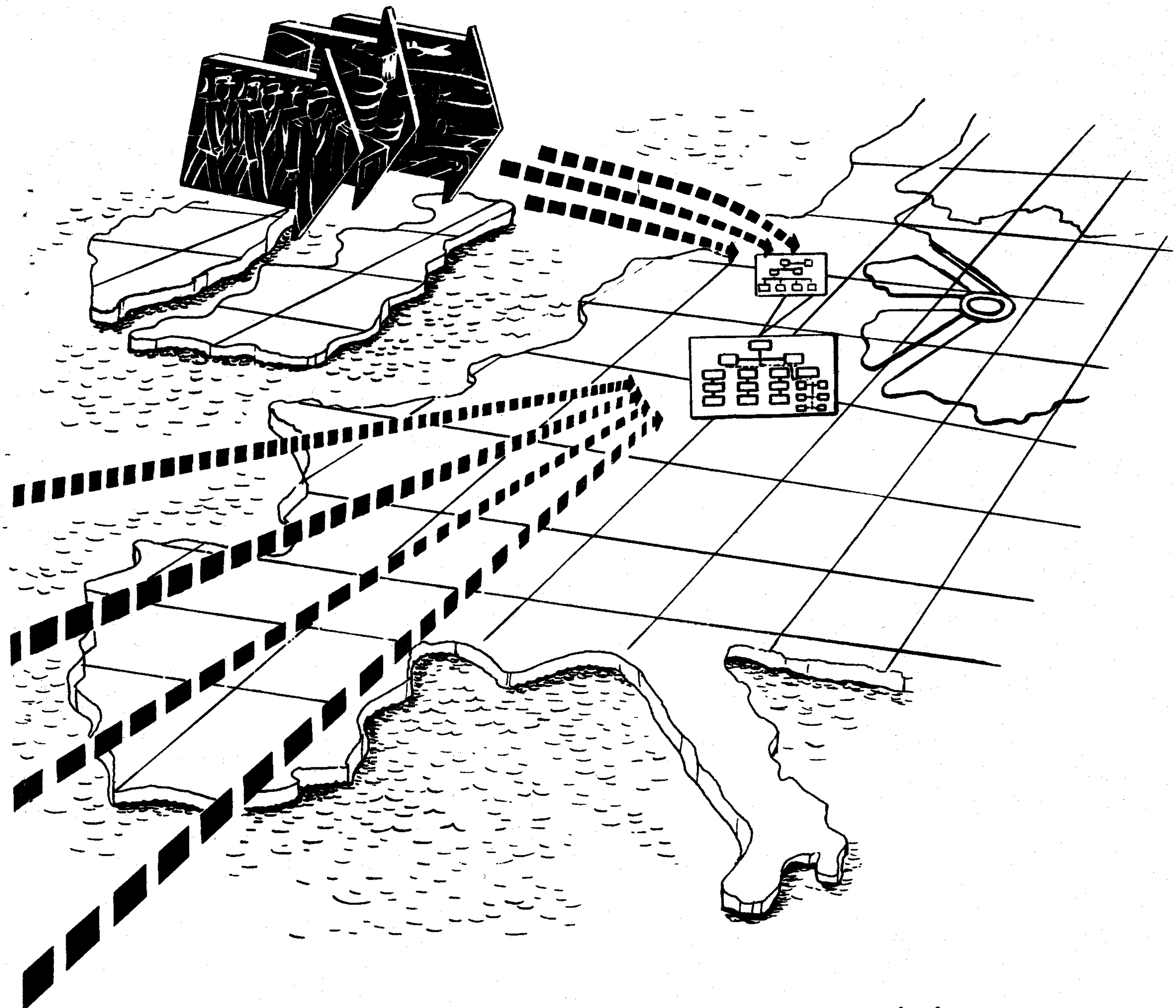
This mission was a decided change from the individual missions given to the Airlift Task Force (Provisional)—and the No. 46 Group. Instead of attempting to supply the 4,500 tons daily as minimum requirements for Berlin, the mission then became an all-out effort to supply the maximum possible within the capabilities. This mission never was changed basically until the removal of the blockade.



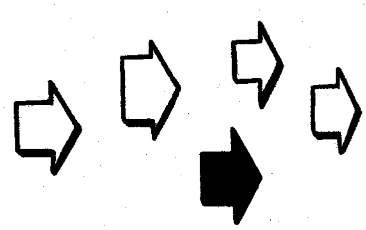


3 Tools of an AIRLIFT





Before describing the method by which the mission was accomplished, it is necessary that a brief description be given of the tools of the Airlift. These consisted of the aircraft, the men, the bases, and the organization that welded them into a composite machine. The machine then needed only the spirit of determination, coupled with mutual confidence and good will between the many partners, to ensure success of the mission.



ORGANIZATION

United States Air Force

The United States element of the Airlift was operated originally by the Operations Division of Headquarters, USAFE, but it was soon necessary to open a special branch of this division to deal with the many problems arising. As the extent of the operation increased, even greater decentralization and specialized control was found needed. On 26 July 1948, the Chief of Staff, USAF assigned a commander and staff experienced in transport operations to the United States Air Forces in Europe and on 30 July 1948, the Commanding General USAFE ordered the establishment of the Airlift Task Force (Provisional) as a separate organization. Originally, this Task Force Hq was chiefly operational and depended upon Headquarters, USAFE for many administrative functions. The two Airlift bases in the U.S. Zone were administered directly by Headquarters, USAFE. However, by the time the Airlift began its phase-out, Headquarters, 1st Airlift Task Force (as it was subsequently renamed) was almost completely responsible for the administration of its own bases.

USAF bases operated on the Wing-Base set-up which proved satisfactory. A modified form of the base unit system was introduced at Fassberg, but this was later rejected. Although patently less expensive in manpower, it was deemed fruitless at the time to continue the experiment. At Fassberg and Celle, British bases from which the Airlift operated, the USAF was responsible for operations while administration was divided between the RAF and the USAF.

Minor difficulties were encountered owing to the lack of any legal machinery to govern combined RAF-USAF operations. Fassberg was an interesting experiment, as it developed organizationally into an RAF station with a USAF station commander. Celle, on the other hand, remained throughout the operation an RAF Station with an RAF commander, from which an American Troop Carrier Wing operated.

In the USAF squadrons it was found that 15 aircraft of the C-54 type could be assigned and operated satisfactorily. During the operations the number actually varied from 8 to 15.

Royal Air Force

On the British side, the Airlift started under the operational control of a commander and a small staff, sent by Transport Command, who were responsible to the AOC-in-C, British Air Forces of Occupation, for operations. After a few weeks the Transport Force was divided between two bases and was operated under normal BAFO Station organization.

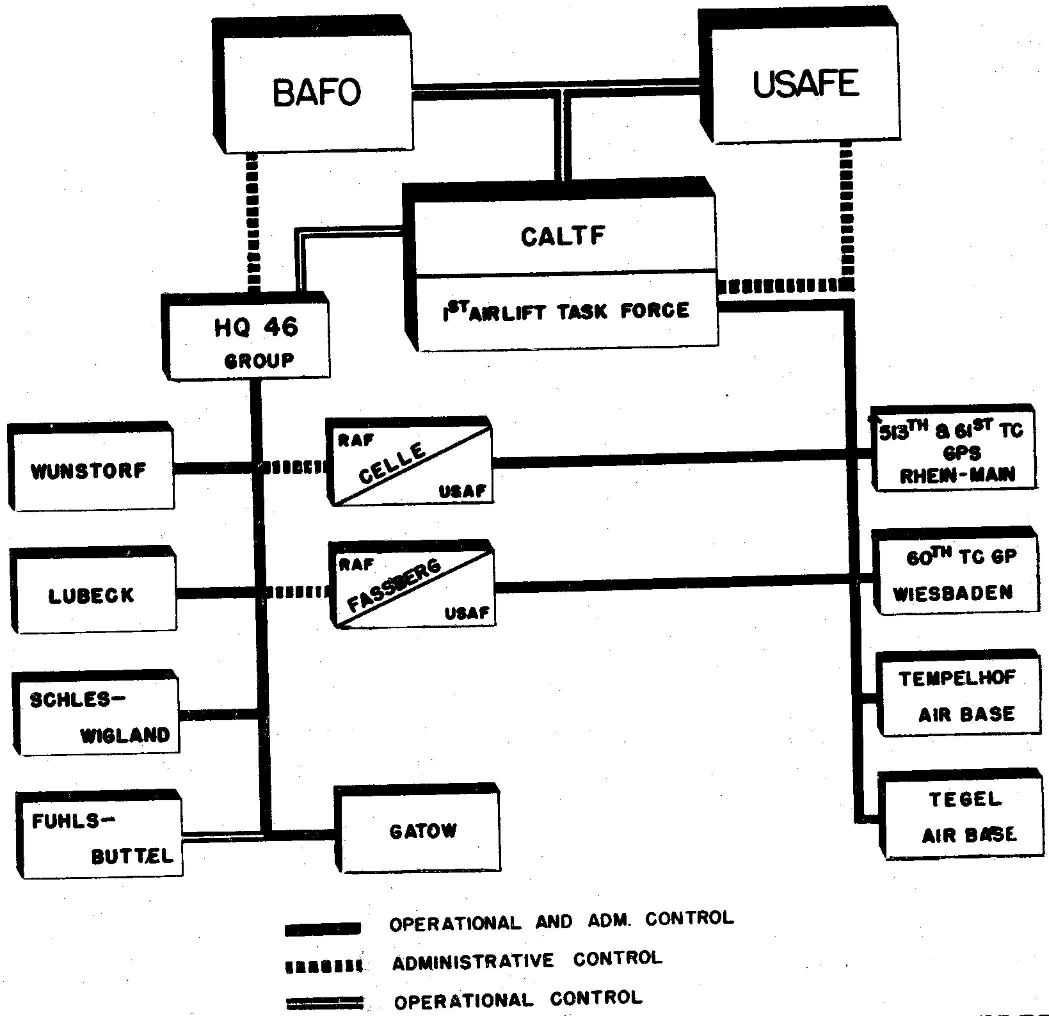
In September 1948, Advanced Headquarters, No. 46 Group RAF, was detached to Buckeburg from Transport Command. This Headquarters at first was purely operational but, like its U.S. counterpart, it took over responsibility for the full administration of its stations and became an integrated part of BAFO.

RAF bases operated on the normal three-wing system, but aircraft and aircrews had to be pooled. Squadron commanders were responsible for the efficiency and welfare of their personnel, carried out route checks, and withdrew squadrons for regular rest and training periods. In this way squadron identity was preserved. Exceptions were Fassberg and Celle, which operated under dual RAF-USAF control.

Combined

It was appreciated by both the RAF and USAF in the early stages of the operation that some form of combined control of operations was necessary. After consultations, it was agreed between the AOC-in-C, BAFO, and the CG, USAFE, that a Combined Airlift Task Force Headquarters should be formed at Wiesbaden. The Commander of the Combined Task Force, who was named by the two above-mentioned commanders, was jointly charged with the operational aspect of the Airlift and his directive is reproduced on pages 18-19.

CALTF ORGANIZATIONAL CHART



The Combined Headquarters did not develop exactly as the directive implies, and its combined functions were restricted to an over-all planning and control of the traffic patterns, routing, and aircraft timing in the corridors. It was not found necessary in the operational control of the RAF element to provide anything other than the control of traffic. Training, pilot supervision, technique of handling the operation were performed in accordance with RAF procedures and standards and these were not interfered with by the CALTF. It was only in the realm of Traffic Control, i.e., the assignment of altitudes, block times, methods of approach, landings, diversions, that this operational control became necessary.

Hq CALTF was integrated with Hq. 1st ALTF, with the addition of a small number of RAF officers. Fuller operational control over the British element and a closer integration could not have been accomplished without a very much larger RAF staff, and an encroachment on the authority of Headquarters BAFO and No. 46 Group. However, the integrated effort worked, and worked well, chiefly due to the great measure of mutual confidence and good will that existed and developed throughout the operation.

AIRCRAFT

United States Air Force

At the beginning of the lift, USAFE had two groups of transport aircraft, the 60th and 61st. These were equipped with C-47 aircraft. Reinforce-

AIR HEADQUARTERS
BRITISH AIR FORCES OF OCCUPATION (GERMANY),
ROYAL AIR FORCE,
c/o B.A.O.R.1.

HEADQUARTERS,
UNITED STATES AIR FORCES IN
EUROPE, A.P.O. 633,
U.S.ARMY

SUBJECT: Letter Directive for a Combined USAF-RAF Airlift Task Force

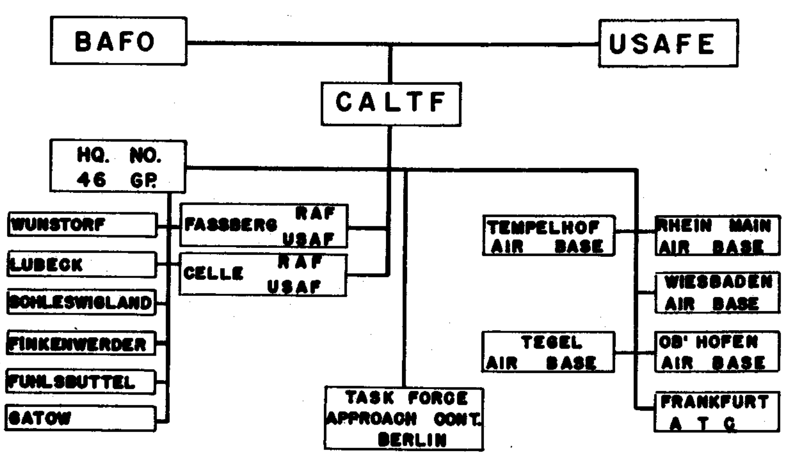
TO : Major General William H. Tunner, US Air Force.

1. By agreement with the Air Officer Commander-in-Chief, British Air Forces of Occupation, announcement is hereby made of the establishment of Headquarters, Combined Airlift Task Force. Major General William H. Tunner, USAF, is designated Commander thereof and shall be located in Wiesbaden for the time being. Air Commodore J.W.F. Merer, No. 46 Group, R.A.F. is designated Deputy Commander and will be located at Buckeburg. The Combined Airlift Task Force shall be organized generally along the lines indicated in the attached organizational charts.

2. The purpose of this organization is to merge the heretofore coordinated, but independent, USAF-RAF Airlift efforts in order that the resources of each participating service may be utilized in the most advantageous manner. Its primary mission is to deliver to Berlin, in a safe and efficient manner, the maximum tonnage possible, consistent with the combined resources of equipment and personnel made available.

3. Matters of policy and emergency planning of mutual concern to USAFE and BAFO, and affecting the Combined Airlift Task Force, will be agreed upon by the Commanding General, USAFE and the Air Officer Commander-in-Chief, BAFO prior to dissemination as combined USAFE-BAFO directives. Matters not covered by combined policy directives and requiring immediate action will be acted upon by the Commanding General, Combined Airlift Task Force and information of action taken will be forwarded expeditiously to USAF and BAFO with request for future guidance. Routine matters related to base logistics and personnel administration, singularly peculiar to either USAFE or BAFO, will be handled as heretofore; that is, directly with the air base concerned. Each of these major commands will provide complete support at bases used solely by its own operating forces, and each will be responsible for administrative functions at bases within its own Zones or Sectors when such bases are utilized operationally by air units of the other. The Task Force will monitor this support and ad-

Shown on these two pages is a reproduction of the official letter directive establishing the Combined Airlift Task Force.



vise USAFE and BAFO Headquarters of any deficiencies which adversely affect the mission of the Task Force.

4. The major functions of the Combined Airlift Task Force shall be generally operational in nature rather than administrative. The Commanding General is given command over all U.S. units and operational control of R.A.F. units to which aircraft are assigned and which are directly engaged in the Airlift effort. He is granted the authority to direct Wing, Base and Station Commanders, as a first priority mission to provide within the limits of their capabilities administrative and logistical support for his operating units. He is further granted the authority and responsibility to regulate all air traffic entering or leaving the air space utilized by Airlift aircraft in the delivery of supplies to Berlin, subject to such policies as may be jointly issued from time to time by USAFE and BAFO. He is also empowered to direct the operational aspects of those elements of air traffic control agencies, facilities and services assigned to support the Airlift in order to insure their proper contribution to the Airlift. He will keep the Commanding General, USAFE and the A.O.C-in-C BAFO informed as to the progress of the Airlift effort, and as to major difficulties encountered in the accomplishment of his mission.

5. Normal channels of communication for Airlift Task Force are through USAFE or BAFO Headquarters; however, authority is granted for the Commanding General, Combined Airlift Task Force to communicate directly with the following on matters indicated:

a. EUCOM, BAOR and BICO relative to supplies being transported to and from Berlin, including but not limited to maintenance of backlogs, safe and expeditious handling of supplies at airports, and management of cargo handlers.

b. Headquarters Military Air Transport Service and R.A.F. Transport Command relative to personnel, technical and training matters.

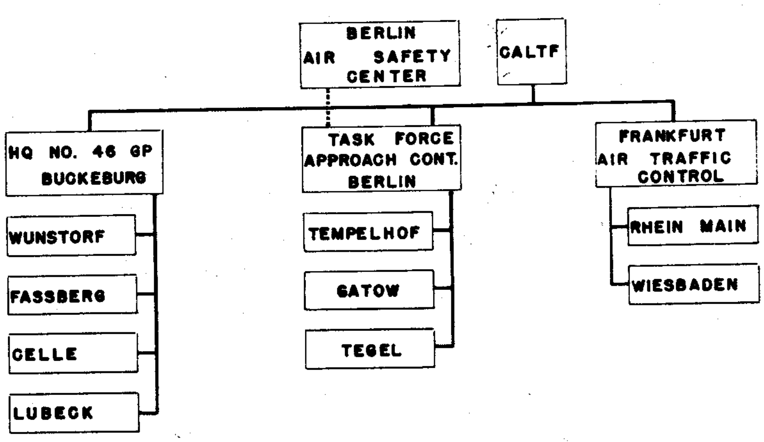
/s/ A. P. M. Saunders

SIR ARTHUR P.M. SAUNDERS,
AIR MARSHAL
AIR OFFICER COMMANDER-IN-CHIEF.

/s/ Curtis E. LeMay

CURTIS E. LeMAY
Lieutenant General, USAF
Commanding.

Shown at the bottom of these two pages are organizational charts as established in above letter directive.



ments of C-54s from the Military Air Transport Service and Troop Carrier Commands soon became available, and at the end of the first month of the lift 161 aircraft were in operation, of which 107 were C-47s and 54 were C-54s. The C-54 lifted 10 short tons against the 3½ tons of the C-47.

By the end of September 1948 the C-47s were withdrawn. It was decided to use the C-54s exclusively, except for a few C-82s which were required to lift difficult loads for which they were especially suitable. Eventually the Task Force was assigned 225 C-54s, with sufficient reserves to allow for cycle reconditioning and the pipeline to and from the United States. These aircraft were flown to Germany from Panama, Alaska, Hawaii, Japan, Guam and the United States.

A C-74 and C-97A were each flown experimentally for a short period.

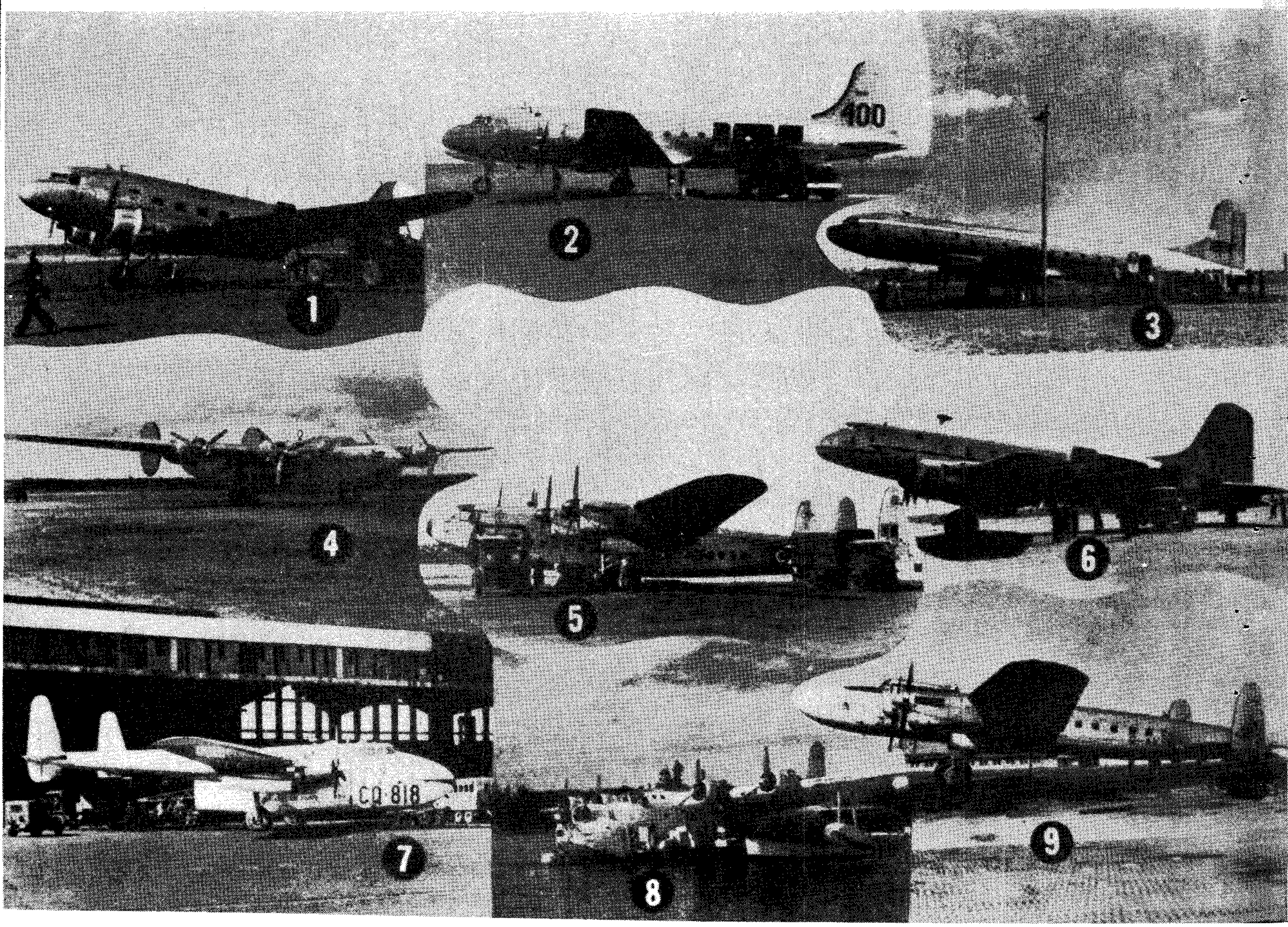
Royal Air Force

Dakota aircraft from Nos. 38 and 46 Groups, Transport Command, formed the original RAF Detachment, soon joined by Yorks from Nos. 38 and 47 Groups. A total of 54 Dakotas and 40 Yorks were concentrated at Wunstorf.

Two squadrons of Coastal Command Sunderland flying boats also were used from early in the operation until the middle of December 1948, when they had to be withdrawn because of the formation of ice on waterways.

The Hastings, the eventual replacement of the York, arrived in Germany and began operating early in November 1948, increasing in numbers throughout the winter and early summer.

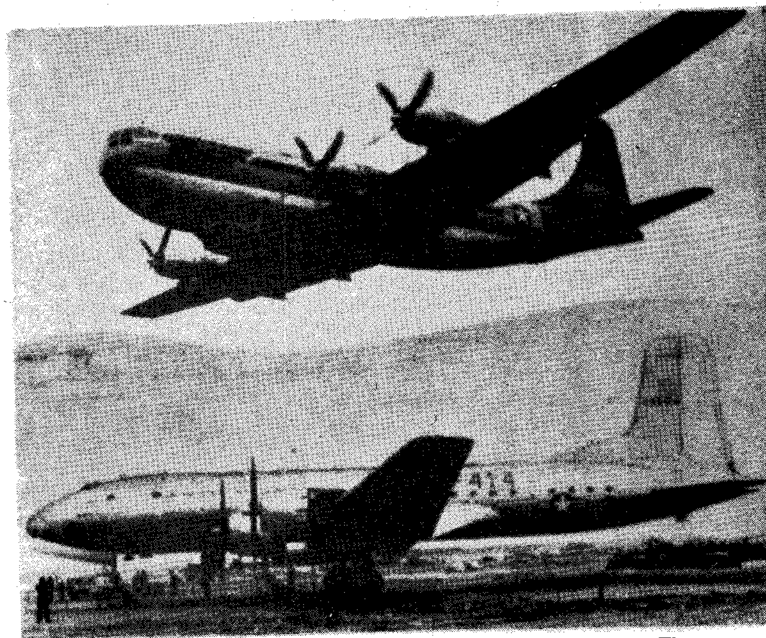
The strength of RAF aircraft varied throughout the lift, but their numbers and average payload prior to the phase-out were: 40 Dakotas, 3½ tons; 35 Yorks, 8½ tons; 26 Hastings, 9½ tons.



British Civil Aviation

British Civil aircraft began operating in July 1948. The initial fleet included Dakotas and Bristol Freighters, but these light transports were later withdrawn and the civil element consisted of Tudors, Lancastrians, and Haltons, together with one Liberator and one York. Two civil Hythe flying boats were used until mid-December 1948.

The civil fleet specialized in Tanker aircraft and their average numbers in Germany and average payload prior to the phase-out were; 4 Tudors, freighter, 11 tons – tanker, 8½ tons; 1 York, freighter, 8½ tons; 12 Lancastrians – tanker, 7½ tons; 20 Haltons, freighter, 6 tons, – tanker, 6 tons; 2 Liberators, tanker, 8 tons.



Two of the largest aircraft used. The C-97 (top) and C-74 both were classed as 20-ton transports on the Airlift.

PERSONNEL

United States Air Force

Personnel from units within USAFE began the initial operation of the USAF share of the Airlift. On 4 July 1948, the first increment to augment USAFE personnel arrived from the Zone of Interior in a temporary duty status. The operation began to assume a permanent character in the month of September, when the USAF military strength of assigned and attached personnel reached 1,320 officers and 3,605 airmen. By 1 January 1949, this strength had increased to 2,374 officers and 7,563 airmen, and by 1 June 1949, the military strength of assigned and attached USAF personnel was 2,463 officers and 9,017 airmen.

Many personnel were ordered to duty with the Airlift from theaters outside of Europe on very short notice. This caused hardships in many cases, since officers and airmen were not given sufficient time to take care of personal affairs and prepare for overseas shipment. Thinking that the duty would be of short duration, they made only temporary arrangements to take care of personal matters. The initial temporary duty tours were extended from 45 days to 90 days, and then to 180 days. As a result, a number of personnel had to be returned to their home stations to alleviate pressing emergencies.

Categories Established

Due to the intense flying effort in the operation, personnel were classified into two separate categories, each having its own peculiar problems: a) crew personnel, and b) maintenance and other supporting personnel.

At the start of the Airlift, it was determined that at least three crews, each consisting of two pilots (officers) and one aerial engineer (airman), per allocated aircraft, should be provided.

The USAF needs from November until February were set at three aerial engineers per aircraft. However, with the rapid turn-around time, and 24-hour operation, it became necessary to allow the assignment of five aerial engineers per aircraft, so that a crew chief could be with the aircraft at all times, whether in the air or on the ground. This practice resulted in dividends of better maintenance.

Photo (left) shows some of the British and American aircraft used on the Airlift. Numbered from top left are: 1. Dakota (C-47) 2. Skymaster (C-54) 3. Tudor 4. Liberator 5. York 6. Hastings 7. C-82 8. Sunderland (Flying Boat) 9. Lancastrian. Also used was the British Halton, which is not shown.

It soon became obvious, however, that the proper factor for determining crew requirements should be the aircraft utilization. With the arrival of replacements and adequate maintenance personnel in the Theater, it was possible to raise the utilization factor of each aircraft from an average of 5.5 hours per 24-hour day in July to the average of 9.5 by April 1949.

Increased flying hours generated the need for more personnel, both on the ground and in the air. Toward the conclusion of the Airlift, it became apparent that an average of approximately 3.6 pilot crews per aircraft would be required to sustain the all-out effort, and to provide the crew rest and relaxation necessary to preclude lowering of operational efficiency.

Rotation Plan

With the establishment of the RTU at Great Falls, Montana, under the guidance of Military Air Transport Service, sufficient replacement crews became available for the first time, in December 1948, to permit replacement of TDY personnel. When it became apparent that the number of incoming personnel through the Great Falls pipeline would be sufficient to permit rotation of TDY personnel, and at the same time provide a steady gain in personnel assigned to the Airlift, the Command was able to announce that all crew members could be rotated to the Zone of the Interior after six months duty. By February 1949, rotational policies were firmly established and rotation of crew personnel to the Zone of Interior was occurring regularly, without hitches.

With the attainment of an average of 104 crews per month in December, as normal replacements, it became possible to divert some incoming personnel, such as those highly experienced in transport operation, to supervisory positions as check pilots and as standardization and qualification board members.

The input of Great Falls trained personnel not only provided replacements for TDY personnel, but enabled this Command to increase assigned duty pilots. A total of 1,258 were flying the Airlift in July 1949, against an estimated requirement of 1,322 pilots, based upon a planning factor of 70 hours per month for the northern corridor and 80 hours per month for the southern corridor.

PCS Replacements

In February, the Airlift had approximately seven men per aircraft assigned in the maintenance field. It was determined that a minimum coverage to operate 24 hours, seven days a week, would be 15 maintenance men per aircraft, plus German civilian mechanics. The flow of incoming replacements in February began to increase in numbers and experience level. A rotation policy was instituted and its effects on morale were immediately felt. The bulk of the TDY personnel were moved out, as the incoming replacements were PCS. By 15 May, all TDY personnel were returned to home stations with exception of a few isolated cases. The replacements from the specialized schools in the ZI were also arriving, and the maintenance field increased in numbers as well as quality. Assigned maintenance personnel per aircraft reached 12, plus the seven German mechanics per squadron assigned. A few specialists were still needed, particularly hydraulic mechanics, power-plant mechanics, electrical mechanics and propeller mechanics.

German Nationals

The utilization of German nationals proved highly successful in the operation of the Airlift. The major difficulty encountered in their use as aircraft mechanics was their lack of familiarity with American aircraft and this, mixed with their language difficulty, caused a problem of supervision during the initial period of their employment.

A formalized training program was established to familiarize this type of personnel with C-54 type aircraft. German translators were employed and

Technical Orders were translated in order to familiarize mechanics with the aircraft. The use of Germans is further discussed in the chapter on USAF Maintenance.

German Nationals were used to good advantage in other fields than maintenance. Their increased use is indicated by the additional authorizations for maintenance personnel. Original authorization allowed 50 mechanics for each transport squadron. Due to favorable experience, the authorization was increased to 65 per squadron in the American Zone, and 75 in the British Zone. Finally, the authorization was increased to 80 per squadron in the Air Force Units.

Personnel - RAF

The RAF suffered from a lack of air and ground crews. The air-crews were augmented at first from No. 38 Group Training Establishments, and later from the Royal Australian Air Force, the South African Air Force and the Royal New Zealand Air Force.

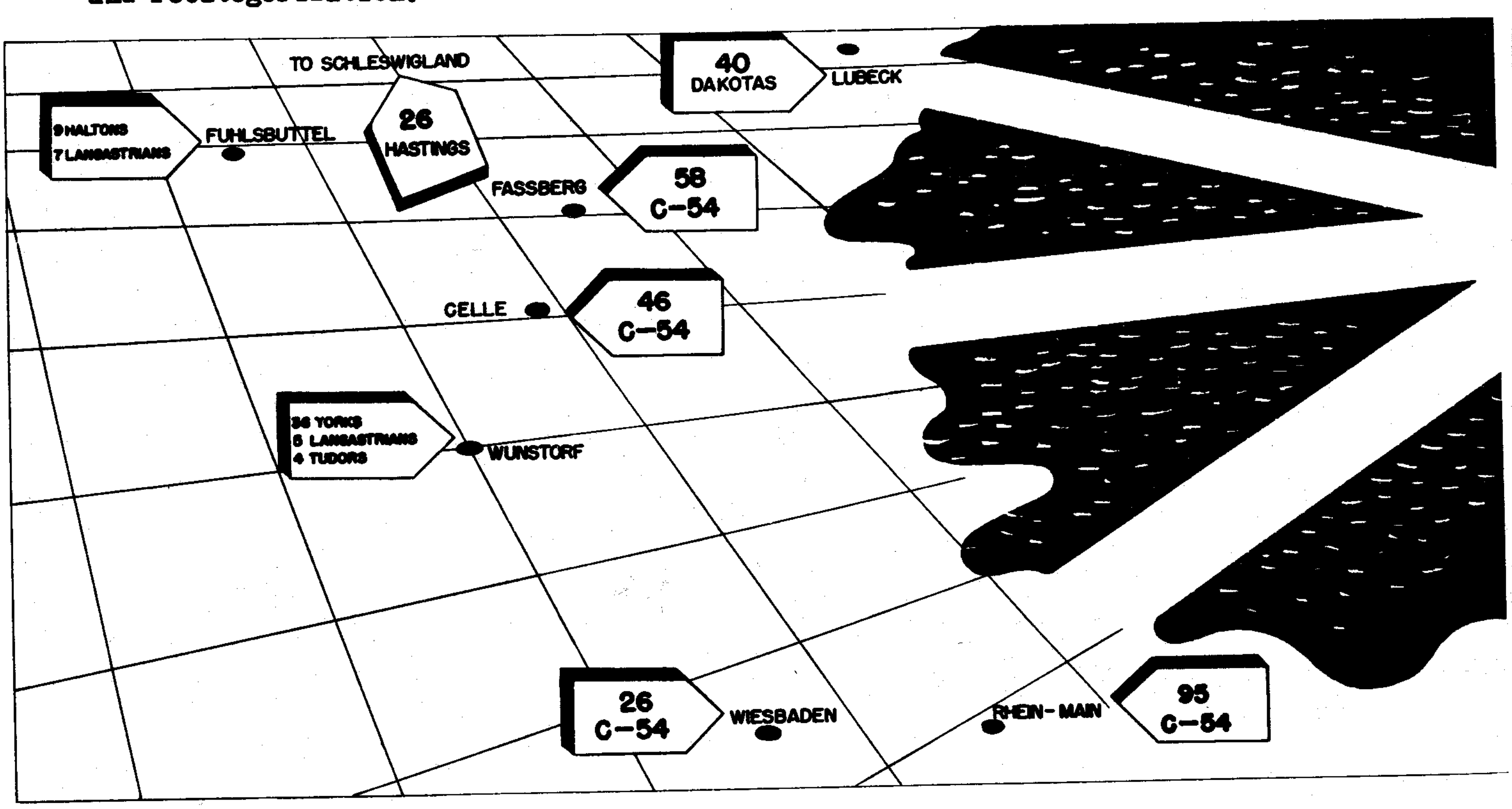
Owing to the close proximity of the United Kingdom to the theater of operations, the RAF was not affected by the question of rotation in the same way as the USAF. Squadrons were returned to the United Kingdom at regular intervals. There the aircrews had leave, underwent continuation training and recategorization.

BASES-USAF·RAF

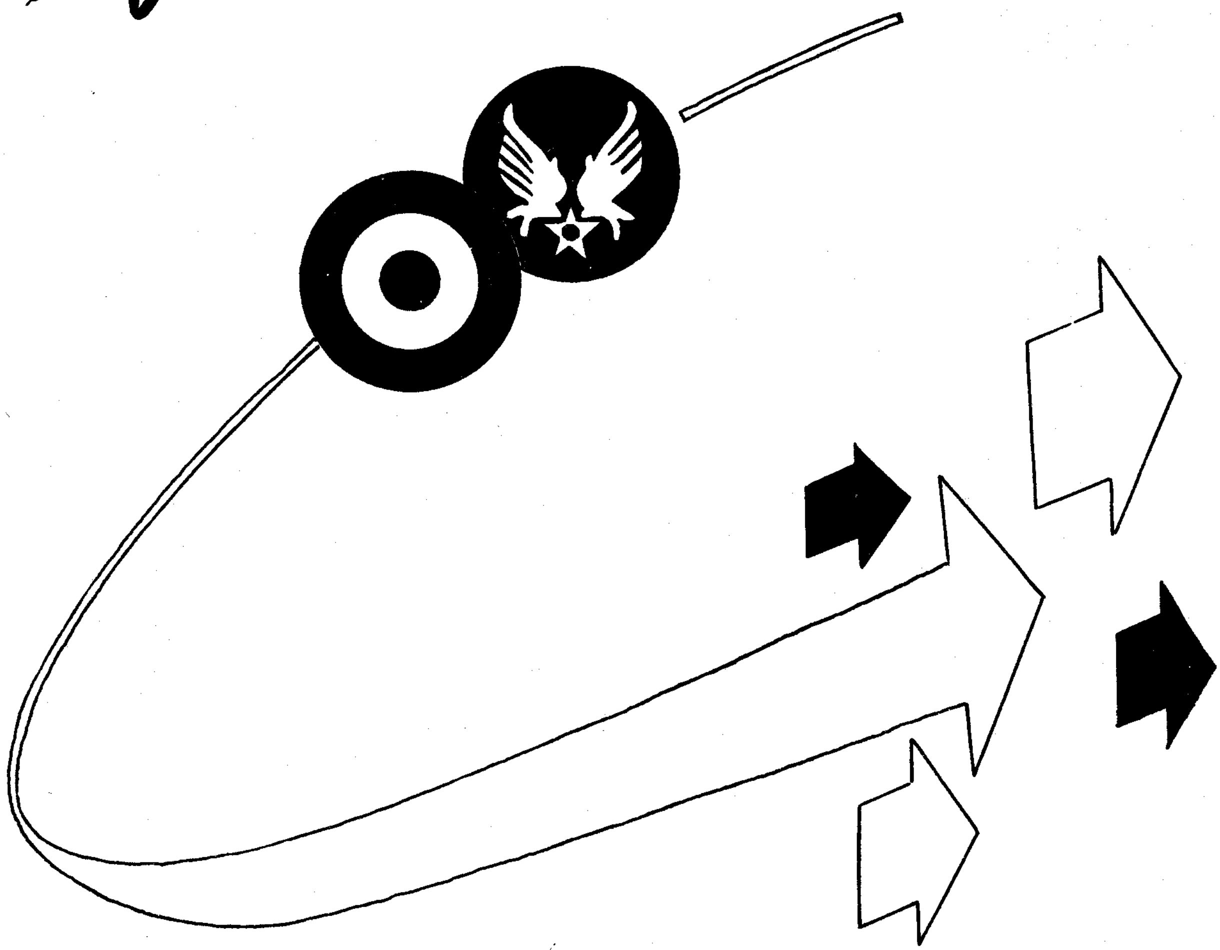
At the beginning of the Airlift five existing airfields were selected for the operation. These bases were, Rhein Main and Wiesbaden, located in the American Zone of Occupation, Wunstorf in the British Zone, and the Berlin terminals of Tempelhof and Gatow. Bases were chosen because of their immediate availability for conversion to Airlift operation and their physical location.

As the Airlift expanded, additional bases were required, both in the Western zones and in Berlin. By the end of the blockade 11 bases had been equipped and used, with one additional base under construction. Because of the distance factor, it was profitable to utilize bases in the British Zone which were located near the entrance to the shortest corridors. Celle and Fassberg, located in that zone, were made available to the USAF for the operation of C-54 aircraft.

Airlift bases and the number of aircraft stationed at each, prior to the phase-out, are shown in the chart below. A more detailed description of each base is given in Chapter V of this report.



4 Performance of the MISSION



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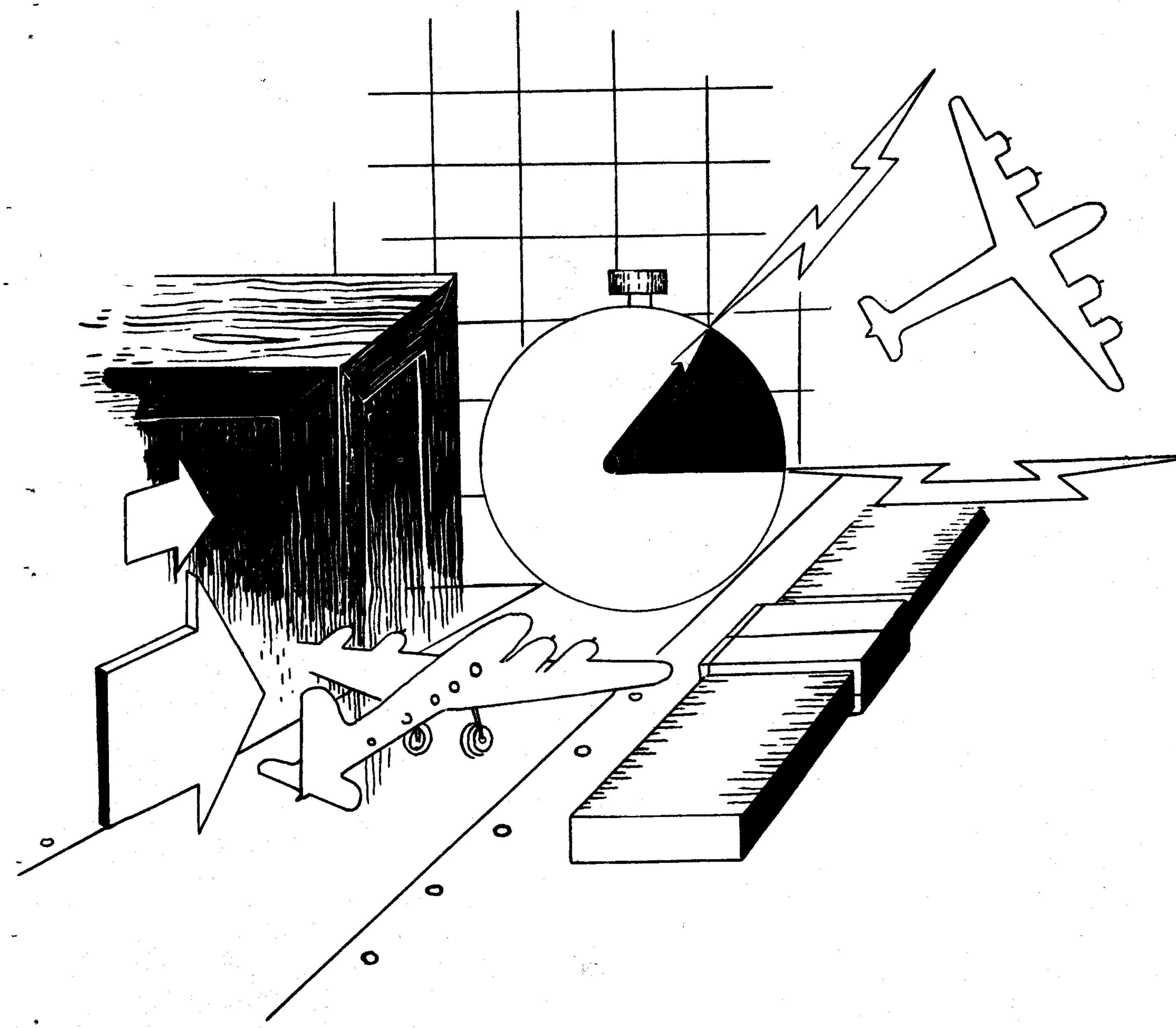


AIRLIFT TASK FORCE

PERFORMANCE OF THE MISSION

The accomplishment of the Airlift mission depended upon the number of loaded aircraft successfully landed on receiving airfields in the Berlin area. The number of these landings, from an over-all viewpoint, was governed by the available resources of the American and British organizations and their operational capabilities. From an operational viewpoint, the primary limitations were the number of aircraft in commission and periods of flyable weather. Later, the limitations of landing facilities largely dictated the tempo of the mission performance.

Background

Under the Quadripartite agreement of November 1945, all traffic to and from the city of Berlin was confined to three corridors, each 20 miles wide, and to an area 20 miles in radius around the center of the city. In the small area in and about the city of Berlin there were seven Soviet airfields, each having about it a restricted area two miles in radius. Although this international agreement critically reduced the airspace available for Airlift operations, both the American and British operational procedures were carefully designed to respect those restrictions.

Operational Agreements

It was apparent early in the Airlift operations, that there would have to be joint agreements among the Air Force Commanders in Germany of Britain, France and the United States. One of the first was to eliminate French aircraft from participation in the Airlift. This was necessary because of the almost insurmountable language problem involved in the joint use of the communications facilities and landing aids in the limited Berlin airspace, and because the French had only a few aircraft available for operations. Under this agreement, the American and British fulfilled the French military requirements. In return they were granted the use of facilities in the French Sector.

Another situation requiring a decision was the method to be used in the center, or Buckeburg corridor, by American and British aircraft. It was decided in conference that the lower altitudes in this corridor would be used by the British, while American aircraft would be held to the higher altitudes. No attempt was made during the first few months to integrate the air traffic of the two nations.

The Airlift was still, with the exception of a limited amount of coordination and cooperation, two separate and distinct air transport operations.

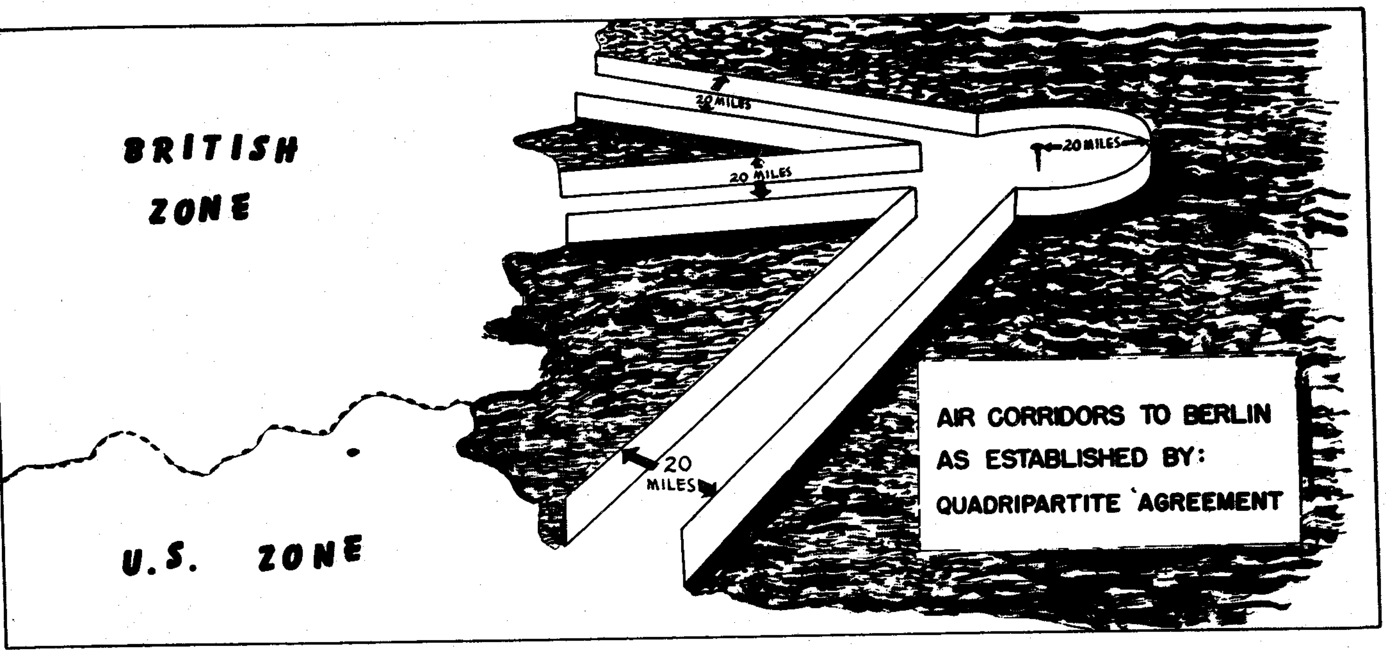
Combined Air Traffic Control Need

As the operation became more intense, particularly in the Berlin area, it became obvious that the individual efforts would have to be combined to insure safety and the success of the mission. Air movements in the restricted air space around Berlin were becoming so numerous that serious complications in air traffic developed.

While both countries had provided necessary landing aids for their airfields, overlapping traffic patterns of Gatow and Tempelhof resulted in a dangerous situation. The need for one central control in the Berlin area was acknowledged by both countries. The combining of the two operations was speeded by this pressing need.

EARLY PROBLEMS of AIR TRAFFIC CONTROL

It is not derogatory to state that the first phases of the mission were marked with a high degree of confusion in the handling of air traffic. This problem was seen immediately as being the point for major consideration and improvement.



Existing Aids and Agencies

To understand the situation that existed during the early period, it must be fully realized that although the necessary control agencies were present, their methods of controlling, the equipment being used, and the personnel employed, were not geared for other than normal occupation operations.

Airway traffic control was effected by the Air Traffic Control Centers at Frankfurt in the U.S. Zone, Bad Eilsen in the British Zone, and the Berlin Air Safety Center. A manual system of posting flights and altitudes was in use at these centers.

The controllers at these centers had been trained and indoctrinated in a system that was capable of handling safely only a limited number of aircraft at a time. Their main difficulty in the beginning lay in their inability to descend aircraft rapidly from cruising altitudes down to approach altitudes. This was aggravated by lack of confidence in the landing agencies to dispose rapidly of the aircraft placed under their control. The principal efforts of the controllers, therefore, during periods of bad weather, were directed toward safely stacking aircraft over widely-separated holding points and descending them only when fully convinced that each aircraft was clear of a particular altitude and that there was no danger of collision.

Prior to the operation, a single GCA, (Ground Controlled Approach) unit existed at each USAF base, primarily used in a standby status for periods to adverse weather. At each Royal Air Force base, there was a system designated as BABS (Blind Approach Beacon System). This system involved airborne radar equipment, and required a specialized operator aboard aircraft.

GCA was used as the primary controlling agency for all Airlift landings in Berlin, since it was the only landing system common to both forces.

These units could land one aircraft approximately every 15 minutes, and this limitation to the operation became clearly evident with the advent of the first period of low clouds and reduced visibility.

The control tower operators were troubled at first by the heavy traffic. It soon became necessary, where possible, to detail one operator to take-offs and another one to handle landings. A separate frequency was given to each of these activities. It was also quickly apparent that the radio transmission to and from each individual aircraft had to be reduced from the accepted standard to only those items absolutely essential. In relaying instructions, only the assigned altitude, altimeter setting and take-off or landing clearance were transmitted. By so reducing the conversations between the aircraft and the ground, much of the early radio transmission confusion was eliminated.

Descent to Approach Altitudes

Trial and error methods were used to determine the USAF system of routings during the formative stages. Originally the flights were considered in two separate phases: the en route phase, and the approach pattern and landing phase. However, there developed a third very important stage, wherein lay the key to the solution of the air traffic problem — the descent to approach altitude phase.

The problem of descending the aircraft operating in the British Zone was negligible, since there was no high terrain between RAF dispatching bases and Berlin. Aircraft could be flown at much lower altitudes than in the American Zone. Furthermore, because of the radar navigation equipment used in RAF aircraft, it was possible to operate safely all RAF aircraft of the same type at one altitude.

Altitude Separation

En route separation of USAF aircraft was effected easily at first by using different altitudes for successive aircraft. In determining the number of altitudes to be used, the thought was always toward increasing the margin of safety for aircraft in the air. Six separate altitudes were used during the early days. The first take-off would be assigned an altitude of 5,000 feet, the second 6,000 feet, and so on up to 10,000 feet, at which time the cycle would be repeated.

In effect, this provided a series of ladders of aircraft proceeding to Berlin. Safety in the air while en route was ensured, but the problem of maintaining position and descending to common approach altitudes was aggravated out of proportion to the en route safety afforded. Revisions were made by using five altitudes with 500-foot separations. After that also proved too cumbersome, three altitudes of 5,000, 6,000 and 7,000 feet were used. Again little success was gained in lessening the problem of descent.

Eventually it was determined that two altitudes were adequate for safety, provided spacing en route between aircraft was maintained.

Frequent checks of spacing over designated fixes by each pilot indicated that six-minute separation between aircraft at the same altitude was entirely adequate which, of course, was in effect, 3-minute intervals at take-off. Little possibility of overtaking was found to exist if the spacing was readjusted over these designated fixes.

Well-Defined Routes

Well-defined routes were established very early in the operation. These were laid out for all aircraft to follow, regardless of the weather. The routes were established to afford adequate horizontal and vertical separation between individual streams of traffic. Low frequency beacons or radio ranges were installed originally at the entrances to the corridor, and radio beacons at each turning point.

This system of marking routes was found to be inaccurate, resulting at times in deterioration of the separation between successive aircraft. A visual-aural range at the ends of each corridor was installed. This enabled pilots to establish themselves in the center of the corridor. Low-powered beacons were replaced by 500-watt beacons to afford more positive directional aid during periods of static. Because the RAF aircraft carried navigators, and did not rely entirely upon these beacons, they were affected to a lesser degree by the limitations of these earlier aids.

Flying Techniques

The routes had to be flown in certain prescribed manners so that the resulting system of traffic flow would guarantee regular arrival of aircraft at the terminals. The requirement for such a highly standardized system of flying called for strict aircrew discipline. The slightest variation in the procedures stipulated for an individual aircraft resulted in almost insurmountable traffic problems. The operation worked well only when each aircraft remained in position with respect to adjacent aircraft and followed all instructions implicity.

As RAF crews engaged in this mission were fully trained and classified Transport Command aircrews, no great problem was encountered, and little further training or standardization was required. However, during the operation it was necessary to check their rigid adherence to the prescribed procedures and the Transport Examining Unit was used for this purpose.

On the American side, to accomplish the formidable task of regimentation, a check pilot system was inaugurated. The sources of aircrews were widely varied and pilot's techniques were in turn as varied as the U.S. Air Force missions. Pilots were proficient individually in their techniques, but these had to be molded into a single method of flying. To produce the desired results, a Standardization Board consisting of the best qualified USAF transport pilots in the Task Force, was established in the Headquarters.

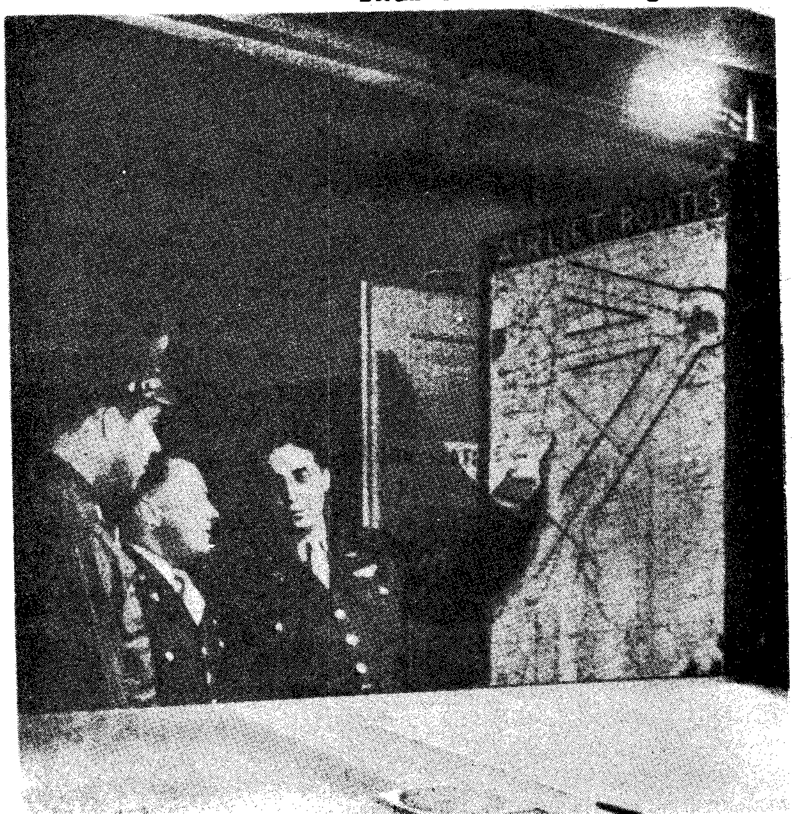
This Board prescribed all the techniques for each phase of the USAF operation. When controversial points arose, the concensus of the Board dictated the best method of performance. Instructions were published in booklet form and made available to each pilot in the Command, through the Group Chief Pilot and check pilot. To guarantee sufficient training of all pilots, it was necessary to appoint one check pilot for every 10 first pilots. In turn, each Group had a Chief Pilot Section in its operations, the Chief Pilot being under the general supervision of the Standardization Board and the check pilots under the supervision of the Group Chief Pilot. Piloting techniques were therefore supervised from the top, i.e. the Standardization Board, down through the Group Chief Pilots, the check pilots and to each of the operating pilots. All pilots received a check at least once every 30 days. It was found that the check pilot system afforded the quickest means for rapid indoctrination of crew personnel. It also prevented bad habits or carelessness from developing in flying techniques. In addition to providing necessary regimentation, it is believed that the liberal use of check pilots was one of the contributing factors in the low accident rates.

BRIEFING - USAF

In the development of the Airlift, the ever-changing aspects of facilities, installations and procedures established an immediate need for an adequate briefing organization.

Under the system of crew scheduling necessitated by the 24-hour operation, it was not possible to depend upon the proper dissemination of pertinent information through the normal means of NOTAMs and written directives. Due to the absolute necessity of keeping pilots informed on Airlift procedures, a system of verbal daily briefing was introduced. All pilots scheduled for flight in any one block period were briefed collectively immediately prior to block time. When the continuous method of dispatch was used, briefings at specified hours during the day were provided.

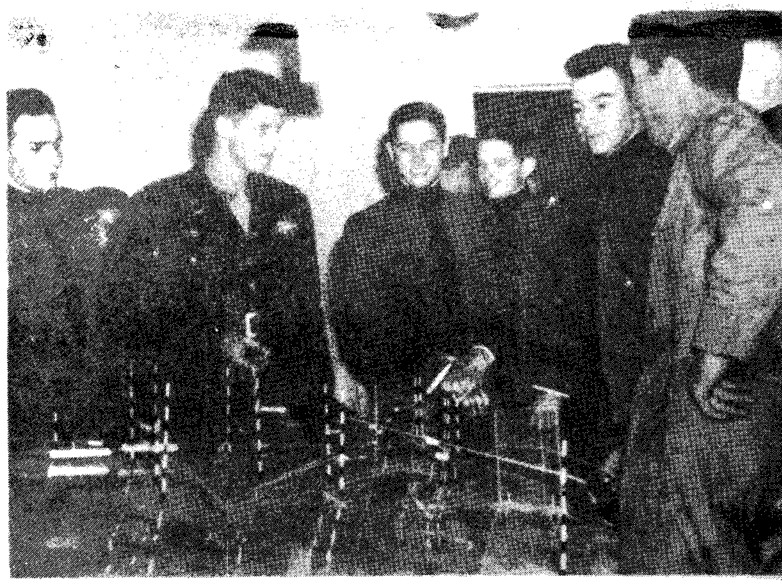
● Individual Briefing



These mass briefings were complete in the coverage of every phase of the flight from that particular base to Berlin and return at a particular time. The routes were described in minute detail specifically stressing accurate position reporting points, the necessity for adhering to air traffic control instructions, knowledge of any anticipated Soviet harassing or interference, the weather en route and at the terminals, and best available alternates. The briefing was conducted by the Operations officers in conjunction with the Navigation and Briefing officer, Weather officer, and the Intelligence officer.

Immediately after the briefing, pilots were issued complete air navigation and briefing kits, containing up-to-the-minute information of their flight. In addition, the pilot was furnished a flight plan based upon current winds and weather. Alternates were provided with operational minimums and clear weather conditions. Maps, and charts, covering all necessary information for using these alternates, were included in the briefing kit.

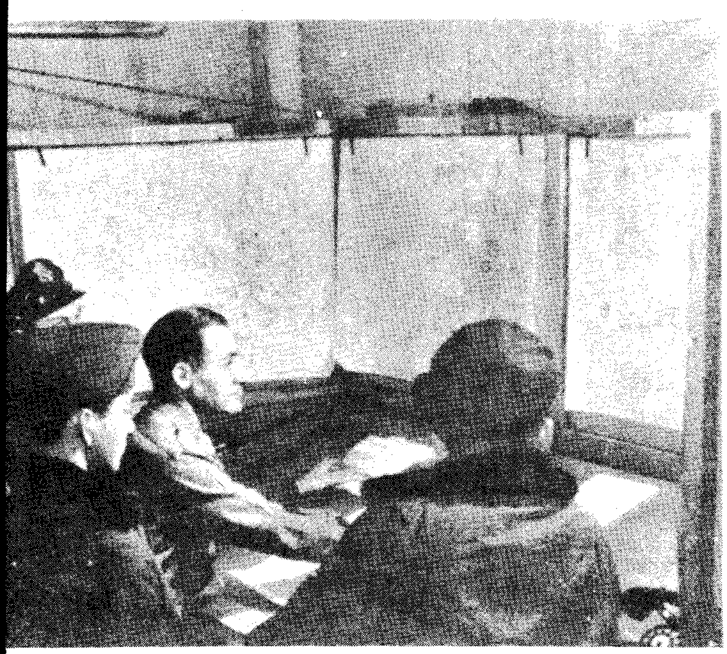
One of the most valuable of the briefing materials was a comprehensive Manual of Airlift Routes and Procedures. This manual included a detailed description of the procedures to be followed from each of the Airlift bases to Berlin. In the manual could be found all emergency procedures, missed approach procedures, and instructions to be followed for all radio contacts. A series of standard operating procedures charts, accomplished in simplified diagrammatic style, portrayed all the essential navigational aids and communications facilities. These manuals were collected after each flight to enable Navigation and Briefing officers to insure they were current at all times.



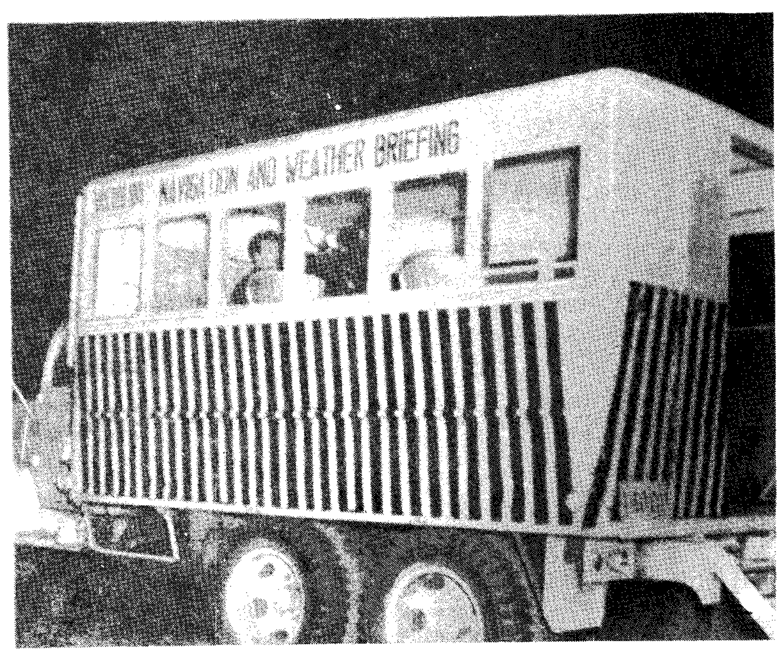
Briefing Table in Use

As in the entire Airlift operation, every effort was made in briefing to minimize the time aircraft remained on the ground. As an example, at Tempelhof a mobile briefing truck met arriving crews, and a rapid but thorough weather briefing and flight plan for the return trip was given each pilot. This unit also served as a de-briefing agency for any crew having pertinent information to divulge. At the home base, de-briefing by weather and in-

Weather Briefing before Flight



Mobile Briefing Unit in Berlin



telligence officers was required after each trip.

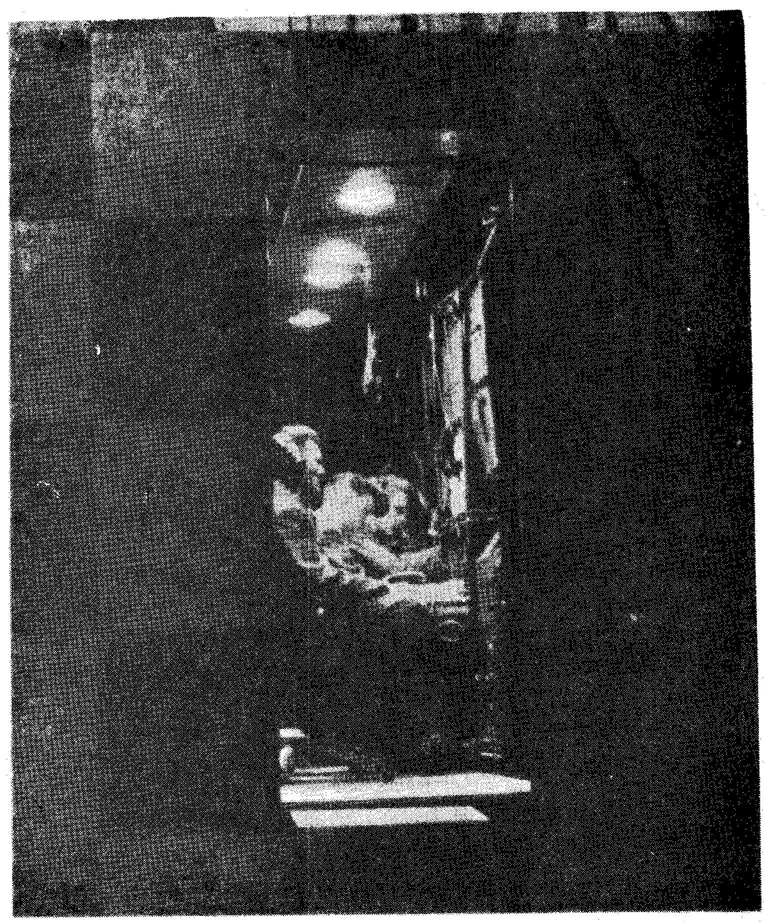
With the density of traffic in the corridors and the closely-knit traffic, it was essential, for safety reasons, to insure that all personnel actively engaged in the operation were not only fully conversant with their own particular routes or section, but with those of all other traffic engaged in the operation. To insure this over-all familiarity, three-dimensional plan models of the complete Airlift area were constructed. These showed routes, heights, and traffic patterns of all aircraft engaged in the operactions, as well as radio and radar facilities in use. These plan models were placed in all Operations and Briefing rooms, and enabled all personnel to assimilate quickly the complexity of the over-all operation.

COMMUNICATIONS

Throughout the entire operations, very high frequency radio was used almost exclusively for the direct control of aircraft. Initially, it was a simple problem as only a few airfields were involved and four channels of communications per aircraft were adequate. As the Airlift expanded it became increasingly difficult to allocate sufficient frequencies to avoid congestion. In December, after the opening of Tegel, a plan was adopted to cover requirements of both the RAF and the USAF elements. It was necessary to revise completely the entire crystallization plans at all Airlift bases and on all Airlift aircraft so that aircraft could be controlled by the ground agencies at any base in the event of diversion. Bases in close proximity to each other never were permitted to use the same frequencies for controlling aircraft because of interference. It was found that the number of frequencies which could be used was limited by the number of channels available in airborne equipment. All USAF C-54s carried eight-channel VHF sets, but the only British aircraft so equipped were the Yorks and Hastings, whereas the Dakotas and the majority of civil aircraft had only four channels available.

When the three airfields were operating in the Berlin area, a minimum number of 12 channels were required on the ground to provide interference-free communications. Since some aircraft only carried four-channel equipment, ground radio installations had to be extended considerably so as to give flexibility and to allow for diversions. Each of the three terminals had as many as five different frequencies available in the tower in case aircraft were diverted from one airfield to another. As such diversions were rare, a proportion of the ground equipment remained idle for considerable periods.

GCA During Night Operation



DEVELOPMENT OF AIR TRAFFIC CONTROL

In order to control the amount of traffic in this operation, it was necessary to keep all aircraft on a single route when operating between any two bases. These routes were designed to eliminate complication with traffic from other bases and to provide a six-mile final leg. This was accomplished by the use of radio and radar beacons, radio ranges in conjunction with visual aural ranges, and radar surveillance.

All traffic, regardless of weather conditions, was considered as being conducted under Instrument Flight Rules and no variations were allowed in any of the approach patterns. All approaches to all airfields, including random itinerant approaches, were channelled from an initial radio or radar fix and were established to conform with the requirements of a Ground Control Approach.

Intervals between aircraft were determined by the acceptance capabilities of the terminal airfields. These had to be established at take-off and maintained throughout the entire flight. Whenever more than one airfield fed aircraft into a single receiving airfield, a dispatch system under a predetermined schedule had to be established.

Dispatching - U. S. Zone

The two bases in the U.S. Zone operated in the same corridor into Tempelhof. It was, therefore, necessary to coordinate the traffic from these airfields. The first system used was a four-hour block system of dispatches. Under this system each base was allotted alternate four-hour periods in which to dispatch its aircraft, the interval between aircraft being determined by the forecasted weather conditions at the terminal coupled with the rate at which the landing aids could land the arriving aircraft. The first obvious drawback to this system was the long periods of aircraft stand-by time caused by numerous aircraft lining up prior to their scheduled take-off time in order to fill each available space in the block. During this period it was common to see as many as 20 to 30 aircraft lined up near the take-off position with their engines idling. In order to overcome this, the block times were eventually reduced to a one-hour cycle, each base being allocated time in proportion to its number of aircraft. By this means idling time was materially reduced, but the system did not allow all serviceable aircraft to be fully utilized.

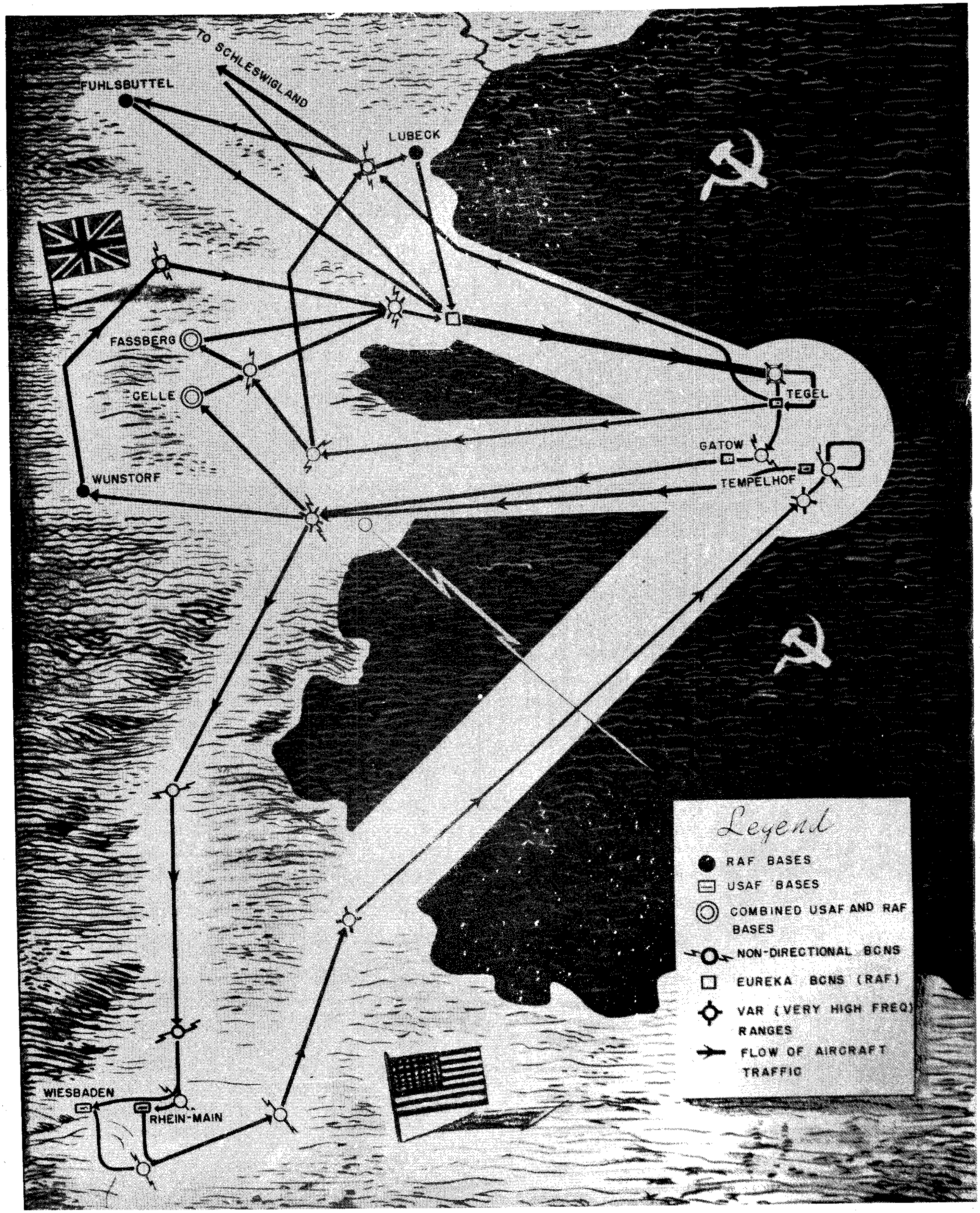
The final solution to this problem was the adoption of an integrated system of dispatch, whereby the flow of aircraft from both bases converged at a merging radio beacon. Aircraft times at this beacon were allocated by the coordinating agency according to the aircraft availability at each base. This system proved satisfactory and ensured, to a large degree, that all aircraft could be used as soon as they were ready

Block System

With the introduction of American aircraft into Fassberg, in the British Zone, it was realized that the integrated continuous dispatch system then in use by the RAF could not be continued. This was due to the difference in navigational techniques employed by the two air forces.

Royal Air Force aircraft were fitted with radar navigational equipment, including distance measuring equipment, and they carried navigators. They were therefore able to arrive at a given point at a given time within a reasonable degree of accuracy. United States Air Force aircraft did not carry navigators, and relied largely on radio compasses. They therefore had to depend on dead reckoning based on forecasted winds, the accuracy of which was variable. In order to insure the most even flow of traffic, it was necessary to adopt a block system of dispatch, as previously described. The potential sorties of each dispatching airfield was studied and a four-hour pe-

ROUTES OF THE AIRLIFT



riod was fairly divided into time blocks among the fields.

Disadvantages of Block System

The four-hourly block system, although satisfactory from a purely operational point of view, caused peak loads followed by periods of comparative idleness at the dispatching bases. Furthermore, it reduced the utilization of aircraft, by keeping them on the ground when serviceable. As it has already been explained in connection with the U.S. Zone, later it was found possible to change to an hourly block system, thereby overcoming most of the disadvantages.

Rhein Main and Wiesbaden Procedures

From the two USAF bases in the Frankfurt area, Rhein Main and Wiesbaden, one integrated flow of aircraft was dispatched through the southern corridor to Tempelhof. These aircraft were assigned 5,000 and 6,000 feet, alternately, for their flight through the corridor. At a point approximately 70 miles from the Tempelhof range station, the aircraft reported to Tempelhof Airways, and were descended to 2,000 and 2,500 feet prior to reaching the range station. After the aircraft passed this station, the Approach Controller vectored it by radar through the approach pattern to a point six miles from the end of the landing runway. Here the aircraft were delivered to either the final Ground Approach Controller, or to the tower, according to the condition of the weather.

The return flights from Tempelhof were made through the central corridor, aircraft being staggered alternately at 6,500 and 7,500 feet. After passing Braunschweig, the aircraft turned south via Fritzlar Beacon. Shortly after passing Fritzlar, all aircraft contacted Frankfurt Airways and were descended to 4000 feet prior to reaching the Staden Beacon. As the aircraft left Staden, they came under the approach control of either Rhein Main or Wiesbaden, whichever was their destination. Rhein Main aircraft were de-

Night Operation

scended for a straight-in approach over Offenbach Beacon and the Rhein Main range station. When the aircraft was six miles from touch-down, control was given to either the final GCA controller or to the tower if weather permitted. Wiesbaden aircraft were routed from Staden via the Rhein Main range and the Marxheim Beacon in the same manner.

Wunstorf, Celle and Lubeck Procedures

Three of the six bases in the British Zone, Wunstorf, Celle and Lubeck, dispatched their aircraft in waves, or blocks, through the northern corridor via the Dannenberg and Frohnau Beacons into Gatow. Wunstorf and Lubeck dispatched RAF aircraft, at one altitude each, 3,500 feet and 5,500 feet, respectively. Celle dispatched USAF aircraft at two altitudes, 4,000 and 4,500 feet, alternately.

When the aircraft was approximately 20 miles from Frohnau Beacon, Gatow Approach Control took over and descended it to 3,500 feet over the Frohnau beacon. From this point, aircraft were vectored southward directly over Tegel airfield at a minimum height of 2,500 feet, and thence to the Grunewald Beacon. Here the control of aircraft was passed to the final controller of the GCA unit, or to the tower. Return flights were made at the middle altitudes, through the central corridor, via the Braunschweig Beacon. After passing Braunschweig, aircraft diverged toward their home bases under the control of their respective Approach Controllers.

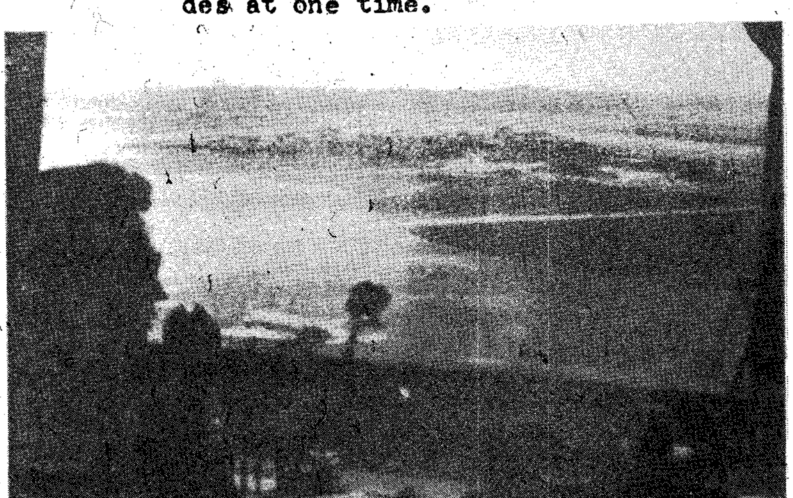
Fassberg, Fuhlsbuttel Schleswigland Procedures

From the other three bases in the British Zone, Fassberg, Fuhlsbuttel, and Schleswigland, aircraft were dispatched at low altitudes via Dannenberg and Frohnau beacons in the northern corridor to Tegel. Fassberg, with USAF aircraft, dispatched at 2,000 and 2,500 feet alternately, while Fuhlsbuttel and Schleswigland both used 1,500 feet inbound, staying on the southern side of the northern corridor.

The Frohnau Beacon was the initial approach point for the landing pattern. Since it was close to Tegel airfield, the aircraft were usually vectored through the traffic pattern by Approach Control and the final controller of the GCA unit. After take-off from Tegel, Fassberg aircraft proceeded outbound between the two Russian Airfields at Staaken and Schonewald, and thence out the central corridor at 2,000 and 2,500 feet via the Gifhorn Beacon to their home base. Fuhlsbuttel and Schleswigland aircraft returned via the north side of the northern corridor at 1,000 feet directly to their respective bases.

One-Way Traffic

The flow resulted generally in one-way traffic in the three corridors -- inbound in the northern and southern, and outbound in the central. By using this system, 500 feet vertical separation was found to be completely adequate for all traffic proceeding in the same direction in both the northern and central corridors. One thousand feet of separation was used in the longer southern corridor, since it was not required to use but a few altitudes at one time.



AIR TRAFFIC CONTROL BERLIN AREA

Air Traffic Density

The proximity of the three Airlift bases in the Berlin area can be compared to that of LaGuardia, Idlewild and Newark airfields, in the New York City area. A circle with a six-mile radius can be circumscribed around Tegel, Gatow, and Tempelhof airfields. Using the facilities and procedures existing for controlling traffic as finally developed, 2,796 aircraft movements, or one every 30.9 seconds, were conducted in this confined area in one 24-hour period on 16 April 1949.

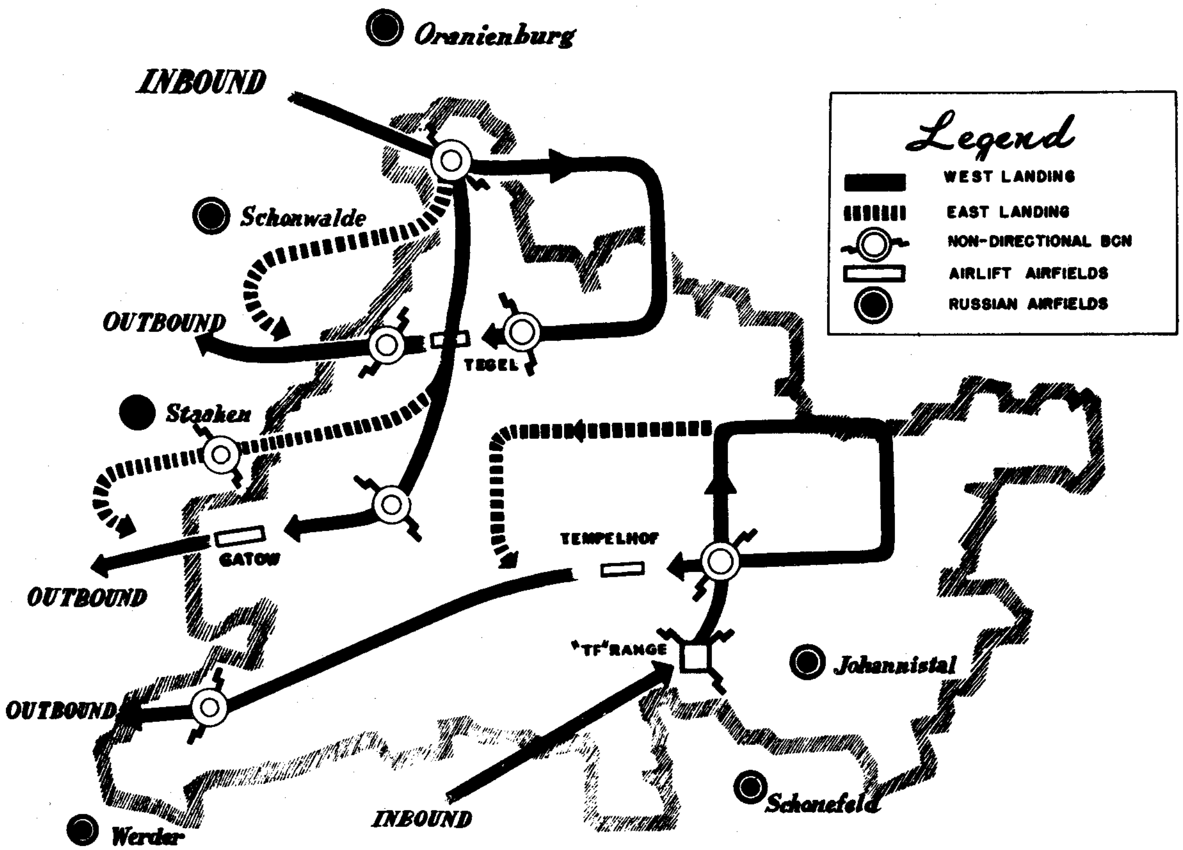
Airways Procedures

The purpose of the Airways Control was to deliver evenly spaced aircraft at the proper altitudes at the initial approach point. Where it was necessary to descend aircraft to the approach altitude, airways control was provided far enough back in the corridors to insure that all aircraft could be descended without any possibility of stacking or holding.

Aircraft in the southern corridor were generally higher than those in the northern corridor and had traveled longer distances from take-off. These factors made the problem of descents much more complicated. As an assistance in handling aircraft, a leg of a localizer was beamed across the southern corridor to provide a fix for position reporting to Tempelhof Airways Control. This report provided the spacing information necessary for the controller to start the safe descent of the aircraft. Readjustments of interval were made wherever necessary, so that all aircraft could safely reach approach altitude prior to arrival at the Tempelhof range station.

In the northern corridor, traffic destined to Tegel was low enough to enable all descents to be executed in the approach pattern. In controlling both Tegel and Gatow-bound aircraft,

Controlling from Tempelhof Tower



Berlin Approach Patterns

the shorter flights and relatively lower altitudes used, combined with the RAF assignment of arrival times to be made good by their aircraft, lessened the need for airways control in the northern corridor.

Approach Control

The approach control portion of the flight into Berlin was concerned with delivering properly spaced aircraft to a point between six and seven miles out on a projection of the landing runway. Each Approach Control was assigned its own radio frequency. Aircraft were given all landing instructions and were assisted in following the prescribed pattern, through the use of radar. Necessary adjustments in spacing were conducted by slight variation in vectoring to the turn on final approach. Whenever any aircraft presented a serious interruption in regular spacing, it was taken out of the stream and returned to its home base.

Landing

GCA was used as the primary aid in all landings in Berlin during marginal and instrument conditions. GCA allowed each aircraft but one approach; if that was missed, the aircraft proceeded to its home base without landing, following all procedures as prescribed for take-offs at the airfield. In this manner, it was possible to keep the flow moving without interfering in any way with subsequent flights. This was a very important factor in the elimination of stacking and holding, since aircraft could continue approaches toward the runway without the danger of another aircraft being out of position.

Elimination of Stacking

The Air Traffic procedures were designed to eliminate stacking. To accomplish this, descents had to be made far enough out to permit all aircraft to make straight-in approaches. Missed approaches had to leave the area, following the take-off route, to return to base or out of the area. Itinerant traffic was not allowed to interrupt the steady flow of Airlift aircraft. The passing of aircraft from one control agency to the next was streamlined to the maximum.

Beacon Approaches

Beacon approaches were permitted when weather conditions were well above the known limitations of these facilities. GCA was always put into use long before ceilings and visibilities had lowered to the point where this aid was required. The use of beacon approaches permitted sufficient time for the performance of preventive maintenance on the GCA unit.

Effect of Winds

Due to the layout of the runways at each of the three fields in Berlin, only two directions of landing were available, generally East and West. In the confined Berlin area, it was found necessary to change landing directions at all fields simultaneously, to eliminate any conflicts in approach patterns. This system often resulted in one base being required to conduct slightly downwind landings. A 10-mile tail wind component was established as the maximum before direction had to be changed.

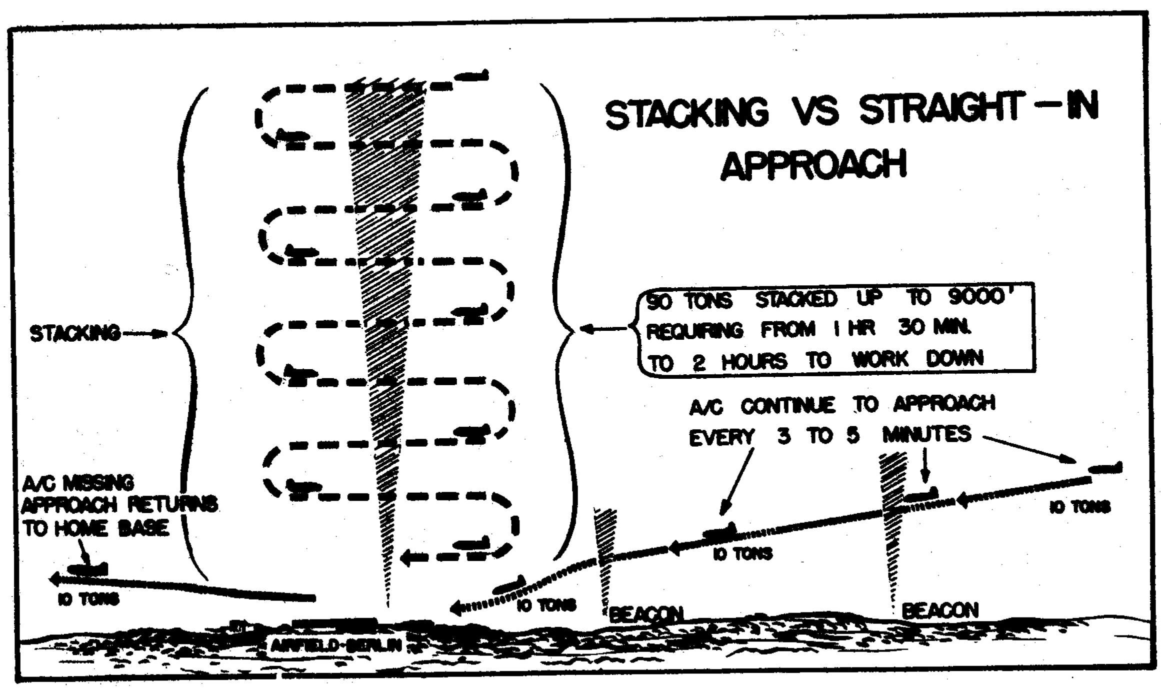
CPS-5 Radar

A major contribution to the safety of Air Traffic in the Berlin area was made by the CPS-5 (Traffic Control Search Radar) installation at Tempelhof. By means of this system, aircraft approaching Berlin by either the southern or northern corridors could be picked up on the radar scope, identified by a procedure turn, and vectored into position in accordance with the acceptance rate of the final approach facilities. Although traffic procedures were not materially changed by the installation of CPS-5, the added safety factor realized, in knowing the accurate position of each aircraft in the area, allowed a minimum spacing interval to be used during instrument conditions.

The CPS-5 allowed all airways and approach control functions to be incorporated into one control room which received all flight plans of the Airlift traffic. Each controller was presented a picture of not only the traffic into his own field, but also that into the other two Airlift terminals. Whenever any one field became inoperational, traffic destined for that field could be diverted to either or both of the remaining two bases. This provision gave elasticity to the Berlin operation that could not have been provided in any other manner with the necessary degree of safety.

EFFECT of WEATHER

In the anticipation of winter flying conditions, considerable stress was laid by Airlift planners on precautionary measures to cope with en route weather conditions. Procedures were prepared whereby the flight altitude



and intervals would be changed during the periods of icing or turbulence in order to minimize the en route weather hazards.

Enroute Icing

It was inevitable that Airlift aircraft would encounter icing during the winter months. These icing conditions never exceeded moderate intensity, however, and the equipment available on most of the aircraft for combating ice was adequate within the limits of serviceability. Some of the British civil cargo aircraft did not have sufficient de-icing equipment, and it was necessary to route those airplanes at altitudes where the least icing was expected.

The ice-combating equipment available, though reliable and adequate when operational, posed many difficulties, necessitating the improvement of existing installations. Occasions arose when ice formation on windshields could not be removed adequately prior to landing by the ordinary use of the windshield de-icing equipment. Routine corrective maintenance and anticipation of icing conditions by the pilot were the main factors in obtaining the most efficient use of ice-combating equipment, and prevented icing from materially affecting the operations.

Turbulence

Effects of turbulence likewise were felt to a minimum degree, completely stopping the operation on only two short occasions of a few hours each. At other times, when turbulence was present, the intervals between aircraft were increased to permit individual variations of airspeed and altitudes when found necessary by the pilots. No accidents during the flying of the Airlift have been attributed to turbulent conditions; however, frequency of fuel leaks in the C-54 was increased during these periods, and could have been caused by prolonged flexing of the wings.

During the early months of this operation, when the most turbulence was encountered, fuel leaks on aircraft were a major problem and an average of five airplanes were out of commission for this reason.

Under no conditions were any changes made in the cabin load or gas load to minimize the effects of turbulence. Pilots were standardized in the practice of employing slower airspeeds and attitude flying, and this constituted the only concession to the turbulence problem.

Terminal Weather

The effect of terminal weather upon the Airlift, however, was not minimized. Terminal weather below 200 feet and one-half mile effectively stopped the operation. Gradual lowering conditions of ceiling and visibility ordinarily gave sufficient warning of impending closed conditions to enable the flow of traffic to be slowed to a point where only a minimum of aircraft had to be diverted. The advent of sudden below-minimum conditions usually presented a problem of great magnitude in properly disposing of the en route aircraft. Considerable studies were made in the preparation of precise procedures to control both planned and emergency diversions due to weather.

The only facilities available in reasonable quantity at the beginning of the operation were GCA units. GCA controllers, after proper indoctrination, were able to land aircraft every three to four minutes under marginal conditions. During these periods of minimum weather in the Berlin area, all aircraft continued operation in exactly the same pattern used for good weather. The aircraft continued to descend, by GCA instructions, until the prescribed minimum was reached. If the pilot was unable to see the runway when he reached the minimum altitude, he pulled up and left the area exactly as if he were just taking off, and proceeded to his home base. If the minimum weather conditions existed at the aircraft's home base, and the GCA approach was missed, the pilot proceeded in accordance with the previously prepared diversion procedures to one of the Airlift diversion bases.

Ground Icing

The accretion of ice or frost on the aircraft surfaces while on the ground was considerably aggravated by the lack of interior heating facilities for aircraft. The removal of ice necessarily had to be performed out of doors. The first effort at removal of ice was made with a mixture of alcohol and kerosene applied by a swabbing method to the lifting surfaces of the airplane. The demand of the operation forced the discontinuance of this method. A second method was devised whereby the same mixture was applied by means of a tank unit mounted on a truck body equipped with power spraying attachments. A raised platform was connected to the truck for the easy application to the top of wing surfaces. An airplane could be completely sprayed in approximately 10 minutes using this equipment. One objection to the mixture used was that the kerosene application enabled a formation of dust and dirt to collect on the airplane surfaces. For this reason, the mixture was changed to 100 per cent alcohol. This process of ice elimination was considered to be very expensive and somewhat limited by the shortage of iso-propyl alcohol in this theater . As a further means of eliminating ice, a jet engine was mounted on a truck bed and the hot blasts of air were directed toward the aircraft. Careful use of this equipment quickly eliminated all accumulated ice, but did not prevent the rapid reformation within a short time, if weather conditions were favorable to ice.

Weather Service

With the approach of winter, it became obvious that the Airlift would require the most accurate weather observing and forecasting obtainable. For planning purposes, extended interval forecasts were prepared covering periods of 4 to 7 days. This information enabled weekly forecasts of tonnage to be given to procurement agencies. Forecasts covering periods up to three months were also prepared for long-range planning of Airlift tonnage capabilities. This weather information was necessary in making the long-range tonnage estimates by the Task Force, which information was required by the supporting logistical agencies.

In order to be prepared for emergencies because of closing weather, a composite forecast which would be available at all bases to all pilots was necessary. In order to achieve this desired composite forecast, the USAF Air Weather Service established a system of telephone conferences between all stations on the routes. This composite forecast enabled all stations to operate with the same weather picture in view, and guaranteed that in the event of emergency, the current reliable weather picture would be known to all concerned. This conference proved of such value that a later effort was made to establish a corresponding system between the U.S. and British weather services, but it did not become operational before the ending of the Airlift.

Further conforming to the exacting requirements of the operations, a weather observer was stationed on the landing end of each runway during periods when visibility was below one mile. In this position, he could observe actual runway visibility by counting the visible runway lights and report by field telephone direct to the weather office.

For corridor weather aloft, and local conditions, a reconnaissance squadron of B-17s was organized for the purpose of weather scouting. Because of the anticipated heavy icing conditions enroute, these aircraft were dispatched to fly up and down the corridors at varying flight levels and inform traffic controllers of dangerous ice accretions.

However, it was found that the lift pilots operating regularly in the corridors provided enough information when given weather debriefing to keep all weather centers, and thus subsequent flights, informed on weather trends. It was therefore decided that there was no continuing need for the scout service and so after a period of approximately one month, it was discontinued.

The speed of the Airlift operations necessitated an immediate dissemination of weather information, which required the installation of durable telephone and teletalk lines between the weather office, Control Tower and GCA. Observations had to be transmitted instantly to those operational sections concerned, and special observations were often taken on the recommendation of the Control Tower or GCA.

Weather Limitations

One of the realizations of the Airlift operation was the limitations of the weather services. It became apparent that the weather services are unable to forecast with 100 per cent accuracy, over a period longer than 30 minutes, weather changes during times of marginal weather -- airlift marginal weather, 200 to 400 feet ceiling and one-half to one mile visibility. Since this limitation is a technical one, and its solution requires basic research, no discussion will be included here. There are present limitations in the observing service, however, that were disclosed by the Airlift's precise needs, which can be mentioned here.

Observing

First, the Airlift's needs have proven conclusively that the necessary observing accuracy cannot be achieved by human eve measurement and that electronic equipment is the only solution Second, with the use of the electronic ceiling measuring equipment available, the desired accuracy cannot be realized without more careful placement of this equipment. The ceiling over the terminal or the weather station may or may not be the ceiling off the end of the landing runway, particularly in periods of low cloud, which is usually diffuse and fluctuating. The general all-around visibility may not be visibility encountered by the landing aircraft. The wind direction and velocity taken on top of the tower or operations building may not be the wind velocity and direction affecting the landing aircraft (as in the case of Tempelhof airfield where the surrounding buildings caused a very marked difference between the wind on the runway and at the recording point on the tower).

In this operation an effort was made to improve reporting accuracy, and by means of an observer on the end of the runway, a temporary solution to the runway visibility problem was found. The Airlift's requirements were at least a stimulus to the development of an instrument called a transmissometer, which will give a continuous recording of the very important <u>approach</u> ceiling and visibility. It was recommended that a second set of wind-recording instruments be placed on the ground near the end of the runway to

● Approach under Fog Conditions

achieve accurate wind reports for landing aircraft; but the installation was not achieved, due to technical difficulties with the equipment.

DISTRESS PLAN

In order that aircraft emergencies in flight would not constitute a hazard in the crowded corridors, it was necessary that a distress plan be produced. The general procedure for aircraft in distress was to turn out of the traffic flow, and climb or descend to emergency altitudes, kept free for this purpose, and return to bases or to alternates, as the emergency and weather conditions allowed.

Communications Failures

In the case of communications failure, which precluded the aircraft rigidly adhering to air traffic rules and being controlled by ground agencies, aircraft were required to leave the stream of traffic and climb to 9,000 feet, and return to home base, or proceed to the designated clear weather alternates.

Engine Failures

In the case of engine failure which prevented an aircraft maintaining its controlled airspeed, it was required to turn at right angles to the traffic stream, adjust altitude to emergency level, and return to its home base. If a single engine failure occurred on a loaded inbound aircraft, and the pilot was able to continue without endangering other traffic by maintaining rigid compliance with the air traffic procedures, and the weather permitted, he was allowed to land at Gatow or Tegel, but not at Tempelhof in the Berlin area. This was because the approaches at Tempelhof were not as good as at the other two bases. If the trouble could not quickly be rectified, and the weather permitted, pilots so qualified were allowed to make a three engine take-off after being unloaded, and return to the home field for the performance of necessary maintenance.

Crash Landings

In order to insure that Airlift airfields were not obstructed by aircraft making emergency landings where they might have to be removed from the runway by wrecking equipment, crash landing fields, not connected with the lift operation, were designated. Special procedures for flying to and landing at these fields were produced and published.

Emergency Diversions

When the sudden onset of below minimums weather conditions prevented Airlift aircraft from landing at their destinations, emergency diversion action had to be taken. Where possible, these aircraft were diverted to other Airlift bases. Should the adverse weather conditions be widespread enough to cover all Airlift bases, an effort was made to divert to airbases as near as possible to the Airlift area. For this purpose certain nearby European airfields were selected and designated as diversion alternates.

Although the individual pilots were well briefed on alternates and clear weather alternates, the choice of diversion airfields was the decision of Task Force Operations. In the case of more wide-spread bad weather conditions, aircraft had to be diverted to any available airbase, sometimes as much as 600 miles away. However, this was impossible for British aircraft, due to the limited fuel load carried. Therefore, it was mandatory to insure that these aircraft were landed before closed weather conditions became so wide-spread.

SUCCESS OF GROUND CONTROL APPROACH

Restricted Visibility

The factors which, in the early operation, slowed down the Airlift did not relate to GCA alone. Improvements were effected in the standardization of flight procedures and traffic patterns, controlled dispatch of aircraft, standards of instrument flying, pilot discipline and pilot confidence in GCA, and coordination between controlling agencies.

It was found that an average of 10 to 15 minutes was required by GCA to land an aircraft in conditions of low cloud and restricted visibility. The GCA units were neither manned nor trained to the standard required to handle a sustained, continuous flow of aircraft for long periods. To increase the efficiency of the GCA crews it was necessary to implement a training program in better methods of control.

The first step was to allocate two frequencies for the exclusive use of each GCA unit, one frequency for use by the final controller, the other by the initial controller. This enabled the reduction of the interval between aircraft to one every six to eight minutes during periods of minimum weather. The GCA crews of four men each were increased to five crews per unit, each crew working a six-hour shift. During each shift, a percentage of the operation was GCA-controlled regardless of the weather, so both pilots and GCA personnel gained needed experience.

When the airways control agencies had become competent at delivering to the GCA unit, properly spaced aircraft at the correct initial approach altitude, the problem confronting the GCA team was greatly minimized.

With the aircraft positively identified, the GCA controllers could efficiently direct these regular arrivals through the approach pattern and in to a successful landing at four-minute intervals in weather down to generally 200 feet ceiling and one-half mile visibility.

At the three airfields in Berlin the continuous flow of traffic was handled without a single accident directly attributable to faulty GCA control. This record is the best indication of the success of GCA in this operation.

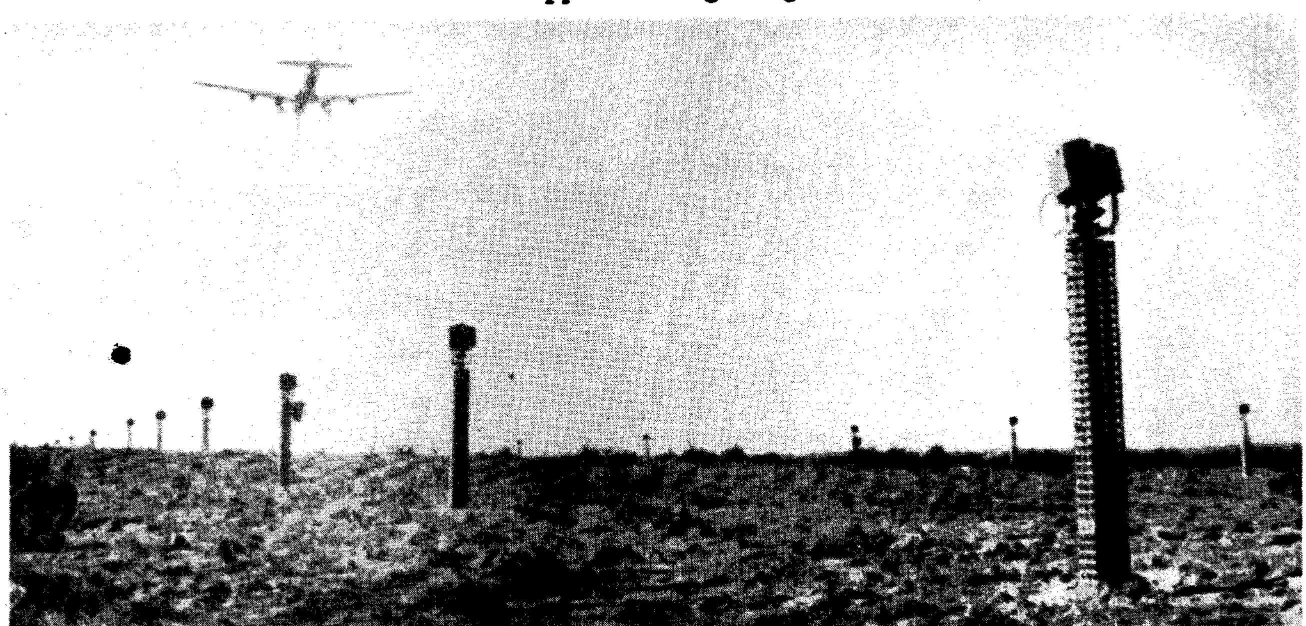
LIGHTING SYSTEMS

Approach Lighting

In order to increase the margin of safety during instrument approaches, high-intensity approach lights were ordered and installed at all Airlift bases. Three different types of systems were put into use.

The primary system used by the British was a Calvert single row with horizontal cross-bars, employing sodium lights. To this configuration was later added a set of variable intensity fixtures. This installation

● A Twin-row Approach Lighting Installation



was employed at Gatow, Celle, Wunstorf, and Fuhlsbuttel, and was scheduled for future installation at other RAF stations.

At USAF bases, the standard installation was a twin row of American Gas Accumulator (D-2) red and amber lights to which was added a lead-in row of Krypton condenser discharge lights. Due to an obstruction in the vicinity of Tempelhof airfield, an experimental double row of Krypton lights was installed on the tops of apartment buildings on the approach to the runway.

The effect of the installation of these approach lighting systems was to increase the number of successful landings during periods of restricted visibility. Lighting systems were installed so that pilots from each base were confronted with the same type lighting system at their home bases and their terminals in Berlin. Under this arrangement no accurate concensus could be obtained for evaluation of the different systems in use. However, since adherence to established minimums had been directed, relatively few successful approaches were made when weather conditions were below 200 feet ceiling and one-half mile visibility.

Area Lighting

In the main, floodlighting of the marshaling area was effected by mounting floodlights on 30-foot poles around the edge of the area and at appropriate points within the area. The primary disadvantages of this system lay in the number of lights and thus the number of poles required for effective floodlighting. As each pole constituted an obstruction, extreme caution was necessary when taxiing in areas floodlighted by this system.

"Artificial Moonlight". trials were carried out at Wunstorf and Celle by using three search lights turned to form an apex over the loading area. Results were not satisfactory and the trials were discontinued. The limitations were obvious, inasmuch as the success was influenced by the height of the cloud base in the region. At Celle, two 60-foot towers, each carrying a circular cluster of 12 Hollophane wide-beam 500-watt lamps, were erected in the marshaling area. This method proved the most satisfactory, but experiments still can be made to increase the efficiency of this form of lighting. An obvious advantage is, of course, that a maximum amount of light is obtained with a minimum obstruction risk to aircraft. It is considered that a system is required whereby the source of light is concealed, but at the same time provides sufficient radiation to illuminate the loading area without shadow.

● Area Lighting

In any large-scale transport operation, whether in the air or on the ground, accidents are inescapable. No one could reasonably have expected the Berlin Airlift, with its complex, round-the-clock pattern of operation, to prove an exception. Set up without advance preparation and subjected to mushroom growth, the Airlift was regarded skeptically at first by many observers, who predicted a soaring accident rate. These fears never materialized. The remarkable fact is that in a full year of intensive operations the U S A F average monthly accident rate, based on the number of accidents per 100,000 hours flown, was down to less than 50 per cent of the over-all United States Air Force average for the same number of flying hours.

The USAF Airlift effort, accounting for 566,000 flying hours in the 12-month period from July 1948 through June, 1949, was marred by 120 minor and major accidents, including 11 crashes which cost the lives of 28 American personnel. From the standpoint of probabilities, these figures are astonishingly low and reflect, above all else, the constant and uncompromising efforts of Task Force authorities to keep the all-weather operation as safe as humanly possible.

The discussion herein pertains only to the USAF element of the Combined Airlift Task Force; it does not include the Royal Air Force.

Night VS. Day

It is significant to note that only 12 more accidents (66) occurred at night than during daylight hours (54). In the second half-year of operation, night and day accidents were nearly equalized in number, partly as a result of a reduction in taxi accidents which tended to be more frequent at night when obstructions were less visible.

Improvement of airport conditions and facilities was mainly responsible for reduced night danger. The number of accidents occurring under instrument conditions dropped from 12 in the first six months of the operation to two in the last six months.

Taxiing Accidents

The most prevalent type of Airlift mishap was the taxiing accident, which accounted for 37.5 per cent of the total, or 45 out of 120. It was definitely established that pilot error was the chief cause factor in most instances. It was certainly true, however, that the inadequacy of airport facilities in the early part of the operation constituted a predominant underlying factor in taxi accidents.

Landing and Take-off

Landing accidents made up the second largest group, totaling 29, or 24 per cent of the 120. Twelve of these took place in the first six months of operation and 17 in the last half-year. The increase was due chiefly to landing gear materiel failures, understandable in view of the tremendous strain they underwent in the intensive operation. In the second period, for example, eight accidents were attributable to nose-wheel failures, while only one such accident occurred in the first six months. It is worth noting that in no case were the established Airlift landing and take-off minimums considered a cause factor in an accident.

Mid-Air Collision

One of the most surprising aspects of the operation, in view of the highly saturated traffic conditions, is the fact that only one mid-air collision took place between aircraft. The one collision was caused by bad flying discipline, and not by Air Traffic procedures.

Ground Collision

Nine, or 7.5 per cent of the total

accidents, involved flying into the ground, accounting for 24 of the 28 fatalities. Weather, in varying degrees, was a contributing factor in each of these accidents, but it was in no case the primary factor.

Pilot Error

The accident picture supported the long-accepted contention that pilot error is a prominent cause factor in the great majority of aircraft accidents. In 77 Airlift accidents, or 64.1 per cent of the total, pilot error was indicated. Significantly, this cause factor remained fairly constant throughout the year's operation. This is not to say that pilot error was considered the compelling cause in most of the accidents; in fact, it was held to be the sole cause factor in only nine accidents.

Going further into a breakdown of pilot error, it is noted that failure of pilots to observe -- particularly apparent in the case of taxi accidents -- had important bearing on 32 of the 77 accidents indicated above. This factor was reduced appreciably in the second half of the year by continual emphasis on ground operational control.

Other Personnel Error

Errors on the part of personnel other than pilots were determined to have been a cause factor in 35 of the 120 accidents. Nineteen of these involved supervisory personnel, who were held responsible only when the presence of removable hazards, improperly parked aircraft, or other conditions under jurisdiction of the supervisory, contributed to an accident.

Twelve accidents were laid largely at the door of ground crews, who assisted in the taxiing or parking of aircraft. Maintenance personnel error, however, was a negligible factor, contributing to only four minor accidents in the first half of the year and none in the second.

Weather

The controversial subject of weather as it affects air transport safety received a thorough airing during the Airlift and enabled the Command to draw an important conclusion: that weather is definitely not a major factor in the accident rate of an operation of this type. Weather showed up as a factor in 30, or 25 per cent of the accidents.

Airport Facilities

In 43 of the accidents, or 36.8 per cent of the total, the inadequacy of airports and facilities was indicated as a cause factor. A reduction in this factor was achieved in the second half of the operation, despite rapid Airlift development and expansion.

Materiel Failure

Materiel failure played a role in 50 or 41.6 per cent, of the accidents. One outstanding type of failure, which occurred six times in the first six months of the Airlift, was the exploding of the hydraulic pressure accumulator. Modification of the hydraulic system eliminated the problem and no further accidents of this sort took place during the Airlift. Other notable structural failures, which increased in the second half of the operation, involved nose gears (causing eight accidents) and tires---brakes (failure indicated in nine accidents).

Accident Investigation

In a consideration of accident causes, it must be remembered that in a majority of the 120 Airlift accidents more than one cause factor was involved. In some cases it was difficult or impossible to segregate the primary cause from contributing factors, but the Command's policy of conducting a Headquarters' investigation of every serious accident immediately after its occurrence aided immeasurably in the accurate determination of the facts in the case.

Safety Program

No aspects of the Airlift were of greater significance than the Command's constant preoccupation with the subject of flying safety. The broad program of accident prevention, which saved lives and materiel, centered around a number of key policies which are regarded "musts" for any air transport operation. Among the basic points stressed were: complete standardization of flight procedures and techniques; a highly comprehensive system of flight checks; thorough checking out of pilots (Airlift standards in this respect were higher than those ever before used in this type of operation); constant screening of aircrews, regardless of the proficiency level of the individual; and emphasis on ground operational control.

GROUND TRAFFIC – USAF • RAF

As the magnitude and tempo of the Airlift increased, it was apparent that a well-organized ground handling program would be required. U.S. and British Ground Force organizations called forward the supplies, furnished railhead support, vehicles, vehicle maintenance and the necessary native labor. However, a definite need existed for a staff section in the Airlift units, manned with personnel who had technical knowledge of air cargo handling, to coordinate the Air Forces' growing responsibilities in traffic.

Organization of Traffic Sections

With the establishment of the Airlist Task Force (Provisional) such an organization was introduced into the American effort. A Director of Traffic, on the staff of the Commanding General of the Task Force, was charged with the supervision of ground handling of aircraft with respect to loading, unloading, tie-down, documentation of cargo and passengers, and liaison with shipping and receiving agencies to assure correct weights, proper packaging and routing.

This Staff Division performed the necessary liaison with supporting agencies and British traffic units, advising all concerned of variations in the capabilities of the fleet, and briefing shippers as to proper preparation of freight for air shipment. Standard procedures for loading and unloading functions were instituted at all bases.

Field Traffic Sections were provided at each base from which USAF aircraft operated. A similar pattern for ground handling was effected at the British bases. These units worked in close coordination with support elements engaged in the delivery of cargo to the airfields. They supplied experienced air traffic technicians who supervised the ground handling of each aircraft, thereby insuring safe and expeditious loading of the various supplies required by Berlin.

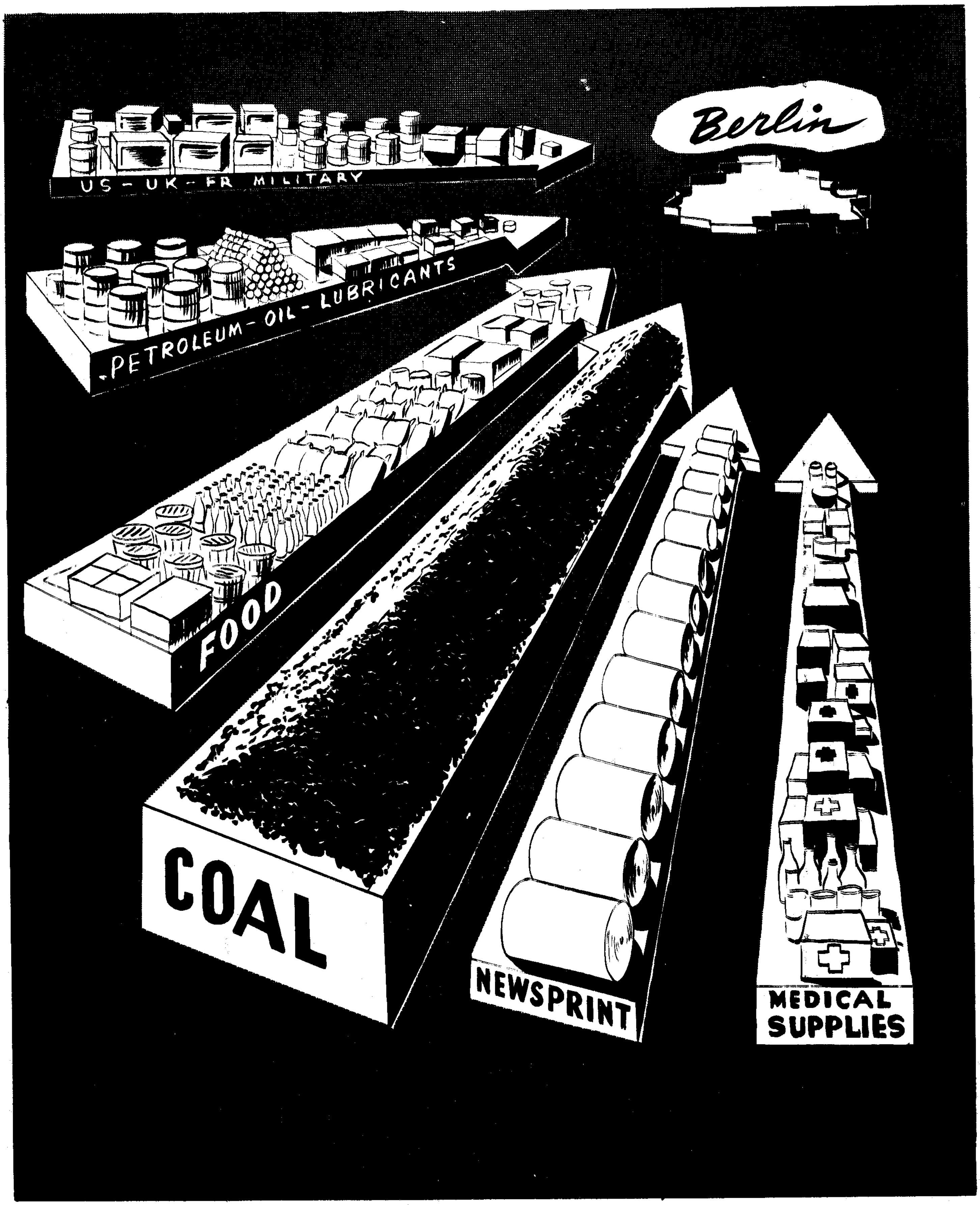
Planning Factors

To provide a basis for advance planning by all agencies involved in procurement, surface transport, and cargo handling at the airfield, the Combined Airlift Task Force issued a monthly

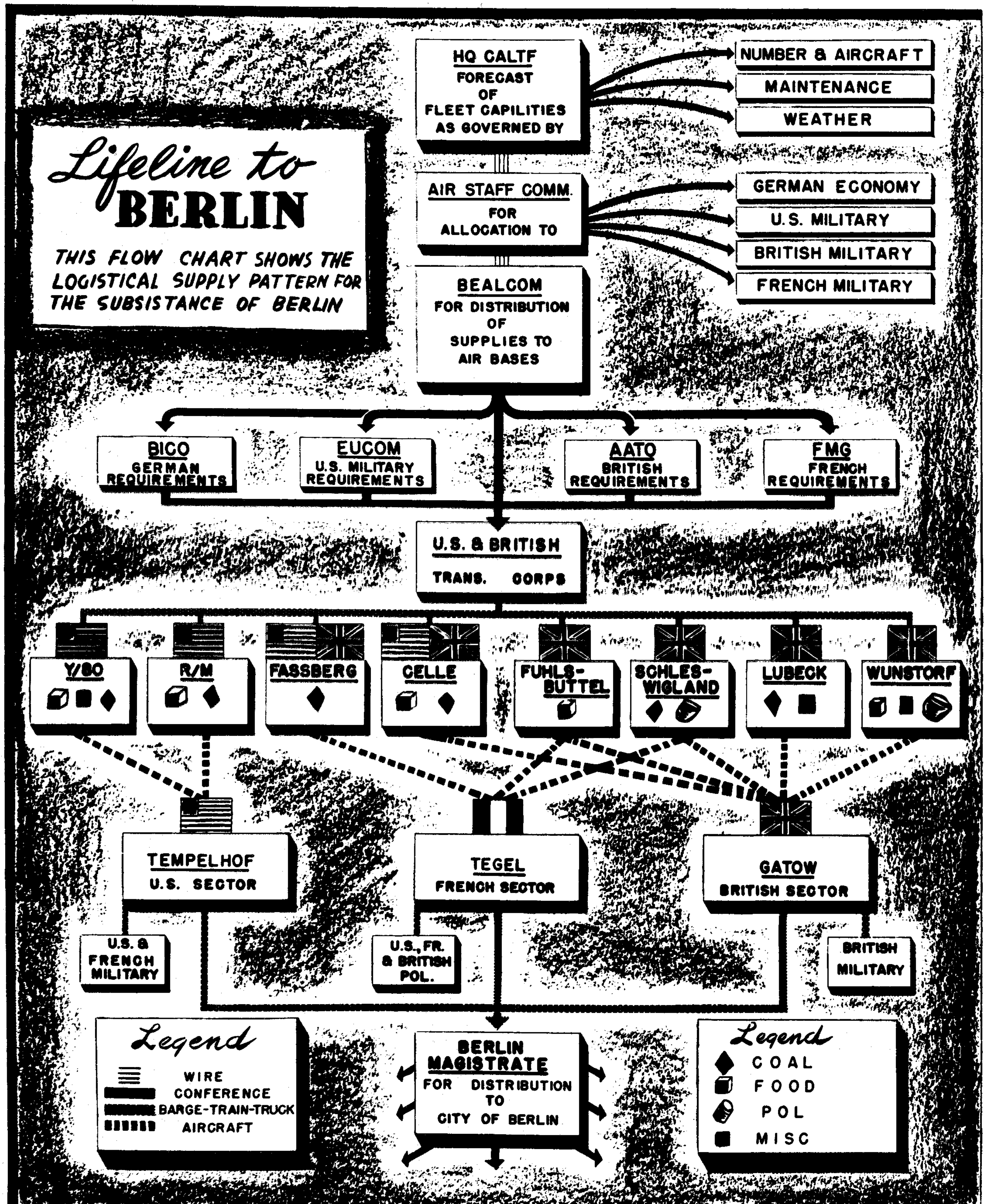
• A C-54 fuselage used in training.

• Checking foodstuffs at the railhead.

Day and night, operating in the aerial arteries to the heart of Berlin - the three corridors guaranteed by international agreement - Airlift aircraft carried the sustaining necessities of coal, food, medical supplies, and newsprint for the free press.



The planning necessary to insure delivery of proper supplies to predesignated airfields involved several agencies. This pattern is reflected in the chart below, depicting the functions of each agency and the resultant flow of cargo into Berlin.



forecast of the tonnage capabilities of the transport fleet. The capability figure was presented as a daily tonnage estimate to the Air Staff Committee in Berlin and thus it became a key factor upon which the logistical supply of Berlin was planned for the following months.

This Committee was composed of representatives of the French, British and United States offices of Military Government. In joint session, this Staff allocated the available tonnage lift to provide for the requirements of German subsistence and industry, retaining a small portion for the support of the occupying forces in Berlin.

This Committee also passed on the general classifications of commodities and established the priority for their movement. No changes in the scheduled movement could be made without clearance by the Air Staff Committee. Such action was necessary to prevent any available transport space from being utilized for the delivery of cargo not absolutely essential to Berlin needs.

The firm allocations were transmitted to BEALCOM (Berlin Airlift Coordinating Committee), located in Frankfurt, and composed of BICO (Bipartite Control Office), British and American Ground Force support commands, and CALTF Traffic. It was the responsibility of BICO to administer and control German production and transportation, insuring adequate stocks of supplies required for the German economy and populace of Western Berlin. This Committee, in joint session, scheduled the flow of supplies into air bases from which they would be airlifted.

Ground Support Units

It was essential to the Airlift mission that aircraft be loaded and unloaded as expeditiously as possible. This operation involved the services of those supporting elements which provided railhead facilities, truck transport and labor supervision. With units operating independently, it was difficult in the early stages of the Airlift to effect prompt coordination with the various units.

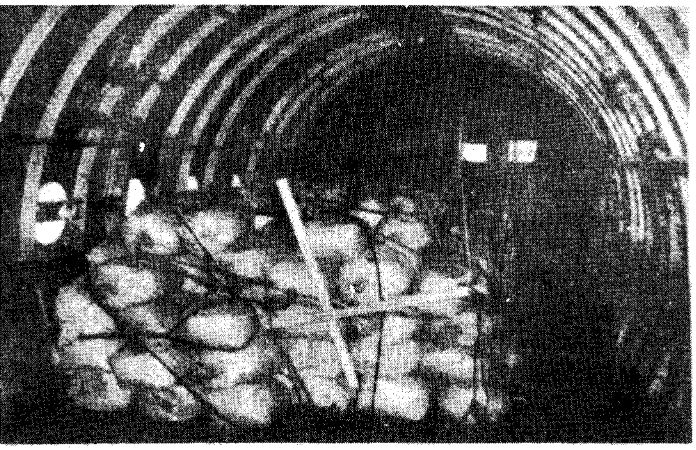
Consequently, EUCOM established an Airlift Support Command under which all U. S. cargo handling support elements were organized. This was patterned after the British Army Air Transport Organization, which commanded all ground support units at British bases. Ground support was rendered by the French at Tegel Air Base in Berlin where both U. S. and British aircraft were unloaded.

Tonnage Requirements

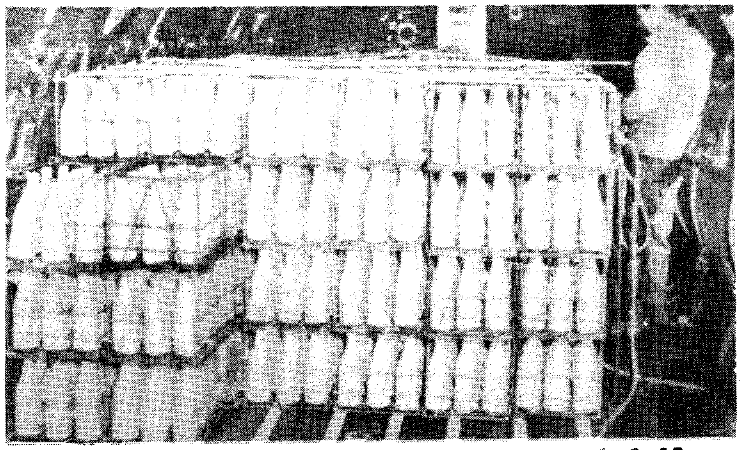
The daily minimum supply requirement considered necessary for the city of Berlin was estimated initially by the Office of Military Government at 4,500 tons. This was revised on 20 October 1948 to a total of 5,620 tons. These requirements, when referred to as tonnage, should be visualized as commodities ranging from baby food to bulldozers. The 5,620 tons were broken down as follows:

FOR THE GERMAN POPULACE:	TONS
Food	1,435
Coal	3,084
Commerce and Industry Supplies	255
Newsprint	35
Liquid Fuel	16
Medical Supplies	2
Sub-Total	4,827
U.S., BRITISH AND FRENCH MILITARY:	763
Three C-54 Passenger Flights Daily (U.S. and French)	30
TOTAL	5,620

● Typical loading operation.



Coal in 55 lb. paper sacks.



● Fresh milk delivered daily.

As the Airlift tonnage capacity increased, it became possible to improve the daily ration allowed the city's inhabitants, thereby returning living conditions to a higher standard. Available lift in excess of daily forecasted capability was utilized to build a stockpile of coal in Berlin.

Commodities Airlifted

The wide assortment of commodities airlifted created numerous problems in ground handling. Complete accounting of the methods tested and techniques developed are too detailed to permit inclusion in this report. Therefore, only the most salient materials are discussed.

Coal

Never before has the need for coal to sustain city life been so forcibly exemplified. It is the source of heat, light and power, without which no modern city can survive.

Approximately 65 per cent of the total tonnage developed was allocated to the movement of this fuel. Although at first coal appeared to be relatively easy to handle, the problem of controlling the dust which sifted through the canvas duffle bag or jute sack containers required the institution of corrective measures. This dust was sharp and abrasive, and was the direct cause of a definite increase in manhours for maintenance and inspection.

In an effort to control the dust, the 110-pound sacks of coal were dampened prior to loading and stacked on tarp-covered aircraft floors. This method reduced the payload and did not produce the desired result. To further this control and save in the purchase of sacks, a multi-layer paper sack was adopted. It was found that smaller containers stood up much better under heavy service.

Continued re-use of paper containers established their life expectancy at three to five trips, before excessive breakage made them unserviceable. This type of container controlled dust more adequately, and, combined with thorough sweeping of the aircraft after each unloading, produced the best solution to the problem. At the request of the Task Force, tests were carried on with floor sealing by the Burtonwood Air Depot. The desirable condition would be a floor sufficiently sealed to allow periodic flushing.

Food

Ranking second on the tonnage list was food, consisting of items such as sacked grains, vegetables, frozen meats, fish, dairy products and fresh fruits. Products which could be dehydrated were so processed in order to provide the maximum caloric value per ton airlifted. This increased the bulk per unit of weight, adding to the problem of total payload utilization.

● Fresh vegetables ready for tie down.

Lancastrian unloading petroleum at Gatow.

Frozen foods and meats were transferred so rapidly that no appreciable loss was realized.

Berlin had a daily requirement of approximately 38 tons of salt which required special handling, since this item has a corrosive effect on the alloys and cables used in the structure of an airplane. British flying boats, equipped with overhead cables and treated to resist corrosive action, were used to transport salt until 15 December 1948, when the danger of ice on Havel Lake necessitated withdrawal. Thereafter a modified version of the Halifax bomber, equipped with a pannier slung in the bomb bay section, carried a load of approximately 6.6 tons.

One of the largest problems presented by the movement of these commodities was the necessity for security measures, as food was more valuable at this period than normal currency and could be exchanged more readily. Constant vigilance was required to control pilfering.

Petroleums, Oils and Lubricants

In the early period of the Airlift, petroleums, oil and lubricants were carried in 55-gallon metal drums grossing approximately 365 pounds each. Owing to the difficulty encountered in loading, and the necessity of steam cleaning and backhauling empty containers, this proved to be an uneconomical method for the airlift of fuels.

The British had contracted with civil charter aircraft companies for the services of aircraft which had been modified as aerial tankers. The tanker method of fuel transport proved to be by far the most efficient, for it increased the usable payload by decreasing tare weights, eliminated container backhaul, and minimized loading and off-loading time. Consequently, the airlift of all liquid fuels was assigned to the British Civil Tanker Fleet. To meet the liquid fuel requirements of Berlin, the tanker fleet was increased to the following:

	Capacity
16 Lancastrians	8.4 Tons
7 Tudors	8.8 "
17 Haltons	6.0 "
2 Liberators	7.3 "

This fleet was capable of producing an average daily capacity of 550 tons of liquid lift. Approximately half of the total liquid fuel airlifted originated at the British base of Wunstorf, the remainder being lifted from Fuhlsbuttel and Schleswigland.

At Wunstorf a unique loading system was installed. This consisted of rail sidings which permitted rail tanker wagons to deliver the liquid fuels to central storage tanks by gravity flow. From these storage tanks the various fuels were pumped through 12 distributing pipes to aircraft parking positions on the loading ramp. To load an aircraft, the desired quantity was selected on the regulator dial and the electric pumps were started. This system provided for a flow of 100 gallons per minute and stopped automatically when the pre-set gallonage was delivered.

The tankers were routed into the Berlin airfields of Gatow and Tegel, where underground storage tanks and pipes enabled unloading by gravity flow. A reduction in unloading time from 25 to 18 minutes for eight and one-half tons of liquid fuel was accomplished by lowering the drainage tanks and increasing the rate of gravity flow. From the air bases, the liquid fuels were pumped through underground pipe lines to storage depots.

Industrial Supplies

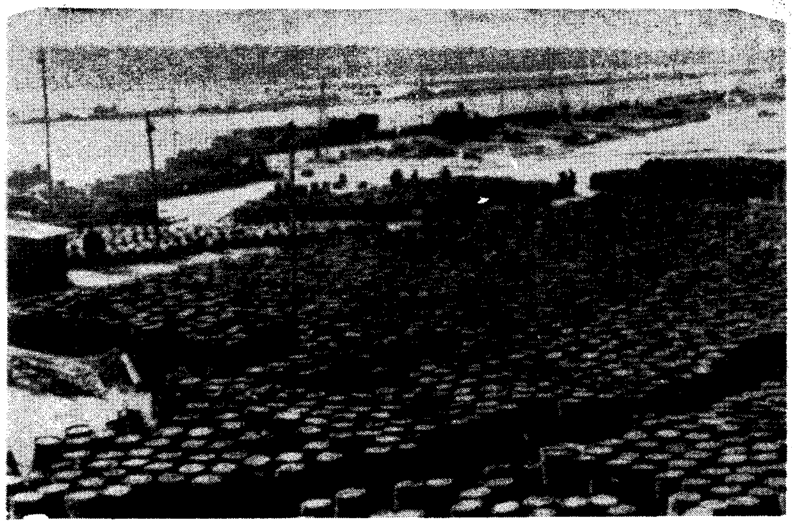
To prevent complete economic collapse and the demoralizing effect of idleness, it was essential to provide continued employment in the city's normal industry. The thousands of tiny "handewerke" concerns in Berlin were occupied mainly with processing basic materials into finished products. Therefore, raw materials of every description were required by industry to sustain itself and afford a means of livelihood for the people of Berlin. The continuous flow of raw materials resulted in the industrial concerns retaining at least a portion of their export markets in Western Europe.

These materials presented many difficulties in loading and tie-down because of irregularities in weight, high density, size, and shape. Another problem in their handling was presented in that a portion of these items were materials that were restricted for air shipment and required close monitoring to insure proper crating and handling.

Engineering and Construction Material

Construction in Berlin of new air bases, additional runways, and ramps required supplies ranging from steel matting to dismantled road-rollers. The EUCOM Engineering Depot at Hanau completed the cutting and dismantling of the equipment and supplied cranes and operators for assistance in loading.

The lift of these heavy and odd-shaped items emphasized the necessity for the assignment of special utility aircraft to any Task Force. This is best illustrated by the accomplishment of the Bristol Freighters and the Fairchild C-82s employed in the Airlift. These aircraft are especially adaptable for the carrying of abnormally bulky items and were exceedingly valuable despite their small payload. The larger dimensions of loading doors and square construction of the cargo compartment facilitated movement of this machinery to Berlin by air for airstrip construction. As a result of the additional facilities constructed with this equipment, the tonnage figures pyramided with ever-growing rapidity.



• Tons of Asphalt for a Berlin airfield.

Asphalt, shipped in metal containers grossing approximately 400 pounds each, was transported in sufficient quantity to enable completion of air base construction. Leakage was controlled by use of tarps under and over the load. Ropes used in the tie-down of this item were replaced often, since they soon became impregnated and slick with absorbtion of this type cargo.

Berlin Power Plant

This plant had been located in the British Sector of Berlin and had a daily capacity of 228,000 kilowatt-hours, or almost half of the present total electrical power produced in the three Western sectors of Berlin.

The Military Governors of the three Western Powers had agreed that this dismantled plant would be rebuilt, and contracts had been let to German manufacturers to produce all of the necessary integral parts.

The lack of power available in Berlin made it mandatory that this material be airlifted as soon as possible. The material was mainly of a weight, size and shape which made its transport by air a most unusual requirement. The only item which was to any degree normal was the fire brick, with the balance ranging in weight for single pieces as high as 32,000 pounds.

Study revealed that there were 12 pieces with weights or dimensions in excess of the capabilities of available aircraft, without structural modification. These 12 pieces were pre-

9 Pressure tanks, West Berlin Power Station.

dominantly shafts or rotor valves of length, breadth and weight which necessitated special ground-handling equipment and modified aircraft to make their transport possible.

The heavy and bulky items which would have to be transported on aircraft such as the C-74, C-97 or other large and modified aircraft amounted to approximately 450 tons.

The Combined Airlift Task Force had undertaken the movement of this material, but with the lifting of the blockade surface transport was utilized to complete the project. The heaviest single piece transported by air weighed 9,680 pounds and was of dimensions which just permitted loading.

Miscellaneous Supplies

A wide assortment of miscellaneous goods were delivered by air. Of these, medical supplies were among the most urgent. For example, ether had been supplied to Berlin by firms located in the Eastern Zone. With the loss of this source, it was found that there was only enough on hand to cover one month's consumption. The ether was packed in small cans for air shipment and required extremely delicate handling, as there would have been drastic results if leakage developed in flight, subjecting the crew to its vapors.

Newsprint, used for publication of the Berlin daily newspapers, was transported in huge rolls, each with an average weight of 600 pounds. Loading was accomplished with fork lifts, and at the destination the unloading chutes were built wide enough to accommodate these rolls.

Other items included in this general classification were clothing, household goods, office supplies, and even the daily mail and parcel post.

The most publicized of all miscellaneous items flown was the candy dropped to the children who gathered in the vicinity of Tempelhof airdrome. This was an unofficial operation, known as "Little Vittles," started by Lt. Gail Halvorsen and continued by others

Passengers

The imposition of the blockade trapped many Western Zone residents in Berlin. From the inception of the Airlift the Royal Air Force carried more than 80,000 passengers from Berlin. The majority of these were carried in Dakotas, with some being transported by Sunderland Flying Boats and Yorks.

On 20 September 48, the British commenced moving personnel requiring medical treatment not available in Berlin. These were pre-TB and early TB cases, persons medically certified as requiring long periods of rest and good food, and the delicate and undernourished children. This movement was necessary because of the over-crowded condition existing in the Berlin hospitals. Poor housing, dampness, inadequate heating and severe winter weather amplified this hospitalization shortage.

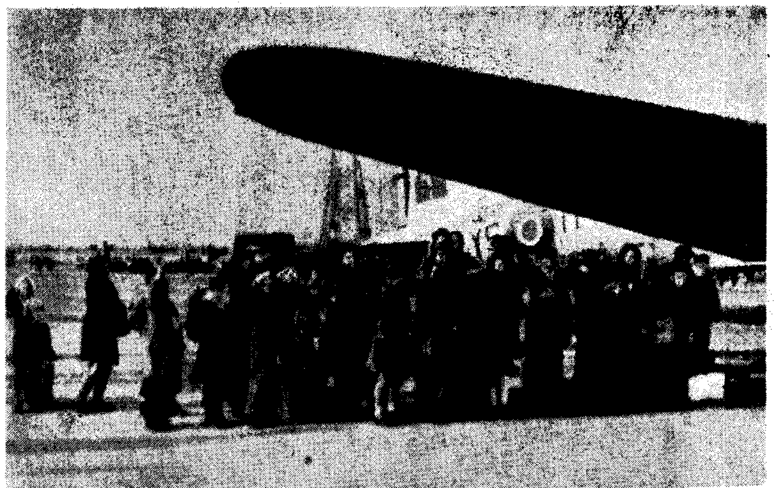
In addition to this large outshipment, more than 32,000 Allied and German passengers were transported into Berlin by the British.

The constant requirement for transportation of administrative personnel between the U.S. Zone and Berlin resulted in the establishment of scheduled passenger flights operated from Rhein Main Air Force Base. These flights were started on 16 August 1948 and carried more than 44,000 persons into and out of Berlin. A daily passenger flight also was operated from Wiesbaden Air Base for Airlift of French personnel. A total of 19,000 inbound and outbound French passengers were transported.

Backhaul from Berlin

The outbound cargo airlifted from Berlin averaged approximately 350 tons daily for the major portion of the Airlift. This included manufactured products such as electrical supplies, pharmaceutical supplies, machinery, mail, empty coal sacks, vehicles and possessions of personnel transported from Berlin after the imposition of the blockade.

As in any type of transport, the carrier is non-productive while standing idle. Consequently, the time required to load and unload aircraft with cargo outbound from Berlin was reflected in a proportional loss in delivery of tonnage to Berlin. Although the prime objective was supplying the beleaguered city, it was essential that many items be airlifted from Berlin in order to maintain production. Shipments were scheduled in such a manner as to prevent excessive delay in aircraft turn-around.



● German children departing for Western Germany.

Preparation of Air Cargo

Continued handling of these varied commodities brought out many salient points in the processing of cargo for air shipment. Ranking first was the standardization of packaging, proper marking and weighing, and control of tare weight.

Delivery of maximum net tonnage was insured by reducing the container weight, or tare. An illustration of the importance of this weight saving can best be made by showing the tonnage savings made possible by preparing food specially for the Airlift. The daily requirement for potatoes was reduced from 900 tons to 180 tons by dehydration. Boning meat saved 25 per cent and sacking cereals reduced surplus packaging by 25 per cent. The average tare for food was reduced to approximately six per cent, a considerable saving when applied to the tonnage developed throughout the operation.

To maintain reliable control, it was frequently necessary to re-check the weights of individual packages and in some cases to weigh loaded trucks on platform scales. A graphic example of the gravity of this problem was exemplified, during one period, by the necessity for checking, re-weighing and adjusting the contents of numerous freight carloads of coal, purportedly containing coal sacked at 110 pounds.

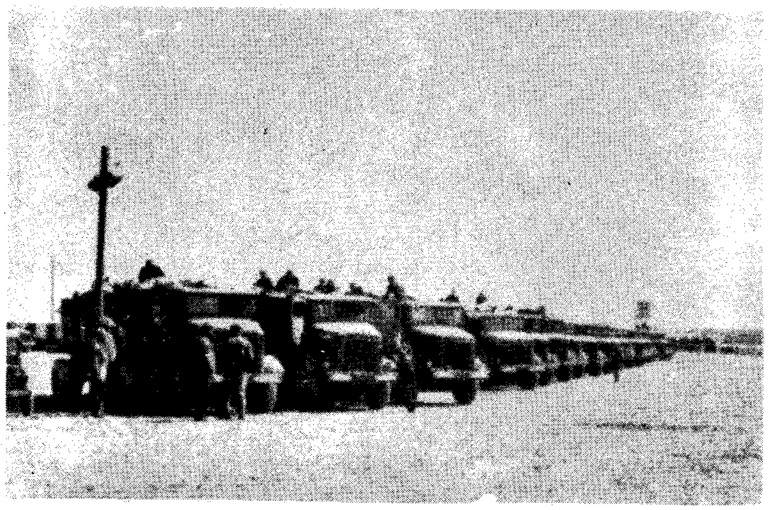
The over and short weight variations discovered were so great that complete carloads were returned to the sacking plants for correction. Without this check it would have been possible to overload an aircraft as much as 5,000 to 6,000 pounds.

Steps were taken through the Bipartite Control Office (BICO) to insure uniformity and accuracy in package weights. That office was provided with copies of U.S. TO 00-85-9 and requested to contact the shippers, acquainting them with the items prohibited for air shipment, and advising proper marking of restricted articles.

In any future operation, conducted in a foreign country, the shipper should be supplied with this Technical Order translated into the native language of that country, to make its contents easily understandable for supervisory personnel in packaging and shipping departments. This action is considered mandatory to insure delivery of maximum net tonnage and reduce the possibility of error in loading which could jeopardize flight safety.

Documentation

Cargo arriving at Airlift bases received a modified documentation. The traditional red tape, characteristic of normal cargo transportation, was eliminated. This was replaced by a



● "Ready-line" Rhein Main.

simple but effective procedure based on the use of an air manifest. Large-scale operations make the streamlining of paper work essential.

Payload Utilization

A major traffic responsibility was the assurance of proper payload utilization within safety factors. An aircraft may put an unlimited number of hours in the air, but, if not loaded completely with proper commodities, the expense of this mode of transportation is excessive. Controlled volumes of bulky items were scheduled into selected Airlift bases where a "marrying" process was accomplished at the railhead by the Ground Support Command units. This load marriage was the mixing of light, bulky cargo with heavier, concentrated cargo to produce a manageable load corresponding to the weight capacity of the aircraft and still not exceeding its cubic capacity.

These "married" loads were prearranged on the trucks at the railhead so that the lighter, more bulky cargo would come off of the truck last and be to the rear of the aircraft. This facilitated accurate compliance with weight and balance requirements.

To increase the payload of the aircraft, all equipment not essential to the operation of the plane was removed. The apparently small savings realized by replacing unnecessary equipment with cargo, and insuring that every pound of the allowable load was utilized, mounts to very important proportions when applied to the number of trips accomplished throughout the Airlift mission.

As an example, if 100 pounds of surplus equipment had been carried on each aircraft, or if they had been allowed to depart that much short of what could be carried safely, it would have meant the loss of 12,892 tons of premium transportation during one year of operation. This saving alone would have provided enough supplies to sustain the city's life for three days.

Ground Handling Techniques

A key to successful air transport lies in the ability of the operating unit to render efficient ground handling. The loading and unloading process must be accomplished in a minimum amount of time to effect maximum delivery of tonnage.

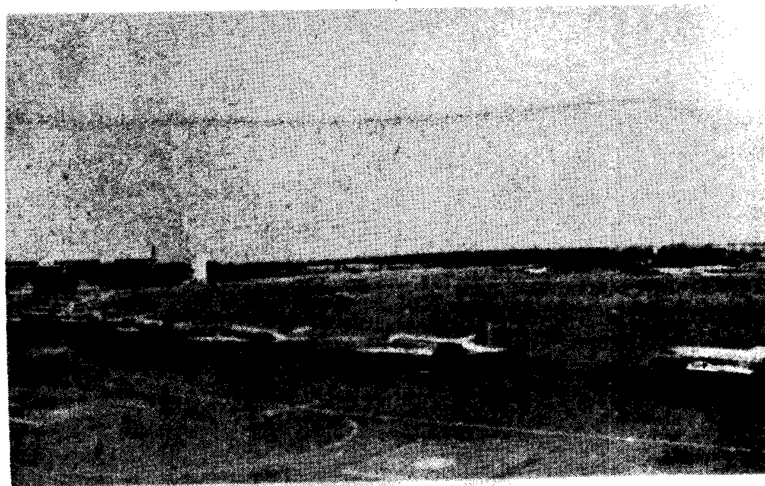
A considerable reduction in loading time developed through the channeling of uniform cargo into specific bases. With previous knowledge of cargo weight, bulk and type of container, the loading technicians could plan weight and balance compartmentation, loading equipment necessary, and tie-down requirements. This also kept the load-marriage problem at a minimum.

The loading of an aircraft differs considerably from the loading of any other type of transport unit, in that floor stresses, load distribution by compartment, and proper tie-down are the primary factors which determine whether or not the aircraft is safely balanced for take-off and landing.

A simple and efficient system for weight and balance control is essential for safe, mass operation. The tempo of the Airlift demanded that weight and balance documentation be simplified. A plan was developed wherein a single loading diagram, outlining compartment-load breakdown and specifying the total allowable cabin loads, was posted in a conspicuous place within the fuselage of each aircraft. This enabled the loaders to effect safe and expeditious loading.

Loading crew alert and truck dispatch was reduced to a simplified system. Aircraft returning from Berlin called in to their home base when ap-

● Caution, in backing into position.



● Unloading at Tempelhof.

proximately 10 minutes out, giving the mechanical condition of the aircraft and whether or not it had any return load on board. This was accomplished in a very short coded radio call. Upon receiving this information of an aircraft's availability for loading and expected arrival time, the Air Force loading technician collected his manifests, truck and loading crew, and directed the driver to the position where the aircraft was to park.

Several things happened simultaneously when the aircraft switches were cut. The loading doors were swung open by the flight engineer, the tail stand was placed in position, fueling trucks pulled up for refueling the plane, and an aircraft mechanic met the crew to check on any minor maintenance needed. The loading supervisor guided the loaded truck into position, halting and blocking the trailer in time to insure safe clearance between the truck and aircraft, and the loading operations began.

In most cases the loading and unloading could be accomplished very effectively by utilizing available manpower. During the early period of the operation loading crews were comprised mainly of DPs (Displaced Persons), but later they were replaced by German labor companies.

The maximum in efficiency was obtained from these labor crews when one member was selected as a crew leader and given a very slight increase in pay over the others. Combined with this was the institution of competitive programs, with the winning shift being awarded prizes of cigarettes, etc. All functions of the operation benefited from this competitive spirit and it aided in maintaining morale at a time when every man's capability was being taxed to the utmost.

The physical facilities, types of loading areas, types of cargo, aircraft available and the amount of native manpower on hand, all regulate handling techniques and equipment requirements. The Rhein Main unit practiced the hardstand loading system for almost the entire duration of the assigned task, due to the tactical layout of the field.

The difficulty of this system in connection with expeditious loading can be seen when it is taken into consideration that approximately 20 minutes are lost in traveling to and from the widely dispersed areas to perform the loading.

A production-line system of loading on the ramp directly adjacent to the Traffic Check Point and railroad was effected at Celle, Fassberg, Wunstorf and other Airlift bases where ramp facilities permitted, proving its efficiency and economy plus providing a more stringent monitoring of any difficulties or delays.

Loading teams consisted of 12-man labor crews under the supervision of an Air Force loading technician. Cargo weighing less than 250 pounds was ordinarily manhandled right into the aircraft. On some occasions it was even found more expeditious to load items up to 400 and 500 pounds by this manual method. The more heavy and cumbersome construction material and raw materials for Berlin's commerce and industry required the use of loading aids such as fork lifts and cranes.

The speed attained by the loading crews in their handling of sacked goods was almost unbelievable, unless witnessed. In one instance, the Director of Traffic at Fassberg ran a speed test to determine how fast a ship could be loaded by hand. This test was not prearranged and utilized only the regular number of loading crew. In less than six minutes the 10-ton load of coal was aboard the aircraft, tied down, and doors closed.

Average time for this loading was approximately 15 minutes, with the more difficult loads of food and industrial goods taking 28 to 30 minutes. Loading times were computed from the opening of the cargo doors until the load was tied down and the loading truck pulled away.

Specialized Loading Equipment

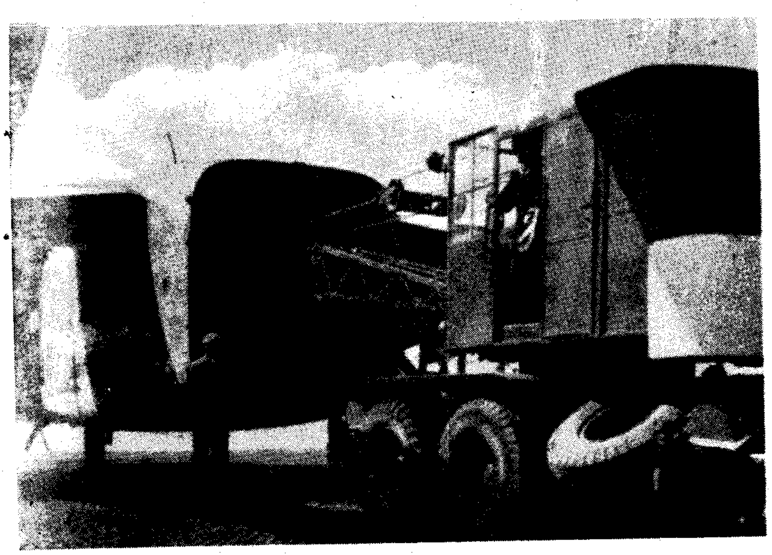
Fork lifts proved very satisfactory when operated on solid loading ramps, but during winter and spring months when mud penetrated the pierced steel planking used on some loading areas, they lost their maneuverability, imposing an operational hazard. High-lift trucks proved slow due to limited capacity, which necessitated the positioning of more than one loading truck to an aircraft.

Both of these systems increased the chance of damage to aircraft by loading equipment, for every time a vehicle approaches there is the possibility of structural damage to the aircraft. Therefore, with the reduction of such approaches a safety factor was instituted. That was the principal reason for utilizing a loading truck capable of carrying the total payload of the aircraft in one trip. The low percentage of damage done by loading equipment to aircraft doors and door sills is proof of the soundness of this procedure.

For loading heavy construction material and machinery into C-82s, a mobile crane proved invaluable. The boom of this crane could be lowered to the horizontal position and the load driven directly into the aircraft and lowered into its correct position, without the wear and tear of sliding or rolling cargo across the cargo compartment flooring. This also allowed for provision of dunnage under extremely dense items.

With the arrival of the newer, large type transports for service tests, a need for a conveyor belt to assist loading was recognized. The extreme length of cargo compartments in these huge air transports, and the height of their loading doors, make the use of mechanical loading aids almost a necessity. A portable conveyor belt was used that extended well into the cargo compartment and speeded the operation considerably. The loading time for 20 tons of coal, using this system was about 35 minutes, whereas the manual method took from 45 minutes to one hour. With the present trend of air transport turning to even larger aircraft, there will be increasing need for the further development of mechanical loading aids.

• Cranes help load heavy equipment.



• Conveyer belts used in 20-ton transports.

Platform loading was discarded after testing, for it involved considerable delay in platform and plane positioning. Commercial airlines have considered this system as feasible, but when a large number of aircraft are to be loaded continuously the problems involved prohibit its effective use.

Cargo Tie Down

A satisfactory answer was approached to the question of what type of tie-down gear is the most desirable for the lashing of air freight within the aircraft. However, this is a problem on which much additional research is needed, for the variation in size and type of cargo presents many difficulties in tie-down. An intensive study was made of the tie-down equipment utilized on the Airlift, with every traffic unit experimenting to develop something new that would be rugged enough to withstand the heavy workload imposed upon it.

The Evans tie-down equipment was standard for USAF aircraft upon their arrival for duty with the project. But with the heavy work load, and small stock of resupply items for the kit on hand at the Supply depots, the normal attrition soon rendered unserviceable much of the equipment available.

A study of the attrition rate of this equipment proved that it was not excessive, as had been anticipated, yet was still so expensive as to make the change to a more rugged article desirable. Life expectancy of the Evans rod, which is one of the most easily damaged items of the kit, was established at approximately 100 trips.

The lack of adequate supply necessitated the establishing of extensive tie-down repair and maintenance shops at each of the traffic installations. Component parts were salvaged, repaired and re-used.

To appreciate the cost of supplying this type of gear, the following cost analysis for just <u>one</u> item in the kit is presented:

Evans Tie-Down Rod:

Average depreciation (per day) per group, 35 rods. Multiplied by groups in operation, 175 rods. For a 30-day month, 5,250 rods. Monthly total, times cost (1.78 each), $9,345.

The life of one-half inch tie-down rope which was used with this equipment was also studied and found to vary considerably. This was accounted for mainly in the methods used in binding the ends so they would not unravel. The most satisfactory system was to bind the ends with twine and dip them into aircraft dope. This prevented fraying, and lengthened the life of the rope considerably. As an average, 75 trips were considered the normal life of the rope; but, as the type and quality of the rope employed varied greatly, this is not conclusive.

Continuous research was carried on to determine the most efficient tie-down procedures and equipment. With the reserve supply rapidly dwindling, the web strap tie-down was investigated. Little was known of this equipment in the military air transport field, although it had been placed in use on some commercial airlines. Results of preliminary tests were encouraging and a supply was ordered. Continued use proved that modifications had to be made on the buckle assemblies before this type could be considered versatile enough for regular use.

Along with the web strap, a steel cable tie-down was introduced for securing high-density cargo, such as construction machinery. Aircraft used for transporting machinery were equipped

Web strap tie-down equipment was used.

with this cable tie-down, and very satisfactory results obtained. Some difficulty was noted in the design and the lack of elasticity made it undesirable for cargo which settled or packed down during the vibration encountered in flight.

A link chain tie-down system was used by the British. Although it was somewhat cumbersome and heavy it proved satisfactory, the principal advantage being its durability, which eliminated the problem of repair and resupply. The British also used cargo nets with some degree of success. However, this method was not suitable for all types of cargo loads.

Air Drop Test

An experiment in air supply through free drop was conducted in August 1948. To prove as conclusively as possible the advantage or disadvantage of this type of supply, a wide variety of items were dropped such as coal, flour, canned goods, baby foods and cereals.

Closely observed results of the drop brought forth the following conclusions: Closely-woven fabric is unsatisfactory, as it provides no elasticity. Fully-packed containers, with the exception of those containing canned items, should not be air dropped, as sufficient space must be provided for expansion of contents upon impact and roll. The free space should be twice the cubage of the item in all cases except cartonized canned goods. When double bagging is used, the ends must be opposite each other and closed with wire ties.

This experiment was considered a success in that it provod that if the situation required an air drop supply, material could be delivered in limited quantities.

Ground Safety

Development of safety procedures and techniques was not left to chance. The following measures were introduced on the Airlift, resulting in minimum damage to aircraft and vehicles:

a. Loading trucks which could handle sufficient cargo to load an aircraft completely in one trip were utilized to reduce the number of vehicle-to-aircraft approaches. This item alone reduced immeasurably the possibility of loading-equipment damage to aircraft.

b. Wheel blocks were placed at a measured distance from the aircraft to insure safe clearance between the truck and aircraft as the vehicle backed into position for loading.

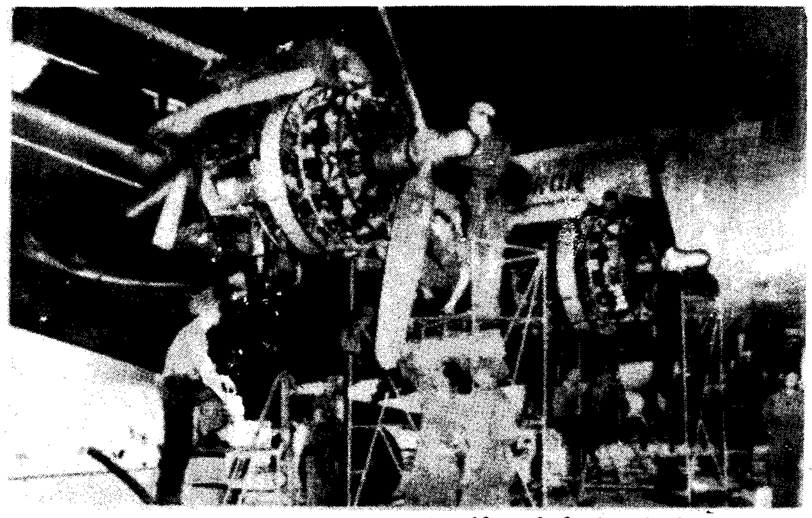
c. Lighting for night loading, a very important safety factor, was augmented by the installation of additional floodlights on ramps, and spotlights on vehicles and fork lifts.

In conjunction with these physical safety precautions, instructions were given to traffic personnel and truck drivers to insure caution in vehicular operation in the vicinity of aircraft. These procedures, coupled with close and competent supervision and monitoring, resulted in an enviable safety record for such a large-scale operation in which speedy handling was the essence.

Summary

The ground handling of cargo on the Airlift proved the ability of Air and Ground elements to work in harmony while combining their efforts toward a common goal -- tons to Berlin. In addition, it emphasized several basic principles which must be considered in any future operation. These can be briefly summed up as: The need for a single organization responsible for ground support; a mobile traffic organization, formed into a separate squadron with appropriate Tables of Allowances and correct Military Occupation Specialty assignments; the acquisition of warehouse facilities prior to inception of the operation, with a view to peak requirements; adoption of standard traffic reporting and documentation systems; supplying adequate tie-down equipment of a rugged nature with simplicity of design; and, after screening the climatic conditions and manpower requirements, render decisions as to the mechanical loading aids advisable for the project.

MAINTENANCE - USAF



On-the-job training.

Unrelenting high utilization of USAF aircraft in the round-the-clock, seven-day-a-week operation on the Airlift, coupled with the abnormal wear and strain of the short-haul, maximum-load take-offs and landings, soon presented complex maintenance problems requiring extraordinary solutions. Added to the need of assuring a proper balance of specialized mechanics was that of obtaining special maintenance equipment and an adequate flow of replacement aircraft parts.

The decision to replace C-47s with C-54 aircraft as quickly as possible imposed the first of the larger maintenance problems. Crews had to be converted and trained in a minimum period of time for the servicing of 4-engine C-54 aircraft. Special tools had to be requisitioned and C-54 maintenance docks were a necessity.

Early Situation

Since aircraft out of commission reduced directly the number available for the movement of Berlin tonnage, an additional burden was thereby placed on those aircraft remaining in commission, to meet the tonnage target. This in turn reduced the available time for preventive maintenance and contributed to general deterioration of the fleet.

As a result of increased tonnage quotas, less and less preventive maintenance could be accomplished, with the result that many aircraft were flown on red diagonals until such discrepancies could be corrected at the time of scheduled inspections. With the indoctrination of squadron personnel in methods of better maintenance, the construction of maintenance docks, procurement of sufficient tools, and the acquisition of additional personnel, the general condition of the USAF aircraft gradually improved without sacrificing time and, consequently, operational efficiency.

It was necessary to spread the maintenance experience thinly. The well-trained personnel accompanying the C-54 aircraft to this theater were assigned to the newly-formed units in an attempt to balance the general level of the maintenance experience. The personnel to fill the gaps were generally capable, but were not thoroughly qualified C-54 maintenance men and were not able to adapt themselves immediately to the unusual working conditions which existed. This condition, along with the return of TDY personnel to the ZI, presented a serious problem.

On-the-Job Training

This situation necessitated a comprehensive on-the-job training program, using as instructors those qualified officers and non-commissioned technicians available in the squadrons. A preponderance of inexperienced personnel sometimes doubled and even tripled the time required for the most elementary maintenance operation. Engine, electrical and hydraulic specialists were almost 100 per cent on-the-job training personnel, with the result that trouble-shooting degenerated to practically a trial-and-error proposition. A natural elimination of this problem was accomplished as personnel became familiar with maintenance aspects of the C-54.

Even with qualified personnel to perform maintenance functions, the lack of special tools and allied equipment was critical. The lack of washing and cleaning facilities, and the consequent filthy condition of the aircraft carrying coal and flour caused morale and maintenance problems incident to working on such aircraft. The cleaning of landing gear struts and other parts after each flight was curtailed by the lack of rags and proper cleaning agents.

Maintenance of aircraft records, an extremely vital part of the aircraft maintenance, was made difficult by the shortage of administrative personnel and trained supervisors. The concurrent result was that many aircraft component parts were changed and unnecessary work accomplished, chargeable to incomplete and inaccurate historical reports of the aircraft involved.

Maintenance Control

In October 1948, when C-54 aircraft were being used exclusively, it was realized that a command-wide Maintenance Control system, dealing with aircraft assignment, inspection scheduling, and aircraft status was of utmost importance. Plans by this time called for a fleet strength of 225 C-54 aircraft on the Airlift. A maintenance control was established, giving 24-hour-a-day coverage at Combined Airlift Task Force Headquarters, and the Group and Squadron levels of the USAF.

This system provided for reporting on an hourly basis to Headquarters and on a status change basis at Group and Squadron levels. These control boards were duplicated at each command level, with the master control board at Headquarters portraying condition of the entire fleet at a glance.

A color scheme, universal for all command levels, was adopted to indicate status of aircraft undergoing maintenance. At this time, CALTF Form No. 10 was devised, which provided a complete historical record of each USAF aircraft, and furnished necessary detailed information for comparative studies between groups and squadrons.

Headquarters Maintenance Control was charged with responsibility for the intricate scheduling of all aircraft to USAF Air Depot at Burtonwood, England, for 200-hour inspections and to the United States for 1,000-hour cycle reconditioning. In addition, Maintenance Control obtained information on many problems that were bound to occur in the groups, and expedited coordination with other divisions in Airlift Headquarters, USAFE Headquarters, and Erding and Burtonwood depots.

Inspections

During September, October, November and a part of December 1948, 200-hour inspections were performed at the USAFE Air Depot at Oberpfaffenhofen. On 15 November 1948, when the performance of these inspections was transferred to Burtonwood, the Airlift was generating sufficient flying hours to require seven 200-hour inspections per day. This was established as a mission for Burtonwood. During November, December, and January, Burtonwood was not able to accomplish this requirement, and it became necessary to perform those inspections at the operating bases, without sufficient personnel and equipment to do required work.

During this period, the condition of the entire fleet again deteriorated considerably. It was not until March that Burtonwood was able to accomplish six inspections daily, and then the output increased to eight during April and May. By 15 April, 10 months after the start of the operation, Burtonwood could perform the required number of inspections, eliminating the need of 200-hour inspections at the operating

CALTF Maintenance Control Board.

200-hour inspectio

Burtonwood Operations

Originally it was planned to conduct all aircraft maintenance inspection in accordance with Technical Order OI-40-NM-6, which was designed primarily for a long-haul type operation with a minimum of landings. As early as December, it was realized that a 100-hour type inspection, in accordance with Technical Order 00-20-A, was more efficient for this particular operation, but since Burtonwood had been established to provide 200-hour inspections, the pattern was not changed. Instead of changing the entire system, the second intermediate inspection (comparable to the 100-hour inspection) was augmented to take care of the additional work items necessitated by the Airlift short-hour type operation. These items consisted primarily of oil change, spark plug change and brake inspection.

Performing 200-hour inspections at Burtonwood made it difficult to fix responsibility for certain maintenance functions between the operating agency and the supporting agency. Such inspections normally are an organizational function and should be performed by the operating agency, with only field maintenance or maintenance of a higher echelon performed by a supporting agency.

Inspections at Burtonwood were expensive to the over-all mission. The requirement of eight inspections daily involved ferrying eight aircraft to and a like number away from Burtonwood each day, as well as maintaining a backlog of aircraft to assure an uninterrupted flow of production-line operations. The flying time for ferrying aircraft to and from Burtonwood averaged 1,680 hours per month.

1000-Hour Reconditioning

Since the number of available C-54 aircraft in the USAF was limited, and new C-54s were not being produced, it was imperative not only that aircraft should be kept in safe operating condition, but that they be conserved. To accomplish this it was decided by Headquarters, USAF, to return all C-54s to the ZI for cycle reconditioning for each 1,000 hours flown. This proved of inestimable value in maintaining the fleet in good operational condition, and was one of the major assets in performing the mission.

Difficulties which arose at the beginning of the procedure resulted from failure to authorize contractors to do all required work, but by mid-February this situation had been remedied. Intermediate inspections were performed at 50-hour intervals, in accordance with Technical Order 01-40-NM-6, the first and third intermediate inspections being essentially the 50-hour inspection covered by TO-00-20-A.

Aircraft Utilization

An aircraft utilization of eight to ten hours a day per assigned aircraft required a maintenance schedule of 24 hours a day, seven days a week. Personnel shift-scheduling, and particularly supervision, became important since work was completed usually by crews other than those which had started the maintenance operation. Lack of efficiency of swing and graveyard shifts had to be compensated for by additional personnel, best possible lighting facilities, equipment and supervision.

As maintenance facilities became available, and quality of the mechanic personnel improved, the USAF units on the Airlift attained a utilization of almost 10 hours a day per aircraft.

Unscheduled Maintenance

It was determined by 1 November 1948 that the percentage of aircraft in unscheduled maintenance was entirely too great. This condition was caused primarily by the inability of squadrons to perform first - class scheduled preventive maintenance. This condition was aggravated by the type of work required to perform the mission. A concerted drive was made to improve the scheduled preventive maintenance by utilizing training equipment, improved lighting and closer inspection. Improvement was indicated by March 1949, and during April and May mechanical breakdowns decreased to nearly normal expectations.

Engine Failure Factors

To prevent delayed take-offs, an unusual condition arose involving excessive engine ground time. There were often from five to nine aircraft waiting take-off at the end of the runways, and statistics show that the ground idling time averaged approximately 30 minutes per trip. Excessive ground time increased the maintenance work load by subjecting seals, gaskets and ignition wiring to excessive heating which resulted in their deterioration and breakdown. Conditions were improved through the change in procedures of scheduling aircraft from hardstands to take-off position.

Excessive ground time contributed to engine failures, as did the nature of the short-haul operation, which required the use of high manifold pressure and r.p.m. a much greater percentage of time than in a normal C-54 operation.

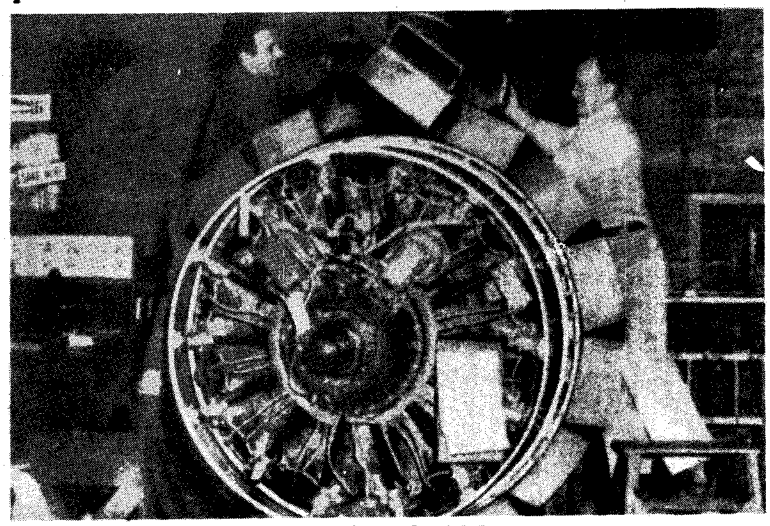
The use of hot-running LS 88 spark plugs did much to prevent fouled plugs resulting from high engine ground time. However, these plugs caused considerable damage in the cylinder combustion chambers due to incipient detonation in take-off and climb power, resulting in piston erosion and ultimately in complete engine failure.

Reports show that of all the engine failures, approximately 35 per cent were due to combustion chamber failures. The large percentage of combustion chamber failures indicated that a cooler-running plug should be used. The Technical Order covering the use of spark plugs in R-2000 engines listed the LS-88 spark plug as the No. 1 choice, and it was necessary to obtain authority to use a cooler-running plug, such as the RB 19-R2 or LS 86.

Approximately 19 per cent of engine failures were due to hydraulicing, and it is believed the primary cause was failure of both flight personnel and maintenance personnel to pull propellers through before starting the engines. This was particularly true in the Berlin area, where insufficient personnel were available to pull propellers through after the aircraft had been unloaded. When statistics became available and attributed 54 per cent of all engine failures to these conditions, a corrective campaign was instituted.

Engine Shortages

In the early phases of the Airlift there was a critical shortage of both R 2000-9 and R 2000-11 engines. The situation was so acute for a time that it was necessary to install both R 2000-9 and R 2000-11 engines on the same aircraft. By March 1949, the availability of replacement engines permitted engine conditioning.



• R-2000 engine buildup.

During November, December and January it was impossible to change all engines that indicated below standard cylinder compression, due to the shortage of engines and cylinders. Standards, of necessity, were lowered. This caused a relatively large number of complete engine failures which could have been avoided by changing cylinders at the standard compression requirements. While the consumption rate of engines near the end of the Airlift did not change materially, a large percentage of engines removed could be overhauled at minimum cost. A comparative study of engine failures.

by bases, was maintained to keep commanders advised of the reasons for failures.

Planned Logistics

The engine tear-down reports from Air Materiel Command did not reach the using agency quickly enough to allow immediate use of the data, but they were instrumental in correcting malpractices, once they were received.

Maintenance and supply support for any aircraft operation is one of the most involved problems confronting a planning organization. It is possible to operate a number of transport aircraft on a mission for approximately 100 hours with essentially no support. Such an operation could be completed in eight to ten days. If the mission extends beyond 100 flying hours, or ten days of operation, however, adequate maintenance and supply support becomes imperative.

The number of C-54 aircraft assigned to the Berlin Airlift was increased to 160 before adequate support was available for more than 50. When it became apparent that this would be a sustained operation, the number of assigned aircraft was increased to 225, although support was available for approximately 100. During the months of January and February 1949, it was calculated that the same tonnage could have been hauled with 50 less aircraft than the number assigned, since, lacking proper support, a large number were grounded for parts and maintenance. By March, however, support improved, and during April and May it was well-balanced, based upon the assigned aircraft, and reflected in the higher aircraft utilization. Equipment requirements, personnel training requirements, and better knowledge of high-mortality parts requirements should be given a high priority in improving maintenance support.

Varied Cargo

Varied types of cargo carried by the Airlift brought new maintenance problems. Concentrated loads, such as machinery and other heavy objects having small bearing surfaces, stressed the need for improving the C-54 flooring. Since this airplane was designed primarily for passenger carrying, the floor was unsuitable for heavy-duty work. The replacement of flooring and repairing floor beams required many manhours of maintenance.

Early in the Airlift operation it was found that coal dust and flour sifted through the floor into the lower baggage compartment. Both types of dust cause an unusual maintenance problem since they are difficult to remove. Coal dust has an abrasive effect on control cables, and causes corrosion on electrical contacts, particularly in cannon plugs on the radio wiring. Tests were made in sealing the floor to eliminate this condition. While results were favorable, there still exists a problem to be solved.

Short Haul Effects

Reference has been made to certain effects that a short haul has on engine lift, but other aspects of aircraft maintenance must be considered. Early in the operation of the Airlift it was found that the consumption of tires, when compared to normal hours flown, was extremely high. A landing was made for approximately each 80 minutes flown, and 50 per cent of the landings were made with a gross weight of approximately 68,000 lbs., much higher than the normal allowable landing gross weight.

Tire consumption was not only abnormally high, but also the consumption of brake discs and other brake parts. Naturally, this high rate of consumption for the hours flown was reflected in the maintenance effort required, since brakes must be repaired, assembled and installed, tires mounted on wheels, and general landing gear inspections must be more thorough. The C-54 landing gear withstood the grueling treatment much better than anticipated. Airlift experience, accordingly, indicate that for emergency-type operations the landing gross could be increased.

During the long hours of winter darkness and 24-hour operations, it was found that maintenance on landing light mechanisms and other lighting was greater than that of any previous operation. The consumption of landing lights during the winter months became critical. The wear on the retracting mechanism called for frequent replacement of parts and much closer inspection. Changing of crankcase oil and cleaning of propeller domes after 100 hours of operation became necessary to eliminate severe sludging. This condition was caused by operating engines in climb power for an unusual high percentage of time. Consumption of starters was 100 per cent greater than that for normal operation.

Personnel Balance

Considerable maintenance experience has been gained in the operation of C-54 aircraft as well as other transport type aircraft since the beginning of World War II. Much experience came from the Hump operation, and from the transport operations in the Atlantic and Pacific areas. By the end of the war, balanced MOS requirements had been compiled and made a part of the personnel requirements for C-54 aircraft maintenance, based on aircraft utilization. These requirements have made it possible to supply the proper balance of personnel for any planned aircraft utilization up to the point of diminishing return.

A utilization of eight hours per day per assigned aircraft was the immediate goal, with a planned goal of 10, or even more, hours per day. Personnel requirements by respective MOS were submitted per assigned aircraft. This requirement amounted to a total of 15 maintenance family-group personnel per assigned aircraft if 200-hour inspections were performed away from the operating bases, and 19 maintenance family group personnel if all organizational maintenance was to be performed at operating bases. During the first few months of 1949, a comprehensive study by a manpower board from Washington and USAFE found the requirement sound in every respect.

Maintenance Training

During the first six months of the Airlift operation, maintenance personnel were insufficient in number, averaging approximately eight men per assigned aircraft, except for the two Navy Squadrons which were manned at a rate of one and one-half enlisted men to one in the Air Force units. It was necessary to employ and assign 50 German mechanics to each squadron. Later this was increased to 85 in the USAF squadrons. Since the German mechanics were not experienced with this type aircraft, an extensive training program was started.

Schooling these German Nationals became one of the important training projects in the Task Force. With the language barrier as the first difficulty, a translation section was organized and work began upon the translation of the required training literature for the initial courses. This translation was extended and eventually material was translated for the Ground Training School, for courses utilizing the Mobile Training Unit, and various technical references such as the C-54 Technical Order, Maintenance Handbook, and AN -1-40NM-2. This was not a complete solution to the language problem, however, since supervisory personnel had to be maintenance personnel capable of speaking German. This required at least one German-speaking, qualified maintenance officer to the squadron who selected and trained competent German supervisory personnel. Eventually, as they acquired proper experience, bilingual Germans were utilized in many key positions, thus reducing the load on the German-speaking maintenance officers. The use of German personnel in the maintenance field is considered practical, and was of major assistance.

During January, February, and March, as Air Force temporary duty maintenance personnel were returned to the ZI, it was found that the replacements were not adequately trained on C-54 aircraft. Consequently a training program was necessary.

Work-Dock Problems

During the operations, four work-dock fires completely or partially destroyed the aircraft undergoing maintenance. In each case the docks were constructed of wood, on dirt foundations, with improvised lighting, since vapor-proof cords and bulbs were unobtainable. Generally they were in unsafe condition. Plans called for replacement with masonry docks on concrete floors when the phase-out began.

Portable steel work docks with adequate fire-fighting equipment, vapor-proof lighting and adequate heating, should be considered for the maintenance of any larger type of transport aircraft. Sufficient testing equipment for various components should be made a part of the squadron's authorized equipment, based on the type of aircraft being used. Consideration should be given to the design of portable washing equipment and protected washing facilities which will permit cleaning during winter months.

Field Maintenance Support

Due to the high aircraft utilization, it became apparent during the early stages of the operation that base shops were inadequately manned and equipped to perform sufficiently the heavy maintenance required. Since the squadrons were faced with a shortage of personnel and equipment, the work load imposed on the base shops by increased flying hours grew steadily.

Two of the major problems confronting the base shops were fuel tank leaks and nose gear repairs on C-54 aircraft. Nose gear failures were caused through faulty pilot operating technique, the towing of aircraft by inexperienced maintenance personnel and, in a few instances, by materiel failure. As a general rule, when nose gear work was necessary, major repair had to be performed.

Fuel tank leaks, one of the most frequent repairs, usually resulted

● Permanent C-54 maintenance dock.

from flying in turbulent weather. However, many leaks probably resulted from hard landings and high gross weight.

These two items of repair, in addition to normal field maintenance support, resulted in a high backlog and, due to the shortage of personnel, many flying hours were lost.

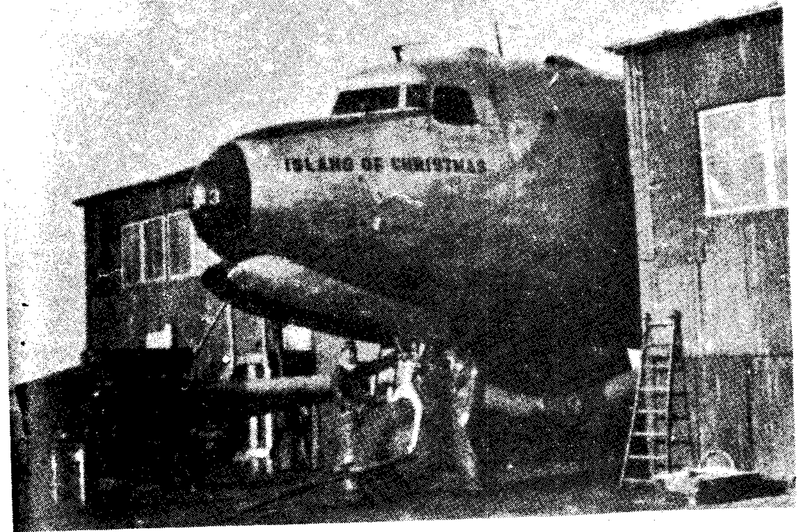
Stripping Aircraft

At the request of the Task Force, a project was instituted at the Burtonwood Air Depot to increase the payload of the C-54 by reweighing and stripping unnecessary equipment and fixtures.

Three models of C-54 aircraft were selected from operating bases for the experiment, performed in April. It was found that by re-weighing the aircraft, an average of 300 pounds payload was gained, and the amount of weight saved by stripping averaged 2,200 pounds per aircraft, thus increasing the payload of each aircraft approximately 2,500 pounds. Following the experiment, the aircraft were flown on regular operations on the Airlift. It was determined that the flying characteristics were unchanged by the modification, and further, that maintenance was less complicated because of reduction in the amount of equipment needing servicing.

Turn-Around Maintenance

At the receiving end of the Berlin Airlift -- Tegel, Tempelhof and Gatow airdromes -- no servicing nor scheduled maintenance were required. This does not mean that mechanical breakdown did not occur. Experience shows that me-



● Temporary maintenance dock.

chanical troubles will occur at any point where aircraft are landing regularly. At each terminal an alert crew cleared the emergency difficulties reported by the pilot. The major emphasis at Berlin was to get an airplane off the field and back to its base as quickly as possible. This meant there should be no delay in making repairs.

Berlin maintenance was plagued with the shortage of parts, equipment and specialized personnel. Since 3-engine take-offs were authorized at Tegel and Gatow, this tended to relieve the problems at these stations. However, at Tempelhof, 3-engine take-offs were not permitted, due to obstructions around the field, and it was necessary to perform engine changes and other engine repairs before take-off could be accomplished. In many instances, this required a delay while a part or an engine was being airlifted from the home base or some other supply point.

It is important to have experienced mechanics, men with the broadest possible knowledge, to handle trouble-shooting at the terminal point, and to devise means by which a crippled aircraft can return safely to its base.

Statistical Reports

At the start of the Airlift, and for the first few months of operation, a minimum of maintenance statistics could be compiled and utilized. It was not until the fifth month of operation that adequate reporting facilities could be provided to maintain accurate statistics.

Maintenance statistics are valuable management tools in that, if properly set up and maintained, they serve to spot unsatisfactory conditions and trends as they develop. Graphic charts and permanent statistical records should be initiated at the earliest possible date after an operation begins.

MAINTENANCE-RAF

Basic Decisions

The difficulties facing the Royal Air Force technical organization in solution of the problem of keeping an adequate number of aircraft serviceable for the Airlift were made worse by the intensity of the operation, coupled with shortages of personnel and inadequate accommodations in Germany.

In the early days, when the operation was expected to last only a few weeks, it was decided that all base and terminal inspections would be carried out in the United Kingdom, and that the maintenance in Germany would be limited to first-line, or daily servicing, and to minor repair work. This decision was made to avoid transferring all the second and third line maintenance personnel from England. As the operation developed into a long-term project, no change was made in the earlier decision, and the base maintenance continued to be carried out in the United Kingdom.

The loss of productive flying hours involved by this decision was more than outweighed by the fact that aircraft flying to and from the United Kingdom for inspection provided essential airlift for personnel, spares and equipment that otherwise would have necessitated special flights.

Maintenance Organization

The base and terminal inspections were carried out by the personnel already available at the Transport Command stations in the United Kingdom. A maintenance detachment also was sent with original Dakota and York units assigned to Airlift duty in Germany.

The personnel of this maintenance detachment were split into two sections whose functions were to perform daily, or first-line maintenance, and repair outside the scope of the daily maintenance sections.

Experience has shown in an operation of the nature of "Plainfare" that the first-line maintenance section worked better on a decentralized basis for the following reasons:

a. Owing to the considerable area occupied by a large number of heavy aircraft, personnel operating from one central point wasted considerable time walking to and from aircraft. The time wasted by this means often represented a high proportion of manhours available.

b. The non-commissioned officers of various trades were unable to exercise effective supervision, since the men under their control were spread over the whole marshaling area.

c. The ground equipment became dispersed over the entire marshaling area, and considerable time was lost by airmen searching for equipment.

In view of these disadvantages of centralized maintenance, it was decided to sub-divide the first-line maintenance section into flights under overall centralized control. With due regard to manpower economy, it was decided that 12 to 15 multi-engined aircraft was the optimum number that could be handled by each flight.

Inspection Cycles

At the commencement of the Airlift the periodic inspection cycle of aircraft was extended from 50 to 75 hours between alternate terminal and base inspections. In the light of experience acquired during the first few months, it was decided to stop terminal inspection altogether and to carry out base inspections every 100 hours.

During the winter an investigation was carried out to determine the relationship between individual defects and the time at which they occurred. This investigation showed that the rate of arisings was barely altered by the periodic inspection in the majority of cases, and that only certain classes of airframe and engine defect rates appeared to be reduced by periodic servicing. Therefore, it was decided in June 1949 to extend the period between base inspections from 100 to 150 hours. Although insufficient experience was obtained, it appeared unlikely that the defect rates would increase materially.

Technical Control

An operation of this nature necessitated matching serviceable aircraft with loads and air crews more or less continuously. It was essential for a control unit to be available, supplied with up-to-the-minute information on the progress of aircraft servicing. This control point, the Technical Control Section, was a vital link in the station operational organization.

The functions of this section corresponded almost exactly to those of Operations Control. It acted as the nerve center for controlling and progressing maintenance work continuously.

The work of the section commenced as an aircraft returned from a trip. The aircraft called up some 30 miles from base and reported its serviceability state. The Technical Control Section then took over the responsibility for progressing any required servicing of the aircraft, including refueling, minor maintenance and routine servicing. This system insured that an aircraft was made ready to fly at the earliest possible moment.

Technical Control was able to advise Load Control of the details of availability of aircraft for loading; of aircraft requiring more than normal turn-around maintenance, thus providing time for awkward loads; and of aircraft which for servicing reasons could not be loaded.

In the event of there being insufficient aircraft for any given wave, 40 minutes before the first take-off the Technical Control Section passed forward the numbers of those aircraft likely to become serviceable during the ensuing half-hour, in order that air crews could be briefed and carry out their pre-flight checks while servicing was being completed.

PRODUCTION CONTROL-USAF

The emphasis in planning, as the flying and ground operations became routine, was shifted to increase the tonnage flown while using the same facilities. The basic concept was established that ground time delay is lost time, and that a dispatching plan must assure aircraft taking off promptly when loaded and otherwise ready. It became necessary to cut corners and speed up production in every department. A staff agency, non-existent in the typical organization of a military unit, was needed to coordinate and expedite all ground activities concerned with the turn-around of the aircraft.

The functions of such an agency were defined and established under a staff section designated as "Production Control" at the Task Force Headquarters, to monitor over-all operational efficiency, conduct analytical studies of performance, and take action to reduce aircraft ground time. Production Control officers were then appointed at each operating USAF base.

Production Control at Bases

To maintain maximum efficiency at the bases, it was necessary for the Production Control officer to phase the activities of traffic, maintenance, servicing, crew scheduling and traffic control. Planning was aimed to avoid lost motion in the ground handling of the operational aircraft, since aircraft ground time meant lost tonnage in the accomplishment of the mission.

The Production Control officer on each base reported directly to the unit Commander, and his section was manned ror 24-nour coverage. The section was physically located in a central Control Room. Direct connection was maintained by telephone and intercom with all the ground handling agencies at the base, with Air Traffic Control and with the Chief of Operations at the Task Force Headquarters. The Production Control officer on duty was given complete authority to monitor and expedite all activities pertaining to aircraft turn-around.

A ramp expediter was placed on the flight line at each base, working directly under the Production Control officer. He was mounted in a jeep, equipped with two-way radio so that he could report on-the-spot ramp activities immediately to the Control Room. In that way, the expediter was able to avoid many unnecessary and costly delays. His reports enabled the Production Control officer on duty to clear up immediately the situation involving any one or all of the responsible activities such as Traffic, Maintenance and Operations. Such close control over the ramp activity resulted in much valuable time being saved.

Status call-in procedures were established, requiring incoming pilots to report, from a point 10 or 15 minutes out, both the mechanical and load status of the aircraft. This information, relayed to maintenance, traffic and aircraft servicing units, alerted them to provide prompt and adequate facilities upon arrival of aircraft.

Thus, aircraft returning to their home bases with loads from Berlin were "positive" and were met with unloading trucks; those carrying no loads were "negative" and were met promptly with loading trucks. When an aircraft was reported "negative" as to maintenance status, personnel were dispatched to meet the aircraft with adequate tools and supplies to perform turn-around maintenance.

If major maintenance was required, the call-in system provided Traffic with notification of availability of the aircraft, and served also as a means of coordinating with the alert crews to park the aircraft in specific areas apart from the active turn-around areas.

The aircraft status and control boards, maintained in the central Control Room, provided a constant check on the location and status of each aircraft. For all aircraft out for maintenance, ETIC's (Estimated Time in Commission) were posted. Using these estimates, Control Room personnel alerted loading, servicing and crews to expedite the movement of aircraft from maintenance back into the traffic flow.

Liaison

Constant liaison with Operations at Headquarters, CALTF, and the Air Traffic Control centers was maintained in the central control room to coordinate block dispatches, weather trends and flight interval changes. Close coordination with these agencies was essential in minimizing delays and lost time. In many cases, additional departure intervals were obtained by alert control personnel, enabling the dispatch of aircraft which would ordinarily have missed a block and waited until the next one opened.

Since the untimely assignment and dispatch of crew personnel tended to nullify the efficiency of other agencies, close coordination was necessary to avoid crew delays. To maintain unbroken continuity in aircraft movement during crew shift changes and the dispatch of aircraft coming out of major and minor maintenance, it was necessary to work closely with crew assignment agencies.

Reports

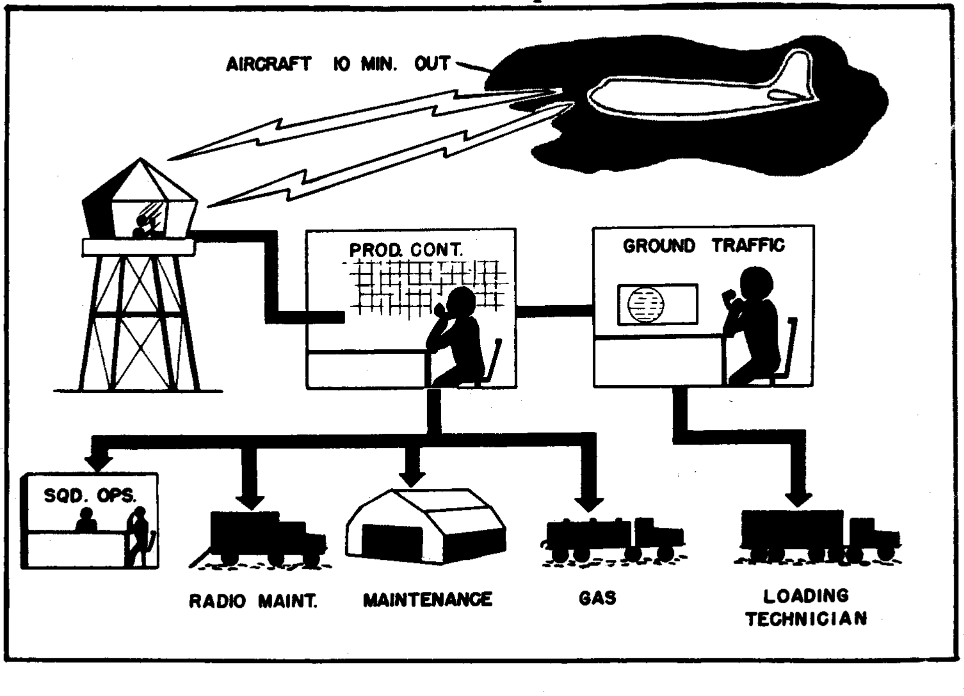
Two standard reports were developed and used by Production Control for submission by operational units to Headquarters, CALTF.

One report was the "Operational Difficulties Statement," which provided a means for field units to report to Headquarters all difficulties of a nature requiring action at Headquarters level. This enabled Staff Divisions to be familiar constantly with field problems as directly affecting tonnage performance. It also provided a daily means of explaining causes for falling short of tonnage commitments.

The other was a "Production Control Summary Statement," submitted daily to Headquarters, CALTF which summarized delays and time lost in loading, unloading, servicing, traffic control dispatch, AOCP items and aborted trips, with cause factors for each. These reported factors provided material for a study of loss trends to initiate corrective action.

This central control agency, primarily concerned with efficiency in the ground handling of aircraft, was highly successful in the Airlift operation. The effectiveness of individual ground handling agencies is greatly diminished, with resultant efficiency loss in the entire operation, if they are not tied together in unbroken continuity by such an agency. Activity of this type could be adapted to any tactical air operation. The coordinating and expediting function is not a new concept, but application to accelerated and sustained requirements of the Berlin Airlift proved its value.

The diagram at the right reflects the "Call-in" procedure adopted by Production Control. This system enabled advance preparation by the sections involved in ground-handling, servicing and maintenance.



SUPPLY - USAF

The high utilization of C-54 aircraft, on a 24-hour daily schedule -- the Task Force concept of operation -- immediately created a tremendous demand for parts and supplies. Organizations arriving in the Theater had been alerted to bring as many spare parts as load limits would permit, inasmuch as there were no C-54 parts stocked in Europe at the beginning of the airlift except a small amount for the Military Air Transport Service turn-around at Rhein Main.

Supply Table 2 for C-54 aircraft was the only source of consumption data for establishing C-54 parts level. Available utilization experience tables were worthless as a guide to Airlift consumption and every means was used to get parts until enough could be obtained to permit orderly supply procedures.

Stock Levels

The C-54 was designed in 1933 primarily as a passenger airplane for use on long flights. The existing supply tables had been derived from military use of C-54s in long-range operation with infrequent landings and take-offs.

Consequently, many of the supplies brought over by the squadrons were rapidly consumed and items that should normally be repairable became unrepairable. Meantime, additional C-54 aircraft were assigned, making the supply of spare parts more critical. This situation demanded long-term planning and contractor procurement of both equipment and spare parts, including the developing of adequate Tables of Organization and Equipment.

Coal and flour dust infiltrating into instruments, control cables and electrical panels caused previously unencountered maintenance and supply problems. In order to determine supply levels of items affected by these conditions, recurring aircraft-out-of-commission-for-parts (AOCP) lists and lists of consumption data from the operating groups were screened and used as a basis for future demand. From this data a list of essential parts for airlift operation was established, based on a squadron with an allocation of 12 C-54 aircraft.

Enough new engines were received from the United States, but serviceable accessories were not available, necessitating change of accessories from old to new engines in the field. This short supply of accessories resulted in a high AOCP condition. If engines had been completely built up in depots in the United States and shipped complete, this critical condition might have been avoided.

Non - Standard Equipment

Although the aircraft used were all of the same type, they were of different series and with non-standard items of equipment installed. One example was the use of the two different engines, R-2000-9 and R-2000-11. Windshield wipers were not interchangeable. One type of wiper operated both blades from a single motor and another type actuated each blade from an individual motor. Flight instruments were both electrical and vacuum types.

Specialized Depot

Tables of Organization and Equipment for a Troop Carrier Squadron proved quite inadequate for the Airlift, particularly for much of the heavy and technical equipment. This required the submission of justified supplementary tables to higher echelons of command for approval.

A specialized depot was required to furnish items peculiar to the type of aircraft in use. Due to limited storage space at other stations, such a depot was set up at Rhein Main Air Force Base. This depot stocked all items peculiar to the C-54 aircraft and the Pratt & Whitney R-2000-9 and R-2000-11 aircraft engines. The common items of aircraft supply were stocked at Erding Air Force Depot.

Since this specialized depot was essential, it should have had authority to requisition replacement items directly from Air Materiel Command in the United States. Such requisitions should have had top priority handling and A-1 air freight priority to insure the fastest possible delivery.

Specialized Depot

The simultaneous arrival of operating units, personnel and supplies caused some confusion, and new supply accounts could not be established immediately. It was necessary to stockpile supplies in hangars, as the tempo of the operation did not permit proper warehousing and binning prior to issue.

Arrival of many items of supply and equipment without accompanying paper work, plus subsequent issue before an accounting system had been established, resulted in the need for a larger inventory section to accomplish adjustment and readjustment of records as they became complete and current.

In many cases, equipment was pressed into service and mixed with recorded property, thereby making inventory of property very difficult and wasting many manhours in research to determine if stock records were accurate.

The task of identifying, sorting, inventorying and binning all items while necessary issues were being made greatly complicated supply procedures. When shipping tickets were processed, it was impossible to make a count of actual property received. Delays in processing paper work necessitated adjusting and readjusting stock records until binning and routine procedures in processing vouchers were established. Processing of vouchers was accomplished, in some instances, as long as a month after issues were receipted.

Cannibalization

Cannibalization of aircraft undergoing inspections or heavy maintenance was necessary to keep the maximum number of aircraft operational. This imposed additional work loads on the maintenance sections and resulted in excessive time required to perform a maintenance repair. When aircraft were damaged beyond repair, immediate salvage of parts was mandatory. At Tempelhof it was necessary to establish a salvage facility in order to speed the return of parts to the operating bases in the Western zones.

Besides cannibalization, ingenuity kept many Airlift aircraft operational. During one period, starters were very critical and could not be supplied at the Berlin turn-around point. Whenever a starter was out, bungee cord was used to start the engine.

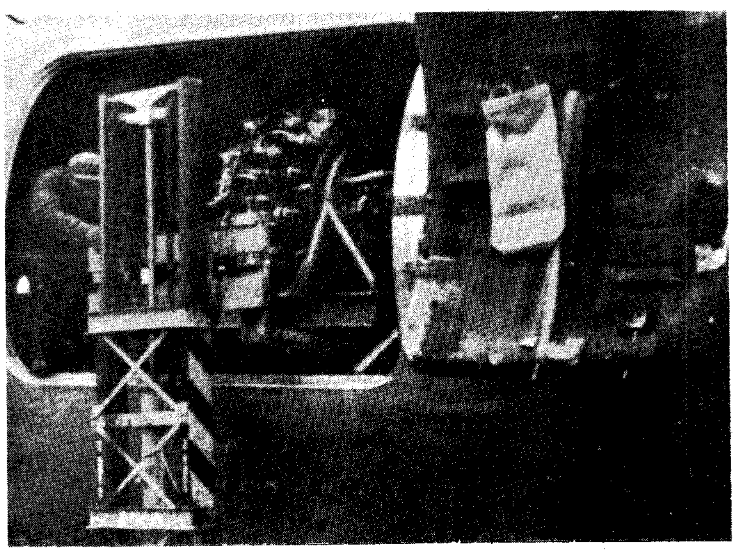
Personnel

All installations and units were handicapped by a critical shortage of trained supply personnel, particularly those schooled in technical services supply procedures. The assignment of temporary duty personnel to fill vacancies resulted in a loss of trained personnel almost as rapidly as they became familiar with their duties and responsibilities. The attempt to rectify this personnel problem by permanent change of station of temporary duty personnel was unsatisfactory from a morale viewpoint.

Permanently assigned personnel were slow to arrive and many were untrained or partially trained in their duty assignments. An on-the-job training program was established, but resultant delays and errors in supply procedures caused by a "learn-by-doing" program were expensive in money and time. These expedients forced a burden on the already inadequate trained personnel.

In the final analysis, permanently assigned and well-trained supply personnel would eliminate the need for

New C-54 engines arrive by air.



time-consuming training, and channel the skill, experience and effort of key personnel into productive supply functions. Trained supply technicians in adequate numbers would produce a smoothly operating section capable of producing the desired item at the required time and place, without resorting to emergency procedures.

Clothing

Temporary duty personnel arrived in Europe for Airlift duty with sufficient clothing for only 90 days. Many men who arrived by air were limited to 45 or 65 pounds of baggage, and often airmen carried tool kits as a large part of their baggage allowance. Consequently, clothing was sent as unaccompanied baggage, and arrived from three to six months later. Frequent transfers of personnel within the Airlift aggravated this condition.

Stock levels of clothing, necessarily restricted by storage facilities, were quickly depleted by emergency issue to temporary duty personnel due to the late delivery of their unaccompanied baggage. At first, outer garments of winter clothing were available through normal supply channels. However, the requirements were not anticipated sufficiently in advance to receive supplies from the United States when this type of clothing was needed.

Office Supplies

Considerable difficulty was experienced at squadron and base level in obtaining enough typewriters and other office machines. Initially, some difficulty was encountered in procuring expendable office supplies. But generally these items were available, despite the tendency of some supplying agencies to neglect issuing substitutes on hand when the specific items requested were not available.

Tanker unloading into pipeline.

Storage

Storage and warehouse facilities were insufficient at all bases and considerable loss of time resulted from improper storage and rewarehousing. Some difficulty also was experienced at bases where there was dual occupancy, and better utilization of buildings and facilities could have been accomplished.

Auto Spares

Automobile spare parts were stocked in accordance with standard Ordnance manuals, which authorized allowances in relation to the number and type of vehicles operated. This allowance was not adequate for the Airlift operation and normal storage of spare parts did not meet the demand. Only when consumption data became available, after several months of operation, was it possible to determine adequate stock levels.

Vehicles

Tables of Organization and Equipment authorization for vehicles were generally adequate for the requirements imposed by the Airlift. However, there were three major exceptions. Insufficient 1/4 ton 4 x 4 trucks, 3/4 ton 4 x 4 trucks, and aircraft fuel servicing units were authorized. The demand for the trucks was due to their suitability for much of the light cargo and personnel carrying that was required at each base. Expedition of aircraft maintenance and transportation of crews greatly increased the demand for these vehicles.

The authorized aircraft fuel servicing units were not sufficient to accomplish satisfactorily the mission, due to the large number necessitated by the rapid cargo loading and unloading on the Airlift. For a 24-hour daily operation, maintenance of servicing units was very critical and this was particularly important.

Maximum payloads had to be carried to Berlin, so aircraft fuel loads were restricted to a minimum. In addition to fuel and oil servicing units, enough support vehicles such as Cletracs, jeeps and powered ground equipment, were vital to the aircraft maintenance program. At times, a delay in moving an aircraft in and out of a work dock would result in loss of a flight.

Vehicle Drivers

The number of motor vehicle drivers authorized by Tables of Organization and Equipment was inadequate to meet the requirements of a 24-hour schedule. The existing tables authorized enough drivers to operate about 90 per cent of the vehicles allotted for a normal work day. The shortage of drivers created by the continuous Airlift operation was overcome by (1) having squadrons furnish drivers to operate their assigned vehicles and (2) authorizing an increase in airmen and German civilian drivers for the motor vehicle squadron.

Although numerically the shortage of drivers was overcome, properly trained and qualified drivers were not available. Inexperienced drivers caused vehicle abuse which required increased maintenance. This led to establishment of schools for German and airmen drivers.

Refueling Equipment

The handling of petroleum products also presented a problem, due to the accelerated Airlift operation. Trouble arose in procuring repair parts for both German and British equipment. This situation was partially alleviated by having some standby equipment available. The gravity-feed type installations lessened the maintenance problem on pumping equipment.

Food Service

Small buildings and outmoded equipment for operating consolidated messes, coupled with a shortage of qualified officer and airmen supervisory personnel, created a most serious problem. With the influx of additional organizations to various bases, mess facilities were expanded by the installation of field equipment in available buildings on or near the flight line. Great over-all improvements were made when trained Food Service personnel became available and a modest building program was authorized. Normal rations had to be supplemented, due to continuous feeding in the messes, from 15 per cent to 25 per cent on coffee, sugar and milk.

Mobile snack bars under the jurisdiction of the European Exchange Service were established to provide food on the flight line at the terminals. In Berlin, this permitted flight crews to secure warm food while awaiting unloading of their aircraft since the minimum turnaround time was essential to the goal of maximum tonnage delivered.

Base Food Service had no direct control over these snack bars but it is believed that they would be better under the operational control of Base Food Service and operated from 24-hour messes, furnishing food to the airmen without charge as this would permit constant supervision of preparation and type of food required to fit the need. Some difficulty was experienced because Food Service personnel were assigned additional duties. Since the continuous nature of this operation demands constant supervision these people should be utilized only for Food Service duties.

● Mobile Snack Bars — Saved Time.

AIR INSTALLATIONS — USAF·RAF

When airfields were selected for the Airlift operation, none was suitable for the exacting requirements of the mission. Some had only grass landing surfaces. Others had inadequate runways, taxiways and hardstands. All had to be adapted to high-speed loading and servicing of aircraft, as well as continuous take-offs and landings.

Complicating the problem of making improvements to meet Airlift requirements was the necessity of performing work on runways, taxiways and hardstands without interrupting the constant flow of aircraft or jeopardizing safe flying procedures.

Conversion of a dozen U.S. and British-operated airfields to the needs of high intensity air transport operations in all kinds of weather involved a large number of construction projects. Development of adequate landing and take-off facilities was dove-tailed into the modernizing of aircraft maintenance shops and the providing of other requirements.

Needed Facilities

Engineers had such problems as installing high-intensity approach and landing lights, erecting floodlighting systems for maintenance work as well as loading and unloading operations, extending power lines, running in railroad spur tracks, and dealing with the housing, messing, recreation and multiple other needs developed by two or three times the number of personnel for which bases originally were designed.

An Air Installations office was established in Airlift Task Force Headquarters to coordinate with other military agencies in planning and initiating the improvements at U.S. airfields. The Air Installations officer prepared plans, made the requests for projects, and served in a liaison capacity between higher echelons of command and the various bases in expediting completion.

The tremendous amount of work required to prepare airfields and air bases as rapidly as possible was done in the American Zone under supervision of U.S. Army engineers aided by USAFE Air Installations. In the British Zone, including the U.S. operations at Celle and Fassberg, improvements were planned, initiated and directed by the Royal Air Force Works Services.

With exception of a limited number of both American and British airmen who served as operators of trucks, power graders, bulldozers and other heavy equipment, manual labor on all projects was done by German Nationals and Displaced Persons labor battalions

One completely new airfield was built at Tegel, in the French Sector, to handle terminal traffic in Berlin. Construction started August 5 and within four months Tegel was handling a large percentage of the total Airlift tonnage. New techniques were devised to airlift the heavy equipment required, including nearly 100 items such as rock crushers, bulldozers, tractors and power graders. When even a C-74 proved incapable of carrying this machinery intact, the plan of cutting it into transportable sections and welding it together in Berlin proved satisfactory.

Runways

Airlift planners set the goal of two parallel runways at every base and recognized the desirability of three--one for take-offs, another for land-

● Runway construction in Berlin

ings, and a third for use when repairs were necessary to either of the others. Only at the receiving terminals of Tempelhof, Gatow and Tegel was this two-runway objective achieved, although a second runway was in construction at Rhein Main when phase-out of the Airlift was effected.

Tempelhof, main terminus of C-54 operations, originally had only one runway, but two additional parallel runways were constructed. Both of the new runways were built of compacted brick rubble 18 inches thick, topped by six inches of crushed rock and asphalt surfacing. The original runway was 4,987 by 120 feet and the others 5,750 by 140 feet and 6,150 by 140 feet. Gatow had a concrete runway 6,000 by 150 feet and this was augmented by a second runway topped with pierced steel planking. Another concrete runway was under construction when the blockade was lifted.

Improvements were made rapidly at all other bases. Runways were lengthened, taxiways expanded, hardstands enlarged and ramp space extended. At Wiesbaden AFB the ramp space was doubled, at Rhein Main it was increased similarly, and at Fassberg a ramp large enough to accommodate 65 aircraft was constructed of pierced steel planking laid on cinders.

Lighting

In the beginning hangar space and outside lighting were inadequate at all bases. Auxiliary generator units were brought in to supply additional power as lighting systems were extended. Floodlighting of marshaling areas posed the problem of placing poles so as to avoid risk in taxiing aircraft. Two 60-foot towers were constructed at Celle, each carrying a circular cluster of 12 Hollophane wide-beam 500-watt lamps. This system gave maximum light with minimum risk to aircraft, but the experiment indicated the need for further improvement in floodlighting methods.

Adverse weather soon indicated the need for high intensity approach and runway lights as landing aids. Installations were speeded at Tempelhof Tegel, Gatow, Rhein Main. Wiesbaden Celle, Fassberg, Wunstorf and Lubeck, and proved of inestimable value.

Storage Space

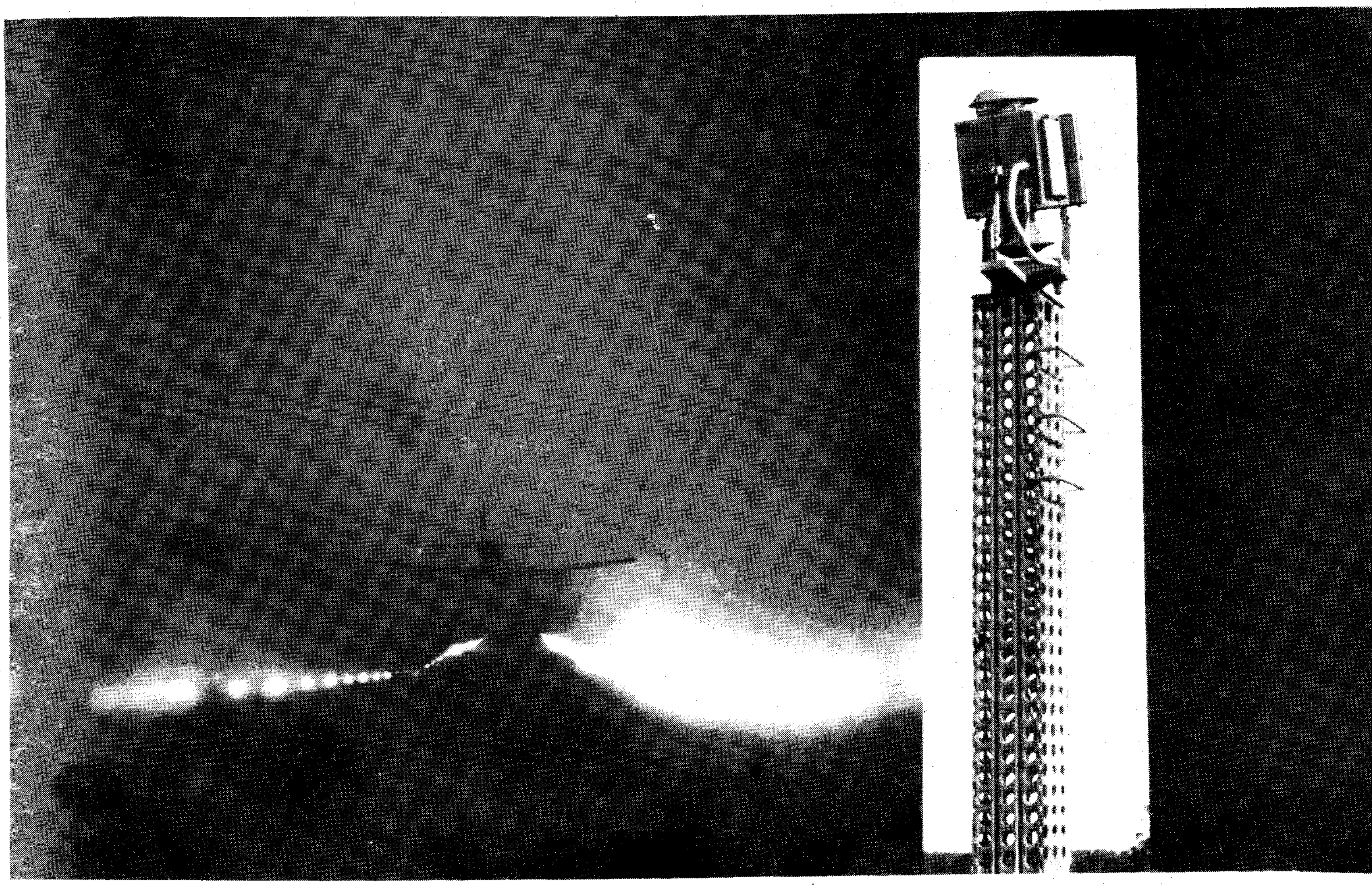
Shortage of storage space hampered activities at all bases. Hangars were used for storage of equipment and parts. In many instances valuable equipment had to be stored in the open. Nissen huts were erected for some critical materials, but did not prove wholly satisfactory. Warehouse space was inadequate for storage of reserve stocks of supplies destined for Berlin. Storage of aviation gas reserves was a problem. Numerous construction projects gradually alleviated these conditions.

Housing

Housing of personnel was a major difficulty, since bases were designed to accommodate only 35 to 50 per cent of the men required for the Airlift. Virtually all barracks were renovated and the attics were rebuilt to provide additional billeting. Sanitation facilities were inadequate for the number of men who had to be crowded into each building, and corrective action was rushed.

Temporary measures were taken at first, including the erection of winterized tent structures for civilian laborers. Later Nissen huts were erected. At Rhein Main a Nissen hut community adequate to house the entire 61st Troop Carrier Group was built but even with this construction, almost 2000 men had to be housed 8 miles away from the field in the city of Frankfurt in renovated former German barracks. Projects for dependents' housing were initiated at Fassberg, Celle, Wiesbaden and Rhein Main.

Recreation facilities had to be provided, along with lounges and day rooms. Line messes were constructed more conveniently to centers of operations to save time of workers going to and from meals. Troop Information and Education accommodations were es-



• High Intensity Lighting.
Insert shows detail of construction.

tablished to permit airmen to use spare time studying many subjects.

Fire-Fighting Facilities

Providing of modern fire-fighting facilities sufficient to the needs of the various bases was one of the problems never fully solved, although extensive improvements were made. In addition to crash-fire hazards, some aircraft were destroyed by fire due to non-fireproof electrical fittings in wooden maintenance docks. Construction of a number of concrete nose-docks to remedy this situation was under way when the Airlift phase-out started.

Model Base - Celle

Facilities at both Celle and Fassberg were developed by the British Works Services with near-miracle speed that won commendation from their American partners in operations at these bases. Celle gained recognition as a model field for an Airlift operation because of the concentration of all requirements in a central area.

The arrangement was such that loading, servicing and maintenance of aircraft could be accomplished with production-line efficiency. Production Control had complete observation of the operation and could take immediate corrective action when complications developed. The design provided for convenient housing, messing, railway and storage facilities, as well as a network of access roads with a minimum of motor transport requirement.

The rapid expansion of Airlift operations was, to an important degree, in direct relation to the speed with which the many improvement projects were completed. Despite unfavorable conditions, such as inclement weather and equipment shortages, the target dates for completed construction projects were met in practically every case. The support of the American and British engineer units accounted for installation of the many facilities necessary for the successful accomplishment of the Airlift mission.

COST CONTROL—USAF

In the formative period of the Airlift, it was virtually impossible to obtain accurate cost data, in the standard form, from the operating units. Later, as organizations became more stable and the procedures more routine, it was possible to select and train airmen and officers in the quite involved procedures of cost reporting.

Analysis of Cost Data

Early in March 1949 the Task Force took over the function of analyzing the cost data from all bases participating in the Airlift. Prior to that time, little or no use could be made by Commanders and Headquarters, CALTF, of the mass of cost information available. Then it was decided that the cost analysis should be made for the dual purpose of providing the Commanding General of the Task Force and Staff with an over-all management tool, and the Commanders with the same instrument on a smaller scale.

Such an analysis should enable the Commander in each echelon to spotlight any excessive cost or classification of costs, and from that ascertain the reasons. In most cases the reasons indicated organizational or procedural weakness. Further, such an analysis should provide an immediate comparison in every classification of cost between any operating Groups.

The analytical method developed was based upon the business costing technique, in which all elements of expense are evaluated in relation to the rise and fall of business. In this case, the "business" was the number of tons of cargo transported to Berlin each month. The costs were varied and many, but they could be divided into three basic groups: Direct Flying Costs, Indirect Base Costs and Support Costs.

Direct Flying Costs

The rise and fall in the amount of tonnage hauled affects most noticeably the direct flying costs. These costs include gasoline and lubricants, the salaries and sustenance of air crews, the Group Commander's staff, and depreciation of the aircraft. These items are similar to those included in the direct cost statements of major commercial airlines.

Indirect Base Costs

These costs include most of the general overhead and housekeeping expenses of the base. These costs remain relatively stable, regardless of day-to-day fluctuation in the tonnage hauled, although they may vary over a long period of time. For instance, the Food Service costs at a particular base would not vary with the fluctuations in tonnage hauled from day to day. But, over a period of months, those costs can vary considerably with the rise and fall in food prices or in the costs of handling.

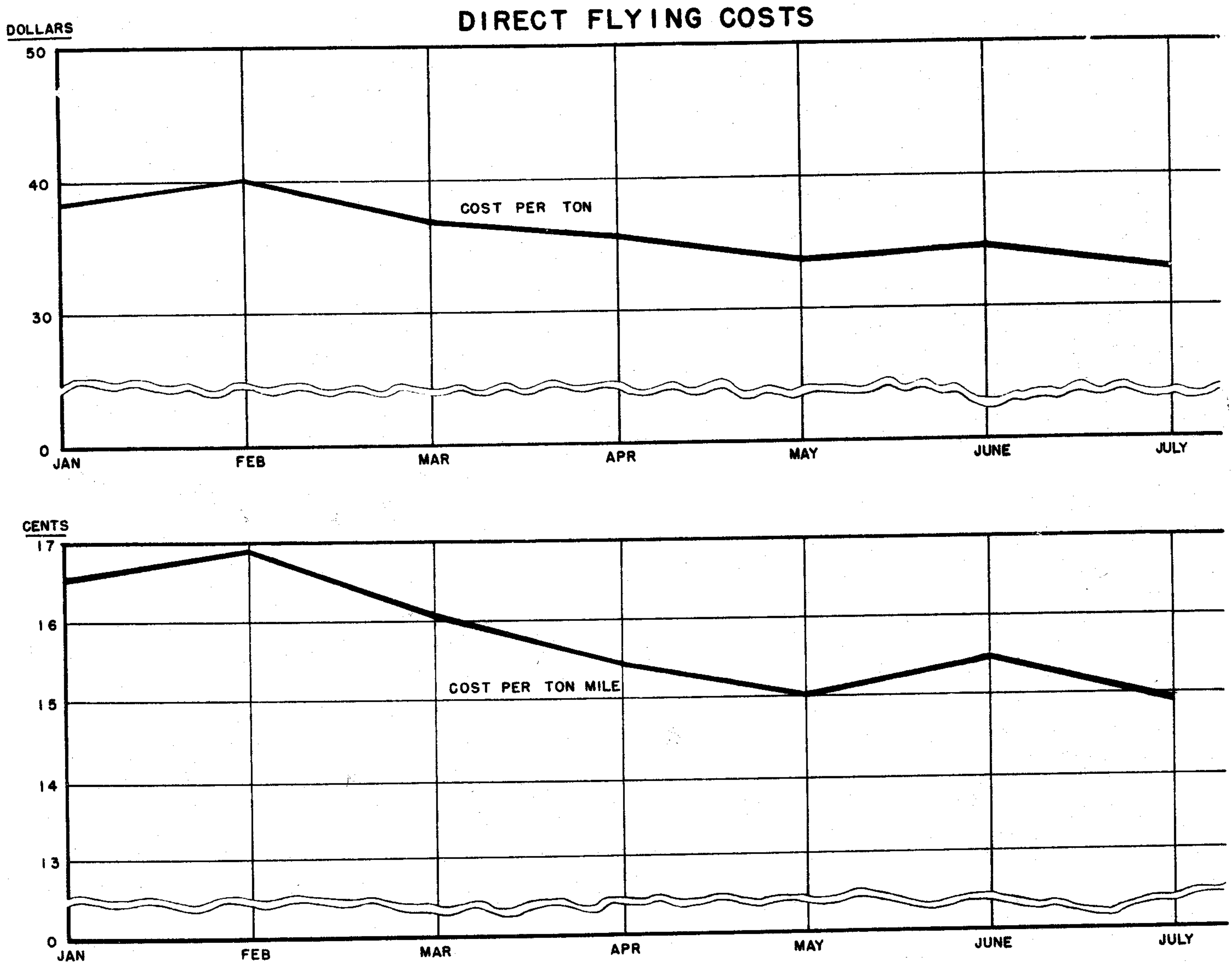
Support Costs

Certain costs were uncontrollable by Group, Wing, Base or Task Force authorities. These were costs off the base and were called support costs. For example, Burtonwood Air Depot (which was not under the command of USAFE) performed the 200-hour inspections for the Airlift, the costs of which are rightfully chargeable to the Airlift. In this case, costs were obtained by using Burtonwood's total costs for 200-hour inspections and apportioning them to the various Groups. Then, too, the costs of providing maintenance and supply services at Erding Air Depot were proportionate among the Groups in the same manner.

Beginning in April 1949, copies of the new cost spread were sent to each Group and Base Commander. During the following four months it was found that this type of analysis not only highlighted administrative weaknesses, but helped increase the highly competitive spirit among the Groups.

The accompanying charts show only the operating, or Direct Flying Costs per ton and per ton mile, on the basis described previously. It will be noted that in the six-month period from January until June, the direct flying cost per ton decreased from $38.61 to $34.68, or approximately nine per cent. The cost per ton mile during the same period was brought down from $16.63 to $15.49, or approximately seven per cent.

It is to be noted that this cost analysis was only a beginning in that it was in operation only for a period of four months. It is believed that a continuation of this cost analysis and a study of the differences between units would eventually have resulted in increased efficiency.



5 Airlift BASES

Altogether, 11 airfields were used in the Airlift. This total does not include Buckeburg, from whence a Dakota squadron operated a shuttle passenger service into Gatow. None of these bases was fully fitted for intensive transport operations and extensive alterations had to be carried out. A brief description of each of these bases is given below.

Celle

The airport at Celle, in the British Zone, was built in 1935 and until Germany's defeat was used as a Luftwaffe training base. Following the war, it was first occupied by the No. 36 Wing RAF and No. 84 Group Communication Flight. These units remained until the No. 1 Barracks Equipment Disposal Unit moved in late in 1947.

In mid-September 1948, with Operation Plainfare two-and-a-half months old, the RAF began converting Celle into an Airlift base. Some 2,000 German workers were employed on the tremendous job of constructing necessary operational facilities and housing. Three months later, Celle went into operation as a Combined Airlift Task Force dispatching base.

Beginning 16 December the 317th Troop Carrier Wing (C-54s), which had been operating out of Wiesbaden, was moved to Celle. By 31 January 443 officers and 2,799 airmen, American and British, were on duty at the base.

The task of building up Celle to meet Airlift requirements involved the construction of a 5,400' X 150' runway, a pierced steel planking loading apron covering 190,000 square feet, and a 9,500' X 50' PSP taxiway. A large amount of other construction, including houses, rail facilities, and an Avgas storage farm, was required to develop Celle into an efficient base considered a model for Airlift needs.

One important aspect of the layout at Celle was the ideal location of the loading ramp, which was set up as close as possible to the domestic accommodations, maintenance facilities and the rail siding.

Fassberg

The airfield at Fassberg was constructed by the Luftwaffe in 1936 and was considered to be one of the best laid out bases in the country. It is situated in the middle of a large pine forest and was very well hidden during the war years. British troops overran the field in April 1945, after which it was occupied by the RAF.

A new concrete runway was constructed and it became a Plainfare base in July 1948 when RAF Dakota aircraft moved there from the overcrowded base at Wunstorf. A month later the Dakotas started to move to Lubeck in order to make room for USAF C-54s, the first three squadrons of which began to arrive on 20 August. Fassberg then became the base of the 60th TC Wing, which included the 313th TC Group.

A considerable amount of construction had to be carried out to fit this base for its new role. This included a large PSP loading ramp which was capable of holding 65 C-54s.

Fassberg has a special interest, as it was an RAF station under the command of a USAF officer.

Fuhlsbuttel

Fuhlsbuttel was built before the war as the municipal airport for the City of Hamburg. After its capture in April 1945 it was used by the RAF as a transport staging post, later being turned over to civil authorities so it could resume its former function.

A new concrete runway and taxi strips were under construction when Plainfare started. Late in October 1948, British civil charter companies were based here and the airfield continued to operate many of the civil aircraft engaged in Plainfare until the phase-out of Airlift operations. The airfield was under civilian management while the aircraft operated under direction of Hq No. 46 Group RAF.

Gatow

Gatow airfield was developed originally by the Luftwaffe into a German training center which was considered equivalent to the Royal Air Force College at Cranwell, England. During the war it was used as a fighter base.

When the Royal Air Force took over the airfield in 1945 there were no runways. A 4,500-foot pierced steel planking runway was laid to handle the limited Dakota traffic and the flying of the fighter detachment based at the airfield. This runway proved inadequate on the sandy soil, and a concrete runway designed for medium-sized aircraft was commenced in 1947.

Gatow was brought into use as the British terminal at the start of the Airlift operation. As the intensity of flying into Berlin increased, the airfield was not only used by the British, but by American aircraft as well. The types of aircraft that have been used on this airfield varied from the relatively small-capacity Dakotas, carrying 3.5 tons, to the massive C-74 with its 20-ton loads. The civil types of aircraft varied from the Bristol freighter to the Avro Tudor, the largest of the liquid fuel tankers with a capacity of 8.8 tons.

During the course of the operation, more than 110,000 landings were made at this airfield. Of this total, approximately 10 per cent were made when the weather minimums necessitated use of ground controlled approach landing aid.

In June 1948 when the Airlift commenced, it was decided to develop Gatow for the largest traffic intensity that it could accept. Based on an estimated tonnage that would be required to break the siege, and an estimate that 480 aircraft could be landed in any 24-hour period, major alterations to the airfield were speeded. These works included:

a. The completion and extension of the concrete runway to 6,000 by 150 feet. This involved laying a further 25,000 square feet of concrete after the blockade was imposed.

b. An unloading apron, approximately 780,000 square feet.

c. Eight large storage tanks, built underground at the end of the unloading runway, where tanker aircraft discharged their loads of petrol and oil.

d. An underground pipeline from the tanks on the Havel Lake.

e. Horizontal Bar and Center Line approach lighting to each end of both the concrete and pierced steel planking runways.

f. The renovation, and extension to 6,000 feet, of the pierced steel planking runway.

Lubeck

Lubeck was built for the German Air Force in 1935 and was opened in 1936. The station is situated just outside the town of Lubeck, about two miles from the Russian Zone frontier. In the early part of the war the Luftwaffe operated HE-111 aircraft from this base and later it was used for fighter training. As more active defense of Germany became necessary, JU-88 night fighters and FW-190 and HE-262 jet air craft were based at Lubeck.

On 5 May 1945, the airfield was taken over by No. 2806 Squadron, Royal Air Force Regiment, and No. 124 Fighter Wing became the first user. Various fighter squadrons have been based at the airfield since the war, and the station was the Armament Practice Camp for the whole of British Air Forces of Occupation, as well as United Kingdom fighter squadrons.

In August 1948, the Royal Air Force Dakotas on the Airlift were moved into the station from Fassberg. During the siege of the city the majority of the evacuee passengers flown out of Berlin passed through Lubeck. Approximately 68,000 such passengers - undernourished children or elderly persons in ill health - were handled by the station during the winter months of the operation. In addition to this passenger handling, two battalions of the Berlin garrison were returned in April and May 1949. All four units, both ingoing and outcoming, passed through the station.

Freight carried to and from Lubeck included coal, newsprint, and a considerable amount of German economic freight. The squadrons that operated from Lubeck were Nos. 10, 18, 27, 30, 46, 53, 62, 77 and Australian, New Zealand and South African squadrons.

The existing concrete runway was extended and hardstandings had to be enlarged and consolidated to produce a parking apron. In all, about 880,000 square feet of pierced steel planking were laid. In addition, the railhead capacity was doubled by laying additional spurs. Other British Works Services projects included:

a. A concrete road to the tank installations about 40,000 square feet in area.

b. Horizontal bar and center line approach lighting, and high intensity runway lighting.

c. Lighting for the loading and unloading area.

Rhein Main

Rhein Main Air Force Base was the largest and most important base engaged in the Airlift and it was improved more than any other station in the U.S Zone as a result of the requirements of Operation Vittles. Largely destroyed by Allied bombing, this former base for German lighter-than-air craft such as the Graf Zeppelin and the ill-fated Hindenburg, and wartime Luftwaffe fighter base, was benefited by approximately 100 improvement projects.

An American fighter squadron was assigned to Rhein Main in April 1945, and the base was developed as a vital sub-command for USAF and as a natural "Gateway to Europe" for civil aircraft operations. C-47s from Rhein Main started the Airlift on 26 June 1948, and the base became the home of the 61st and 513th Troop Carrier Groups, including the only two Naval units on the Airlift, the VR-6 and VR-8 squadrons. These groups later came under the operational control of the 7497th Airlift Wing (Provisional). The 61st Group was at Rhein Main before the Airlift started and was supplemented by C-54 crewmen from many theaters. The 513th Group came from San Antonio, Texas, and was similarly augmented.

The original 6,000 by 150 foot runway at Rhein Main accommodated the intensive flow of Airlift traffic throughout the operation. However, in the spring of 1949, as the tempo of the Airlift was stepped up and the strain on the runway increased, construction of a new and larger runway (7,000 by 200 feet) was started. The project was 20 per cent completed by the time the Airlift phase-out started.

Other phases of Rhein Main's large-scale improvement program included the laying of 850,020 square feet of PSP-covered hardstands, 19,900 feet of 20-foot-wide gravel roads, 330,980 square feet of PSP parking aprons, and 4,638 feet of 50-foot-wide taxiways. Thousands of feet of new power lines were strung.

The task of adequately accommodating the overload of personnel involved the construction or renovation of scores of buildings, including living quarters, clubs, gymnasium, theater, dayrooms, etc. One of the most notable undertakings was development of the large Atterbury Bett housing area.

Schleswigland

Schleswigland was opened in 1936 as a civil glider club and was taken over in 1938 by the German Air Force. During the war, HE-111, ME-110, JU-88 and FW-190 aircraft operated from the airfield, mainly in the capacity of night fighters. In the later stages JU-525 aircraft carrying VIPs flew from the fields, and in the closing months of the war it was a base for jet fighters.

The Royal Air Force Regiment occupied the field in May 1945 and it was later used by No. 121 Fighter Wing until the end of 1946. In May it was opened as an Airborne Forces practice camp and used for this purpose until July 1948, where it was decided to employ the station as a "Plainfare" base.

Readied for the needs of the Airlift, the base was opened again in September, and in November Royal Air Force Hastings commenced operations. The Hastings, Nos, 47, 297, and 53 squadrons, were followed by Halton Tankers belonging to the Lancastershire Aircraft Company. In December 1948 these civil aircraft were joined by Haltons and Liberator aircraft of British American Airways, Westminster Airways and Scottish Airways.

The commodities carried from the airfield included coal, food, gasoline, Diesel oil and kerosene. The German fuel installation, which had been designed for rapid refueling of night fighters, was very useful for loading tanker aircraft, its only drawback being small capacity of the pumps.

Schelswigland is perhaps unique as far as the operation is concerned in that there was a considerable time between the decision to bring the station into use and the date when flying commenced. The result of this was that the majority of the building improvements required were completed before the station came into use. The work that was carried out included:

- a. Construction of an additional hangar.
- b. Modification and extension of spectacles for ease of loading.
- c. Construction of a large apron to increase the area of the east hardstandings.
- d. Rear Airfield Supply Organization area developed on the east side of the airfield and a railway spur extended to this area.
- e. Aviation fuel storage installations enlarged.

Tegel

Tegel Airfield, in the French Sector of Berlin, did not exist prior to the Airlift. The completely new base was built solely to accommodate part of the overload of traffic burdening Tempelhof and Gatow. Laid out on an area which previously had been earmarked as the most suitable place for delivery of supplies by parachute, Tegel was ready for operation in approximately four months from the start of construction on 5 August 1948.

A single runway, 5,500 feet long and 150 feet wide, was built of a 22-inch thickness of tightly-packed brick rubble and crushed rock penetrated with an asphalt binding. In similar fashion, aprons totaling 120,000 square feet and 6,020 lineal feet of taxiways, varying from 50 feet to 120 feet in width, were constructed. The new base also required access roads of 3,200 by 40 and 1,200 by 20 feet, and railroads totaling 2,750 feet.

In addition, buildings were erected for administration, operations, the control tower, fire station, infirmary, transportation office, and guardhouse, along with a warehouse, a small hangar adequate hardstands, and many other facilities. A number of these installations were constructed by the French. The BABS (Blind Approach Beacon System) was installed by the British.

Tegel became fully operational 15 December and effectively relieved the traffic congestion at the other two Berlin terminals. As the Airlift phase-out started 1 August, a second runway was opened.

Flying operations were controlled by the USAF, while the French Air Force dealt with the handling of cargo and civilian labor.

Freight consisted primarily of coal, liquid fuels and food brought in from Fassberg, Schleswigland and Fuhlsbuttel.

Tempelhof

Tempelhof was designed to be Berlin's principal civil airport and has magnificent buildings, but high apartment buildings surrounding it make approaches difficult for modern aircraft

When the Airlift commenced, the airfield had a 4,987 by 120 foot PSP runway and an apron and connecting taxiway built of concrete block. Constructed some 15 years ago, the huge operations and administration building is one of the most remarkable in the world, boasting seven stories underground. During the war years the unique structure housed, among other things, a Messerschmitt factory and a well-equipped hospital below ground.

In the early weeks it became evident that Tempelhof's single, much-used runway was not adequate to accomodate safely the heavy traffic of a major, sustained transport operation such as the Airlift. The wet weather in July and August 1948, and the continued impact of heavily-loaded aircraft seriously weakened the landing strip. Airlift authorities solved the problem by waterproofing and strengthening the runway with a mixture of coarse sand and grit, hot tar and asphalt.

To handle the fast-incoming flow of traffic, a new south runway, 5,750 by 140 feet was built parallel to the existing runway. In lieu of cement for concrete, unavailable in Berlin, a compact 18-inch layer of brick rubble from bombed buildings was used successfully as a foundation. Construction of a third parallel runway, 6,150 by 140 feet, with the same type of brick rubble base, put Tempelhof in a much better position to cope with the growing volume of Airlift traffic from Rhein-Main and Wiesbaden. High intensity approach and landing lights also were installed.

Wiesbaden

Wiesbaden Air Force Base, one of the Luftwaffe's prize fighter bases during the war, played a prominent role in the Airlift from the beginning of the occupation. On 26 June 1948, a handful of C-47s based at Wiesbaden helped launch Operation Vittles by hauling 80 tons of food and supplies into Berlin.

Obliged to expand its facilities rapidly to meet Airlift demands, the compactly laid-out airport was in a constant state of flux during the early days of the operation. The 60th Troop Carrier Group was hastily brought to Wiesbaden from Kaufbeuren and its C-47 fleet shuttled in and out of Berlin until the 317th TC Group (C-54s) arrived from the Far East.

The 60th TC Group then returned to Kaufbeuren, but not for long. In December the Group was called back to Wiesbaden and equipped with C-54s. From that point forward, operational facilities and personnel strength of the airbase increased steadily. By May 1949 when the Airlift reached its peak, 1,998 airmen, 418 officers, and scores of German personnel were engaged in the operation at Wiesbaden.

Improvement projects completed at the airfield included the extension of the runway from 5,500 to 7,000 feet and the laying of 2,435 by 50 feet of concrete taxiway, 2,000 by 120 feet of PSP runway overrun, 4,760 feet of 25 foot wide access roads, 1,586 feet of additional PSP taxiway, and 593,000 feet of PSP aprons. Thirty-seven hardstands, totaling 620,320 square feet, were constructed. The warehouse and fire station were doubled in size and 70 per cent of the garage space for vehicles was rebuilt.

Among other additions were a new 166 by 88 foot hangar, a C-54 washrack, a 175,000-gallon Avigas tank form and connecting rail spur, new nose docks, new generator house, a theater, gymnasium, snack bar, postoffice, and bowling alleys. To provide maximum operational safety, an effective system of high-intensity approach and runway lights was installed

The C-82 aircraft attached to the Task Force were based here and most of the miscellaneous freight and difficult loads from the U.S. Zone were dispatched from this airfield.

Wunstorf

Wunstorf was built in 1934. By 1939 a German Bomber Group had been formed there, and continued to operate from the field until 1940. From 1941 to the end of the war, the activities of the station were mainly connected with T-E fighters, either operational or training. During the last few months, S-E fighters also operated from the field.

In May 1945, No. 123 RAF Fighter Bomber Wing commenced to fly from the airfield and fighter bomber squadrons continued to operate from the station until it became an Airlift base.

The first detachment of Dakotas arrived at Wunstorf on 25 June 1948 and flew the first load into Berlin at dawn on 28 June. This Dakota force remained only a few weeks at Wunstorf and then moved to Fassberg. York aircraft began to arrive on 2 July 1948 and commenced to operate the next day. The York squadrons that have flown from this station are Nos. 40, 51, 59, 99, 206, 242, and 511.

Near the end of July 1948, the first contingent of civil charter aircraft arrived. Since that time, civil firms which have operated from Wunstorf include British South American Airways, Skyways, and Flight Refueling. Commodities lifted from this station included coal, meat, dehydrated foods and liquid fuels of all kinds.

When the operation commenced, the airfield possessed two concrete runways, perimeter tracks and ladder-type hardstandings. Apart from these, and the aprons in front of the hangers, the entire surface was grass. In addition, the station had normal red funnel type airfield lighting.

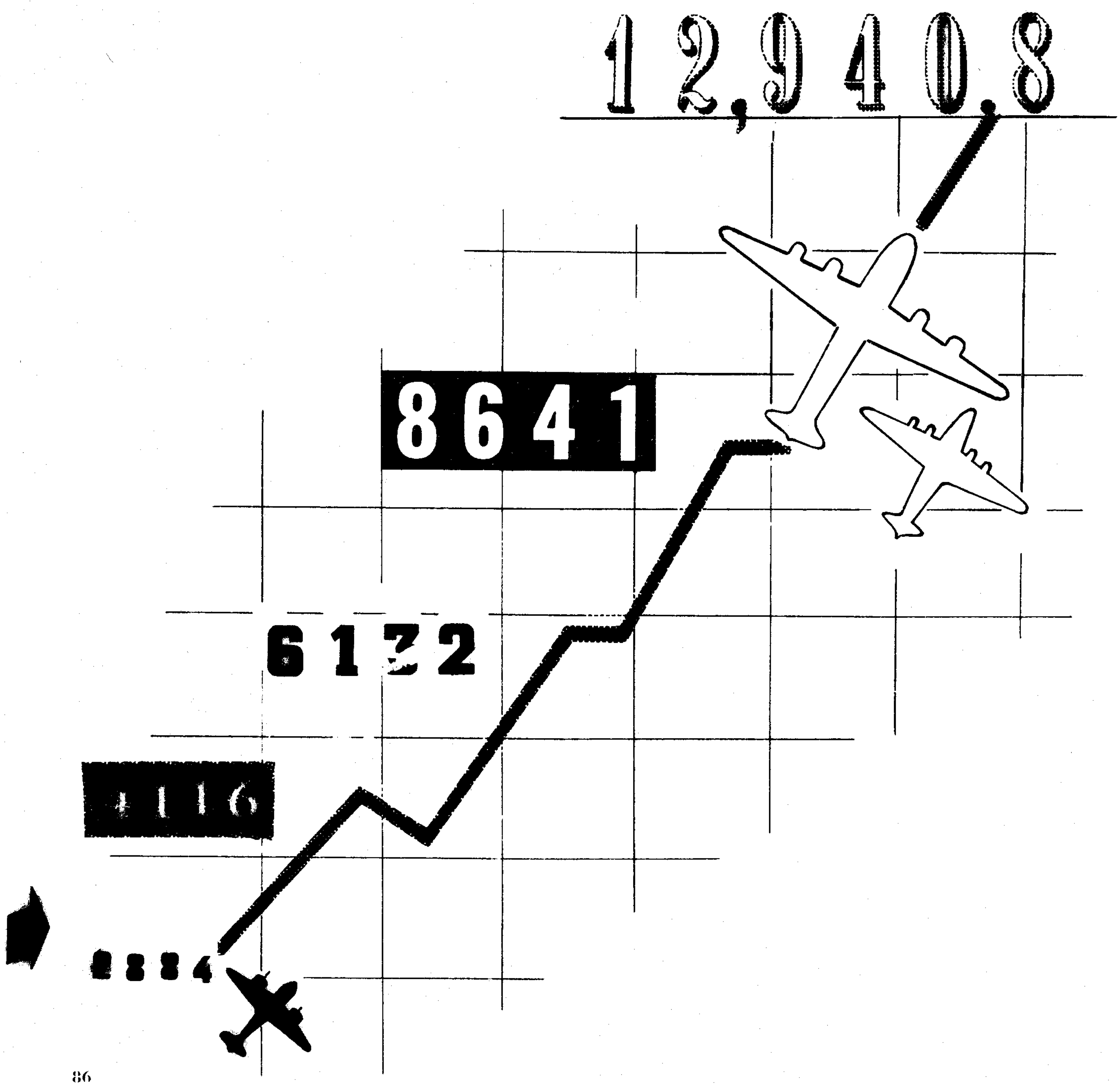
With the increase in the number of aircraft, it became necessary to park on the grass and, to prevent bogging, seven pierced steel parking taxi tracks were laid. In addition, the domestic accommodations had to be increased considerably, not only for the Royal Air Force, but the army as well.

Two railway sidings were provided especially for unloading aviation fuel, one at the west end of No. 1 runway and a second behind No. 3 hanger. A special bulk gasoline and Diesel oil installation, six tanks of 12,000 gallons each, was built with a pumphouse and pipe lines to the refueling area where tanker aircraft were loaded. An average of about 70,000 gallons per day passed through this installation.

In September 1948, Horizontal Bar and Center Line approach lighting, for use in poor visibility, was installed.

The largest construction task undertaken at this airfield was the provision of sufficient hardstandings. Approximately 2,920,850 square feet were built, giving parking space for approximately 75 aircraft. In this construction, approximately 93,000 tons of railway stone and 49,000 tons of tar macadam were used.

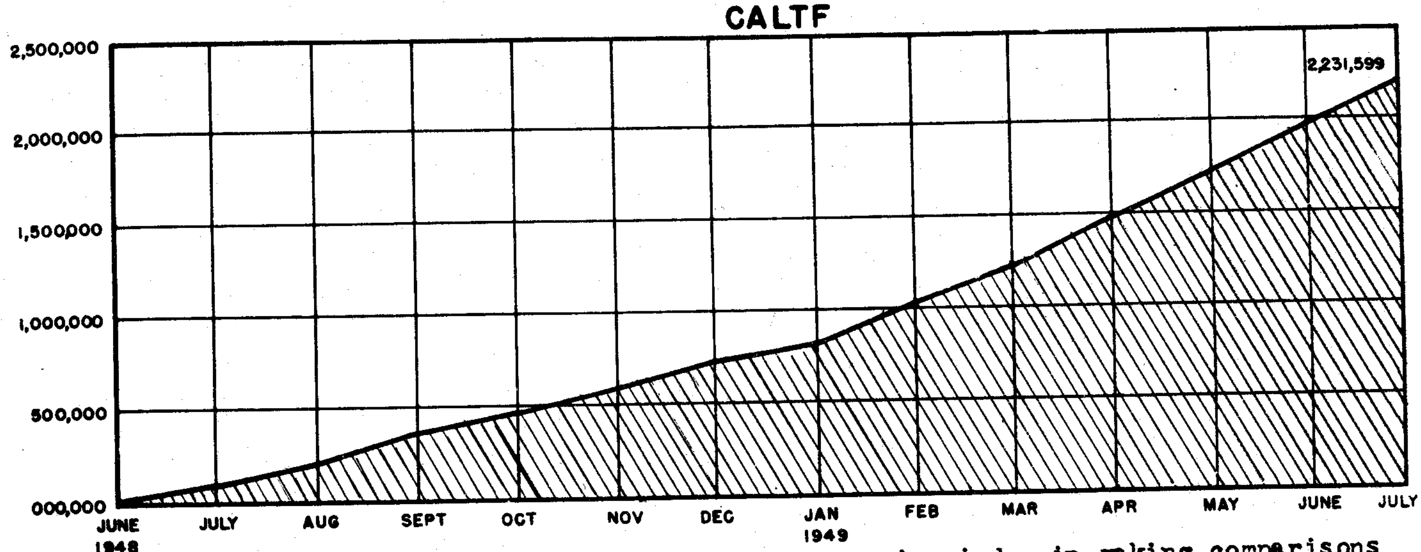
6 *Mission* ACCOMPLISHMENTS



The mission accomplishment of the Combined Airlift Task Force is reflected adequately by a total of 2,231,600 tons of food, fuel and supplies transported to Berlin in 266,644 trips by air during the first 13 months of operations.

The following breakdown shows the total tonnage airlifted by USAF and RAF elements of the CALTF, by types of commodities:

TOTAL TONNAGE AIRLIFTED
CALTF



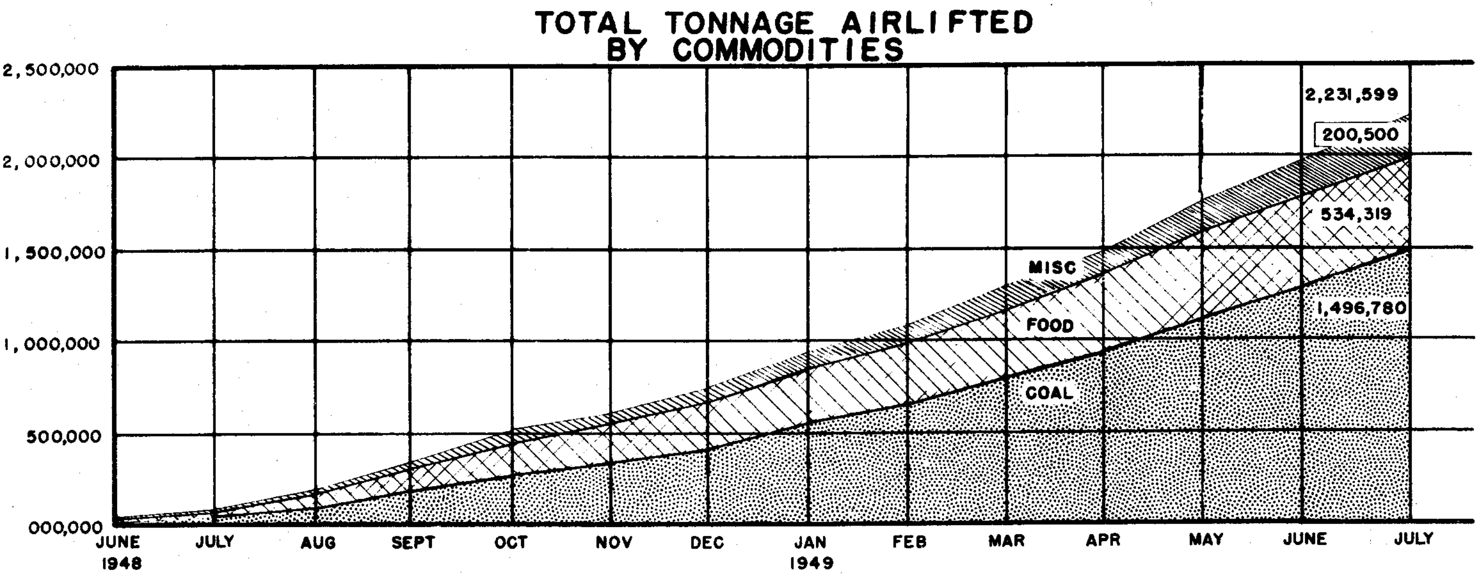
USAF: Food, 296,303.1 tons. Coal 1,353,813.4. Other, 65,464.1. Total, 1,715,585.6.

RAF: Food, 238,016.1.Coal,142,961.7. Other, 135,036.4. Total, 516,014.2.

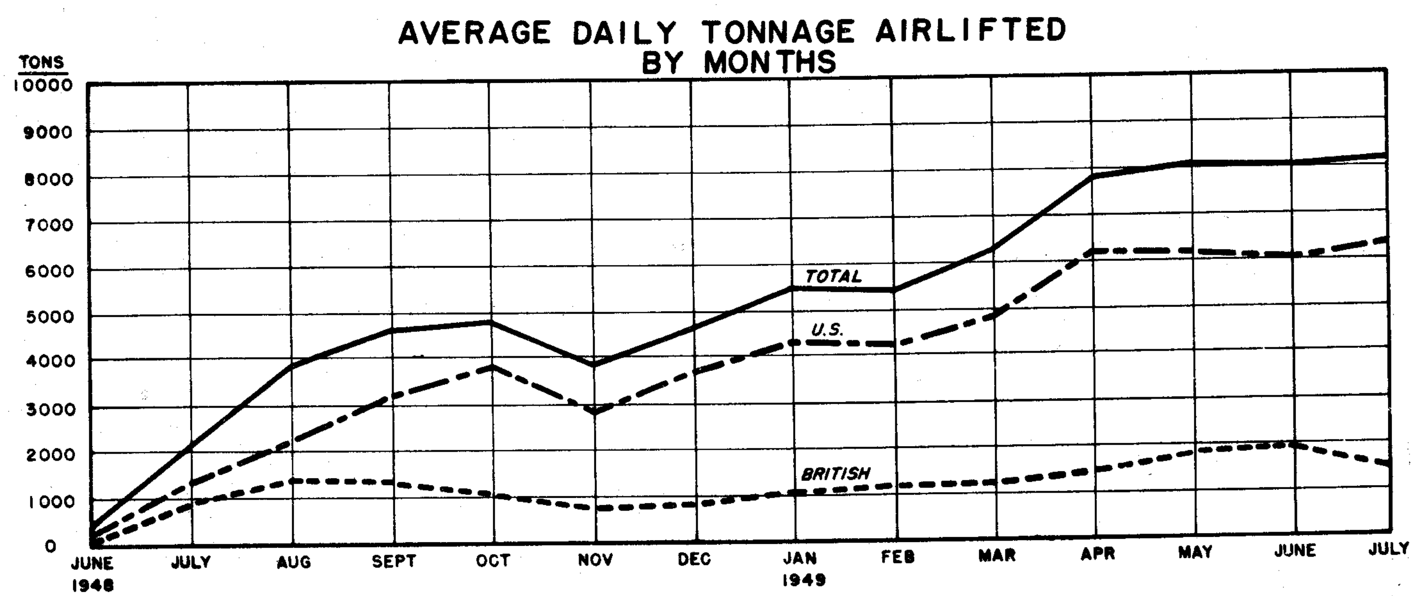
TOTAL CALTF: Food, 534,319.2. Coal 1,496,780.1. Other, 516,014.2. Total 2,231,599.8.

During the life of the mission, the USAF units carried the bulk total tonnage, while the British excelled in the airlift of specialized commodities, such as liquid fuels. It should be borne in mind, in making comparisons of the effort, that the tonnage goals established early in the Airlift called for approximately this ratio, since the American effort was based almost exclusively upon the C-54, having a capacity of 10 tons, while the British used various types of aircraft with smaller carrying capacities.

It is significant that 67 per cent of the total tonnage transported was coal. The complex economic life of modern times is well illustrated by this basic need.



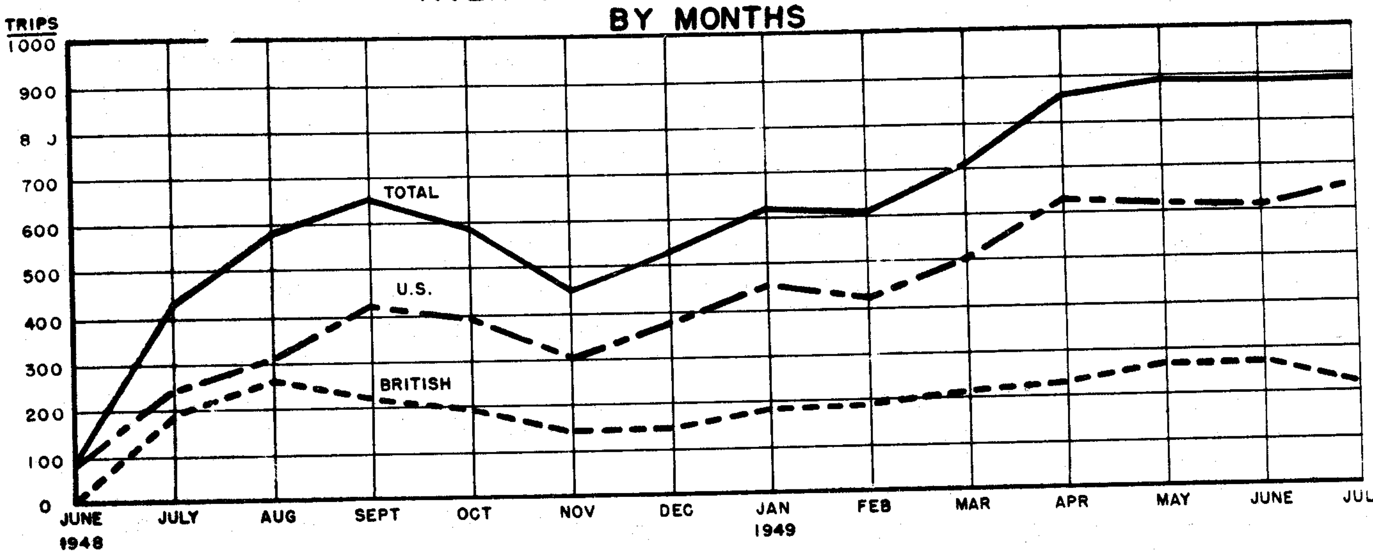
At the beginning of the Airlift 4,500 tons per day was established as the minimum daily requirement and was set forth as the daily mission. This target was met in September and October, but efforts fell short by approximately 800 tons daily in November. The target was reached again in December and the total effort far exceeded the daily tonnage target for the remaining months of the Airlift. The six-month period from October until April reflects an intense period of the Airlift. During that time there were problems involving weather, personnel, supply, maintenance, and air traffic procedures which prevented sustained peak operations until April. During this period, however, total tonnage airlifted each month mounted steadily. In May the Task Force began averaging better than 8,000 tons per day, holding this pace until 1 August 1949.



Daily Trips

The density of air traffic in the vicinity of Berlin can be visualized from the number of trips into the receiving airports of Tempelhof, Gatow and Tegel, which ranged from 868 per day in April to 886 in July 1949. Each trip means a landing and a take-off, so the daily movements in and out of the Berlin area were nearly 1,000 per day, or more than one landing or take-off during every 60 seconds in the 24-hour day. Each airport, therefore, was approaching maximum utilization. For example, Tempelhof was averaging nearly 325 landings per day or 67 per cent of the maximum possible on a three-minute interval between flights.

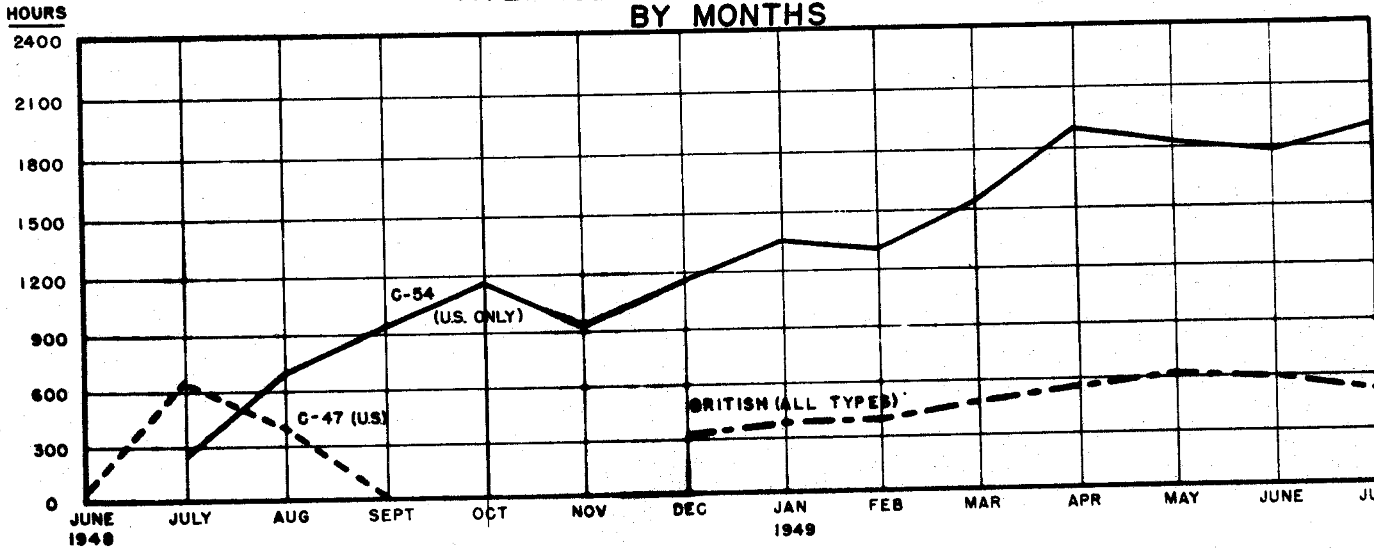
AVERAGE DAILY TRIPS TO BERLIN BY MONTHS



Hours Flown

During the 13-month period, the USAF units flew 567,537 hours. Prior to 1 December 1948, the flying hours for the British units were not available, but an indication of their activity can be gained from the figure of 116,752 flying hours during the eight-month period from 1 December 1948 through 31 July 1949. During the sustained operations, the USAF C-54 units averaged better than 1,800 total flying hours per day, while RAF units averaged 600 total hours per day.

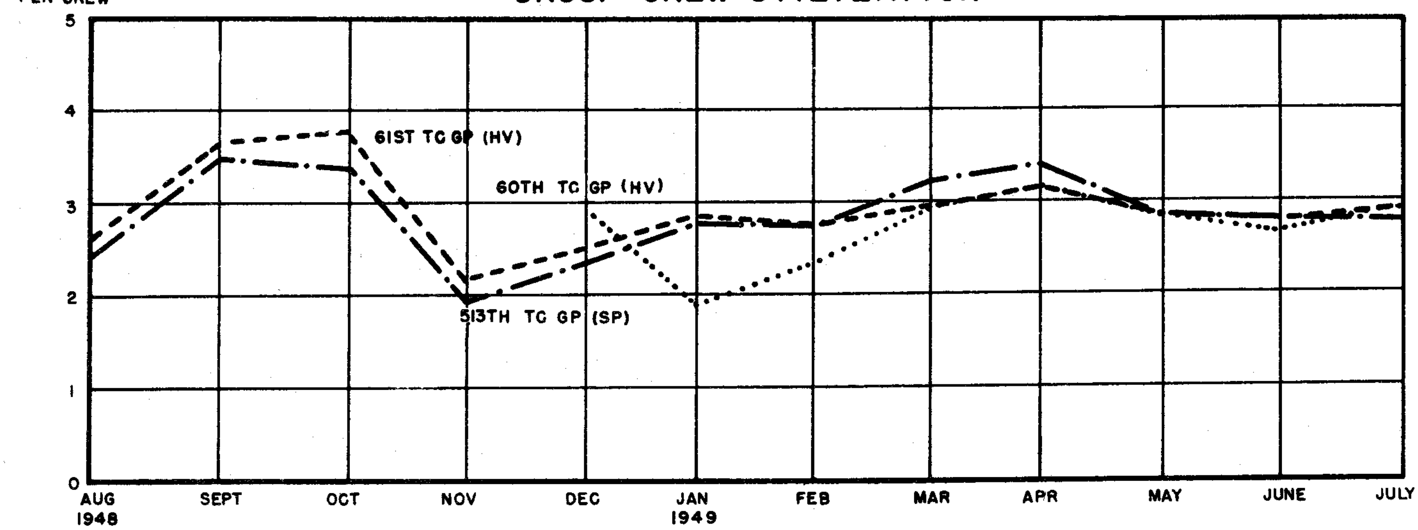
AVERAGE DAILY HOURS FLOWN BY MONTHS

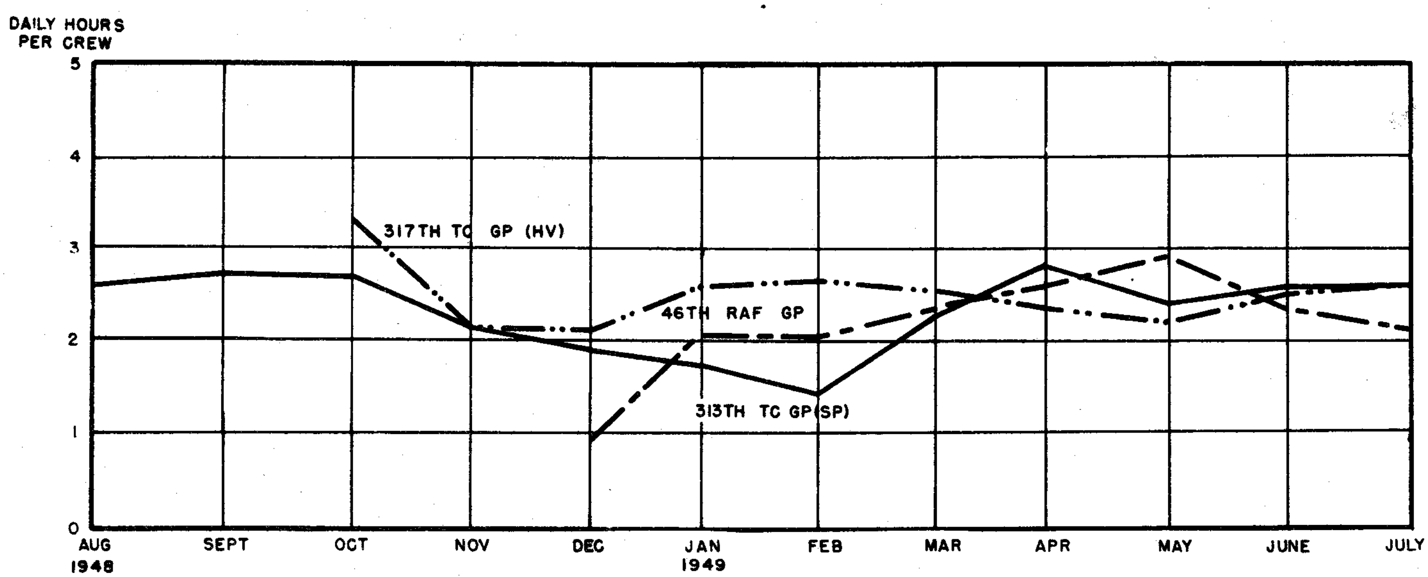


Crew Utilization

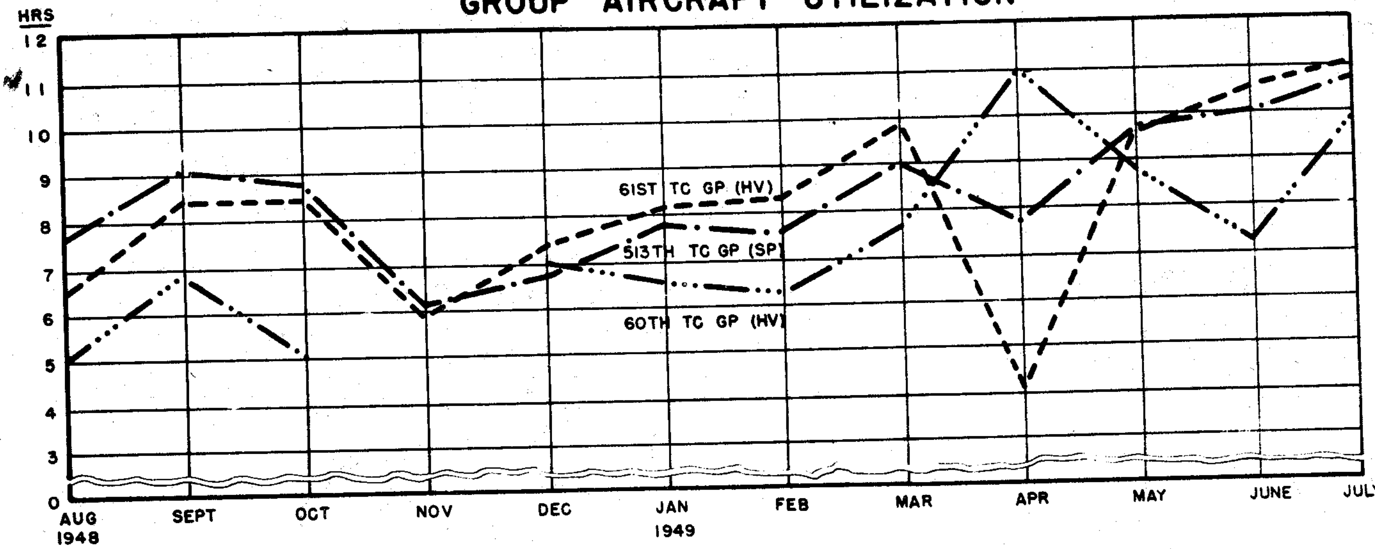
After the early periods of trial and error, a fairly stable air crew utilization of a little better than $2\frac{1}{2}$ hours per day was reached by both the RAF and USAF units. It will be noted that from August until November it was necessary to use crews on an average $3\frac{1}{2}$ hours per day, due to shortages of flying personnel.

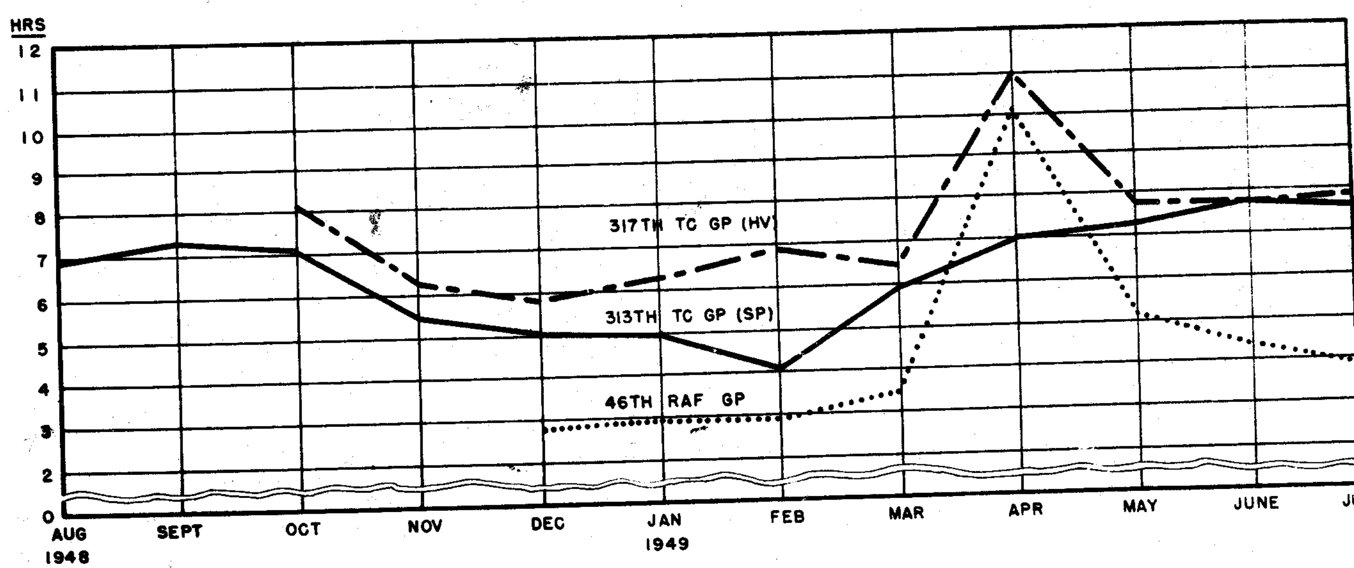
GROUP CREW UTILIZATION





GROUP AIRCRAFT UTILIZATION

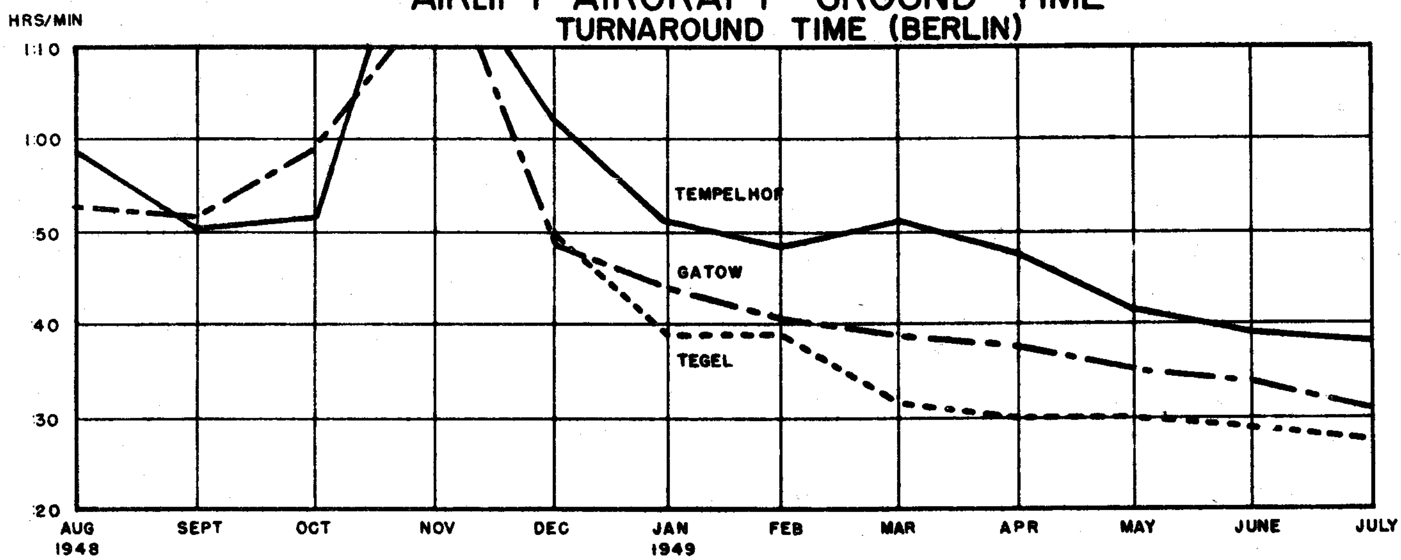


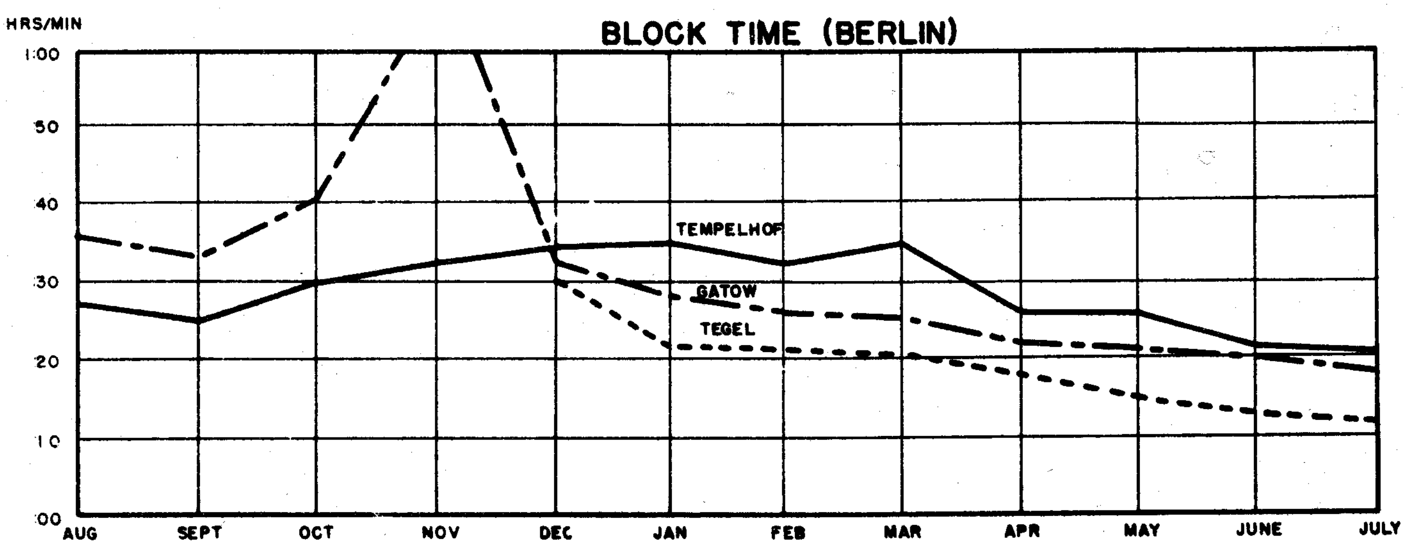


Turn Around Times

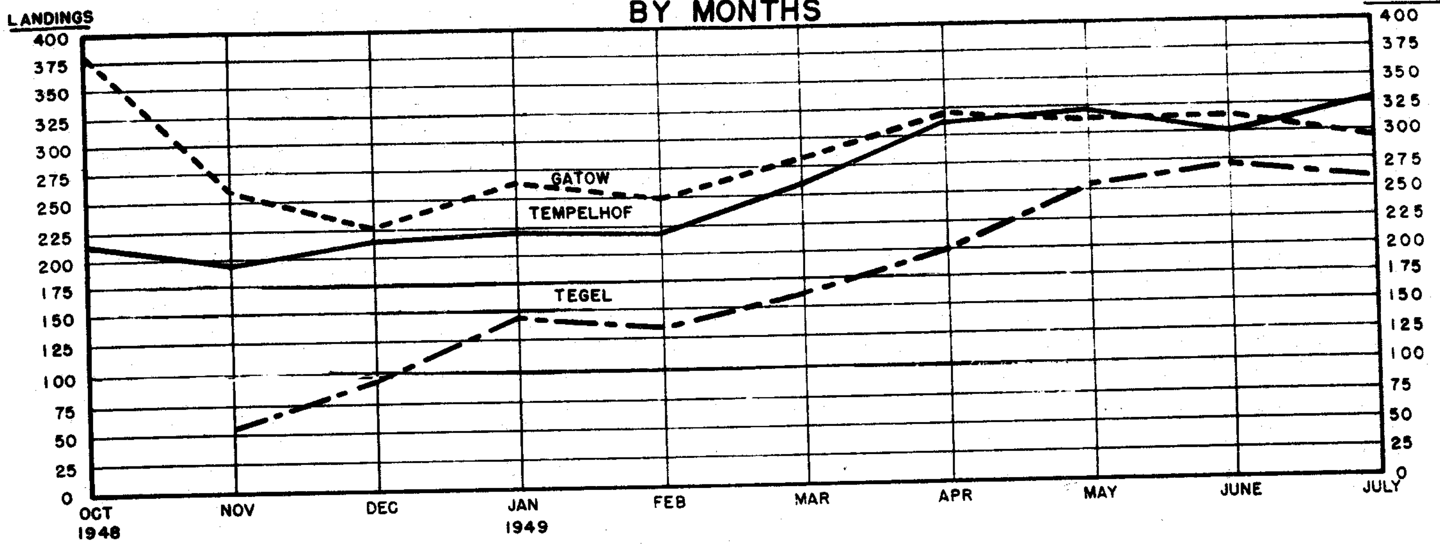
The statistics on the ground time of operational aircraft at the Berlin receiving airports reveal an interesting trend downward in the three main categories of turn-around time, block time and unloading time. At these airfields, by July 1949, the turn-around time had been brought to an average of approximately 32 minutes, block time to about 18 minutes, and unloading time to 12 minutes. The large reduction in over-all ground time may be attributed, in a large measure, to the institution of Production Control procedures which embraced time-and-motion studies and other methods comparable to those applied to a production line in a factory.

AIRLIFT AIRCRAFT GROUND TIME

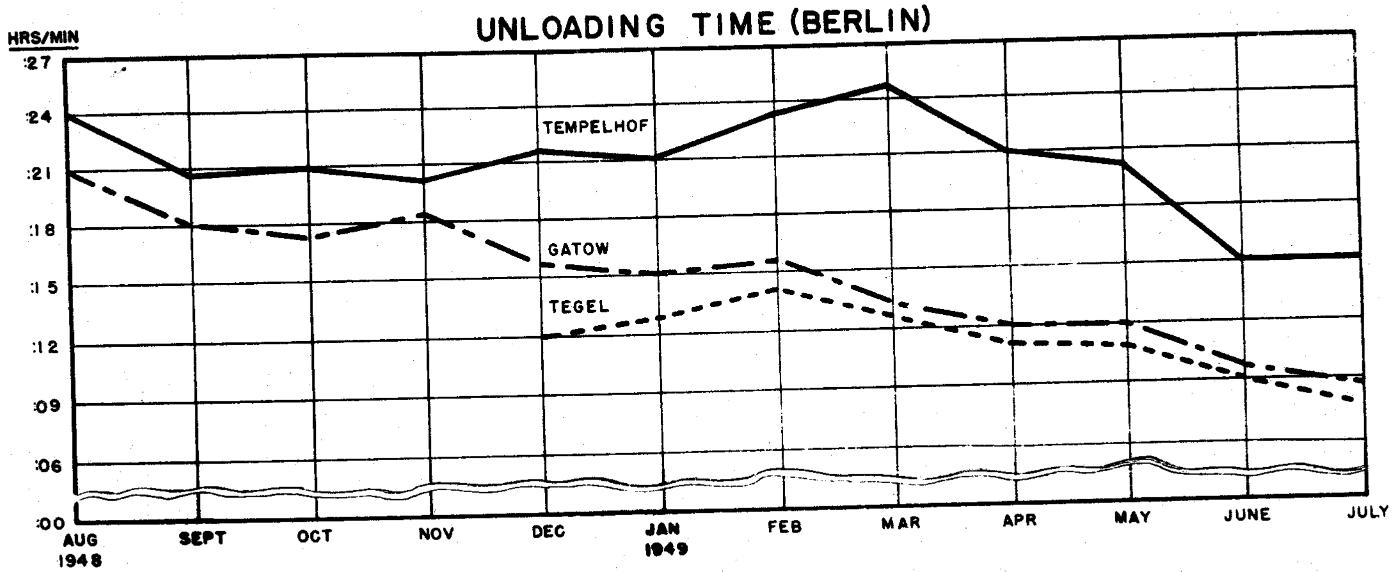


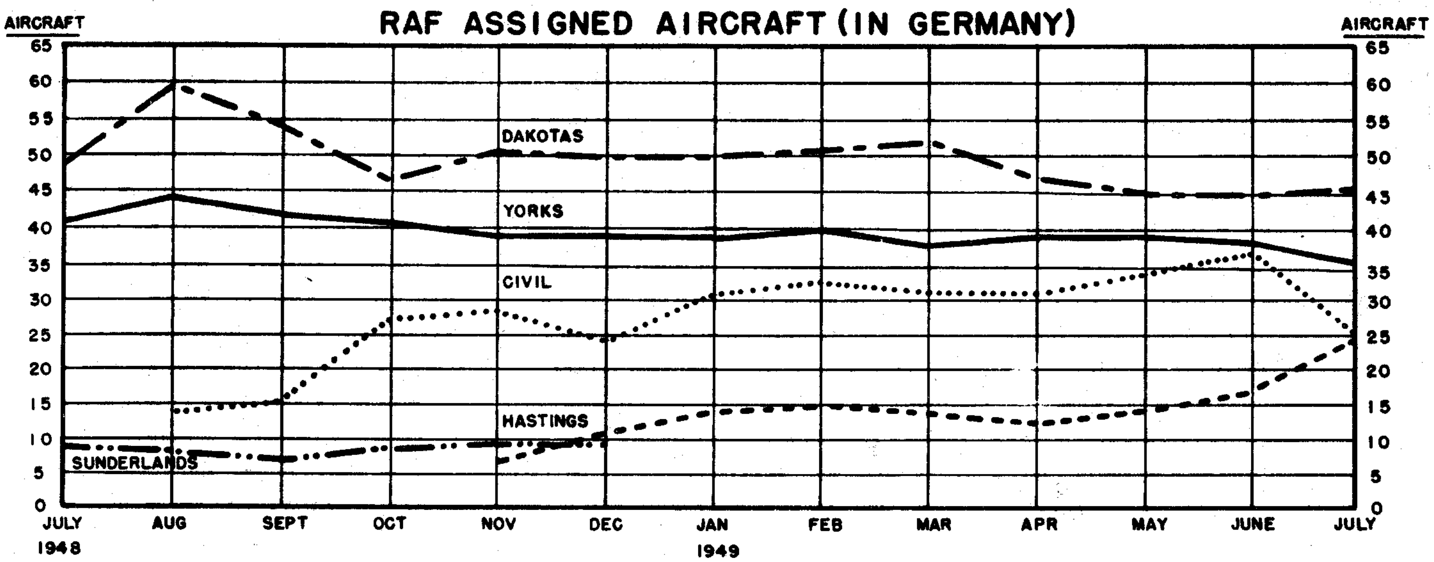


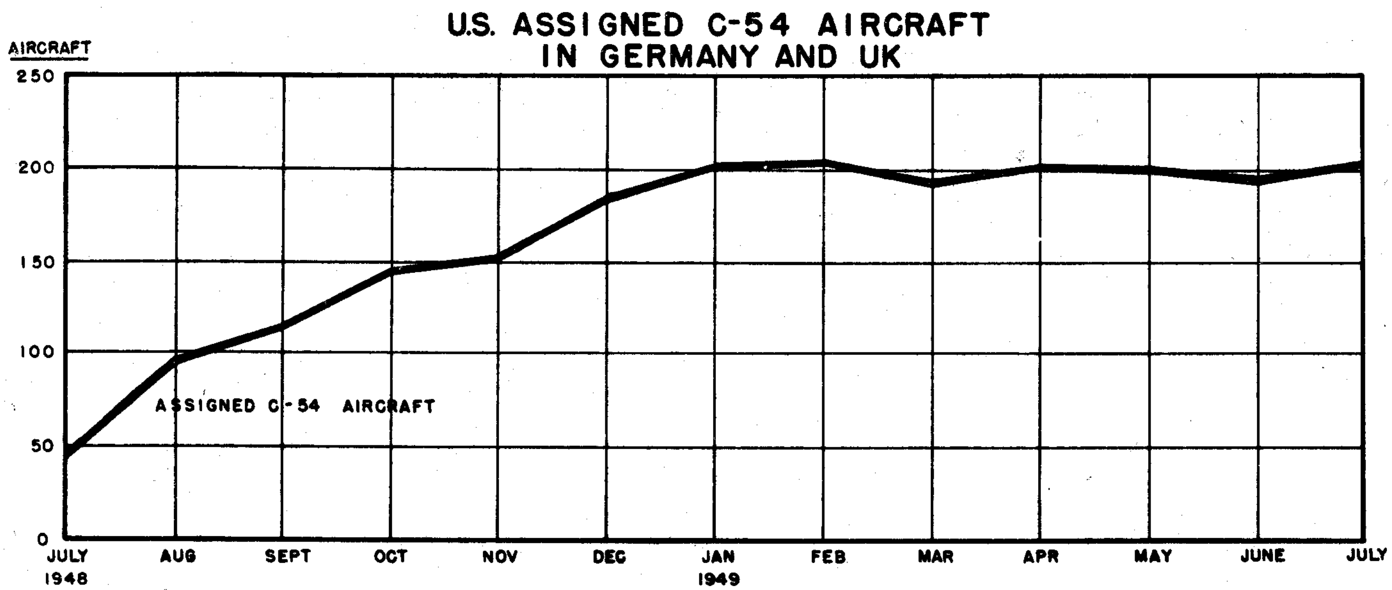
AVERAGE DAILY LANDINGS AT BERLIN AIRFIELDS BY MONTHS



UNLOADING TIME (BERLIN)




RAF ASSIGNED AIRCRAFT (IN GERMANY)
AIRCRAFT
65
60
55
50
45
40
35
30
25
20
15
10
5
0
DAKOTAS
YORKS
CIVIL
HASTINGS
SUNDERLANDS
JULY 1948
AUG
SEPT
OCT
NOV
DEC
JAN 1949
FEB
MAR
APR
MAY
JUNE
JULY


U.S. ASSIGNED C-54 AIRCRAFT IN GERMANY AND UK
AIRCRAFT
250
200
150
100
50
0
ASSIGNED C-54 AIRCRAFT
JULY 1948
AUG
SEPT
OCT
NOV
DEC
JAN 1949
FEB
MAR
APR
MAY
JUNE
JULY

7 Summary and CONCLUSIONS . . .

Considerable experience had been gained by both the RAF and the USAF in air supply during the war, particularly in the "Hump" operation and in Burma. The Airlift served to verify the lessons learned during the war and brought to light several new ones. The more important of these lessons are recapitulated below.

Operations

1. In an operation requiring detailed air traffic control, it is important that control be vested in the hands of one authority. Liaison is insufficient, as differences of opinion are bound to arise and one Commander must have the power to make decisions. If this is not done, confusion or lengthy negotiations may well result.

2. With a carefully regulated flow of aircraft, straight-in approaches and existing landing aids, a three-minute landing interval can be maintained indefinitely except when weather conditions fall below minimum.

3. Strict flying discipline and a standard flying pattern are essential for flying safety.

4. The limitations of the present day weather science cause a considerable waste of effort.

5. Aircraft should be manned and supplied at a rate which will permit 8 to 12 hours daily utilization. It is better to have a minimum number of aircraft with higher utilization than a higher number, with little utilization correlating.

6. With a few exceptions, all the airfields used had one-directional landing strips. Only on rare occasions did this curtail the operation of aircraft equipped with tricycle-type landing gear. Aircraft with tailwheels, however, frequently had to be grounded when strong cross winds developed. Distance Measuring Equipment would considerably ease the problem of spacing aircraft along routes with heavy traffic flow and thereby considerably enhance the safety margins.

Traffic

1. A Traffic (Air Freight) Section should be part of any Airlift Task Force, and personnel trained in the handling of air freight and aircraft loading should be available in sufficient numbers.

2. The concentration of similar commodities at selected bases, with advance information and planning for every load dispatched, results in standardized procedures and minimum loading time at all bases.

3. It is essential that tare weight be reduced to a minimum in order that the maximum useful load may be carried. This is self-evident, but it is most important that this point is appreciated at the source of supply.

Maintenance

1. Cycle reconditioning is a necessary adjunct for maintenance support of a long-term airlift.

2. Centralized maintenance control is essential when large numbers of aircraft have to be scheduled for inspections and maintenance.

3. Maintenance inspections must be flexible and fitted to the operation.

Personnel

1. All personnel ordered to duty with an operation of this nature should be given sufficient time to take care

of their personal affairs and prepare for overseas shipment. All personnel should be screened prior to shipment in order to avoid personal hardships. This action would eliminate many problems which have confronted this organization, and would have a beneficial effect on morale.

2. A reasonable tour of duty, depending on local conditions, must be established promptly in order that all personnel are aware of rotational privileges. This would preclude lowering of morale and efficiency, as the personnel would know their tour of duty and effect appropriate settlement of personal affairs.

3. Skilled personnel trained in air transport techniques are desirable in both tactical and support elements from squadron through command level. Crews must be thoroughly trained and familiar with air transport operations before being assigned. In addition, an adequate flow of qualified replacements is required.

4. The utilization of indigenous personnel in support of an air transport operation has been highly successful from an administrative as well as a maintenance standpoint. A pool of skilled and semi-skilled indigenous personnel, requiring only transition to proven methods and types of equipment, is a potential which cannot be overlooked in any future undertaking and should be given primary consideration in advance of actual commencement of operations.

5. No suitable yardstick existed for a sustained 24-hour operation of this type. Actual flying hours required for each operating group divided by the maximum desired flying hours per crew and supporting personnel should be used as the basis for personnel requirements. The tonnage target should be established at the start of a future operation of this type. and personnel should be furnished based upon the yardstick of flying hours generated. Increases in tonnage to be transported should be accompanied by increased authorization of personnel. Personnel gains within the Airlift were utilized to increase utilization of assigned aircraft and consequently no determination has yet been reached as to the potentialities of such an operation, providing sufficient personnel of required types are readily available.

CONCLUSIONS

As shown in the previous chapters, the mission given to the Combined Airlift Task Force was achieved. A total of 2,231,600 tons of supplies were flown into Berlin between 26th June 1948 and 1 August 1949. This represents an average of 5,579 tons daily throughout the blockade.

The successful accomplishment of the mission was due to many factors, most of which are described in the foregoing chapters of this report. Basically, however, they can be reduced to the organization of the Airlift, the spirit of the men taking part in it, and the unstinted support provided by the higher formations of the RAF and USAF, backed by their national governments.

Some months were required for the provision of sufficient personnel and logistical support, but once these were available the operation settled into a steady and smooth routine. There are major lessons that have become increasingly obvious during the Airlift. These are of sufficient importance to warrant separate treatment.

Cooperation

The Airlift has been a truly combined operation. It has been successful through the joint efforts of many services and many nationalities, but, above all, it has proved that the wartime cooperation between the RAF and the USAF can continue in peace. Personnel of both services have worked together in harmony. Minor difficulties occurred through a lack of legal provisions for discipline when the two services are working together.

Use of Heavy Aircraft

Another lesson was the economy of the large aircraft. On the U.S. side the $3\frac{1}{2}$-ton carrying C-47, the 10-ton C-54 and, to a limited extent, 20 to 25-ton carrying C-74 and C-97 have been used. The use of the C-54 in place of the C-47 showed a great saving in aircrew, maintenance personnel and gasoline. The limited experience on the still heavier types indicated that they would prove similarly more economical than the C-54.

Task Force Mobility

Experience on this Airlift and wartime transport operations has proved that cargo and personnel can be carried between any two points in the world, regardless of geography or weather. The same personnel, the same aircraft, and the same techniques could be used to transport freight across the Atlantic or between New York and the North Pole. The only limiting factors are the availability of equipment and trained personnel. The mass movement of cargo and/or personnel in a sustained effort, anywhere, any place and at any time is not only possible, but will undoubtedly become a vital factor in any future operation.