

AIR TERMINAL BUILDING
FOR
HONOLULU AIRPORT, HONOLULU, T. H.

Submitted in Partial Fulfillment
of Requirements for Degree of
MASTER OF ARCHITECTURE

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September 2, 1949

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Dean William W. Wurster
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Dear Sir:

In partial fulfillment of the requirements
for the degree of Master of Architecture, I submit
herewith my report and proposed solution of my thesis:
Air Terminal Building For Honolulu Airport.

Sincerely yours,

~~Clifford~~ F. Young U

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ACKNOWLEDGEMENTS

During the preparation of this thesis, numerous persons have contributed research information and constructive criticisms all of which have been greatly appreciated. I wish to express my sincerest appreciation to the following in particular:

Mr. Richard B. Black, Assistant Director of the Hawaii Aeronautics Commission, Honolulu, T. H., who, during the research stages of the thesis, supplied valuable information, statistical data, photographs and maps necessary for a thorough study of the airport.

Mr. G. K. Houghtailing, Chairman of the City Planning Commission of Honolulu, who readily contributed pertinent information and maps of recent and proposed developments relative to the Honolulu Airport.

Mr. Edwin J. Meyers, student at Cranbrook Academy of Arts, Bloomfield Hills, Michigan, who was concurrently working on problems of urban re-development for the city of Honolulu and with whom I had the pleasure of exchanging information relative to air traffic passenger flow.

Mr. Thomas Leu of Honolulu who supplied photographs of the terminal facilities at the airport.

Mr. Bennett King, Publicity Representative, United Airlines who furnished statistical data with reference to United Airlines operations in the Pacific.

Mr. Richard N. Barkle, Public Relations Representative, Pan American World Airways System who furnished statistical information with reference to PAA's operations in the Pacific.

Hawaiian Airlines Limited which supplied me with copies of its annual reports and other pertinent information of inter-island air travel.

Mr. John Cunningham of the firm of Coolidge, Shepley, Bulfinch and Abbott, Boston, who patiently gave his time to discuss problems encountered in the design of Logan International Airport and who readily offered constructive criticisms of my solutions.

The Thesis Committee consisting of the Dean and staff of the Department of Architecture, M.I.T. who gave constructive criticisms and raised many questions that led to a logical and systematic solution to the problem.

and to

my wife, Laura, whose patience and moral cooperation assisted immeasurably with the success of this thesis.

A. GENERAL ASPECTS OF THE PROBLEM.

I. Growth of Trans-Pacific Air Travel.

II. Air Transportation in The Territory.

I. GROWTH OF TRANS-PACIFIC AIR TRAVEL.

Ever since Charles A. Lindbergh made his historic non-stop flight over the Atlantic Ocean in 1927, air pioneers have continued vigorously to conquer the air trails across large expanses of ocean. Even before the world-acclaimed flight of Lindbergh the U. S. Navy had become cognizant of the vital importance of trans-Pacific air routes, and as early as in 1925, attempted the first overseas flight from California to Hawaii. This initial flight, made on a Navy PN-9 seaplane with a crew commanded by Commander John Rodgers, did not reach Hawaii by air due to lack of fuel, but the crew managed to sail the flying boat 500 miles to the Island of Kauai after having been given up as "lost" for nine days.

On June 14, 1927, the first attempted landplane flight to Hawaii was made on a Travelair monoplane "City of Oakland", piloted by Ernest L. Smith and Emory Bronte. This flight was terminated when the fuel supply ran out just as the plane passed over the Island of Molokai, less than 60 miles southeast of Oahu, the goal.

Two weeks after the unsuccessful Smith-Bronte flight the U. S. Army attempted its initial flight from the Pacific Coast with a tri-motor Fokker

"Bird of Paradise" flown by Lieutenants Maitland and Hagenberger. After 25 hours and 50 minutes in the air the "Bird of Paradise" landed without mishap at Wheeler Field, Oahu. This was the first successful attempt to reach the Hawaiian Islands from the Pacific Coast by air, and was to be the forerunner of other flights soon to follow.

On August 16, 1927, five single-engine planes left Oakland Airport in the historic "Dole Derby", a non-stop race to Wheeler Field, Oahu. Only two planes reached their destination. First to arrive was the "Woolaroc", a Travelair monoplane piloted by Art Goebel and Lieutenant Davis, navigator, winning the Derby in 26 hours and 18 minutes; second, was a plane with Martin Jensen as pilot and Captain Schuller as navigator. The other planes which participated in the Derby were never heard from. The tragic results of the "Dole Derby" put an end to further attempts by single-engine land planes until 1934.

In May, 1928, a flight was made by Captain Kingsford-Smith on a tri-motored Fokker "Southern Cross" from Oakland enroute to Brisbane, Australia, via Honolulu and Fiji. The Oakland-Honolulu leg of of this flight was made in 27 hours and 30 minutes.

A lull in trans-Pacific flights followed Captain Kingsford-Smith's U. S. to Australia hop until 1934, when on January 10th the U. S. Navy made the first mass flight from San Francisco to Pearl Harbor with six Consolidated seaplanes commanded by Lieutenant Commander McGinnis. All planes completed the flight without incident.

On November 3, 1934, Captain Kingsford-Smith became the first to make an eastbound flight crossing the Pacific from Australia. This flight was made with a single engine Lockheed "Lady Southern Cross" and the Hawaii-Oakland leg was completed in 15 hours.

Amelia Earhart became the first pilot to complete a solo flight between Hawaii and the Pacific Coast when she flew a single engine Lockheed Vega between Wheeler Field, Oahu and Oakland Airport, California in 18 hours and 17 minutes. Three years later, Miss Earhart and her navigator were lost in the vicinity of Howland Island in an attempt to reach Hawaii from Australia.

In April, 1935, Pan American Airways commenced survey flights to Hawaii with a view toward establishing regular trans-Pacific passenger service. The initial survey flight was made in a Sikorsky S-42 seaplane

which left San Francisco Bay and arrived in Pearl Harbor 17 hours and 14 minutes later. This flight was the beginning of the orderly development of trans-Pacific air travel which was to bring Hawaii within a few hours of the Mainland (continental United States.) and a closer cultural and economic relationship with the Pacific peoples.

Frequent flights by PAA and mass flights by Navy seaplanes, all without incident, proved the practicability of this mode of transportation.

By November, 1935, PAA was ready to inaugurate regular service over their trans-Pacific route and the "China Clipper" (Martin M-130) departed from Alameda, California, carrying with it the first air mail across the Pacific to China via Hawaii, Midway, Guam and Manila.

At the beginning of World War II, the facilities of PAA were placed at the disposal of the U. S. Navy, and in 1942, operations for the Navy were commenced on a contractual basis in conjunction with the Naval Air Transport Service. In a like manner, United Airlines and Consolidated Aircraft Company of San Diego performed contract service for the Army Transport Service. Concurrently, the U. S. Army Transport Command conducted

mass flights ferrying cargo, planes and personnel into Hawaii and the Pacific Theater of Operations. Thousands of trans-Pacific flights by crews of commercial airlines, Army and Navy were to provide the experience and the technical know-how that made possible the present development and dependability of trans-ocean air commerce.

Soon after the termination of World War II, Pan American Airways resumed commercial air operations between San Francisco and Hawaii and by 1947, overseas operations between Honolulu and the Mainland and through Honolulu from the Philippines, Australia and the Orient increased by leaps and bounds with six scheduled airlines competing for passenger and freight traffic:

Pan American Airways

United Air Lines

China National Aviation Corporation

British Commonwealth Pacific Airways

Philippine Airlines

Canadian Pacific Airlines

Trans-Ocean Airlines

Pacific Overseas Airlines

Requests for terminal space at the Honolulu Airport from prospective trans-Pacific operators

included the following:

Pan American Airways

United Airlines

KNILM (Dutch Airlines)

Australian National Airways

Far East Air Transport

Matson Navigation Company

Trans-Ocean Airlines

Pacific Overseas Airlines

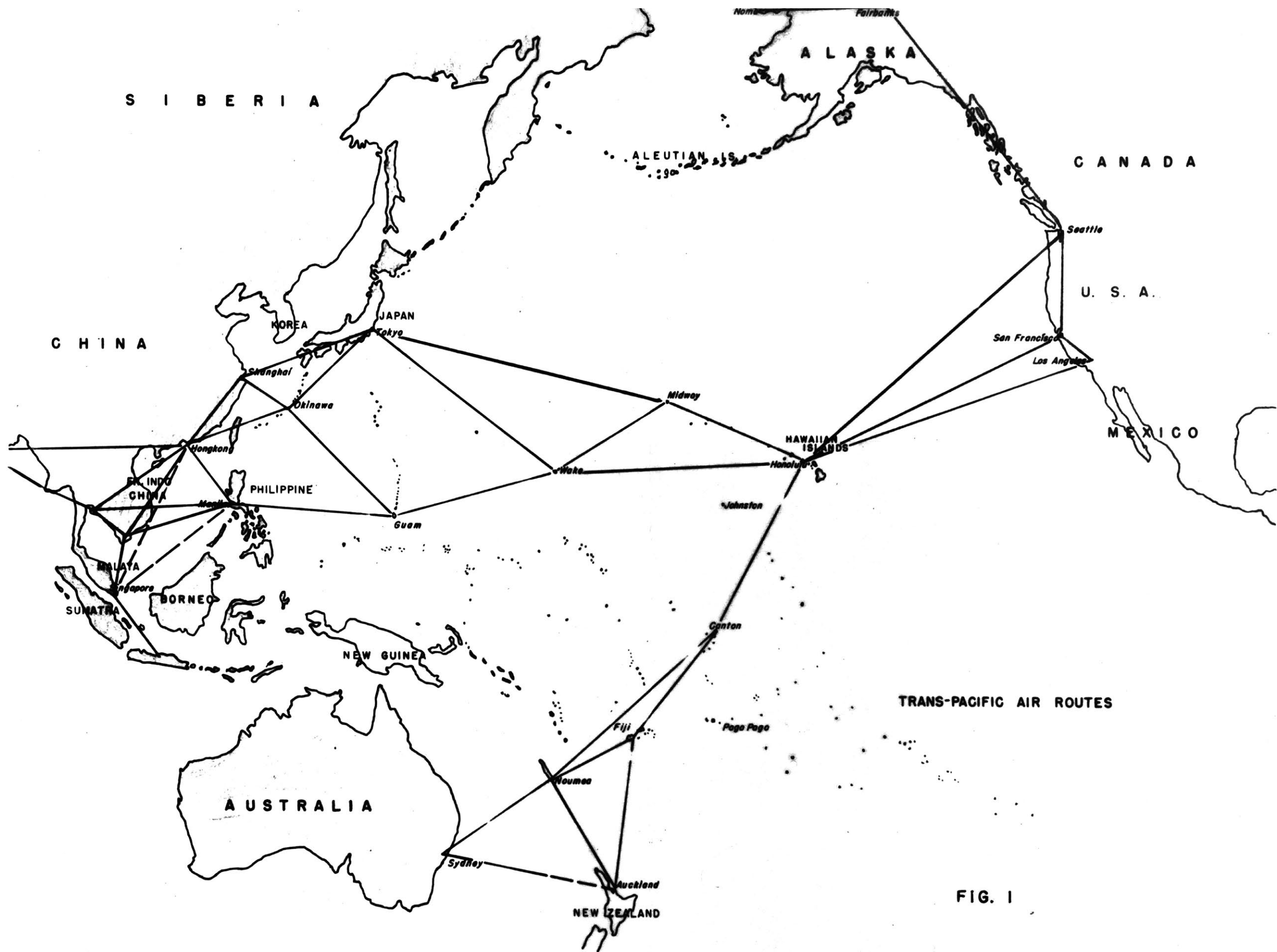
Samoa Area Airways

China National Aviation Corporation

Philippine Airlines

Map, Figure 1, "Trans-Pacific Air Routes" presents a pictorial view of the Pacific Ocean area and the airways system that now crisscross the vast expanse of ocean connecting Asia, Australia, Pacific Islands and the American continent.

FIGURE I



TRANS-PACIFIC AIR ROUTES

FIG. 1

II. AIR TRANSPORTATION IN THE TERRITORY.

As early as 1915, the Territorial Legislature was concerned with promulgation of aeronautical regulations. Act 14, Session Laws of Hawaii, 1915, prohibited the operation of aeroplanes, balloons and other aircraft in the Territory of Hawaii without license, except by pilots of the Army, Navy or National Guard.

Military security was evidenced at that time by a resolution of the Aero Club of Hawaii, to wit: "That no application by persons other than citizens for permission to operate aircraft in the Territory of Hawaii or the waters adjacent thereto, shall originate with nor receive the endorsement of the Aero Club of Hawaii; that no permission to take as passengers one or more persons granted application through the Club shall serve as authority for taking up as passengers any person who is not an American citizen."

In 1925, the Session Laws of Hawaii appropriated \$45,000 for the acquisition and improvement of an airport and/or landing field on the Island of Oahu...within a reasonable distance of Honolulu. The amount so appropriated not to be expended until the sum of \$20,000 had been raised by private subscription and

paid into the Territorial Treasury. From these funds an area of 119.3 acres of land and 766 acres under water was acquired from the S. M. Damon estate as an airport site for the sum of \$27,410. The airport was dedicated March 21, 1927, and was named in honor of the late Commander John Rodgers, who had been Commanding Officer of the Naval Air Station at Pearl Harbor from 1923 to 1925 when he left to command the Navy's historical flight between the West Coast and Hawaii.

In 1927, the Session Laws of Hawaii created a Territorial Aeronautical Commission to consist of not less than five nor more than seven members to be appointed by the Governor...at least three members to be licensed aeronauts (or military aviators). Powers and duties of the Commission: (1) Preparation, promulgation and enforcement of rules and regulations governing aviation and allied activities. When approved by the Governor to have force and effect of law. (2) Examining and licensing of aeronauts and aircraft.... (3) Establishment and chartering of airways.... (4) Exclusive control and operation of all Territorially owned or leased airports.

The Session Laws of Hawaii further appropriated the following sums for airport development: John

Rodgers, \$75,000; Hilo, \$25,000; Molokai, \$5,000; and Maui, \$15,000 for acquisition of land for an airport site. By Executive Order the Governor set aside an area of 204.8 acres at Hoolehua, Molokai, for use as an airplane landing field.

As a result of policy adopted by the Legislature to foster aviation by the development of landing fields, there was an incipient boom in aviation enterprises early in 1928. To quote from the Honolulu Star-Bulletin of July 7, 1928: "In the past three months no less than six separate attempts have been made to launch the incorporation of inter-island air service. Promoters ranged from itinerant aviators to reputable business and transportation interests."

In February 1928, the Territorial Aeronautical Commission adopted a regulation requiring all privately operated landing fields to be licensed. By July, there was a total of thirteen airfields in the Territory. Of these, seven were army fields. They were located as follow: Kauai (3)--Barking Sands, Port Allen and Wailua; Oahu (5)--Luke Field, Wheeler Field, John Rodgers Airport, Waimanalo (Bellows Field) and Kawaihoa (Haleiwa); Molokai (1)--Hoolehua (Homestead Field); Hawaii (3)--Hilo, Upolu Point (Suiter Field),

and South Point (Morse Field); Lanai (1)--Lanai City Airport. Maui at this time did not have an officially designated airport, although two sites had been proposed.

Of the several proposed inter-island air services, the field narrowed down to two contenders: Hawaiian Airways and Inter-Island Airways. Hawaiian Airways, after erecting a hangar at John Rodgers Airport and making survey flights, ran into organizational difficulties and ceased activities. In January, 1929, Inter-Island Steam Navigation Company announced the formation of a subsidiary company, Inter-Island Airways, and on October 29, two Inter-Island Airways S-38 amphibians made pre-inaugural flights to Hilo. The inauguration of the new inter-island passenger service began on November 11, 1929.

During the first year of operations, Inter-Island flew a total of 275,574 miles and carried 10,355 passengers and 18,680 pounds of express. During 1941, Inter-Island Airways' name was changed to Hawaiian Airlines. The company initially operated with nine passenger Sikorsky S-38 amphibians which were later replaced by the larger Sikorsky S-43. In 1941, Hawaiian Airlines began operating flights with DC-3

landplanes. All operations of this airline initiated from John Rodgers Airport in Honolulu, later to be named Honolulu Airport.

By 1941, several flying schools, chartered operators and repair and maintenance services were established at the airport.

Upon the outbreak of the war, all airports were taken over by the armed forces of the United States. Such of those airfields as were considered vulnerable to attack were rendered unusable and the others placed under strict control of either the Army or the Navy. All civil aircraft were grounded. However, within a few days Hawaiian Airlines was making emergency flights, under military direction, carrying engineers, medicines, munitions, etc. to the outlying islands. Passenger priority supervision was exercised by the Army for security purposes and expediting war priority transportation.

Kalaupapa Leper Settlement was isolated and the Gambo Flying Service was authorized by the Military to furnish emergency transportation of medical supplies direct to Kalaupapa.

Hawaiian Airlines Sikorsky planes were converted into cargo ships, carrying critical medical supplies

and equipment to the other islands and bringing back cargoes of fresh vegetables and newly-killed beef.

Hilo Airport was taken over by the Army and later developed by the Navy as Naval Air Station, Hilo, for training of carrier pilots. Upolu Point Airport was operated as an auxiliary field to Hilo. A simulated deck of an aircraft carrier was installed and air-group pilots completed their training by qualifying in day-and-night deck landings before going aboard carrier air groups. Puunene Airport, Maui, was taken over by the Navy and was greatly expanded, operating as the Naval Air Station, Puunene, Maui. Molokai Airport was taken over and developed by the Army. Burns Field, Kauai, was too small for military aircraft and was rendered unusable by the Army.

Due to the tremendous advances in air transportation during the war, there was an unprecedented urge for newly formed business and transportation interest to join in the race for a piece of the lucrative air transportation profits in the Islands. In 1946, Trans-Pacific Airlines entered the inter-island air transportation system as a non-scheduled airline, and in 1948 was granted a 5 year certificate by the Civil Aeronautics Board to operate on a

scheduled basis. TPA now flies identical air routes as the veteran Hawaiian Airlines, each competing bitterly for passenger traffic.

In addition to these two scheduled operators, the local fixed-base or non-scheduled operators number eleven carriers.

The development of air freight has taken place in Hawaii since the end of the War as perhaps no where else in the world. Cargoes of every conceivable nature including fresh fish flown from French Frigate Shoals, livestock, beef, vegetables, furniture, machinery and in fact, anything and everything are being transported by air.

Trans-Air Hawaii, operating DC-3 planes in freight and express service carried a total of about 12,000,000 pounds during 1947. This operator has applied before the CAB for a scheduled air cargo certificate.

Hawaiian Air Transport **Service** operates a deluxe charter and tour service.

Hawaiian School of Aeronautics operates a ground and flying school.

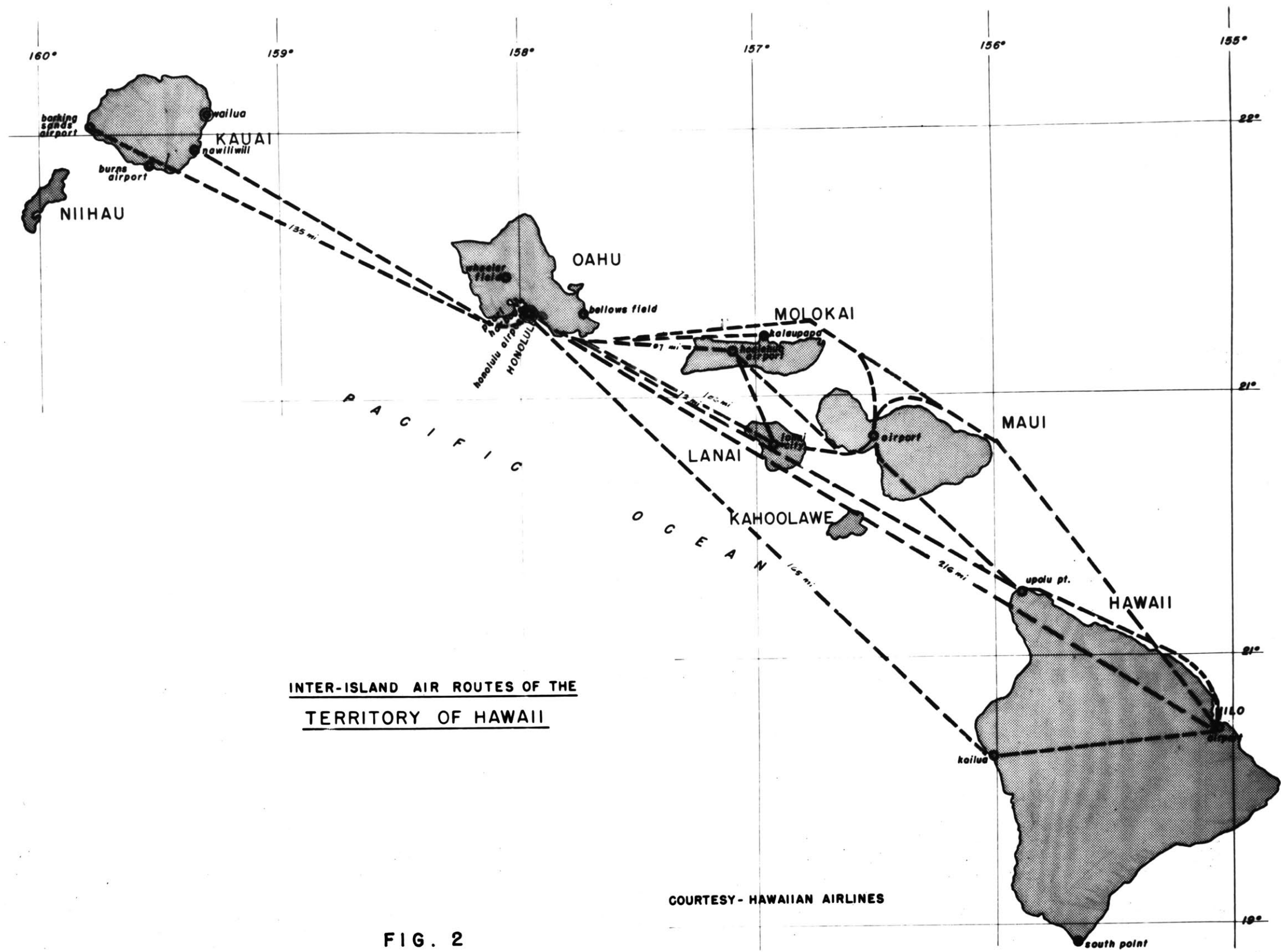
Cockett Airlines operates a charter service with twin-engined Beechcrafts.

Andrew Flying Service and K-T Flying Service both operate charter service and flying schools.

Island Flight Service consolidated with Aero Service and Supply operate a repair, rental and charter service.

Daily flights of scheduled carriers now cover all the islands with the exception of privately owned Niihau and Kahoolawe which is used as a target for Army and Navy bombing and strafing runs. Both scheduled and non-scheduled carriers fly over the system as shown on Map, Figure 2, "Inter-Island Air Routes".

FIGURE 2



INTER-ISLAND AIR ROUTES OF THE
TERRITORY OF HAWAII

COURTESY - HAWAIIAN AIRLINES

FIG. 2

B. PHYSICAL ASPECTS.

- I. Topography of The Islands.
- II. Climatic Features.
- III. The Island of Oahu.
- IV. The City of Honolulu.

B-I. TOPOGRAPHY.

To quote the geographer: "The Hawaiian Archipelago is a group of islands, reefs and shoals strung out from southeast to northwest for 1600 miles between $154^{\circ} 40'$ and $178^{\circ} 75'$ W longitude and $18^{\circ} 54'$ to $28^{\circ} 15'$ N latitude".

The main group of the Hawaiian Islands, consisting of eight islands, lies due south of the Alaskan Peninsula near the northern limits of the tropic zone, directly west of the central portion of Mexico, and just south of the Tropic of Cancer. The Territory of Hawaii is of volcanic origin, elevations rising from the ocean floor as much as 18,000 feet below to a maximum of nearly 14,000 feet above sea-level. Hawaii, the largest of the islands, has an extreme length of 93 miles and a width of 76 miles. Kahoolawe, smallest of the eight chief islands, is 11 miles long, 6 miles wide. Oahu, on which Honolulu, the capital and largest city is located, is 44 miles long and 30 miles wide. Approximately one-fourth of the Territory lies at elevations below 650 feet, and one-fourth above 4,500 feet. By far, the greater percentage of the population lives in the one-fourth area that lies below 650 feet. Much of the land is

unsuitable for cultivation due to rough topography and rocky terrain.

Although the islands lie in the northern margin of the tropics, they have sub-tropical climate because cool waters from the Bering sea drift to the region. Temperature of the surrounding ocean is about 10 degrees lower than in other regions of the same latitude.

The age of the islands is young, geologically speaking. They arose during the middle tertiary period of geologic time. The islands are built up over a fissure 1600 miles long, in the ocean floor. They are really the tops of mountain peaks sticking up out of the ocean.

During the great ice age, the ocean waters subsided and exposed larger areas of the mountain tops. During that period, Molokai, Lanai and Maui were all one island. The ice age was followed by a "submergence" period, when the melting icecaps filled the oceans with water and the sea rose as much as 2500 feet around the island peaks. Next a period of complex "submergences" and "emergences" occurred, during which there was little time for reefs to build. According to geologists, the Hawaiian Islands are now in one of the submergence periods with

the islands covered about 1200 feet.

B-II. CLIMATIC FEATURES.

The outstanding features of the climate of the Territory of Hawaii are the remarkable differences in rainfall over adjacent areas; the high percentage of hours with sunshine over leeward lowlands and the persistent cloudiness over or around mountain peaks nearby; the remarkably equable temperature from day to day; and the small differences in temperature between summer and winter months; the tenaciousness of the trade winds from the northeast and east; and the rarity of damaging storms of any kind.

The annual average temperature at sea-level is approximately 75° F. At Humuula, Island of Hawaii, where the elevation is 6,685 feet, the average is 52° F. August and September are considered the warmest months of the year; January and February the coolest. Owing to the marked marine influence, combined with the persistent trade winds which, in July, at Honolulu, blow 96 percent of the time, there is relatively little uncomfortable heat. Residences on slopes fully exposed to the trade winds and offices on windward sides of buildings are found the most pleasant. Air-conditioning is resorted to in some commercial buildings in the congested business districts, but

electric fans are not as common as in most areas in continental United States. In summer, the sun sets earlier than at latitudes farther north, and the nights throughout the year are seldom too warm for comfort. The most unpleasant periods of the year are likely to occur in the fall, or early winter, at times when the trade winds temporarily give way to light changeable or southerly winds, which bring relatively high humidity. Though trade winds in February diminish to 64 percent of the time at Honolulu, temperature is then lower so that discomfort from southerly winds is greatly reduced.

The highest official temperature record in the islands is 100° F. recorded on Pahala, Island of Hawaii, on April 27, 1931; the lowest, 25° F. at Humuula, Island of Hawaii. An interesting temperature feature is that the highest and lowest points reached during a month may occasionally occur at a station on the same date during a period of relatively calm clear weather when, during the early morning hours, ground radiation has been active, and uninterrupted sunshine follows during the day.

Frost rarely forms below 4,000 feet and probably never below 2,500 feet. In winter, however,

it is sufficiently cold for the higher levels of Mauna Loa (crest 13,680 feet), and Mauna Kea (crest 13,784 feet), Island of Hawaii, frequently to be covered with snow. Snow also falls occasionally on Haleakala (crest 10,023 feet), Island of Maui. It is not so very unusual to see snow on Mauna Loa and Mauna Kea even in mid-summer.

Precipitation.

In general, it may be said that east and north-east slopes (windward areas) are markedly wet, while some of the direct leeward lowlands approach semi-arid conditions. This can be well illustrated on the island of Kauai where in the central portion, near the summit of Mount Waialeale at an elevation of 5075 feet, the annual amount of rain received averages over 450 inches; about 15 miles southwest on the leeward, where elevation approach sea-level, the annual normal is below 20 inches. This similar condition occurs on the other islands, and on Oahu at elevations 2600 and 2800 feet near the crest of the Koolau Range, along the east coast, the annual average rainfall is slightly over 300 inches; while the leeward west coast, elevation 39 feet, the annual average is slightly less than 20 inches.

Considerably more rain falls during the cooler

months than during the warmer months and probably two-thirds of the rain in the islands occur at night. In general, heaviest amounts fall at elevations above the most thickly settled zones of population.

Irrigation systems are extensive. Mountains have been tunnelled; siphons, flumes and canals constructed; ditches and reservoirs dug; many artesian wells and electrically operated pumps are in use. The frequent and heavy rains that fall over some areas may not be conducive to a pleasant climate in those particular localities, but without a plentiful water supply, the chief industry, sugar production, could not exist as many tons of water are used for each ton of sugar produced.

The average mean temperature of the islands recorded and tabulated over a period of 42 years from 1905 to 1947, can be expressed as shown in Figure 3, "Annual Mean Temperature, 1905-1947", showing a marked evenness over a long period. The year 1947 has been arbitrarily chosen to illustrate the variance of temperature from month to month over a period of twelve months where a maximum of about 84.5 was reached in September and a minimum of 65.2 occurring in January. (See Figure 4, "Mean Maximum and Minimum

ANNUAL MEAN TEMPERATURE
BETWEEN YEARS 1905 - 1947

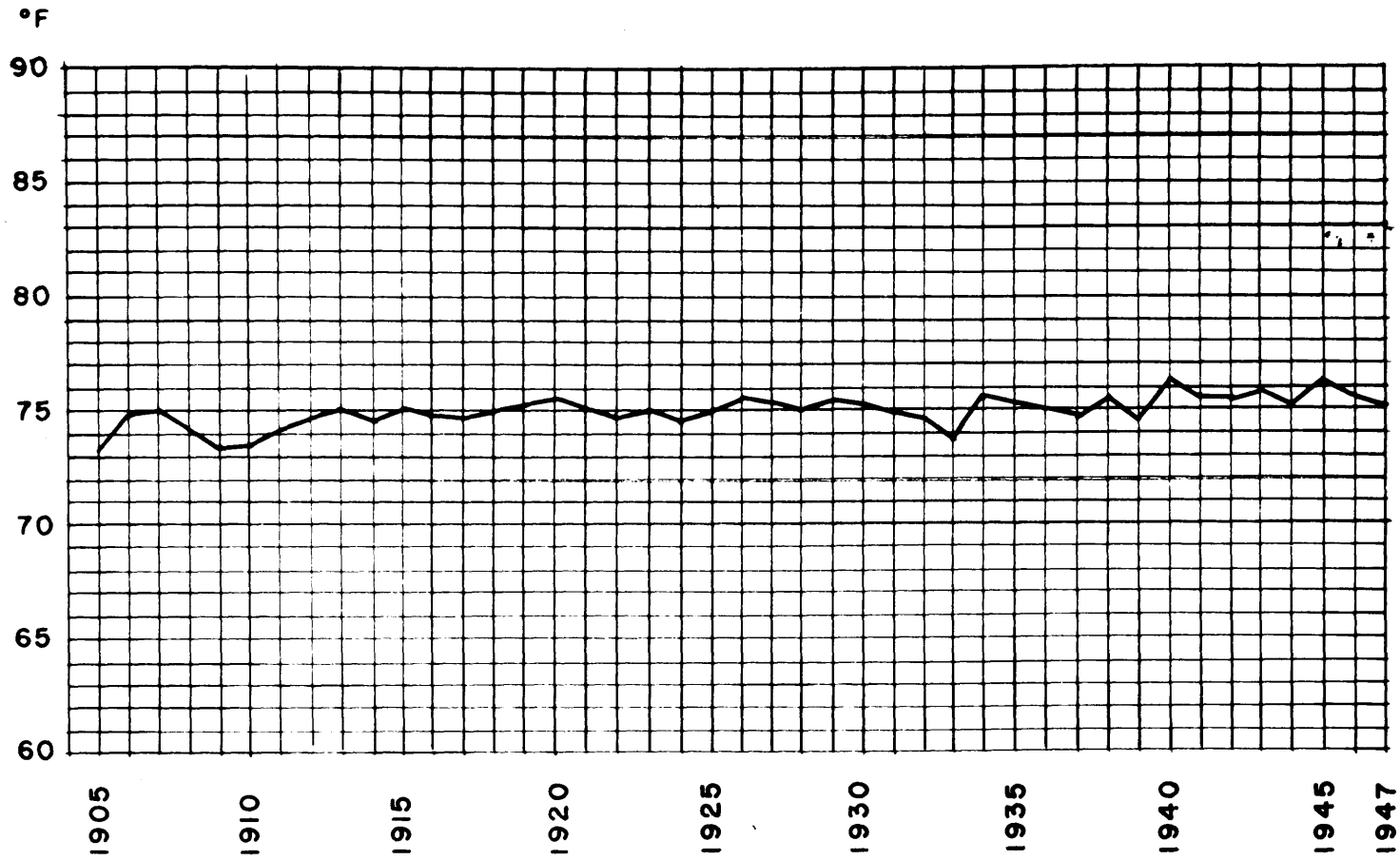


FIG. 3

U.S. Weather Bureau, Honolulu, T. H.

MEAN MAXIMUM & MINIMUM TEMPERATURE
FOR YEAR 1947

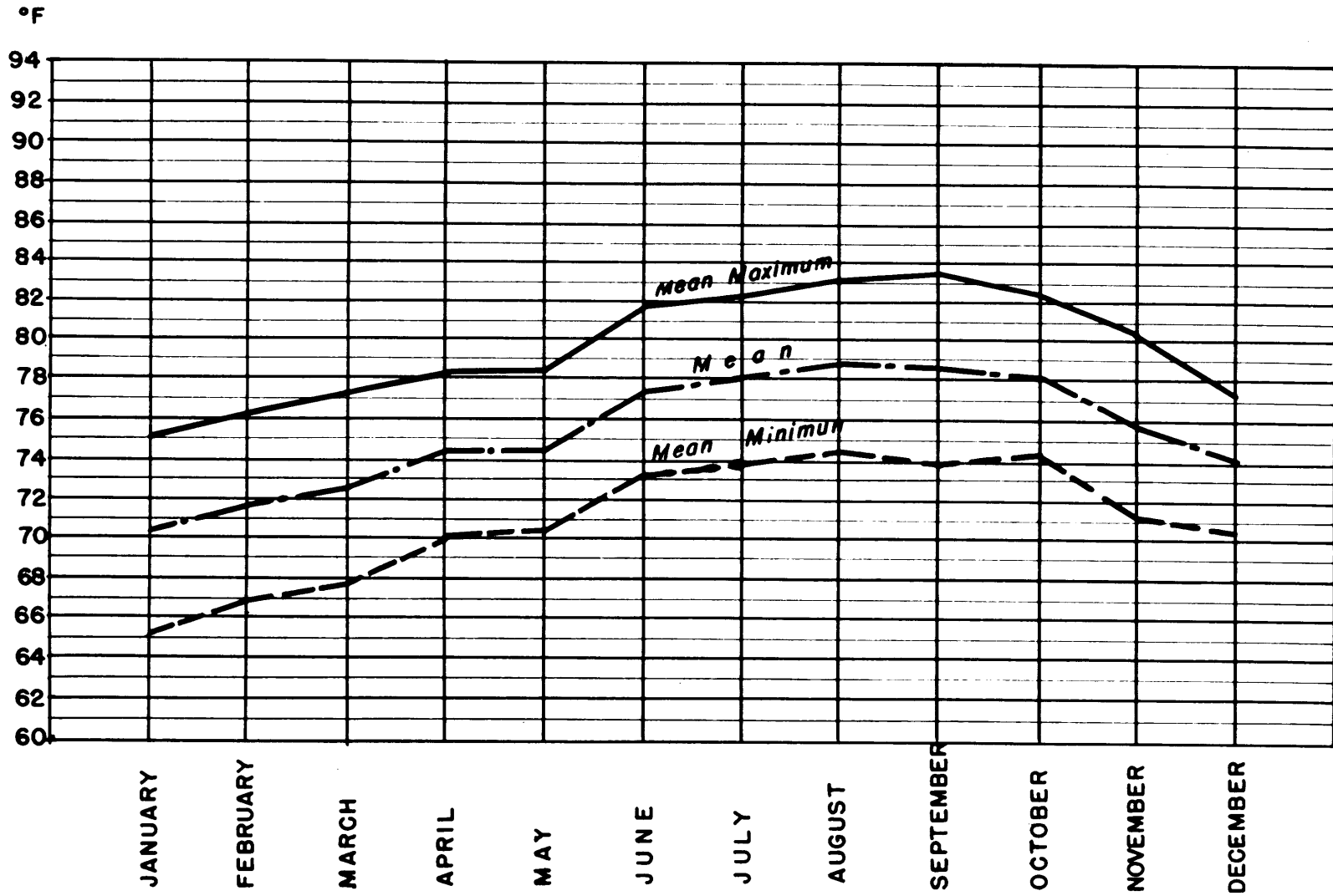


FIG. 4

U. S. Weather Bureau, Honolulu, T.H.

Temperature-1947".)

Comparative data compiled in Table, Figure 5, "Comparative Data", shows that trade winds from the northeast and east persist 81% of the time between the period 1922 to 1941, inclusive. The persistent trade winds give way to the southerly or "Kona" winds only 12% of the time. (A "Kona Storm" is regarded as one of those periods when during the cooler portion of the year, wind from a southerly direction springs up, sometimes attaining a relatively high velocity bringing frequent showers in leeward areas. The word "Kona" is derived from the Hawaiian in the islands signifying southerly, or the leeward side.)

During the year 1947, the trade winds remained true to its character and dominated 81% of the year, yielding to the Kona winds only 12% of the time. (See Table, Figure 6, "Wind Directions".) The prevailing wind direction for that year was from the northeast and east and at velocities averaging about 9.4 miles per hour.

Fog almost never occurs in and around Honolulu but is quite common at high elevations where precipitation is considerably greater. There are very few instances when the sky conditions are completely over-

TABLE

COMPARATIVE DATA

WIND DIRECTION: Percentage of Time From Each Direction
1922-1941, inclusive.

(Weather Bureau Office, Federal Building, Honolulu, T. H.)

	N	NE	E	SE	S	SW	W	NW	Indeter- minate
January	8	24	45	4	5	8	4	2	*
February	8	25	39	3	7	11	4	3	*
March	6	27	46	4	6	7	2	2	*
April	4	28	53	3	5	4	2	1	*
May	2	25	63	2	3	3	1	1	*
June	1	21	70	2	3	2	1	*	*
July	1	20	76	1	1	1	*	*	*
August	1	20	75	1	2	1	*	*	*
September	2	22	65	2	3	3	1	1	1
October	4	27	53	3	5	5	1	1	1
November	7	30	47	3	5	5	1	2	*
December	8	26	44	3	6	7	3	3	*
Annual	4	25	56	3	4	5	2	1	*

* less than one-half of one percent.

Figure 5

TABLE

WIND DIRECTION: Percentage of Time From Each Direction
1947

(Weather Bureau Office, Federal Building, Honolulu, T. H.)

	N	NE	E	SE	S	SW	W	NW	Indeter- minate
January	12	44	20	5	7	4	1	6	1
February	6	35	6	4	9	28	4	6	2
March	4	55	21	3	6	8	1	1	1
April	4	54	32	3	5	1	0	0	1
May	3	74	16	3	2	1	0	0	1
June	1	46	51	1	1	0	0	0	0
July	1	45	52	2	0	0	0	0	0
August	1	41	54	2	1	1	0	0	0
September	3	46	39	4	2	3	0	1	2
October	1	51	44	2	1	0	0	0	1
November	5	41	26	7	8	9	1	1	2
December	9	46	38	1	1	1	0	3	1
Year	4	48	33	3	4	5	1	1	1

Figure 6

cast and visibility limited for long periods of time. Ceiling frequency and visibility data as compiled by the weather office at the Honolulu Airport (Tables, Figure 7, "Ceiling Frequency" and Figure 8, "Visibility"), show that during a large percentage of the time the ceiling was greater than 9500 feet and visibility 20 to 30 miles, or as far as the eye can see.

Honolulu and Hilo Weather.

The chief business section of Honolulu and the Waikiki and Kaimuki areas lie along the leeward coast of Oahu to a distance of over five miles. At the Kaimuki end of the public transportation system of the city extends an additional five miles, or more, to serve residents established along the coastline. At the other end the transportation system extends another five miles or more to serve the Hickam Field and Pearl Harbor areas. Rainfall over this 15 mile long area lying along the coast and extending inland approximately one mile is, in general, from little more than 20 to about 30 inches a year on the average. In progressing farther inland through residential sections, which extend up the ridges and into the intervening valleys toward the Koolau Range, it is found that the annual rainfall increases to 50 inches

CEILING FREQUENCIES (BASED ON HOURLY RECORD OBSERVATIONS)

HONOLULU AIRPORT: 1947 & 1948

1947

Ceiling (feet)	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0												
100-200												
300-400												
500-900										2		
1000-1900	1	2	8	1	13			9	7	7	15	2
2000-2900	20	53	67	40	124	29	25	34	28	25	29	50
3000-4900	122	79	77	139	133	147	105	103	85	86	79	101
5000-9500	41	35	23	41	14	58	41	28	76	23	25	30
Over 9500	560	503	569	499	460	486	573	570	524	601	572	561

1948

0												
100-200												
300-400												
500-900	6	1										3
1000-1900	35	3	1	14			6	1	1			4
2000-2900	66	38	17	25	26	1	35	21	4	8	15	
3000-4900	152	84	64	75	111	73	72	64	54	77	108	
5000-9500	52	51	29	39	44	53	46	59	30	41	64	
Over 9500	433	519	633	567	563	593	585	599	631	618	526	

Figure 7

VISIBILITY FREQUENCIES (BASED ON HOURLY RECORD OBSERVATIONS)

• HONOLULU AIRPORT: 1947 & 1948

Visibility(miles)	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
-------------------	------	------	------	-----	-----	------	------	------	------	------	------	------

1947

0												
1/16 to 1/8					1				1		1	1
3/16 to 3/8					9	1			9	2	11	1
1/2 to 3/4			2	1				1				
1 to 2 $\frac{1}{2}$		1										
3 to 6	1	1										
7 to 15	181	149	202	85	112	114	42	64	31	26	32	30
20 to 30	562	522	540	634	622	605	702	679	679	716	676	712
35 to 50												

1948

0												
1/16 to 1/8												
3/16 to 3/8												
1/2 to 3/4		1										
1 to 2 $\frac{1}{2}$		19		2								1
3 to 6		34	13	5	1		2	3	2			7
7 to 15		123	78	79	72	46	5	26	35	43	58	63
20 to 30		567	602	662	641	697	715	716	706	675	686	649
35 to 30												

Figure 8

within a radius of two to two and one-half miles of the coast, and one mile farther on to 90 to 100 inches. Showers that fall in downtown Honolulu during the daylight hours are usually light, and frequently occur at the same time that the sun is shining, bringing forth the facetious term of "liquid sunshine".

At the Federal Building, Honolulu, (near the harbor), average annual rainfall for the past 40 years has been 24.97 inches. Average monthly values range from 0.74 inches in June to 4.00 inches in January. The maximum amount that has been recorded in a single month is 18.36 inches in January 1916; the least, 0.06 inches in October 1933. During the past 40 years average temperature at Honolulu during July and August and September has been 78° F; during January and February 72° F. The annual average has been 75° F. The average temperature of the water at Waikiki bathing beach varies from 75° F in the morning to 77° F. in the afternoon during March, and from 79° F. in the morning to 82° F. in the afternoon during August.

At Hilo, (Federal Building), a typical windward station on the Island of Hawaii, and the second largest city in the islands, the average annual rain-

fall is 139.90 inches. Monthly average value range from 7.33 in June to 15.69 in March. The maximum amount recorded in a single month has been 66.96 inches in March, 1922; the least 0.26 in February, 1912. An amount of 15.80 inches was recorded with the Federal Building at Hilo (within a few blocks of the harbor.) One mile farther inland the annual rainfall increases to approximately 154 inches. The July-August average temperature at Hilo is 75° F.; January-February average is 70° F.

ANNUAL METEOROLOGICAL SUMMARY

U S. DEPARTMENT OF COMMERCE WEATHER BUREAU

HONOLULU, T. H.

YEAR 1947

Month	TEMPERATURE			RELATIVE HUMIDITY (Airport Data)			SUNSHINE	
	Mean Maximum	Mean Minimum	Mean Monthly	200 HST	1400 HST	Mean Monthly	Total Hours	Percentage of possible
Jan.	75.3	65.1	70.2	80	63	75	244	71
Feb.	76.2	66.9	71.6	79	61	74	256	80
Mar.	77.3	67.7	72.5	76	59	70	283	76
Apr.	78.6	69.9	74.2	74	56	68	272	72
May	78.6	70.1	74.4	79	62	72	277	68
June	81.8	73.1	77.4	76	58	70	285	71
July	82.1	73.8	78.0	74	57	68	308	75
Aug.	83.1	74.5	78.8	75	57	69	303	76
Sept.	83.2	73.9	78.6	78	61	72	262	71
Oct.	82.2	74.2	78.2	73	60	69	263	73
Nov.	80.5	71.3	75.9	83	66	77	251	75
Dec.	77.4	68.8	73.1	77	63	72	227	68
Year	79.7	70.8	75.2	77	60	71	3230	73

Month	WIND				NUMBER OF DAYS		
	Av. Hourly Velocity	Prevailing Direction	Maximum Velocity	Direction	Clear	Partly Cloudy	Cloudy
Jan.	7.8	NE	31	NE	9	15	7
Feb.	9.6	NE	37	NE	13	11	4
Mar.	9.7	NE	24	NE	12	13	6
Apr.	10.5	NE	28	NE	6	19	5
May	10.4	NE	30	NE	9	16	6
June	10.0	E	21	E	5	20	5
July	9.7	E	20	E	5	24	2
Aug.	10.1	E	23	NE	8	16	7
Sept.	8.0	NE	21	NE	4	18	8
Oct.	10.1	NE	26	NE	7	19	5
Nov.	7.1	NE	20	E	11	13	6
Dec.	10.3	NE	31	NE	5	18	8
Year	9.4	NE	37	NE	94	202	69

B-III. THE ISLAND OF OAHU.

(See Map, Figure 9, "Terminal Aeronautical Chart").

Oahu is the capital island of the Hawaiian Archipelago. Although it is the third largest, 44 miles long, 30 miles wide and with an area of 604 square miles, it is the hub around which all activities of the Hawaiian Islands revolve. It is the most important island of the group and one of the most important islands in the entire Pacific Ocean.

The importance of Oahu lies in the fact that it is the site of Honolulu, Pearl Harbor (the home of the U. S. Pacific Fleet) and of Schofield Barracks (the largest army post outside of continental United States). Pearl Harbor is about seven miles west of the center of the city but the city has grown so that the intervening area has made the city and Pearl Harbor one and the same.

The island was constructed from two volcanic mountain chains, the Koolau Range along the east coast and the Waianae Range along the west. The fertile valley between these two mountain ranges is carpeted with pineapple and sugar cane fields and is well watered by streams from both ranges. The valley is sparsely populated with small camps of pineapple

workers with the exception of the town of Waihiawa and adjoining Schofield Barracks and Wheeler Field.

The windward or east coast of the island, comparatively wetter along the precipitous Koolau Range, precipitation averages about 300 inches annually creating lush vegetation along the eastern slopes down to the coast line and from the western slopes of the range into the valley and southward into the city of Honolulu. In contrast, along the west slopes of the Waianae Range and the west coast of the island, conditions are hot and arid where rainfall only averages about 20 inches annually.

Rural Oahu, before World War II, was devoted to sugar and pineapple plantations, small truck farms, dairies, piggeries and some stock raising. That picture is rapidly changing; the city of Honolulu is encroaching upon the rural areas. Plantation lands have been purchased by the government to provide immense military installations and housing for military personnel.

Pearl Harbor is surrounded by naval installations and naval housing areas which touch on the outer fringes of Honolulu. Residential areas have grown up around Honolulu Airport, lying between the

city and Pearl Harbor, along Kamehameha Highway, which leads to the belt road circling the island.

FIGURE 9

B-IV. THE CITY OF HONOLULU.

Honolulu, the capital of the Territory of Hawaii, is one of the two United States cities in which the city and county administration is combined (the other being San Francisco). Honolulu's extended boundaries cover a total expanse of 540,000 square miles, most of which is the Pacific Ocean. Honolulu proper covers about 85 square miles of the 604 square miles of Oahu and has a population of 277,129.

As the territorial capital, Honolulu has jurisdiction over the seven populated islands of the group. As the seat of the county government, its boundaries technically reach to Midway, 1149 miles to the west, and to Palmyra, 960 miles southwest. Within this expanse of ocean is French Frigate Shoals, 480 miles northwest, upon which the United States Navy spent millions constructing an airport during the war.

Fifty-one percent of the total population of the Hawaiian Islands is concentrated in the city of Honolulu in the area along the south shore of the island sheltered from the northeast winds by the Koolau Range. The natural land-locked harbor of Honolulu made possible the development of one of the

most important seaports in the Pacific offering shelter to the world's largest freighters and passenger ships. The importance of Pearl Harbor dawned upon seamen early in the history of the islands and, soon after the annexation of the islands as a United States possession, was occupied and developed by the United States Navy as its principal base in the Pacific.

Growing in importance to Oahu's strategic facilities for shipping are the land areas which are now transforming the island into a fixed base for the airplanes now criss-crossing the Pacific. The rapid expansion of military installations just prior to and during the war saw the development of twelve airfields, some temporary, others permanent, and two seadromes.

C. THE HONOLULU AIRPORT.

- I. Location.
- II. Site.
- III. Runways.
- IV. Passenger Accommodations.
- V. Administration and Maintenance Facilities.
- VI. Volume of Traffic.
 - a. Trans-Pacific Traffic.
 - b. Inter-Island Traffic.

C. THE HONOLULU AIRPORT.

I. LOCATION. (See Map, Figure 10.)

The Honolulu Airport is conveniently located approximately three and one-half miles west of the central business district of Honolulu and about four miles east of the Pearl Harbor area. It is accessible by the main belt highway which passes just north of the airport connecting all points on the island.

The approximate driving time from Honolulu to the airport is from ten to fifteen minutes, depending upon the amount of traffic and time of day. The City Planning Commission has long been approaching a solution to the various bottlenecks of vehicular traffic entering Honolulu from the west. Several proposals of new arterial highways running east-west through the city have been proposed to relieve the congestion caused by funnelling traffic through one point in the highway system.

FIGURE 10

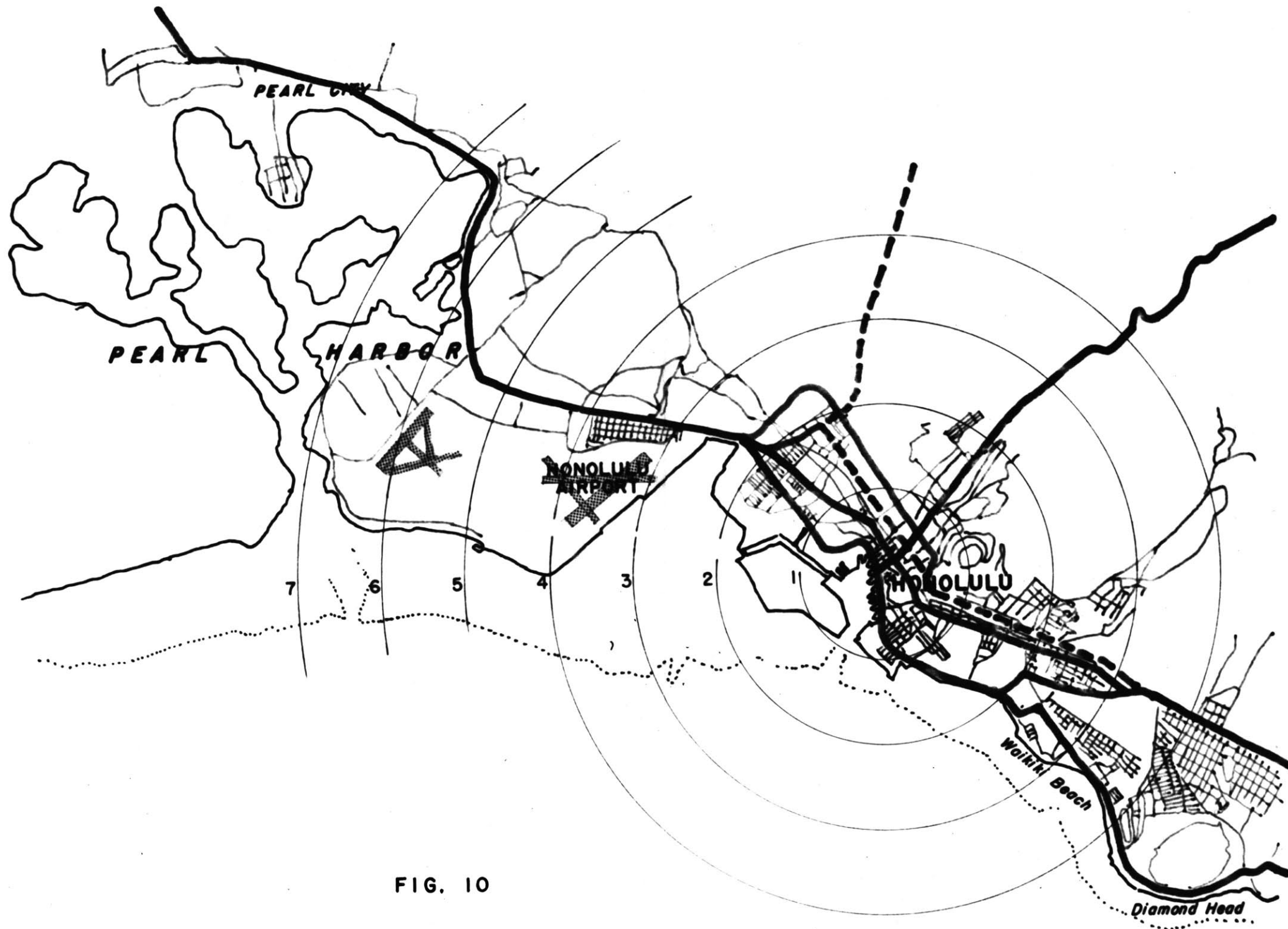


FIG. 10

C-II. SITE.

Prior to the war, Johns Rodgers Airport was being developed by the U. S. Engineers as a seaplane base and airport, under the sponsorship of the Civil Aeronautics Administration as a national defense project. A federal appropriation of nine million dollars had been authorized for development of this and other Territorial airfields. In 1940, \$3,300,300 was authorized by Congress for dredging the Keehi Lagoon, and in 1941, an additional sum of \$1,900,000 was authorized for the development of John Rodgers Airport in conjunction with the seaplane project. A view of this airfield as of 1941 is shown in photo, Figure 11, "John Rodgers Airport, 1941", and Map, Figure 12, showing a single east-west runway-- Dillingham Boulevard, a segment of Kamehameha Highway, can be seen at the top of the photo. S. M. Damon Tract, a residential area consisting of one-family bungalows and some small truck farms, separates the highway from the airport.

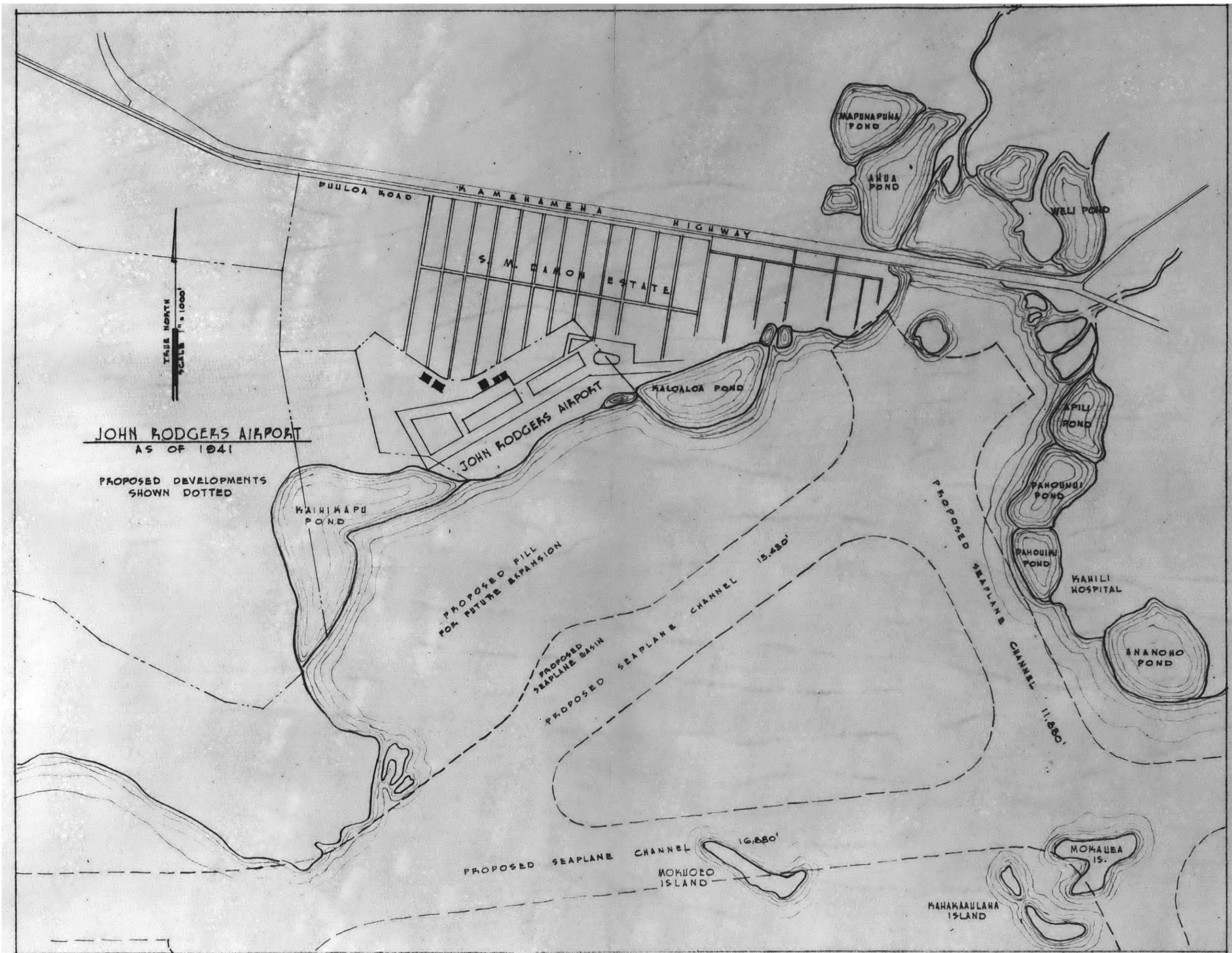
Hawaiian Airlines, the only scheduled carrier in 1941, operated from the two hangars shown on the left and with its passenger terminal in a wing built into the hangar second from the left. Hangars shown



JOHN RODGERS AIRPORT - 1941

FIG. 11

FIGURE 12



JOHN RODGERS AIRPORT
 AS OF 1941

PROPOSED DEVELOPMENTS
 SHOWN DOTTED

FIG. 12

on the right were occupied by small flying schools and repair services.

The main access to the airfield was along John Rodgers Road, shown on the extreme left of Damon Tract, ending in a turnabout in front of the Hawaiian Airlines terminal.

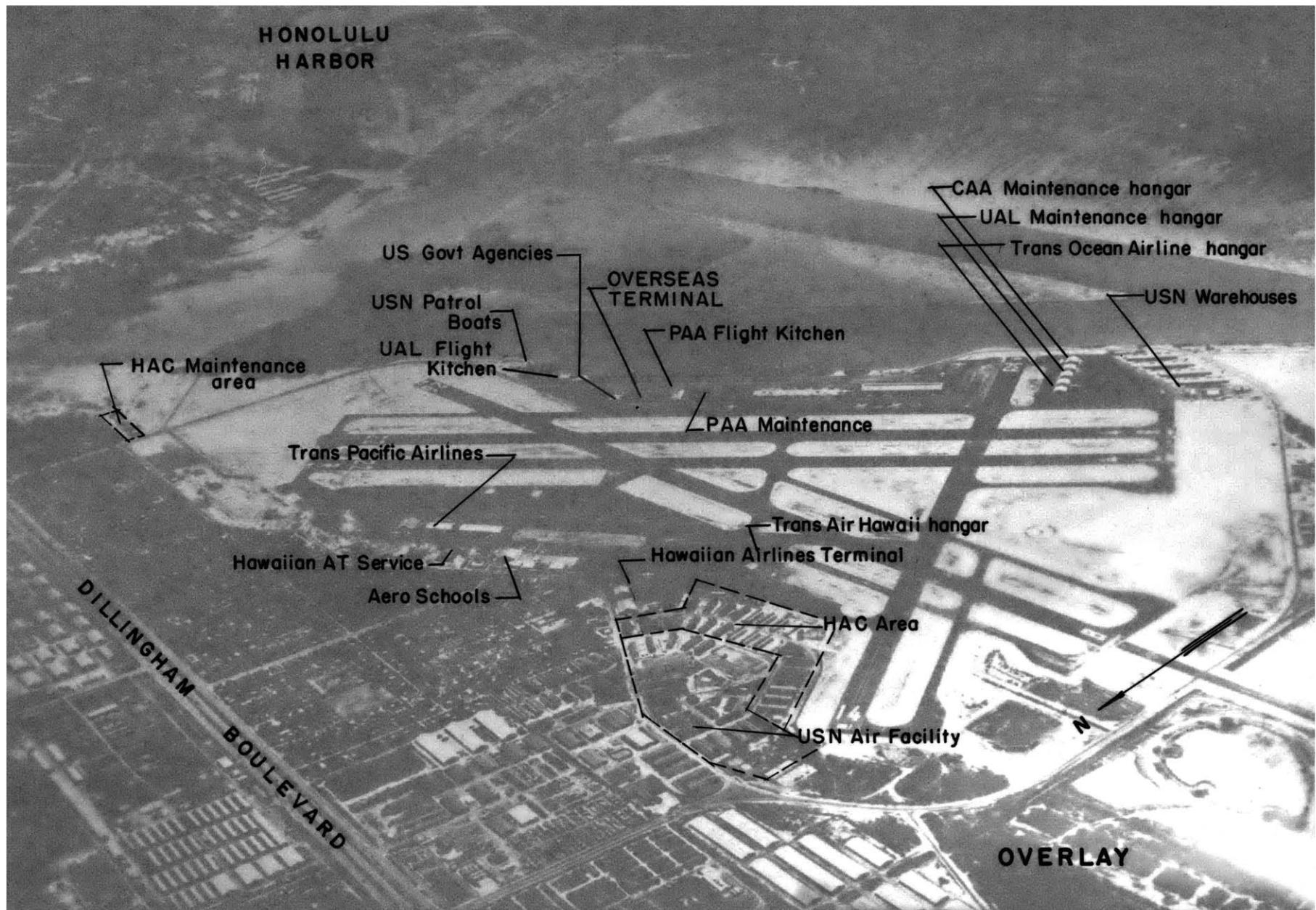
Pan American Airways had not begun to use John Rodgers Airport as a base, but instead, operated their Clipper flying boats out of Pearl City further to the west in Pearl Harbor where a sheltered seaplane anchorage was developed.

Dredging of the Keehi Lagoon began in later 1941 and operations were speeded up soon after the outbreak of the war and by mid-1943 the landplane area had been filled by spoil from the seaplane channel dredging and three runways completed. The field was taken over by the Army at the beginning of the war and used as it as a troop carrier transport base while construction of the runways was in progress. In August 1943, the Navy received from the Territory a permit to enter and construct facilities for their own use. Extensive construction was undertaken to provide a base for seaplane and landplane operations, principally for the Naval Air Transport Service. The field was officially

designated as Naval Air Station, Honolulu. The Army continued to use the field in conjunction with the Navy and all B-29's and many other combat planes were staged through this airport, thus making it one of the most important installations during the war.

At the close of the war, the Honolulu Airport was reconverted to commercial traffic and has become the largest and busiest in the Pacific area, its facilities caring for both land and seaplanes. In 1947, the original name of John Rodgers Airport was officially changed to "Honolulu Airport" in line with the general practice of changing longstanding names of airports to that of the city where the airport is located. The designating of airports by the geographical location eliminated confusion in the sale of tickets and operational communications throughout the world.

Photo, Figure 13 and Map, Figure 14, "Honolulu Airport, 1945", show the extensive development of the airport made in the course of approximately four years.



HONOLULU AIRPORT - 1948

FIG. 13

FIGURE 14

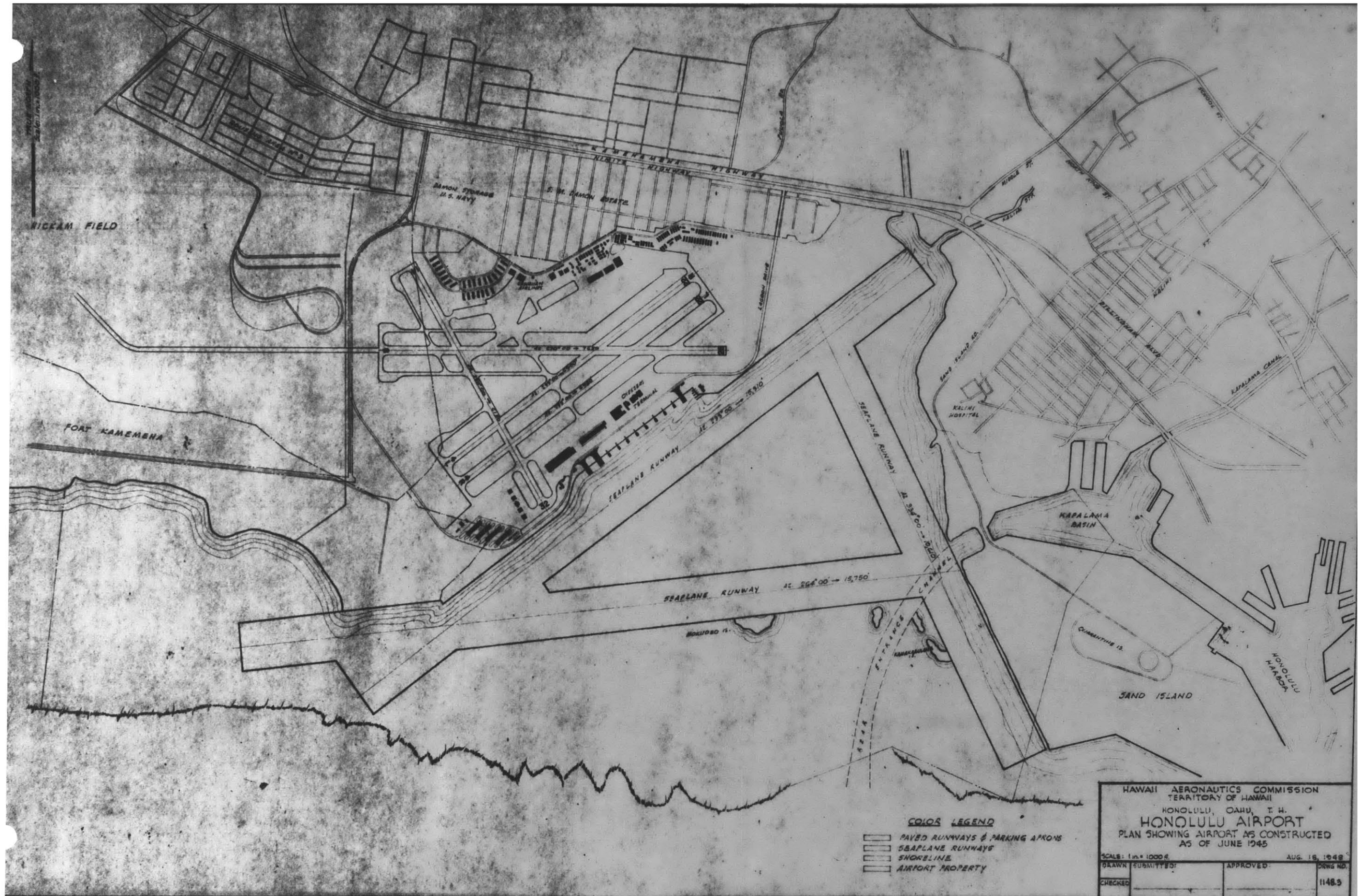


FIG. 14

C-III. RUNWAYS.

In a short period of three years the Honolulu Airport mushroomed from a single runway field into one with a cross-triangular patterned runway for both landplanes and flying boats. The spoil from the dredging of the seaplane runways which began in 1942 was used to build up the coral base upon which the land plane runways were constructed. The lengths of the runways were sufficient to take the DC-6 and Constellation type overseas carriers. It is contemplated that the east-west dual instrument runways be further lengthen in order to permit future use of even larger types of aircraft such as the DC-7 and the Boeing Strato-cruiser. Further, a proposed master plan recommended additional runways to parallel runways 8-26 and 14-32.

C-IV. PASSENGER ACCOMODATIONS.

The present Overseas Terminal Building from which all trans-Pacific airlines operate is located on the south side of the airfield, between the sea-plane runways and the landplane runways. (See Overlay, Figure 13.) It was constructed by the U. S. Navy during the wartime expansion of the airport. Obviously, the Navy did not design and construct the building with the view of its conversion to use by commercial airlines following the war. Nevertheless, it is a well designed light wood frame structure with curtain walls of relatively temporary materials built to provide for the urgent need of wartime operations by the Navy. But it was not designed with the view of any **degree** of permanency.

During the war years the building ably served the needs of the Navy Air Transport Service, handling essential supplies and personnel. After the airport was reconverted to commercial air operations and the building used as the Overseas Terminal the rapid increase of passenger traffic into and out of Honolulu and the crying demand for more terminal space by airlines, foreign and domestic entering the Pacific air system, is forcing this building into a position

of obsolescence.

The airlines operating within the Hawaiian Islands are based on the north side of the field at widely scattered points. There is no one terminal used by the various commercial operators at the present time; each airline has its own. To date, there are two operating scheduled airlines, Hawaiian Airlines and Trans-Pacific Airlines, and several non-scheduled or chartered air services for both passengers and freight.



**EXISTING OVERSEAS TERMINAL BUILDING
APPROACH ELEVATION**



EXISTING OVERSEAS TERMINAL BUILDING
FIELD ELEVATION



"SKY ROOM" RESTAURANT

P.A.A. FLIGHT KITCHEN

P.A.A. MAINTENANCE SHOPS

C-V. ADMINISTRATION AND MAINTENANCE FACILITIES.

The administrative functions of the airport are presently housed in the Overseas Terminal Building and include the following:

Air Traffic Control--a function of the CAA which maintains a 24-hour air-ground communication by means of radio-telephone and radio-telegraph with aircraft operating overseas and inter-island.

U. S. Weather Bureau--furnishes terminal and route weather forecasts for inter-island and trans-Pacific flight operations.

U. S. Customs, Immigration, Public Health, and Agriculture--processing of all foreign passengers arriving in Hawaii via air or enroute to the continental United States; clear all passengers departing for the West Coast; inspect all baggage for quarantinable fruits, plants, seeds, etc.

Hawaii Aeronautics Commission--management and control of all airports used for commercial

aviation in the Territory; establishing and chartering of airways; examining and licensing aeronauts and aircraft; and enforcement of rules and regulations governing aviation and allied activities.

Maintenance and repair facilities and hangars are widely scattered around the perimeter of the airfield, those of the trans-Pacific airlines generally located along the south and the inter-island airlines along the north. (See Overlay, Figure 13.)

C-VI. VOLUME OF TRAFFIC.

Statistics and data compiled in this study show a tremendous increase of air transportation in the Pacific Ocean area and within the Hawaiian Islands during the post-war period. This can be mainly attributed to the introduction of new air carriers into the Pacific airways system, technical advances made during the war period which conclusively proved the safety of air transportation over the Pacific and the public's burning desire for speed of transportation.

The following table and graph published in the Hawaii Aeronautics Commission Annual Report, 1947-1948, included here are to give comparative data of the landing operations at the Honolulu Airport between January 1947 and June 1948.

(See following page for table.)

HONOLULU AIRPORT
MONTHLY LANDING REPORTS

Month	Scheduled Landings	Non- Scheduled Landings	Civilian	Military	Total
<u>1947</u>					
Jan.	740	769	1901	331	3741
Feb.	617	699	2257	355	3928
Mar.	774	842	2705	483	4804
Apr.	773	867	2865	363	4868
May	797	888	3315	658	5658
June	1068	696	3653	571	5988
July	1076	818	3834	615	6343
Aug.	1144	971	5739	813	8667
Sept.	1005	839	5348	678	7870
Oct.	1039	745	4798	640	7222
Nov.	951	755	4905	508	7119
Dec.	1134	752	3988	503	6377
 <u>1948</u>					
Jan.	1054	728	3487	608	5877
Feb.	972	726	5156	532	7386
Mar.	1043	734	4377	607	6761
Apr.	997	720	6964	1027	9708
May	1121	784	6251	921	9077
June	1272	711	5545	884	8412
 % increase between first six months and first six months 1948:					
	35.4	-7.5	90.3	65.8	62.9
 % increase between second six months 1947 and first six months 1948:					
	1.7	-9.8	11.1	21.9	8.3

(See NOTE on following page.)

NOTE:

Scheduled landings include landings of trans-Pacific and inter-island air carriers operated by the scheduled airlines including Pan American World Airways, United Air Lines, Philippines Air Lines, China National Aviation, British Commonwealth Pacific Air Lines and the Hawaiian Airlines.

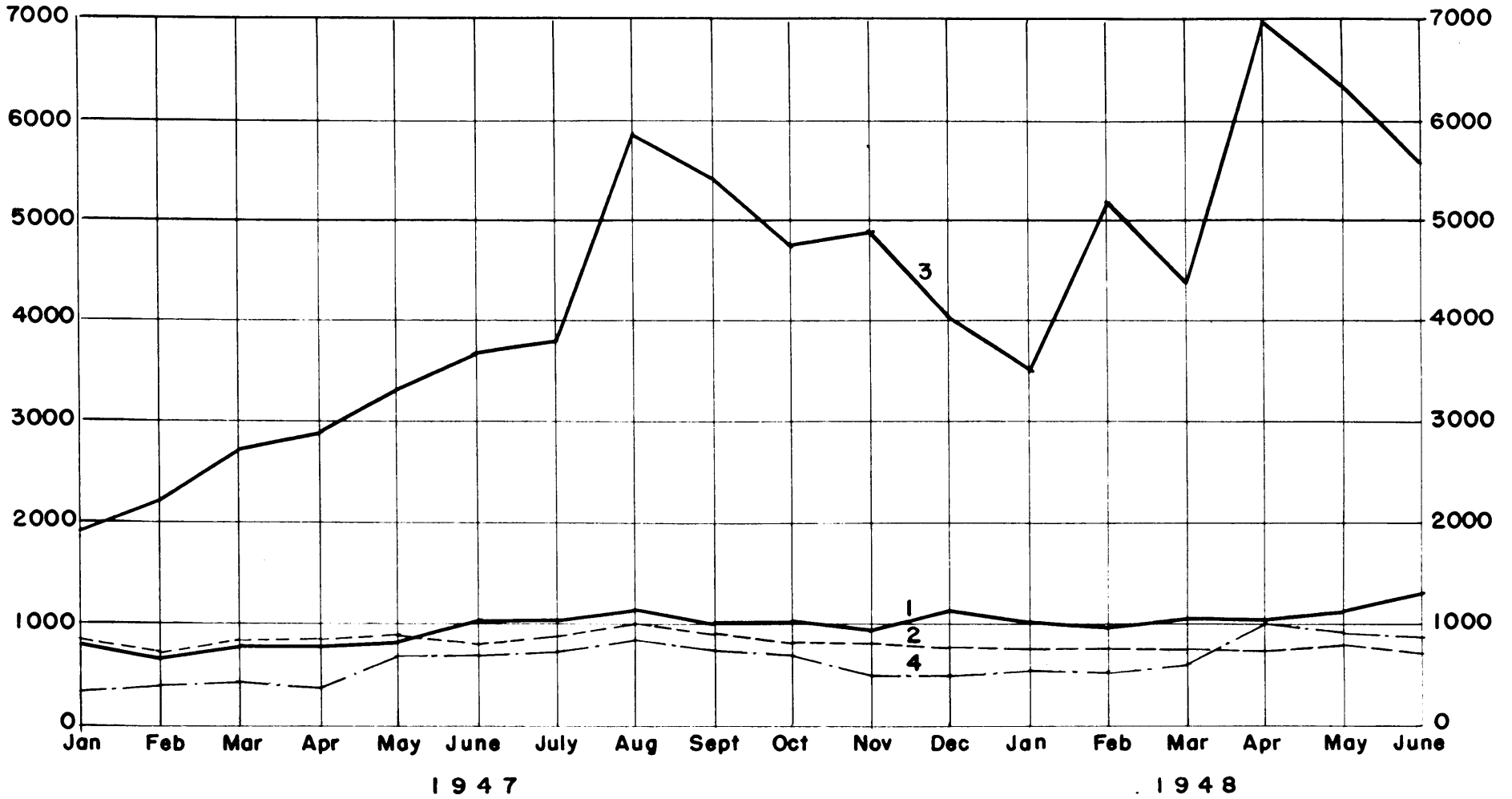
Non-scheduled landings include those of air carriers operated by air line firms other than those mentioned above.

Civilian includes all non-commercial private planes using the Honolulu Airport for instructional, practice flights and personal flying.

Military includes all army and navy aircraft. These include operations of the Naval Air Transport Service for scheduled flights and local training purposes. The aircraft of the Naval Air Facility include those of the Utility Flight Unit which provide the air transportation needs within the Hawaiian Area and aircraft assigned to the air/sea Rescue Service.

The Army has used Honolulu Airport during the past year for the landing of all B-29's and the Boeing C-97 Cargo planes, for which Honolulu Airport offers better landing facilities than adjacent Hickam Field.

HONOLULU AIRPORT — MONTHLY LANDINGS



1 - Scheduled Landings

2 - Non Scheduled Landings

3 - Civilian

4 - Military

Trans-Pacific Traffic.

Figure 15, "Growth of U.S.-Hawaii Traffic", illustrates graphically the marked increase of trans-Pacific air passenger travel, particularly during the recent post-war years. Since the inauguration of trans-Pacific air travel until the outbreak of World War II, only one carrier (Pan American Airways) operated in the Pacific area, but since 1945, eight carriers, foreign and domestic, have entered into competition for trans-Pacific traffic.

During the year 1947, commercial airlines carried 63,055 passengers between Hawaii and the Mainland as compared to a total of 26,000 passengers carried by ship in 1941.

Information in reference to United States Mail and Air Express for the post-war years are unavailable but statistics show that during the years preceding the war there was a significant rise of both United States mail and air express flown by air carriers over trans-Pacific air routes. It is interesting to note that in Figure 16, "Pounds of Air Mail Carried..." and Figure 17, "Pounds of Express Carried..." eastbound mail and express out of the United States and Hawaii are consistently higher than westbound loads.

GROWTH OF U.S. - HAWAII TRAFFIC
TOTAL AIR PASSENGERS TRANSPORTED BETWEEN
MAINLAND AND HAWAII
1937 to 1948

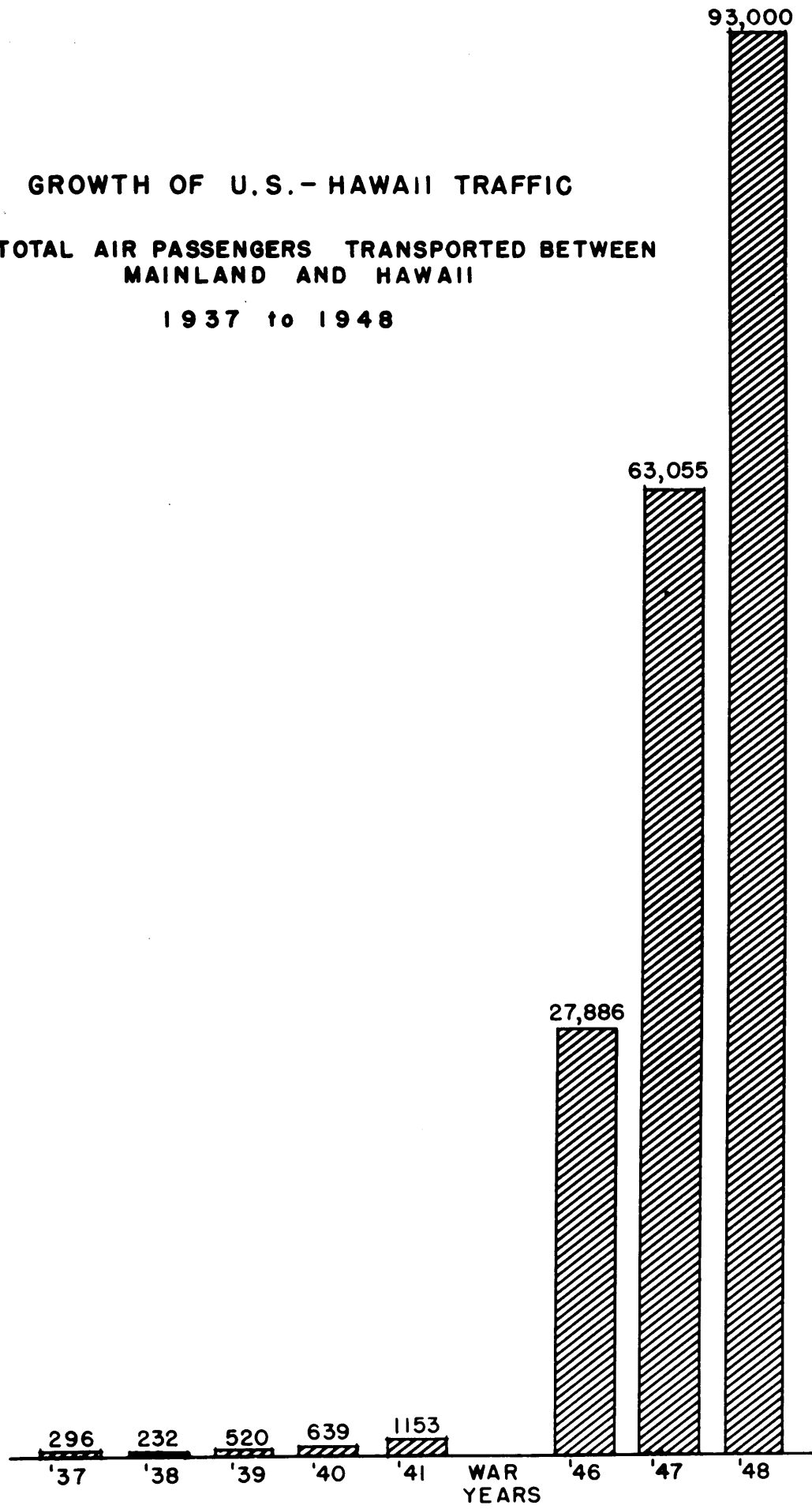


FIG. 15

Aviation Daily
CAB Reports
HAC Statistical Reports

POUNDS OF AIR MAIL CARRIED ANNUALLY
BETWEEN U.S., HAWAII, ASIA AND AUSTRALIA

JANUARY 1, 1937 - DECEMBER 7, 1941

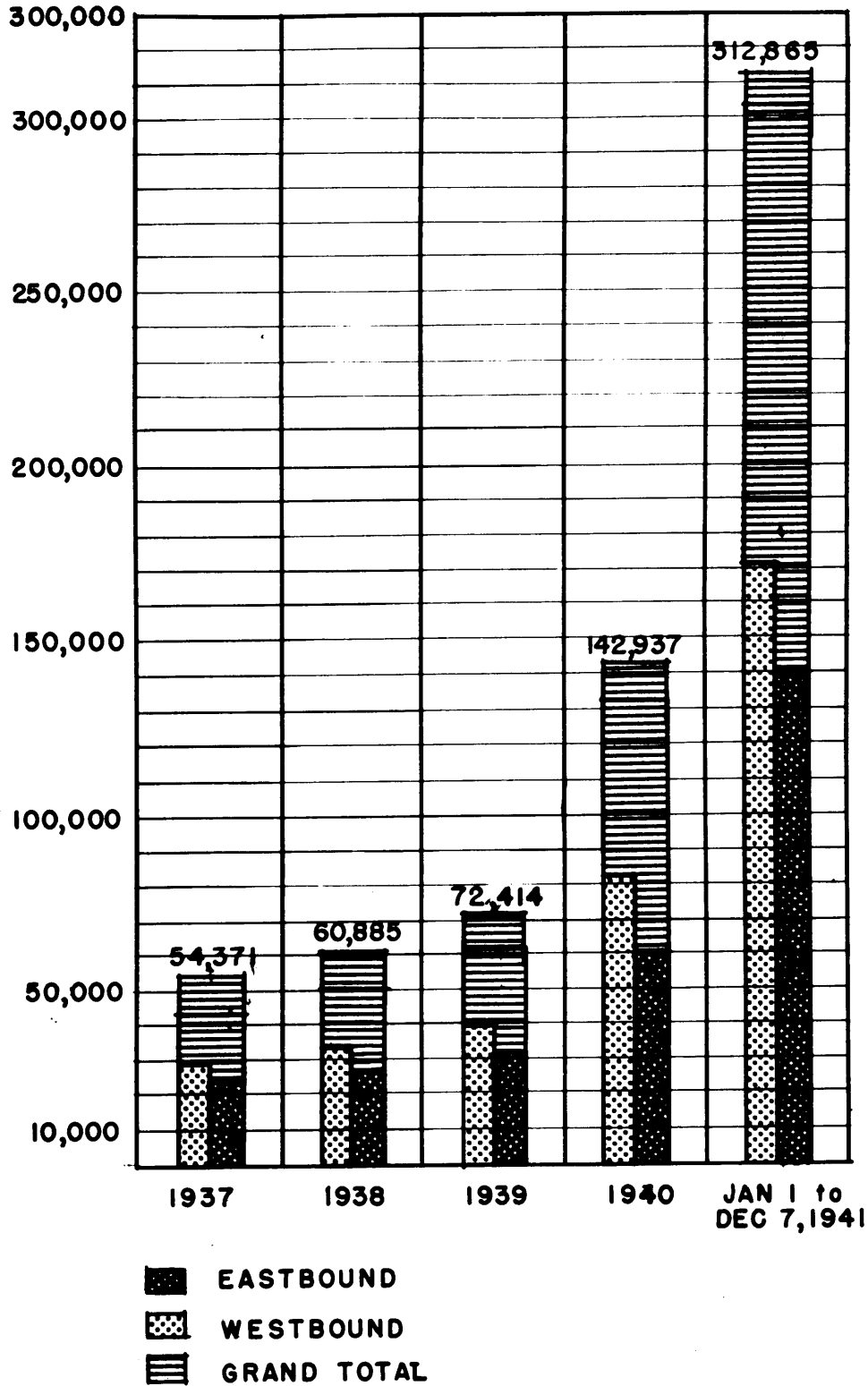
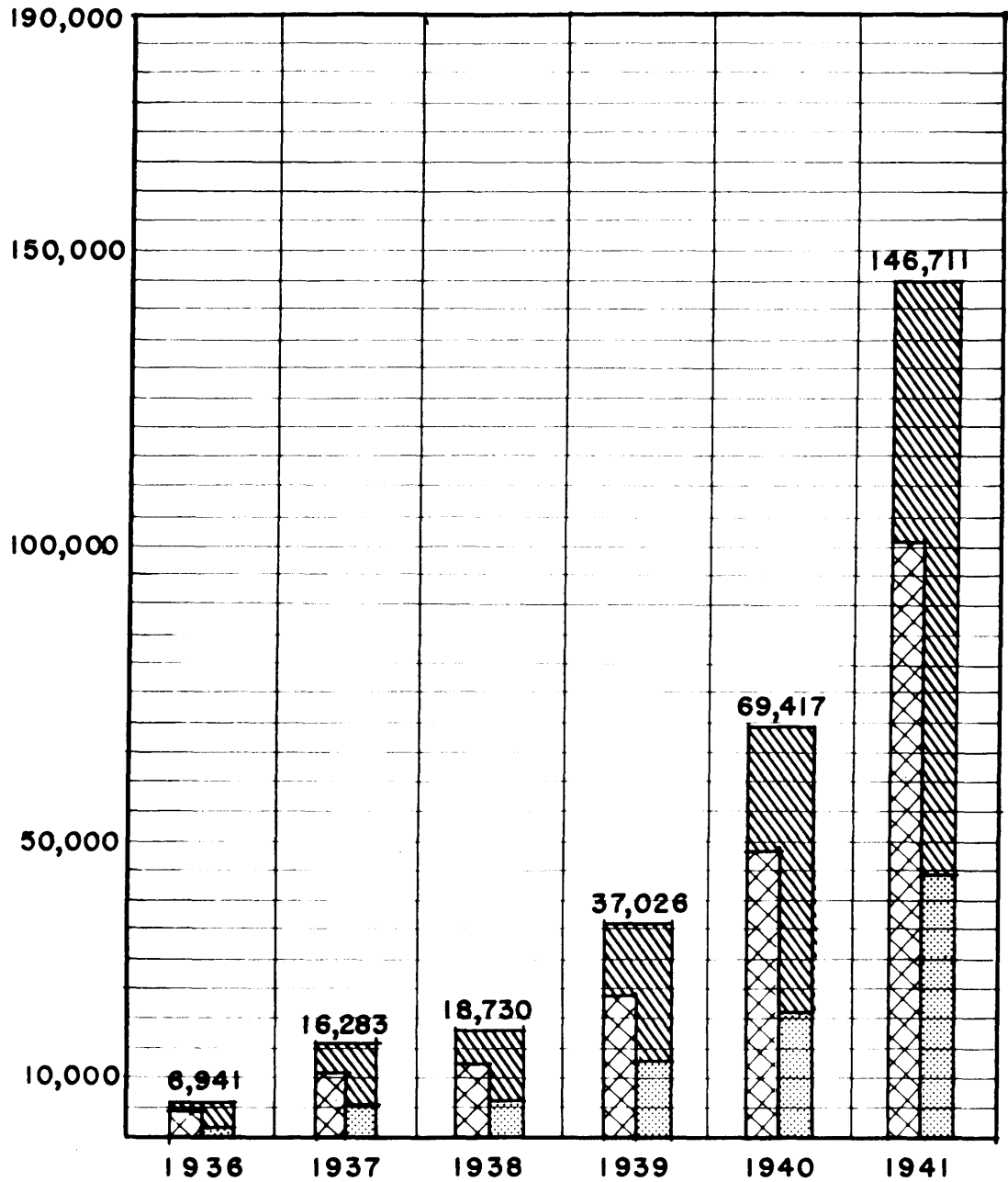


FIG. 16

POUNDS OF EXPRESS CARRIED ANNUALLY
BETWEEN U.S., HAWAII, ASIA AND AUSTRALIA

1936 to 1941



 EASTBOUND
 WESTBOUND
 GRAND TOTAL

FIG. 17

Inter-island Traffic.

The increase in passenger traffic within the Territory of Hawaii followed a similar trend to that of trans-Pacific traffic showing a huge increase following the close of the war. Figure 18, "Passengers Carried In Air Between Islands" is a pictorial representation of the trend in air transportation within the Territory. It may be noted that during the pre-war years only one scheduled carrier operated between the islands and the increase of traffic during post-war years may be attributed to the introduction of a new scheduled carrier (Trans-Pacific Airlines) and several non-scheduled and chartered carriers. Figure 19, "Percent Population Carried by Air" is presented to show the large portion of the population within the Territory that is carried by air transportation. So far as is known, a larger portion of the island population is carried by air per year than in any other area in the world, and it is certainly much greater than the mainland percentage of population carried by air. Perhaps the basic reason for this is the fact that the airport system is the chief means of passenger travel between the islands, while the mainland modes of transportation consist of

PASSENGERS CARRIED BY AIR
BETWEEN ISLANDS

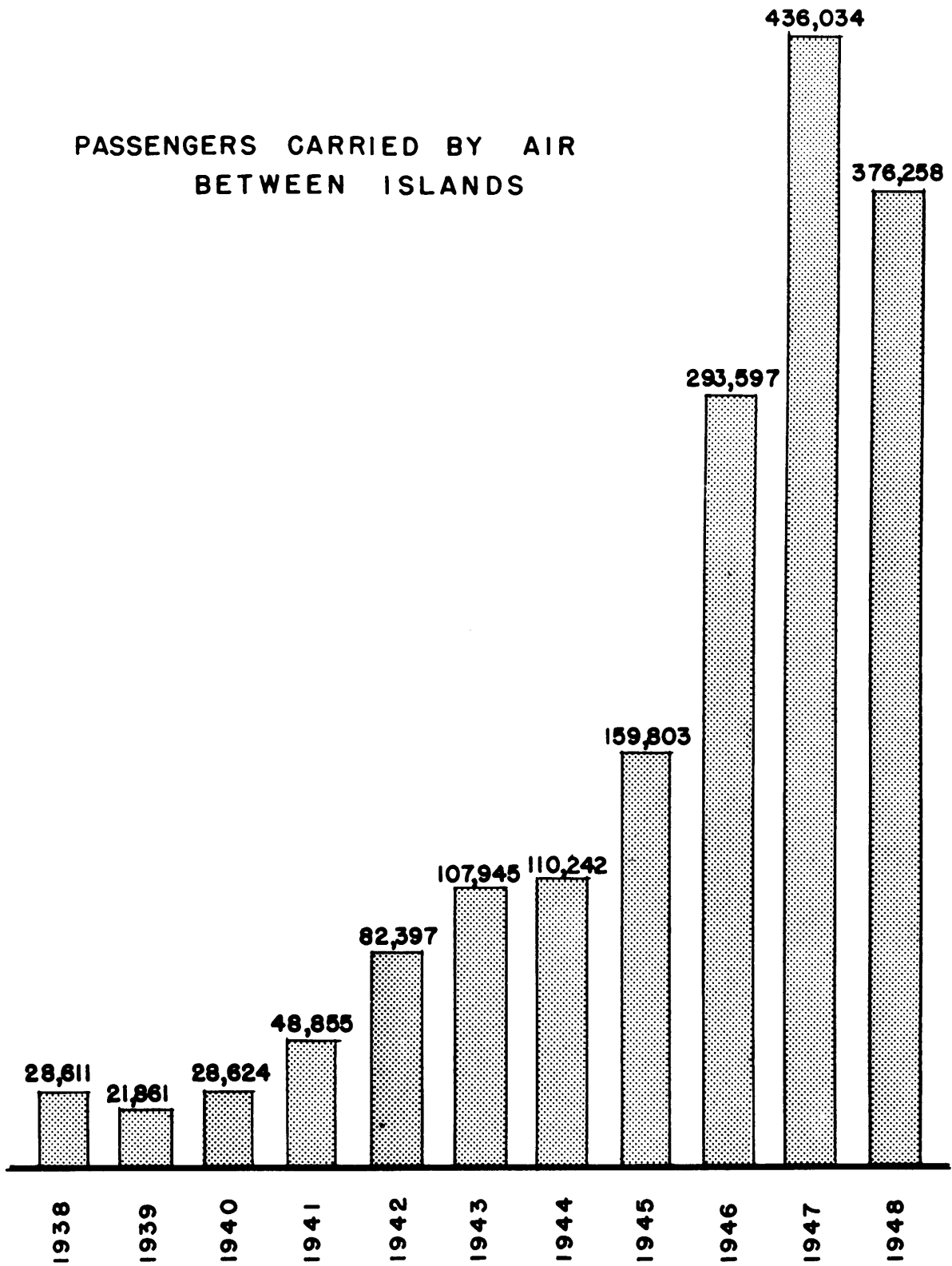


FIG. 18

PER CENT POPULATION CARRIED BY AIR

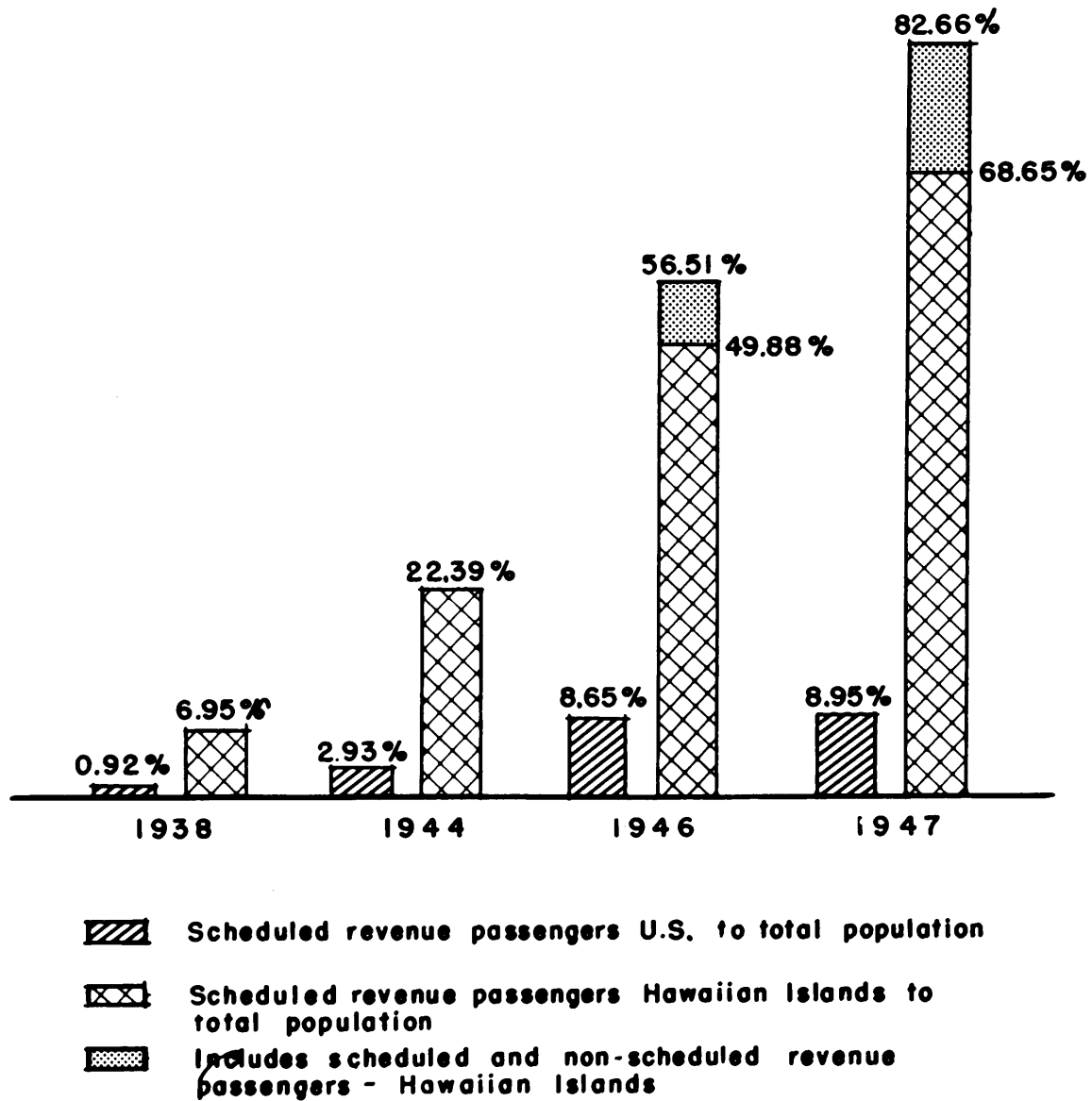


FIG. 19

Library of Hawaii
 World Aviation Annual 1948
 C A B Docket No. 2390

airlines, trains, buses and private automobiles. In the Islands the airways system performs the functions of all four methods of transportation used on the mainland. Figure 20, "Percent Passenger Traffic Originating and Terminating at Individual Airports", shows the relative value of each airport as to passenger travel. It can be expected that Honolulu Airport would obviously have the highest percentage of passenger originating and terminating at that base since Honolulu is the hub of the Islands' economy and the area of largest population concentration.

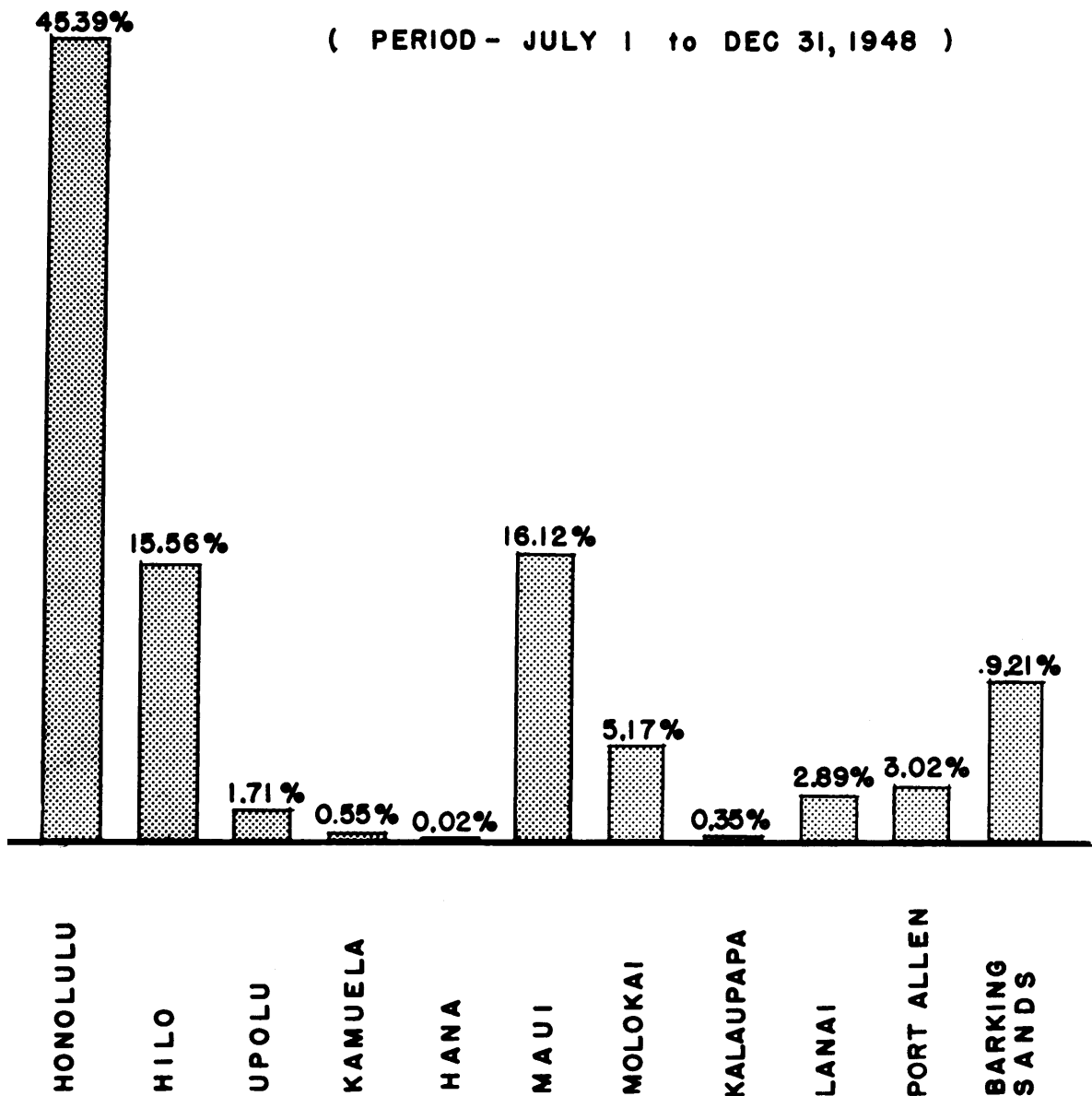
Inter-island revenue passenger air traffic by scheduled airlines during 1947 numbered 314,608 as compared with 48,855 carried during 1941. The increase was 265,753 or, 543.96%. Passenger traffic by non-scheduled airlines during 1947 numbered 85,384. Operations within this category did not commence until the summer of 1946.

Hawaiian Airlines Operations
1938 and 1947

Year	No. of Flights	Air Miles	Passengers Carried	Freight & Express-lbs.
1938	3,858	550,347	28,611	119,746
1947	17,500	2,765,884	314,608	11,173,781
Increase of	13,642	2,215,537	285,997	11,054,035
% of increase	353.6%	402.6%	99.6%	9,231.2%

(HAC Annual Report 1947-48)

PER CENT PASSENGER TRAFFIC ORIGINATING
AND TERMINATING AT INDIVIDUAL AIRPORTS



HAC Statistical Data

FIG. 20

Air freight traffic within the Hawaiian Islands can be shown pictorially by Figure 21, "Percent Freight Originating at Individual Airports" and Figure 22, "Percent of Freight Terminating at Individual Airports". Freight traffic has been broken down into two sections, "originating" and "terminating", in order to show the relative importance of each airport in both categories, the reason for this being that the nature of freight transportation is an uneven flow between any two given points, whereas, the flow of passenger traffic in either direction is almost the same, as is to be expected; Honolulu ranks first in both categories, however, the percent of originating traffic at Honolulu is much lower than the percent of terminating traffic.

Air cargo carried between the Islands increased considerably after the war to a total of more than 22 million pounds in 1948 as compared to approximately 206,000 pounds in 1941. (See Figure 23, "Pounds of Air Cargo Carried Within Hawaiian Islands".)

Statistics with reference to the amount of United States Air Mail carried between the Islands are unavailable for this analysis.

PER CENT FREIGHT ORIGINATING
AT INDIVIDUAL AIRPORTS

(PERIOD - JULY 1 to DEC 31, 1948)

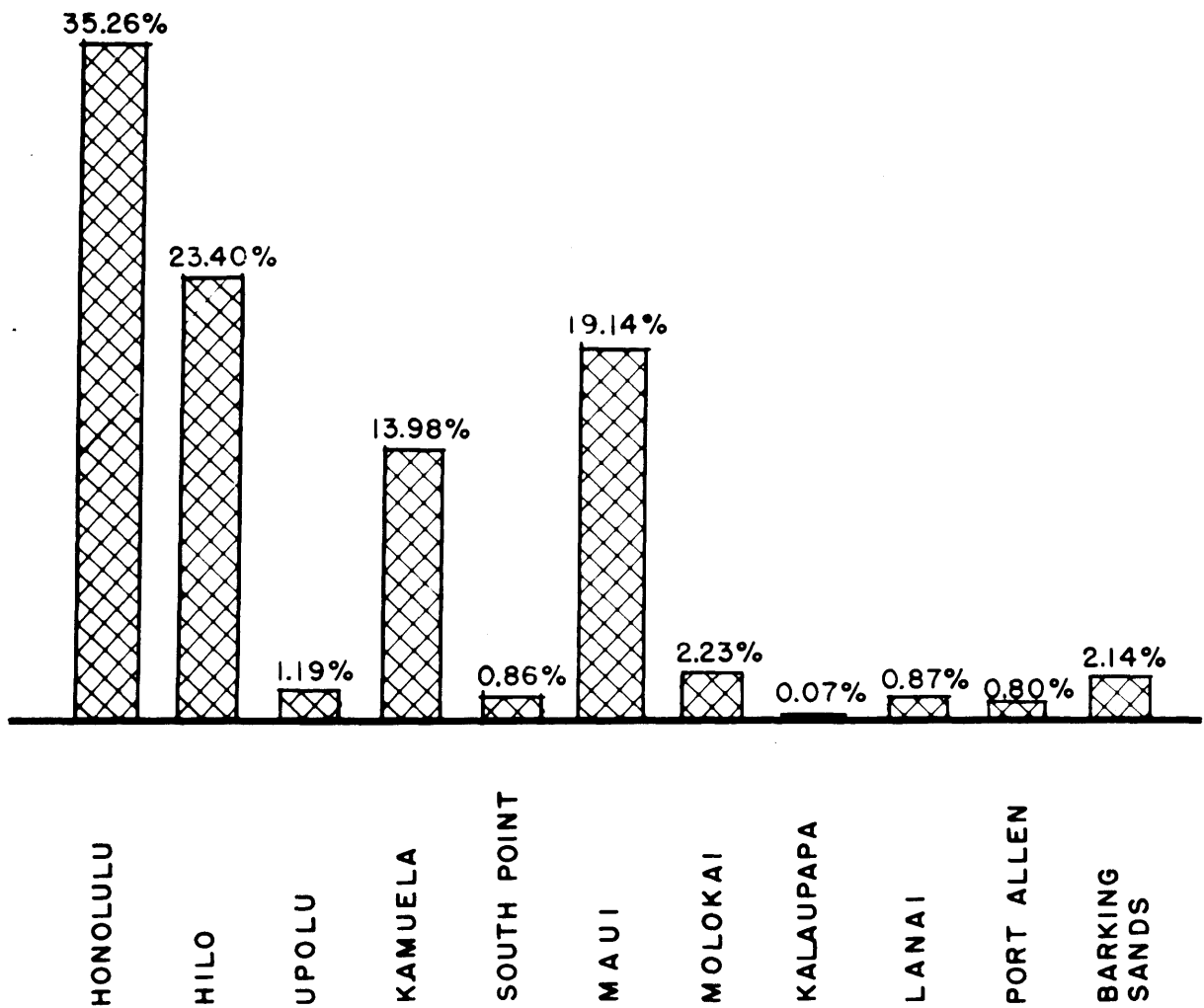


FIG. 21

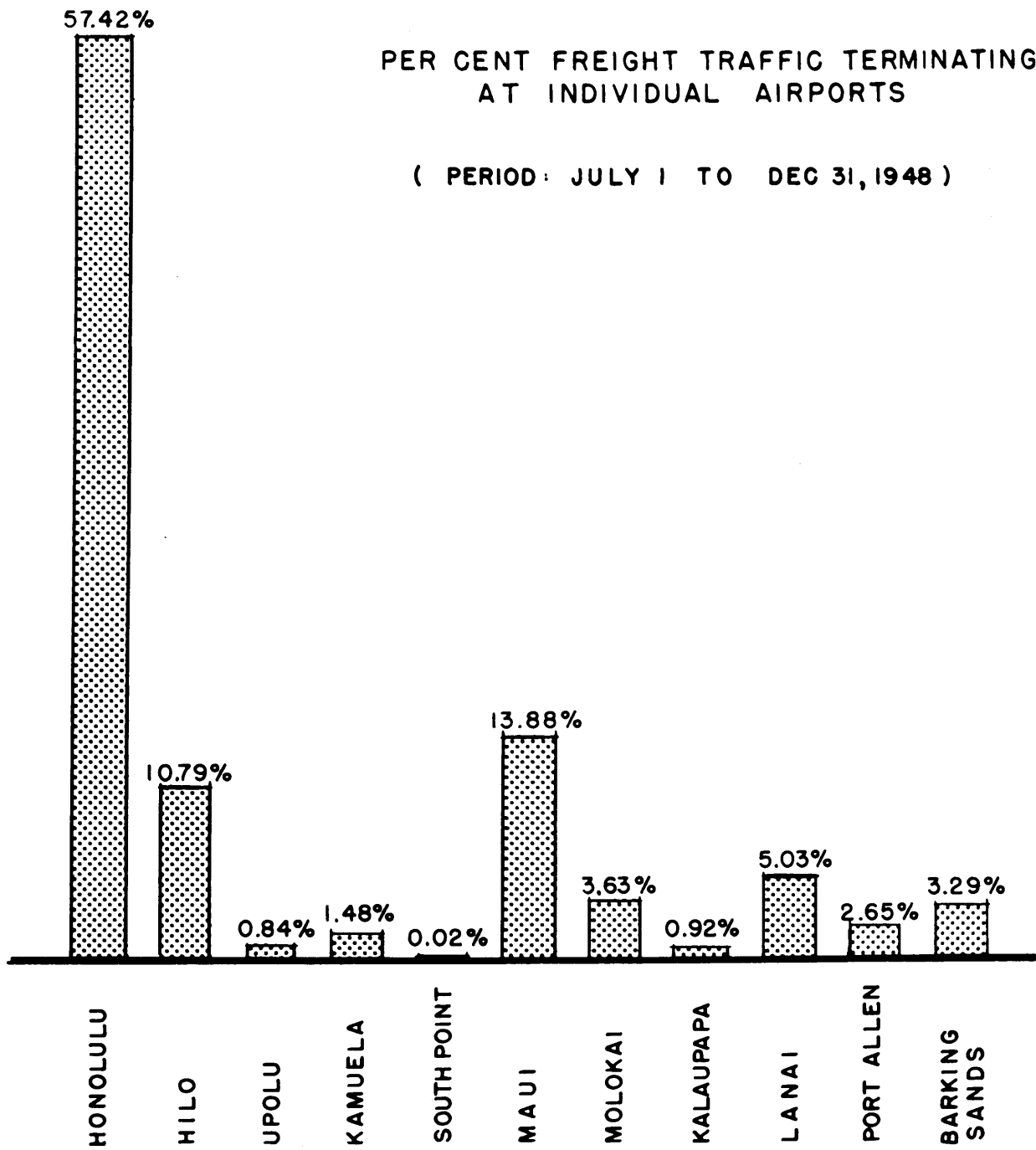


FIG. 22

**POUNDS OF AIR CARGO CARRIED
WITHIN HAWAIIAN ISLANDS**

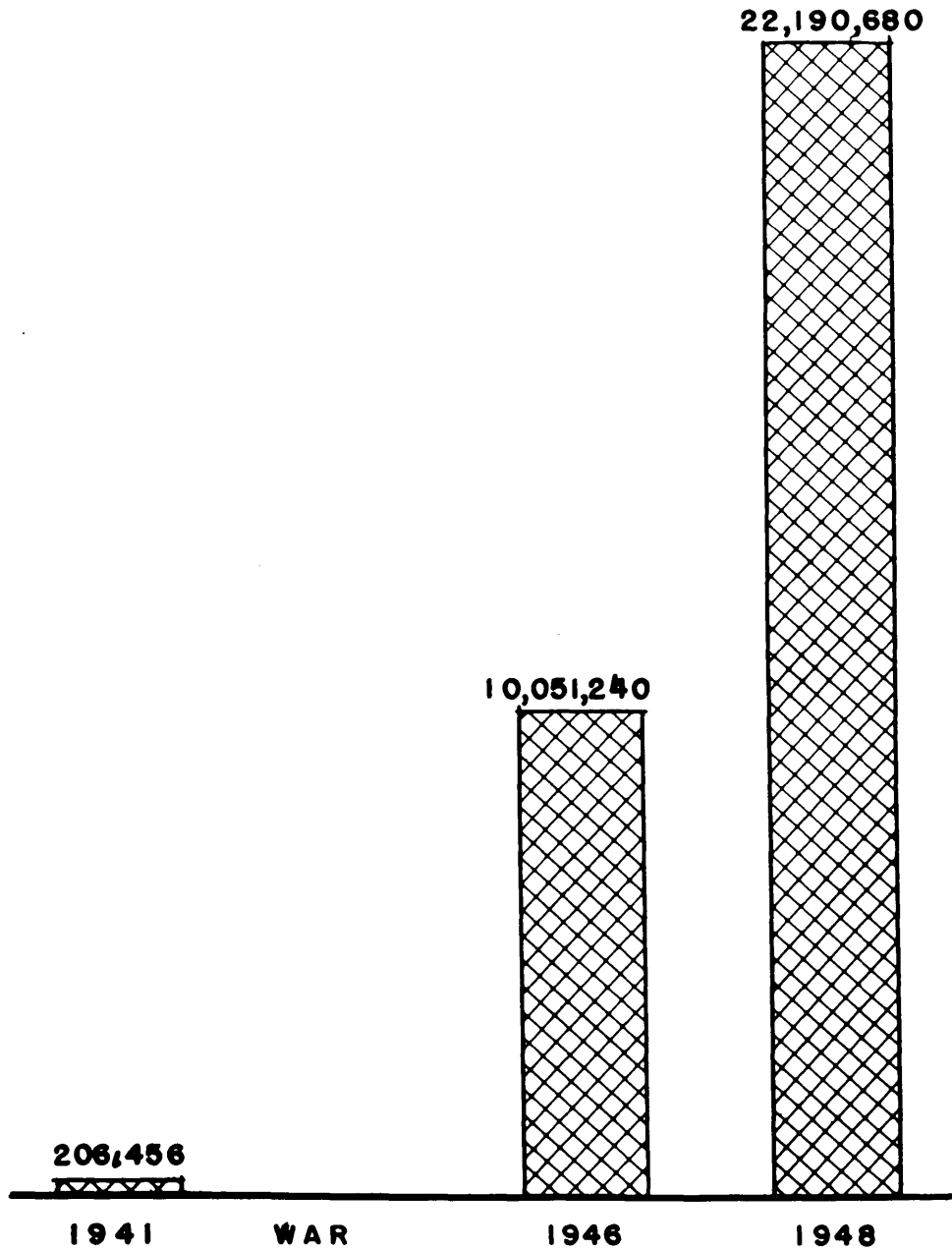


FIG. 23

D. DESIGN OF THE TERMINAL BUILDING.

I. Requirements For The Terminal Building.

II. Basic Considerations.

III. Analysis of The Final Solution.

a. Selection of The Terminal Area.

b. Approaches to The Terminal Area.

c. The Terminal Building.

d. Freight Terminal Area.

e. Structural Considerations.

D. DESIGN OF THE TERMINAL BUILDING.

I. REQUIREMENTS FOR THE TERMINAL BUILDING.

Requests have been made of the Hawaii Aeronautics Commission for the specific requirements for a proposed terminal building for the Honolulu Airport, but this information was not available for the preparation of this thesis. The lack of such information required that assumptions be made based on various airports of similar type, such as, Logan International Airport (Boston), Idlewild Airport, LaGuardia Field and Los Angeles Municipal Airport. Such assumptions were adapted to the most likely requirements of the Honolulu Airport.

The following are the various elements and their appurtenances necessary for efficient operation of the Honolulu Airport:

Terminal Operation and Management Group

1-Public Areas

- a) Waiting rooms and lobby area.
- b) Passengers' concourse.
- c) Spectators' Observation deck.
- d) Information booth.
- e) Public telephones.
- f) Postal telegraph and RCA Communications.

- g) Bar^{ber} shop and beauty salon.
- h) Newsstands and novelty shops.
- i) Florist and lei shops.
- j) Display and sales area for retail shops.
- k) Public toilets.
- l) Branch offices of Hawaii Tourist Bureau.
- m) Newsreel theater.
- n) Restaurant for approximately 200 people-
(preference to second story location
with view of the field.)
- o) Snack bar, separated from or adjoining
restaurant but operating from same
kitchen. Capacity 25 to 30, standing
room permissible.
- p) Complete kitchen facilities to serve
both restaurant and snack bar.
- q) Liquor bar and cocktail lounge.

2. Airline Requirements.

- a) Ticket sales counters and baggage
check-in for each airline.
- b) Eight scheduled trans-Pacific airline
operations.
- c) Two scheduled inter-island airline
operations.

- d) Two non-scheduled trans-Pacific airline operations.
 - e) Six non-scheduled inter-island airline operations.
 - f) Office space for each airline.
 - g) Lounges and rest rooms for airline employees including pilots and hostesses.
 - h) Flight kitchen for preparation of in-flight-meals, (may be operated in conjunction with restaurant kitchen.)
3. Airport Superintendent's Office.
- a) Office space for Airport Superintendent and staff.
 - b) First Aid ambulance and crash trucks.

Aeronautical Control and Management Functions.

- 1. Regional offices of Civil Aeronautics Administration (approximately 3000 sq. ft.), including offices for Regional Director and assistants, operating clerical staff, conference rooms, pilot's check-in, etc.
- 2. Hawaii Aeronautics Commission offices (approximately 3000 sq. ft.), including similar offices as required by Civil Aeronautics Administration.

3. U. S. Weather Bureau offices (approximately 2000 sq. ft.), weather operations rooms, plotting and forecasting, supply storage. (Preferably accessible to roof of building.)
4. Airways Communications System, work rooms for radio and teletype operations, repair rooms for electronics equipment. (Preferably directly related to Weather Bureau and CAA.)
5. Standard CAA Control Tower.

Government Agencies (Non-Aeronautical).

1. Immigration and Customs Inspection, including detention and interview rooms.
2. U. S. Public Health Service.
3. U. S. Department of Agriculture, plants, seeds and fruit inspection.

Site Facilities Other Than Building.

1. Separate parking for employees' cars.
2. Public parking for peak load of 1,000 cars.
3. Provisions on ground level for 200 spectators.
4. Area for taxicabs and airline buses.

United States Mail and Air Express.

1. Air Express workroom for receiving, processing, loading and trans-shipment of

express cargo.

2. U. S. Mail workroom for receiving, processing, loading and trans-shipment of air mail.

Freight and Cargo (not included in design of terminal building.)

1. Workroom for processing, inspection and trans-shipment of freight and cargo.
2. Warehouses and cold storage for storage of perishables and non-perishables.

D-II. BASIC CONSIDERATIONS.

Heretofore airport administration buildings have been erected with little regard for the function of changing conditions. Administrative and terminal functions have been combined within one structure together with any number of related and unrelated minor activities. Too many of these functions, subject to expansion, were crowded into symmetrical structures built too permanently. Many of these buildings were either low-cost structures which rapidly deteriorated into useless slums or expensive monumental show places that soon became obsolete with the changing demands of air travel.

Quite often too little space and too few facilities were given to the airline passenger requirements and airline operational functions in contrast to the public areas. In addition, little thought was given to developing service and revenue-producing facilities of high standard for passengers, public and employees. As a result, the airlines usually bore the burden of high expense of upkeep.

Quite often the terminal building has been poorly placed in relation to the apron and apron expansion, runways and proposed runways, access roads

or drives, parking areas, and other fixed constructions such as hangars and maintenance shops.

In the preliminary stages of airport terminal design one of the basic considerations is the balance in the various types of traffic flow to and from the terminal area. These various traffic flow; 1) plane, 2) passengers, 3) cargo, 4) general public, and, 5) automotive, are governed by the 1) air traffic circle capacity; 2) runway configuration capacity, 3) taxiway pattern capacity, 4) apron or gate capacity, 5) terminal building capacity, 6) parking area capacity, 7) capacity of access drives and roads, and 8) capacity of highway between the airport and city for volume or high speed traffic.

In terminal design, the building, the apron, the parking areas, and the access drives are of primary concern while other considerations such as runway configurations, taxiways, air traffic circle and highways fall into the realm of airport design or city planning. Nevertheless, a balance of all factors is absolutely necessary to provide for a uniform traffic flow of all elements and efficiency of operation.

Centralization versus Decentralization.

The monumental centralized air terminal has as its prototype the railroad station with its central type plan and its vast and impressive lobby or concourse area where passengers, general public and employees intermingle, which causes a great degree of congestion and often confusion. Advocates of the centralized solution for air terminal design draw an analogy between railroad operation and airline operation.

It is difficult to draw a parallel between air and rail travel since these two types of travel differ greatly both physically and operationally. The railroads operate with standard units, standard lengths of coach and pullman cars, standard floor levels and uniform car heights. The equipment of airlines on the other hand, vary widely in length, height, wing span, etc. Unlike the railroads, gate positions and appurtenances must be designed to accommodate the largest reasonable anticipated aircraft.

The physical differences between rail and air travel can be easily seen where in one gate position for a 50-passenger plane 150 lineal feet of gate

space or 150 feet diameter circle of apron area on which to maneuver into and out of loading position is required; in the same area the railroads can provide platform space for eight tracks and sixteen rail cars with capacity for 900 passengers. The amount of apron space required by one person in air travel (based on a 50-passenger aircraft) is roughly eight times track and platform space required for one person in rail travel. The amount of plane gate space required per person in air travel is eighteen times that for rail travel.

It becomes evident that an air terminal based on a centralized solution would force the passenger to walk several thousand feet to the plane and would necessitate "calling" a flight several minutes earlier.

Another aspect in which rail and plane travel differ is in the handling of baggage. The railroad passenger carries his own baggage or checks his heavier luggage through to his destination. This procedure is unlikely in plane travel since weight control is an important factor and the passenger's baggage must be weighed and processed individually.

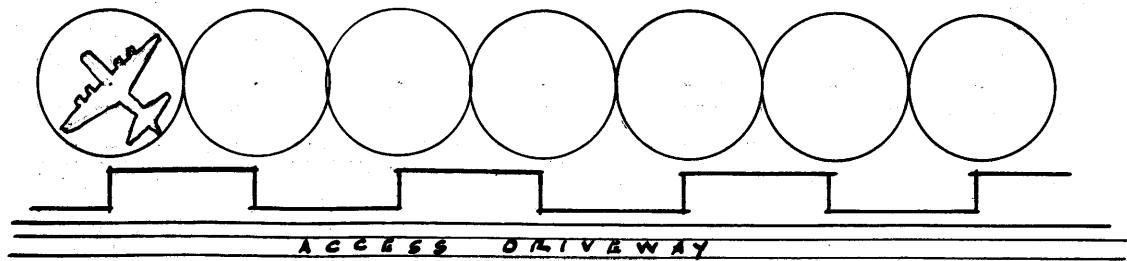
Airports, in contrast to railroads, are invariably situated some distance from the heart of a

city. The air traveler more often arrives at the airport by private car, taxi, airline limousine or bus, and is often pre-ticketed.

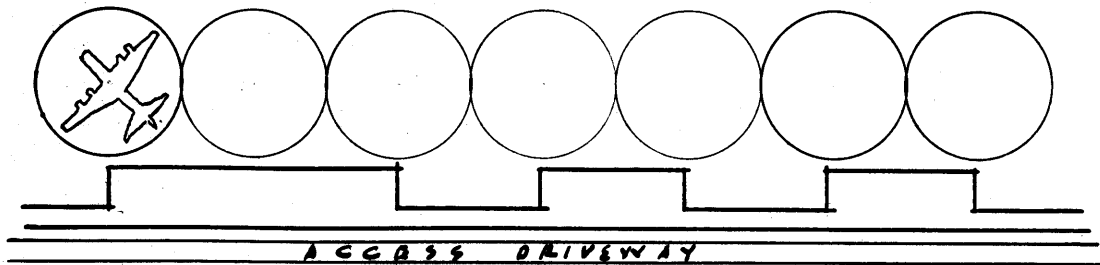
It is therefore impossible to plan an air terminal on railroad standards for the centralized mass handling of passengers.

Both United Airlines and Northwest Airlines have spent considerable time in individual research to determine the most efficient terminal design consistent with the demands of air travel. Both airlines arrived at the same conclusion that a decentralized plan would provide the best possible solution to meet airline needs. The basic premise of the decentralized scheme is the localization of the individual airline functions adjacent to the apron or gate positions, with a driveway on the off-field side so as to simplify and expedite the transition of passengers from automobile to aircraft. The second premise is the concentration of revenue producing concessions, public service areas, airport administration, government and private offices in an "airport community center".

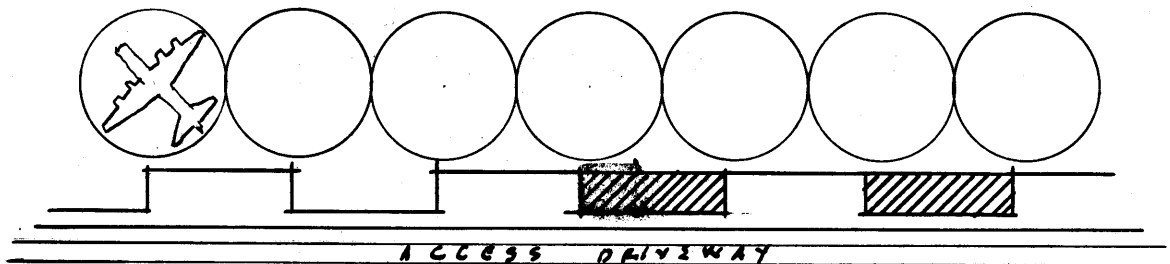
The Northwest Airlines proposed a discontinuous "unit" or "dock" solution while the United Airlines proposed a continuous "unit" solution.



TYPICAL DOCK PLAN



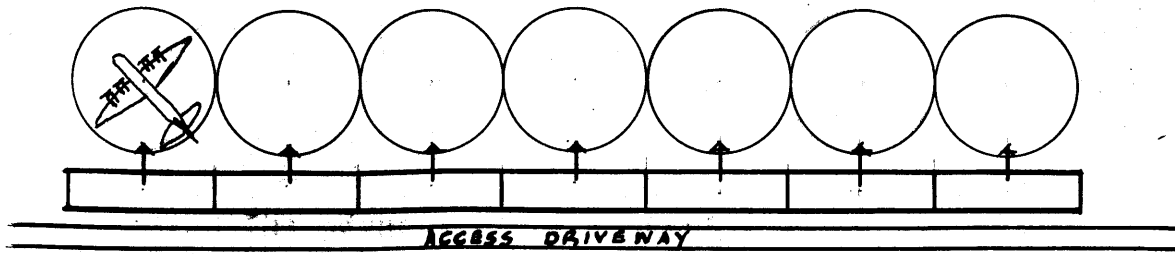
VARIATION OF DOCK PLAN



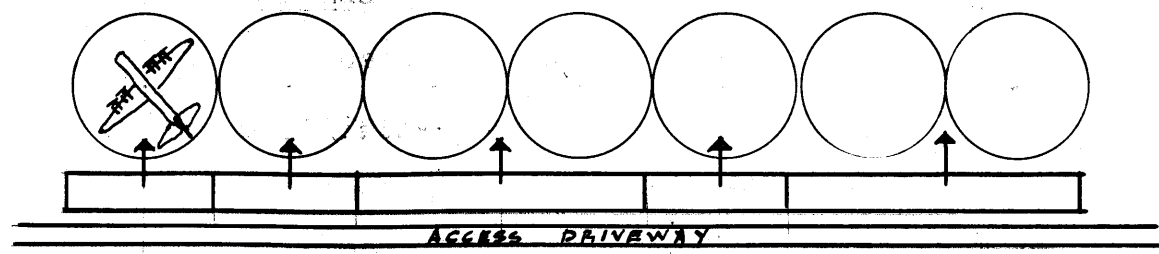
EXPANSION OF DOCK PLAN

NORTHWEST AIRLINE'S DISCONTINUOUS DOCK SCHEME

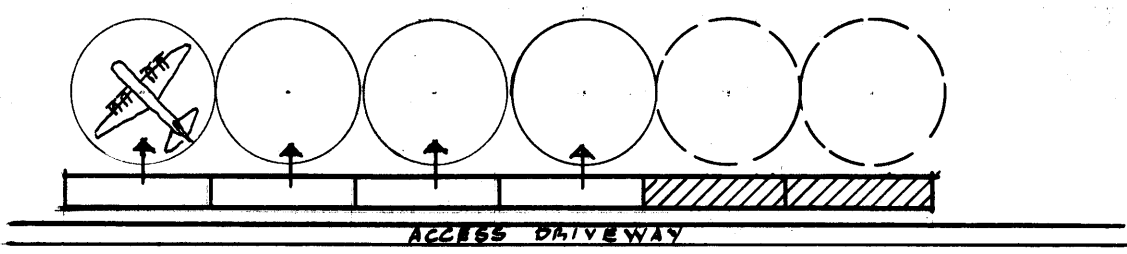
The Northwest Airlines scheme allows for individual docks to be expanded at full length of the gate positions or additional docks and gate positions can be added at either ends of the apron. Such a scheme would allow small original investment and space for expansion when economic justification permits.



TYPICAL UNIT PLAN



VARIATION OF UNIT PLAN



EXPANSION OF UNIT PLAN

UNITED AIRLINE'S CONTINUOUS UNIT SCHEME

The United Airlines scheme is based on housing additional functions at the apron which may present internal expansion difficulties where several airlines are concerned. "Cushion" functions which can be removed to provide for expansion must be located in units between airlines.

The advantages of a decentralized scheme are numerous. They are:

Expandability--horizontal and vertical expansion are possible.

Segregation--each airline has control of its own operation and can render personalized service. Passengers are separated from general public and cargo operations.

Economy--can be developed in stages to parallel the economic demands and justification of facilities.

Passenger Convenience--passengers no longer are forced through central building (with general public) where delays occur and congestion abounds.

Possible disadvantages:

Passengers not fully "exposed" to revenue-producing concessions.

D-III. ANALYSIS OF THE FINAL SOLUTION.

Selection of The Terminal Area.

From map and aerial photo studies of the Honolulu Airport as it exists today, it is noted that the runway pattern has permitted large aprons and plane parking facilities on both south and north sides of the field. The south side of the field where the terminal building is located at the present time was developed extensively by the Navy during the war to meet with its various requirements. At first thought one would suppose that the selection of this area for a proposed development of a new terminal area for the airport would be most suitable because, 1) the terminal building can be so located and designed to serve both land plane and sea plane operations; 2) the apron area parallel to the present dual runways would provide sufficient capacity for any anticipated future peak operations and its location with relation to the runways would allow minimum taxiing distances for land planes; 3) administrative facilities would be fairly centrally located with good view and thereby good control of all the runways.

Although the Honolulu Airport now boasts one set of the finest sea plane runways, these runways

and related facilities are not being used by any commercial airlines but instead have been used exclusively by the United States Navy. Commercial carriers have depended upon land-based planes for overseas flight and no airline, trans-Pacific or inter-island, operate with sea planes or amphibians. Pan American Airways has converted to DC-6 and Boeing Stratocruisers in favor of the older "Clipper" flying boats and Hawaiian Airlines has long ago changed to DC-3 and other smaller land planes replacing their Sikorsky amphibians. There is little possibility that flying boats and amphibians may gain superiority over land planes since the latter have been found more dependable.

The potential capacity of the apron along the south side of the field may be sufficiently great to handle any number of planes for anticipated peak operations but the apron is presently lined with structures of various functions, some temporary, others of permanent construction such as the large maintenance hangars. These permanent hangars would limit future expansion of a terminal building in this area, such expansion possible only along a lineal direction due to the configuration of the apron.

Further, this area is not readily accessible from the main highway and requires passengers and the public to travel almost half-way around the airfield in order to arrive at the terminal area.

The north side of the field offers the best possible area for the development of the terminal area for the airport. This area is easily accessible from the major traffic artery running east-west and connecting Honolulu with the Pearl Harbor area. The Kamehameha Highway (Dillingham Boulevard) is a six-lane highway, three lanes in each direction separated by a 20-foot medial strip and which is capable of handling a large volume of high speed traffic. Paralleling the Dillingham Boulevard along the south is the Admiral Nimitz Highway, a three-lane boulevard for slower moving traffic along the residential area of S. M. Damon Tract and housing areas near Hickam Field. The north side of the field can now be easily reached by an existing road which circuits the south boundary of the Damon Tract residential area and which also serves as a segment of the perimeter road that circles the airfield. In the event the terminal area is developed along the north side of the field this approach road can be made wider and/or

re-routed in order that more uniform flow of vehicular traffic and proper balance between highway and approach-roads may be obtained.

Most of the existing buildings along the north side of the field are of temporary construction with the exception of a few hangars of the Hawaiian Airlines. The barracks area of the U. S. Navy Air Facility have since been returned to the control and management of the Hawaii Aeronautics Commission. Buildings in this area are all of temporary construction built as a war time expedience. Further, there is a possibility that the vast U. S. Navy warehouse and storage area, north of the Navy Air Facility, developed to meet temporary wartime needs, may be obtained by the airport authorities for future expansion and development for a freight and cargo terminal, repair and maintenance, aeronautical schools and for other functions.

The north side of the field, therefore, presents the best potential site for an extensive terminal development. It is possible in this area to provide a plane parking apron of considerable length and more than adequate depth. Widening and re-routing the approach road can provide the necessary uniformity of vehicular flow to and from the airport.

Approaches to The Terminal Area.

It is felt that the present entrance to the field area which branches off from the main arterial highway at the east end of Damon Tract would be the logical beginning of the approach road. This road would lead vehicular traffic toward the center of the proposed terminal area following essentially the same direction of the existing road with the exception of the elimination of two curves and widening to allow for a 100-foot right-of-way. Instead of continuing to the prominent junction to the west of the former U. S. Navy Facility area, it was found that it was better to re-route the road along the western boundary of Damon Tract. This was done principally to prevent dividing the former U. S. Navy Facility area from the warehouse and storage area. Such a road scheme would allow a large undivided area for future development related to the airport functions, and will permit free and easy flow of vehicular traffic to the airport from both east and west. Locating the freight and cargo terminal area in the present Navy warehouse and storage area will allow any heavy trucking to enter this area directly from Nimitz Highway, thus relieving the approach road of unnecessary congestion and

bottlenecks.

The Terminal Building.

The major functions of an air terminal building are, 1) efficient processing of passengers and baggage from their point of arrival at the terminal through to their embarkation for flight; 2) control and management of all aeronautical activities and related activities that may take place on the field and in the immediate vicinity; and 3) providing revenue-producing concessions or retail shops of high standard for the convenience of passengers and public.

In the solution for the Honolulu Airport, the three major functions were segregated, each possible of independent operation but yet all loosely connected to allow free communication among all functions.

The "dock" scheme proposed by Francis Meisch, architect for Northwest Airlines, was felt to be the best solution for efficient handling of passengers. The access road along the off-field side of the airline docks will permit passengers to arrive directly at the specific airline on which he is to travel. Vehicle parking areas near all airline operations will permit minimum walking for those who arrive in private conveyances. Flights operating to and from the Honolulu

Airport can be classified into two categories: 1) inter-island flights that remain within the territorial limits of the islands and, 2) trans-Pacific flights that follow the airways system across the Pacific connecting the west coast of the United States with Asia and Australia. The internal organization and operation of each passenger airline are essentially similar and the dock facilities, therefore, can be standardized to a certain degree. Each airline, however, enjoys the freedom of fulfilling its basic functions in its own peculiar way. Each airline dock was designed to allow for a maximum degree of flexibility within the areas allotted to each airline, the final layout of the interior space to be determined by the airline concerned.

A complete segregation of inter-island and trans-Pacific airlines was made because each operate on a completely separate airways system and functions such as immigration, customs, public health, etc., are necessary for the trans-Pacific airlines but not needed for inter-island passengers.

The control and management agencies have been grouped into an administration building separated from other functions not directly related to them. The

Federal Government agencies include:

- 1) The regional offices of the Civil Aeronautics administration--serves as a headquarters for all aeronautical activities in the Pacific Ocean region.
- 2) The U. S. Weather Bureau which operates as as the center for all weather information in the Pacific Ocean Area.

Territorial agencies include:

- 1) The Hawaii Aeronautics Commission whose function is the control and management of all aeronautical activities within the Territory of Hawaii.
- 2) Airport superintendent who is directly in charge of the operation of the Honolulu Airport and its facilities.

These administrative functions are directly related to the aeronautical aspects of the field and their complete separation from public areas and passenger concourse seem logical and justifiable.

The United States Mail and Air Express work rooms are housed in a wing of the administration group principally so that these functions may be centrally located on the apron area and so as to permit a

vehicular approach through a large service court which also serves the delivery entrance of the kitchen. A limited amount of light trucking will be permitted in this area.

The public area is centrally located and is connected to the trans-Pacific airlines docks and the inter-island airlines docks by covered concourses. In this area is housed most of the revenue-producing concessions such as, restaurant and snack bar, shops, postal telegraph and RCA Communications, Hawaii Tourist Bureau, and a movie theater. Small airline ticket booths are provided for those passengers who may expect to purchase their tickets upon arrival at the airport.

Freight Terminal Area.

Although not included in the final solution of the terminal building, an area north of the inter-island plane docks has been proposed for a freight terminal. It is felt that a centralized freight terminal would more efficiently handle the functions of loading, unloading, storage, and trans-shipment of freight and cargo. Heavy trucking to and from this area can be routed directly from the Nimitz Highway thus keeping the main approach road clear for passenger

vehicles and light delivery trucking.

Structural Considerations.

The keynotes of this solution are: 1) expandibility to meet possible future needs, 2) flexibility to allow for changing requirements of airlines and, 3) economy of construction consistent with good design.

In order to satisfy all three demands, the framing system for the terminal building was laid out for uniformity of structural bays based on a four-foot module. Steel frame construction was selected to support floors of light poured cinder or gypsum concrete and roofs of light roofing planks such as "Kaylo" roof panels. The mild and uniform climate of Hawaii would not require heavy masonry construction since roof loads are low. Insulation against the weather, heating and ventilation do not present problems for buildings in Hawaii and all exterior walls and interior partitions can be constructed of light panel members such as "Cemesto" wall panels or light cinder blocks. The structural frame can be supported by light steel lally columns, permitting floor areas to be free of any permanent bearing walls. This will allow for maximum flexibility within the structure.

Since damaging storms of any kind are almost non-existent in Hawaii, it would be possible to design concourses, loggias, and public areas rather openly to take advantage of the cooling tradewinds from the east and northeast. Artificial ventilating or air-conditioning is not necessary.

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AIR TERMINAL BUILDING

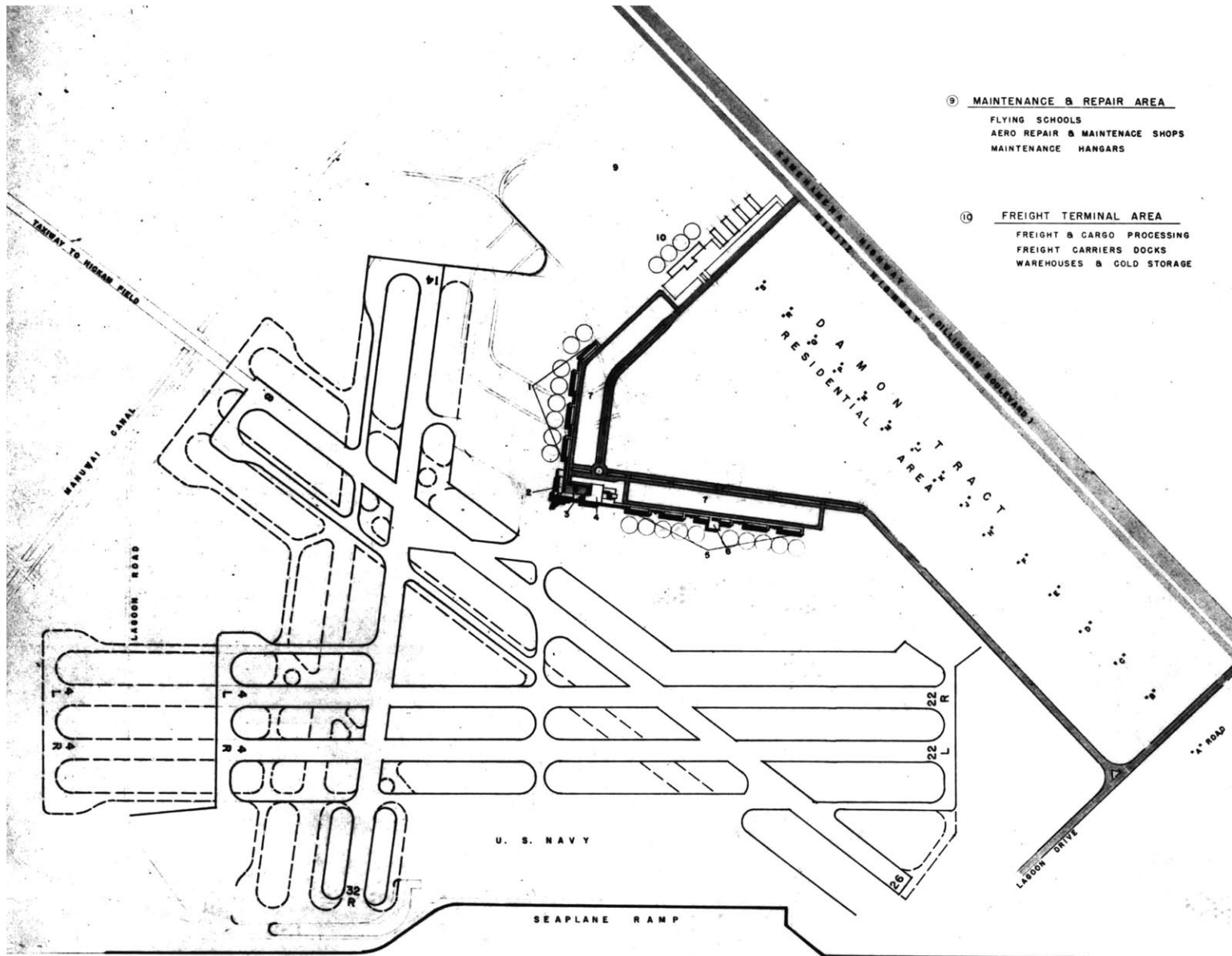
FOR



HONOLULU AIRPORT

EXISTING AIRPORT FACILITIES

- ① UNITED AIRLINE FLIGHT KITCHEN
- ② U.S. CUSTOMS, IMMIGRATION, & PUBLIC HEALTH
- ③ OVERSEAS TERMINAL BUILDING
AIRLINE OFFICES
HAWAIIAN AERONAUTICS COMMISSION OFFICE
CAA COMMUNICATIONS
U.S. WEATHER BUREAU
CAA CONTROL TOWER
- ④ PAA FLIGHT KITCHEN
- ⑤ PAA MAINTENANCE BUILDING
- ⑥ HAWAII AIR NATIONAL GUARD HANGAR
- ⑦ TRANS-PACIFIC AIRLINES MAINTENANCE HANGAR
- ⑧ U.S. NAVY WAREHOUSES
- ⑨ TRANS-AIR HAWAII HANGAR
- ⑩ HAWAIIAN AIRLINES PASSENGER TERMINAL
- ⑪ HAWAIIAN AIRLINES FREIGHT TERMINAL
- ⑫ K-T FLYING SERVICE
- ⑬ HAWAIIAN SCHOOL OF AERONAUTICS
- ⑭ TRANS-PACIFIC AIRLINES OPERATIONS
- ⑮ TRANS-PACIFIC AIRLINES HANGAR
- ⑯ HAWAIIAN AIR TRANSPORT SERVICE
- ⑰ ANDREW FLYING SCHOOL
- ⑱ H A C AREA
HOTEL, APARTMENTS,
WAREHOUSES, VOCATIONAL SCHOOL
- ⑲ U.S. NAVAL AIR FACILITY
- ⑳ H A C MAINTENANCE AREA

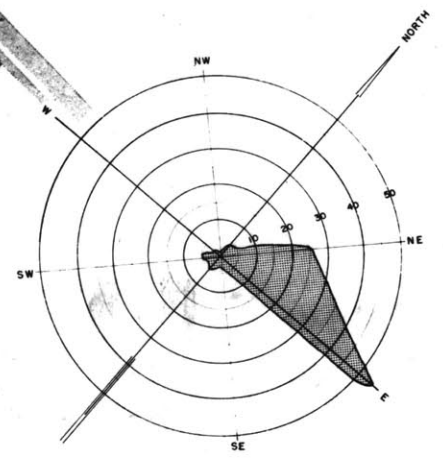


⑨ MAINTENANCE & REPAIR AREA
 FLYING SCHOOLS
 AERO REPAIR & MAINTENANCE SHOPS
 MAINTENANCE HANGARS

⑩ FREIGHT TERMINAL AREA
 FREIGHT & CARGO PROCESSING
 FREIGHT CARRIERS DOCKS
 WAREHOUSES & COLD STORAGE

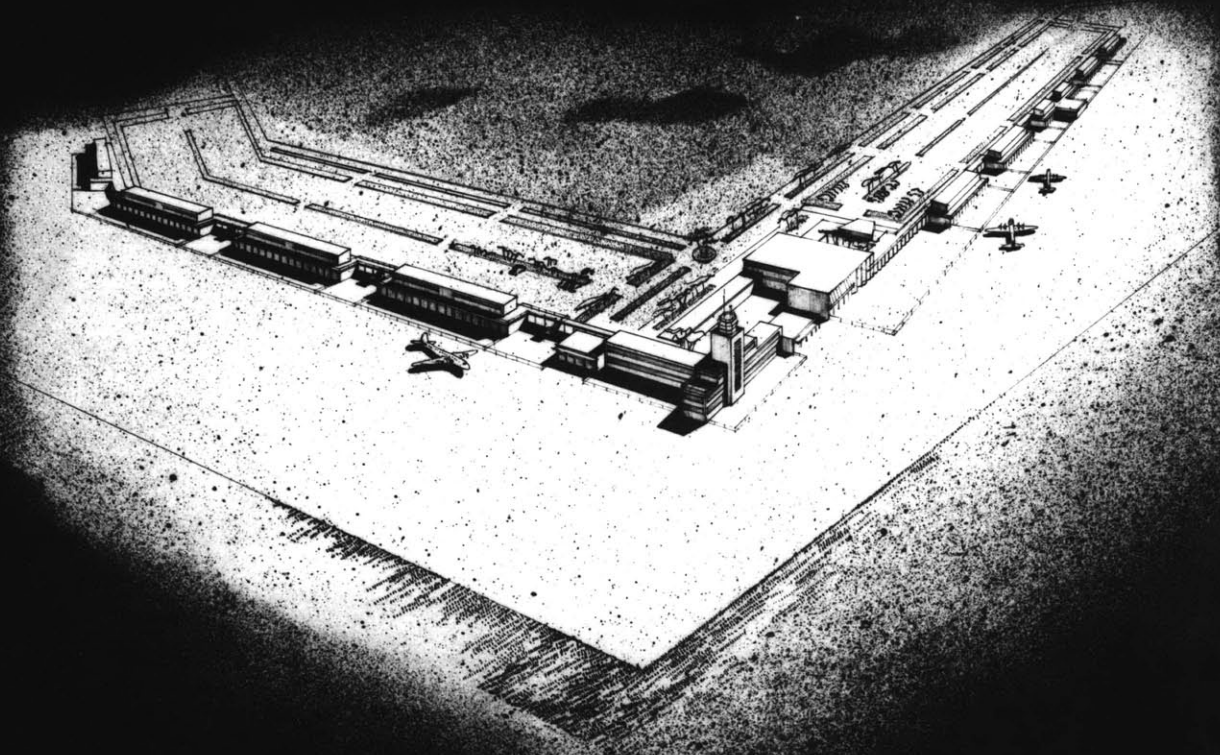
TERMINAL AREA

- ① INTER-ISLAND AIRLINE DOCKS
 SCHEDULED CARRIERS (2)
 NON-SCHEDULED CARRIERS (6)
- ② ADMINISTRATION BUILDING
 CIVIL AERONAUTICS ADMINISTRATION
 HAWAII AERONAUTICS COMMISSION
 U.S. WEATHER BUREAU
 WEATHER OPERATIONS
 AIRWAYS COMMUNICATIONS SYSTEM
 AIRPORT SUPERINTENDENT
 EMERGENCY CRASH TRUCKS & AMBULANCE
 CONTROL TOWER
- ③ U.S. MAIL & AIR EXPRESS
- ④ PUBLIC AREA
 INFORMATION
 AIRLINE TICKET BOOTHS
 CONCESSIONS
 RESTAURANT & SNACK BAR
 KITCHEN & FLIGHT KITCHEN
 THEATER
 OBSERVATION DECK
- ⑤ TRANS-PACIFIC AIRLINE DOCKS
 SCHEDULED CARRIERS (8)
 NON-SCHEDULED CARRIERS (2)
- ⑥ U. S. GOVERNMENT AGENCIES
 CUSTOMS
 IMMIGRATION
 PUBLIC HEALTH
 DEPARTMENT OF AGRICULTURE
- ⑦ PARKING AREAS
- ⑧ EMPLOYEES' PARKING

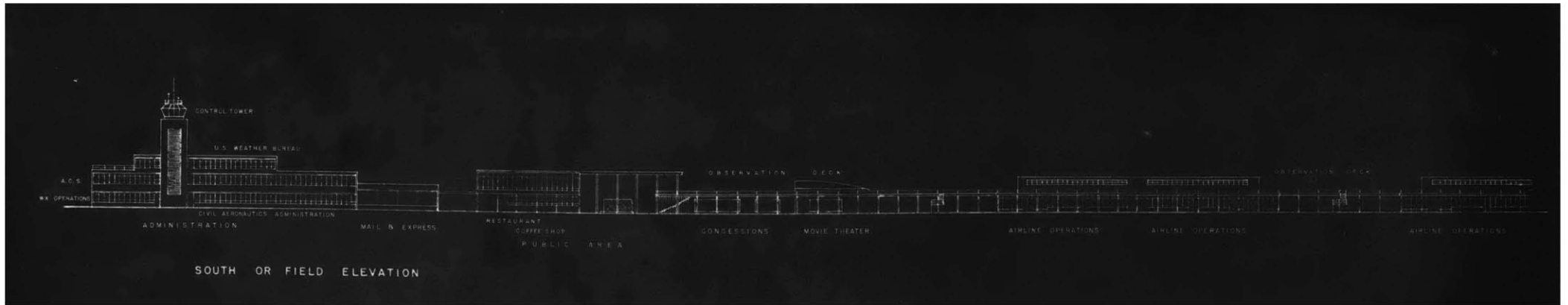


WIND ROSE - PER CENT OF TIME IN EACH DIRECTION
 PERIOD: 20 YEARS

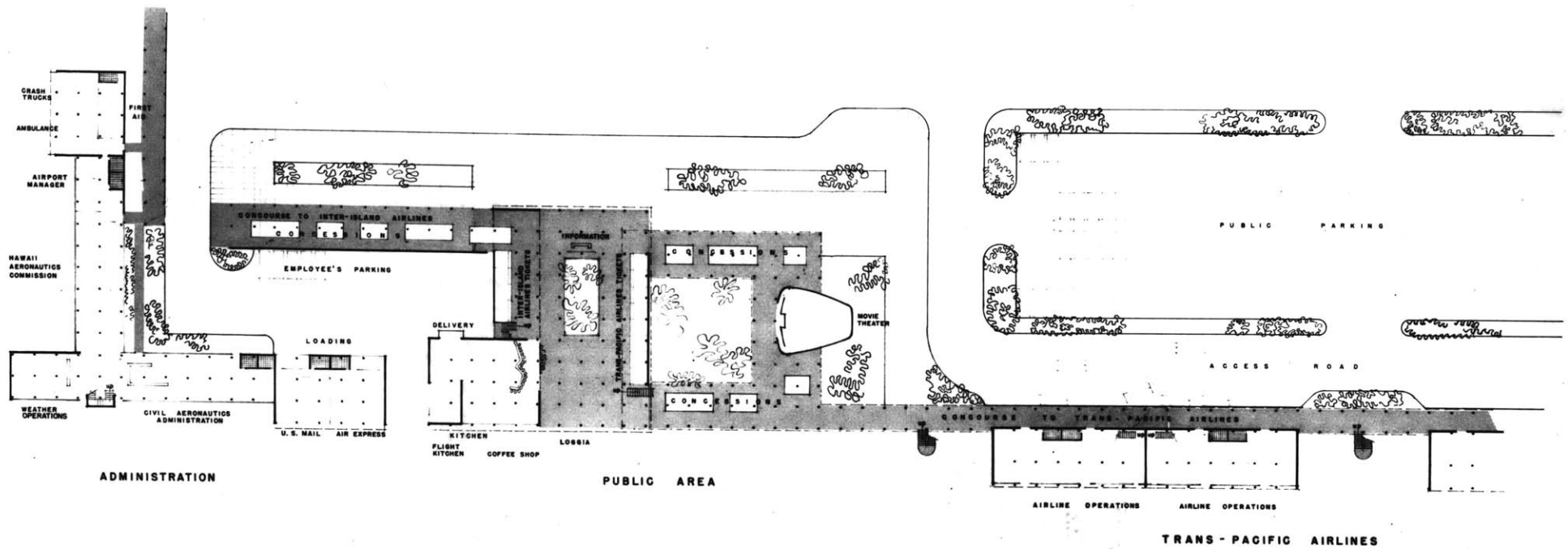
MASTER PLAN



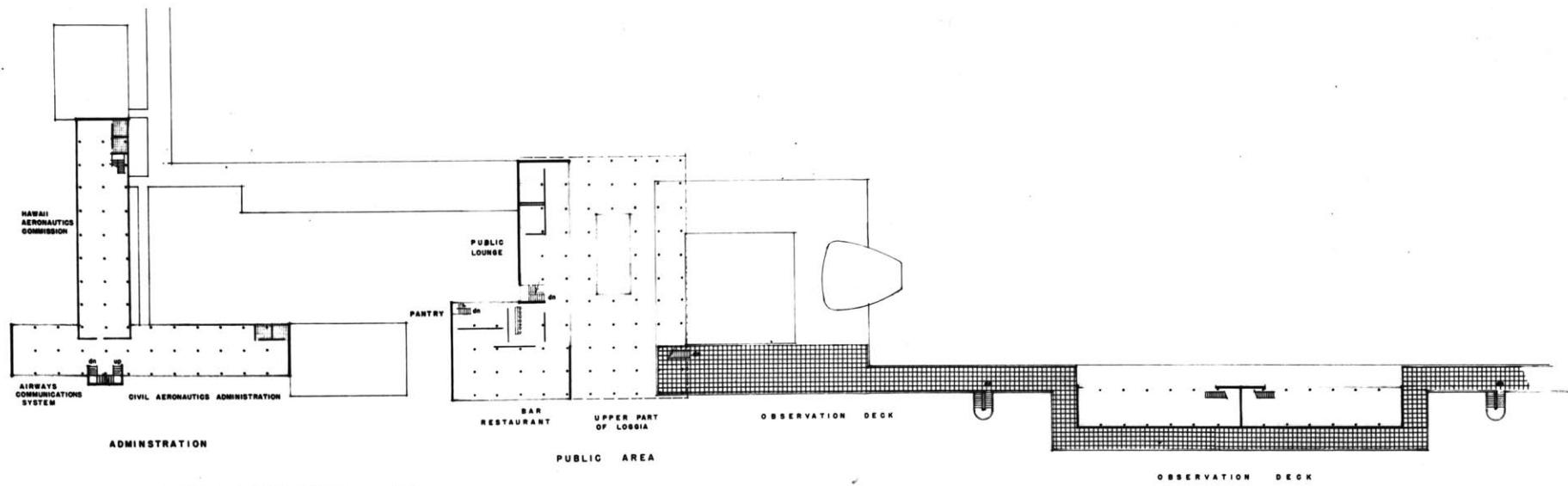
PERSPECTIVE



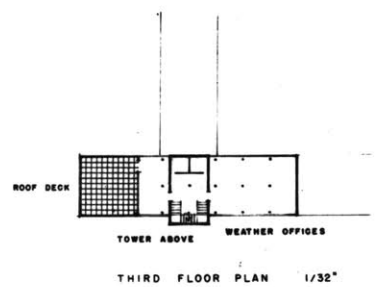
ELEVATION



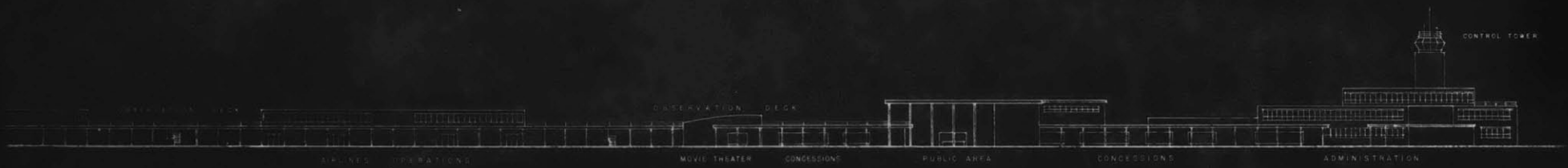
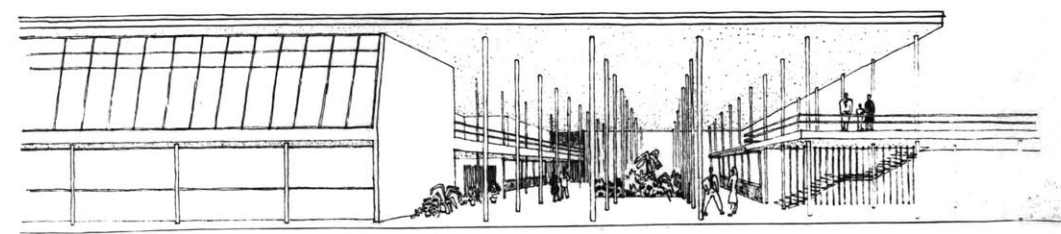
FLOOR PLANS



SECOND FLOOR PLANS 1/32"



THIRD FLOOR PLAN 1/32"

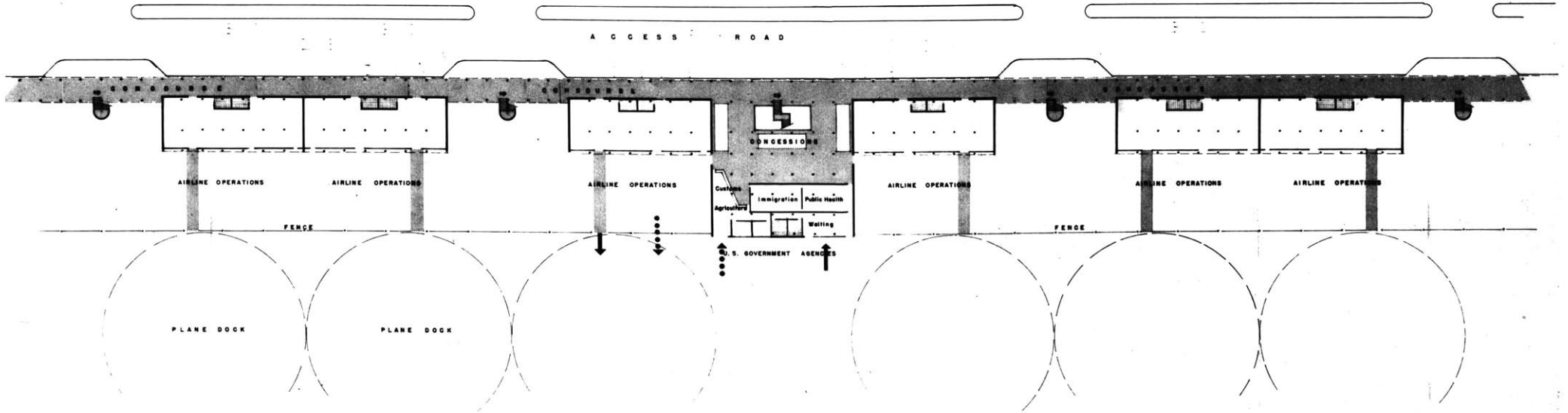


NORTH OR APPROACH ELEVATION

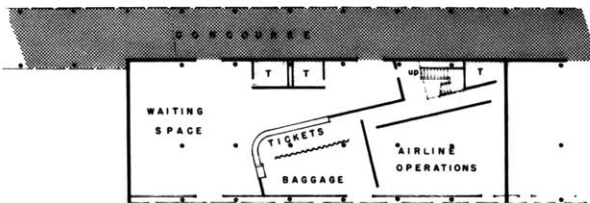
PLANS & ELEVATION



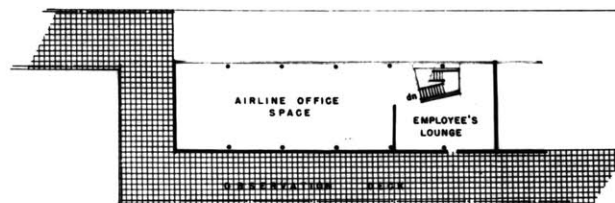
SOUTH OR FIELD ELEVATION OF TRANS-PACIFIC AIRLINES DOCKS 1/32"



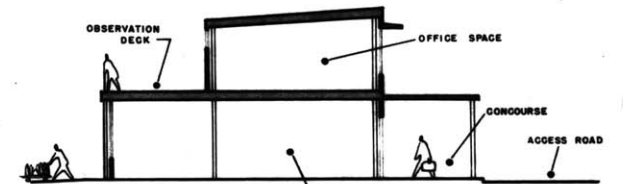
PLAN OF TRANS-PACIFIC AIRLINE DOCKS 1/32"



GROUND FLOOR



SECOND FLOOR

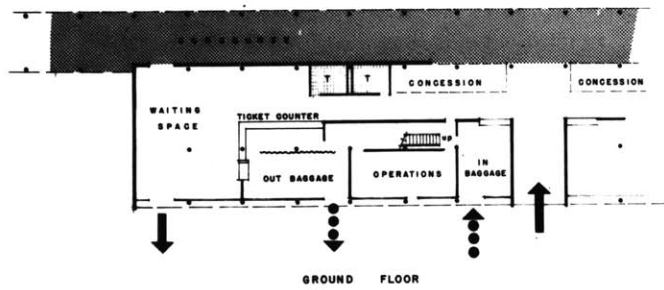


AIRLINE OPERATIONS

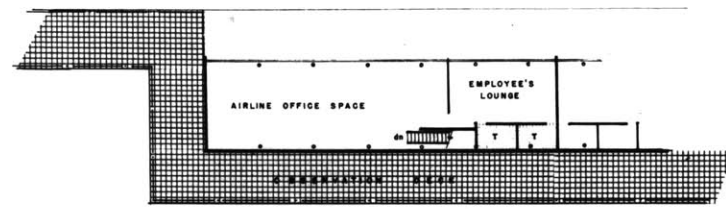
TYPICAL SECTION THROUGH AIRLINE DOCK 1/8"

SUGGESTED LAYOUT OF TYPICAL AIRLINE DOCK 1/16"

PLANS & ELEVATION

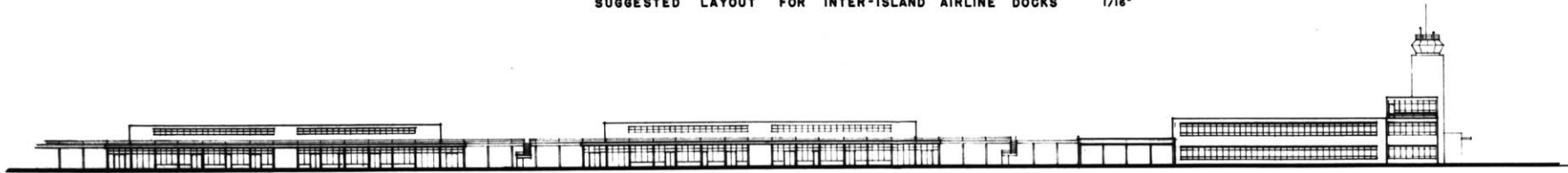


GROUND FLOOR

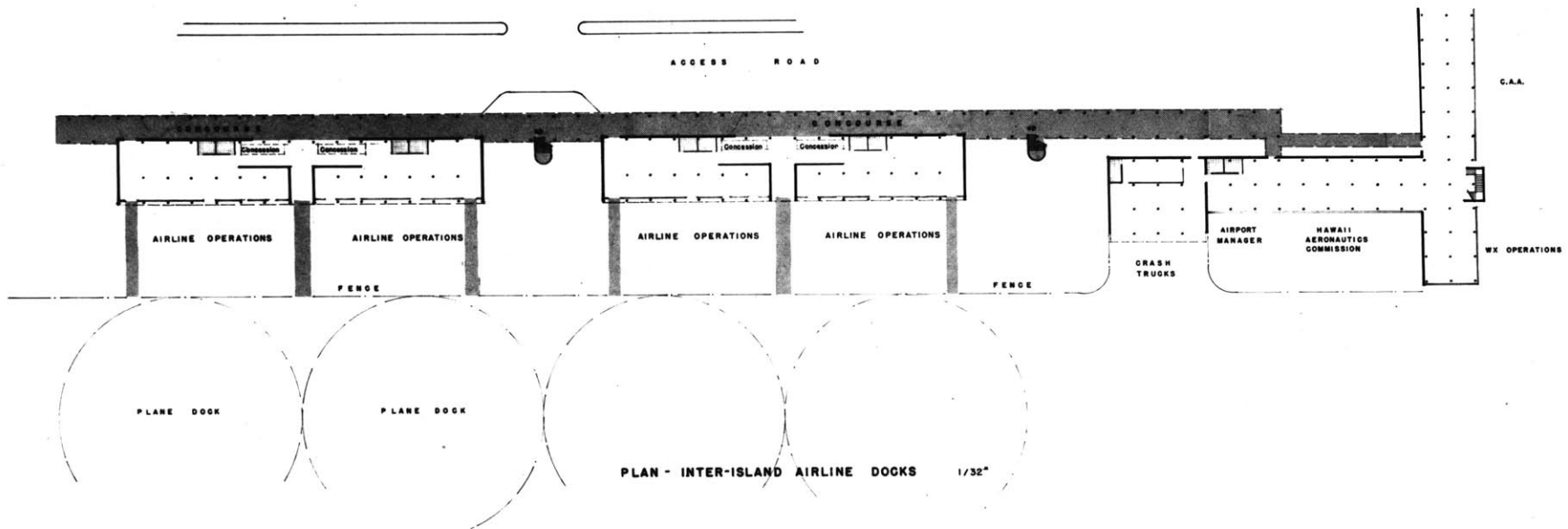


SECOND FLOOR

SUGGESTED LAYOUT FOR INTER-ISLAND AIRLINE DOCKS 1/16"



FIELD ELEVATION - INTER-ISLAND AIRLINE DOCKS 1/32"



PLAN - INTER-ISLAND AIRLINE DOCKS 1/32"

PLANS & ELEVATION

