WASHINGTON AIRPORT

The

FEDERAL ARCHITECT

April - June, 1941

THEY'RE THROWING BOUQUETS AT US

NOT AT ALL UNUSUAL are words of praise concerning the merits of Gulf products . . . and three of the nicest bouquets we've ever received came from Captain Eddie Rickenbacker, President of Eastern Air Lines, Mr. C. R. Smith, President of American Airlines, and Mr. C. Bedell Monro, President of Pennsylvania-Central Airlines.

Comments Captain Eddie Rickenbacker, "Gulf petroleum products were chosen and used during the past five years by The Great Silver Fleet of EAL because Gulf Airline Oil materially reduces cylinder wear and Gulf Aviation Gasolines enable us to maintain the fastest schedules in our history."

Remarks C. R. Smith, "The operation of air transportation requires gasoline of highest quality. We have used Gulf Aviation Gasoline for many years and it meets that requirement."

To which C. Bedell Monro adds, "Pennsylvania-Central Airlines has flown more than 17 million miles with Gulf. Our selection was based on performance and experience, and every plane in our fleet is powered and lubricated with Gulf products exclusively."

* * * * *

We believe the practical endorsements of Gulf products by these three prominent airline officials is a tribute to their high quality.

Next time your car requires gasoline or motor oil—stop at the Sign of the Orange Disc. We're confident that a trial filling of Gulf No-Nox Gasoline and Gulfpride Oil will convert you into a steady Gulf user.

GULF OIL CORPORATION GULF REG. US PAT. OFF. **GULF REFINING COMPANY**

MAKERS OF GULF NO-NOX GASOLINE AND GULFPRIDE OIL

"SOMETIMES I wonder just how far my responsibility toward our clients goes. Air conditioning is one thing that comes up more and more often. Is it really my business to recommend it?

"Our job is to see that a sound building is designed . . . a building designed for *use*. I guess back in the old days, architects used to wonder if it was their responsibility to recommend central heating plants . . . or even *washrooms!*"

We wouldn't venture to tell any architect that he has a direct responsibility to recommend air conditioning—but in the broad interest of his client he often feels that he should . . . and we know that most architects often do.

In fact, the competition for business today has almost made it necessary that most stores install air conditioning. And every architect knows that the cost of air conditioning is much greater after a building is up than when it is included in the plans. That's a service architects can give to their clients that's really worth something!

When you consider refrigerants for an air conditioning system, you'll be interested in knowing these things about "Freon"* refrigerants: (1) they are *safe;* (2) they permit lower first costs; and (3) they save on operating costs.

Equipment using "Freon" refrigerants is light-weight and compact, occupying but little floor space and low headroom. It operates at low pressure, permitting lighter castings. These are among the factors contributing to lower first cost.

Operating costs are low, because "Freon" refrigerants have no corrosive action on any of the metals used in refrigerating machinery. This permits selection of materials which provide maximum heat transfer and efficiency.

"Freon" refrigerants are used almost exclusively in new air conditioning installations because of their unique safety. They meet the safety specifications set by the Underwriters' Laboratories of Chicago. Use of "Freon" refrigerants avoids any possibility of penalty to your client in insurance rates, and promotes safety of life and property.

KINETIC

FREON

REG. U. S. PAT. OFF.

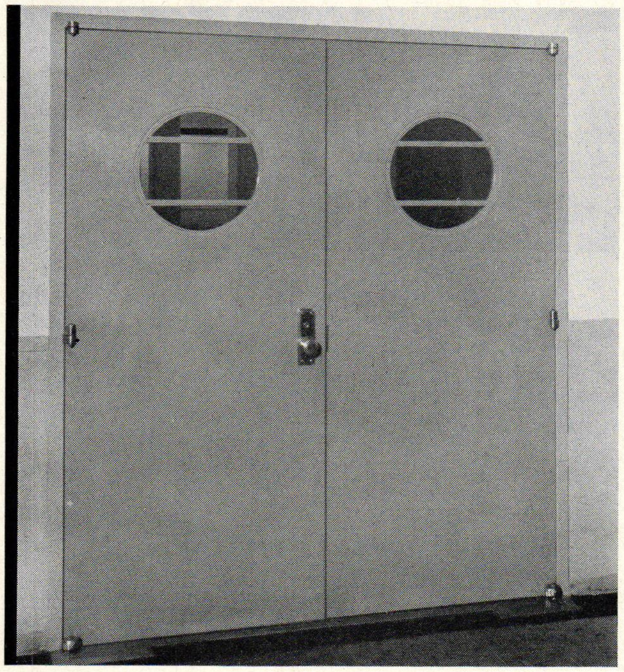
safe refrigerants

"Freon" is Kinetic's registered trade-mark for its fluorine refrigerants.

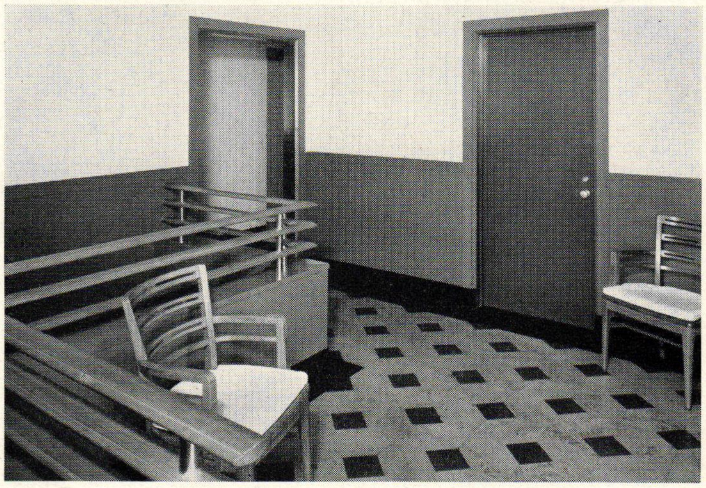
KINETIC CHEMICALS, INC., TENTH & MARKET STREETS, WILMINGTON, DELAWARE

..Modern, Durable,

Formica Realwood counter tops and table tops in the Social Service Department of the Library of Congress.



Formica Doors to the Cafeteria in the Social Security Building, Washington, D. C.



Formica wainscot and doors in the administration building of the Susquehanna Bridge at Havre de Grace, Md., installed by John C. Knipp & Sons.

FORMICA

ALUMINUM, DEFENSE, AND YOU

ALCOA

1

WE INTERRUPT our regular messages to report what's what with aluminum.

AT THE MOMENT delivery for civilian use must make way for defense. Everybody knows the reason. Defense requires and is using more aluminum per month than peacetime America ever consumed.

NEVERTHELESS, we intend that no one shall have to forego the things aluminum can do best one minute longer than we can help.

THERE IS NO SHORTAGE of bauxite, nor of anything else, except time. And Father Time is being given the race of his life.

WE ARE MOVING, for example, 35,000 yards of earth a day at Alcoa, Tenn., to get 50 acres under a single roof by September. It will require 193 carloads of roofing felt. Some of the operations in that plant will start even before the walls are up. That's an annual rolling capacity for 120 million pounds of high strength alloy sheet coming along fast.

LAST MARCH WE STUCK the first shovel in a cow pasture near Vancouver, Wash. In September a 30 million pound plant was delivering metal. It has been doubled, already. A third 30 million pound unit starts delivering in April; a fourth in May; a fifth in June. From cow pasture to 150 million pounds annual capacity in 15 months.

A SIDELIGHT: To make that 150 million pounds of aluminum, we first have to build factories to make 120 million pounds of carbon electrodes. We have to obtain the equipment (transformers, rectifiers, and the like) to feed 162,500 kw. of electricity into the reduction furnaces. This is a generating capacity equal to that of the state of Delaware plus twice that of Mississippi.

WHAT OF TOTAL PRODUCTION? In addition to Vancouver, further installations are being made at other of our plants, so that in less than a year their total capacity will be more than double that of 1939, when 327 million pounds were produced.

IN THE VERY MIDST of this demand we have lowered the price of aluminum ingot 15%. We state, without reservation, our hope that the price can be still further reduced.

DEFENSE APPLICATIONS use aluminum for exactly the same reasons you do. Defense priorities on aluminum simply say that there are some fundamental things that aluminum does supremely well. It will do them still better as important lessons in production, fabrication, and application are learned from every additional pound being produced and used.

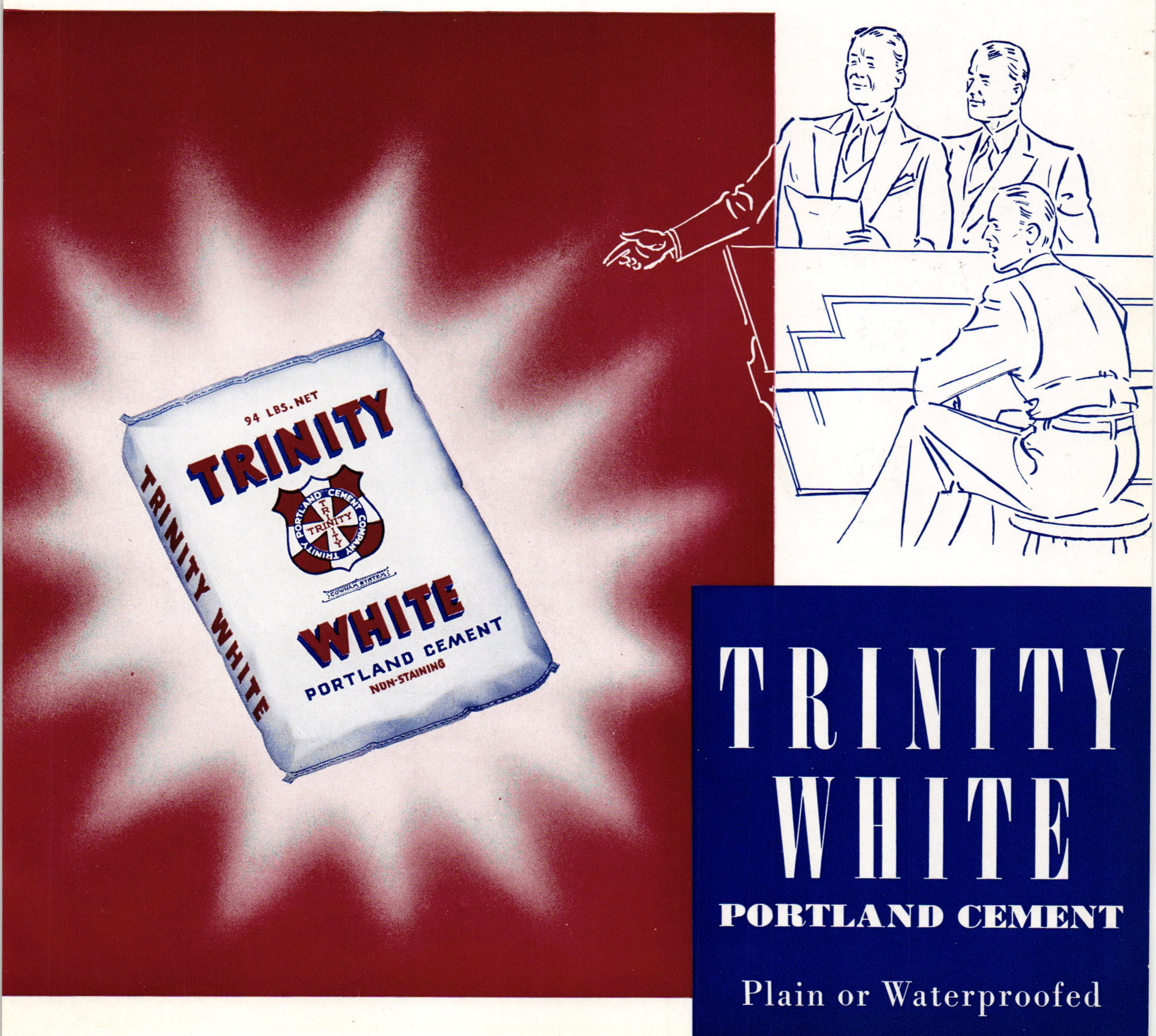
YOU, SIR, have been using aluminum windows and sills, copings, spandrels and doors. It has been a favorite decorative material. It is not easy nor convenient to have to substitute other materials temporarily. We want you to know that we intend to make this hardship as short-lived as possible. Your aluminum is on the way. It is a promise.

ALUMINUM COMPANY OF AMERICA

Maybe you haven't heard, but–

The recent announcement of the *new* TRINITY WHITE Portland Cement was good *news* to you who wouldn't be interested in "just another white cement." For here is something *more* . . . a White Cement that has warmth and life—especially developed to meet *every modern requirement.* In fact, TRINITY WHITE is as up-to-date as today's news. Specify and use TRINITY WHITE on your next job. You'll be glad you did. TRINITY PORTLAND CEMENT COMPANY, Republic Bank Building, Dallas, Texas.

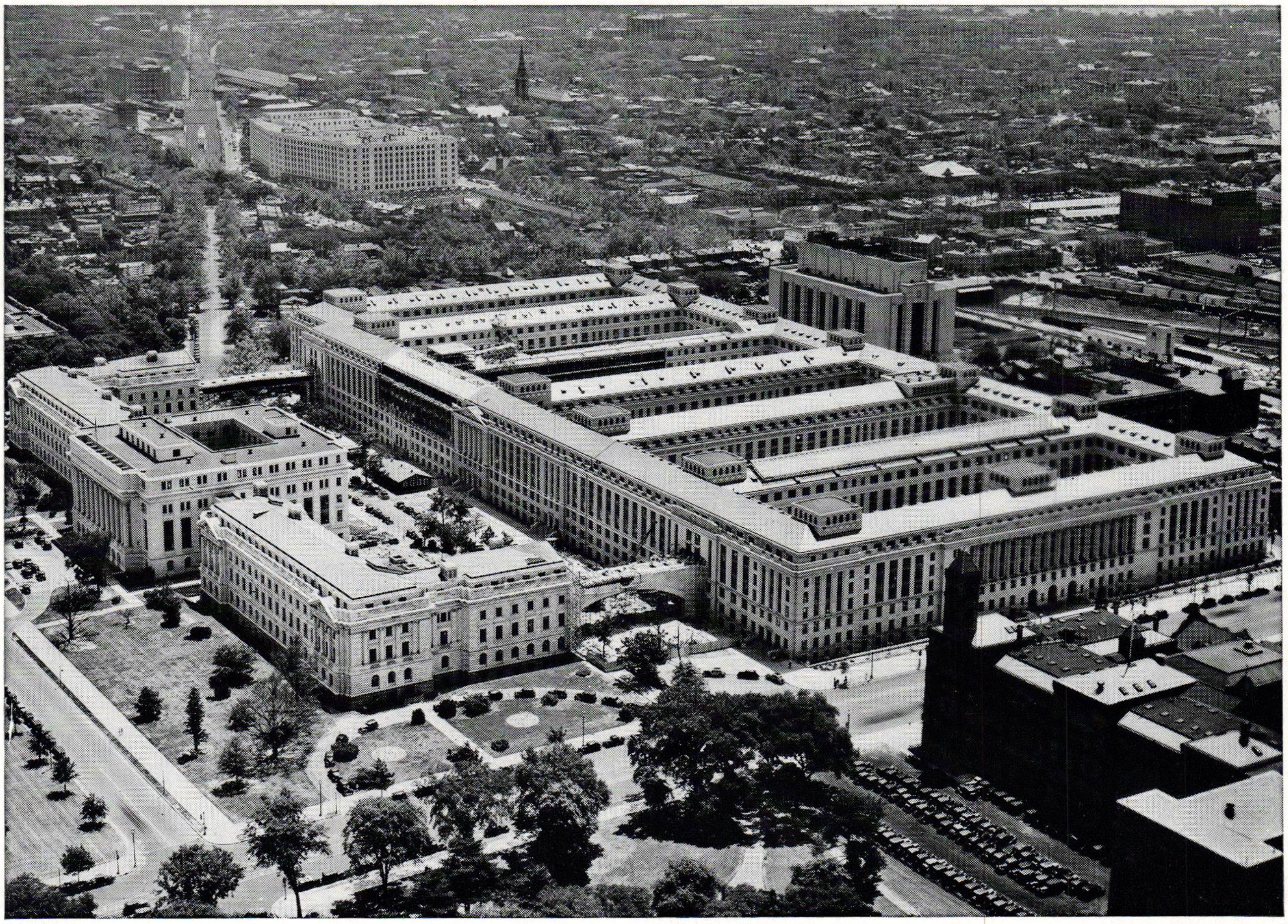
THE NEWS IS OUT!



TRINITY WHITE

PORTLAND CEMENT

Plain or Waterproofed



Approximately 1,000,000 square feet of Nairn Battleship Linoleum bring long life to the floors in the Department of Agriculture Main and Extension Buildings, Washington, D. C.

NEW FEDERAL LINOLEUM SPECIFICATION

SURPASSED BY NAIRN LINOLEUM

• Why is "Nairn" Linoleum being used in many government buildings, both in Washington and in other parts of the country as well?

The answer lies in this striking fact! The specification now in force on Federal requirements for linoleum is more stringent than the one it supersedes. Yet, without any changes in plant methods or production standards, *Nairn Linoleum not only meets this specification, but exceeds the requirements in many of the tests specified.*

Where demands are unusually severe, as in public buildings, Nairn Linoleum furnishes the ideal solution to the floor problem. Its long life—naturally one of the first considerations in buildings of a permanent character — is a proven factor. Beauty and distinction are assured in the wide range of attractive patterns. And the footeasy and quietizing qualities of Nairn Linoleum are especially acceptable for conditions of heavy foot traffic.

When installed by Authorized Contractors, Nairn Linoleum is fully guaranteed.

CONGOLEUM-NAIRN INC., KEARNY, N. J.

NAIRN
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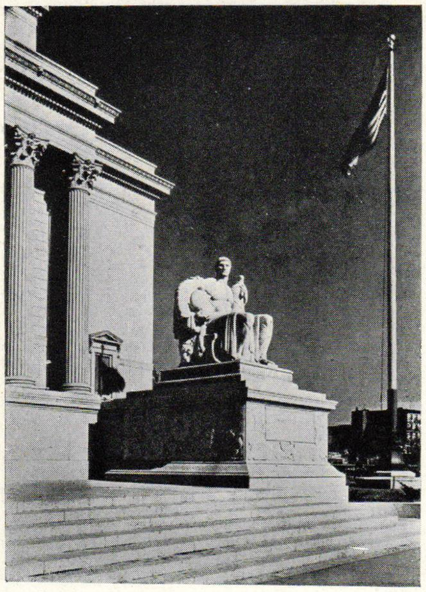
LINOLEUM
Floors and Walls



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EDWIN B. MORRIS, *Editor*

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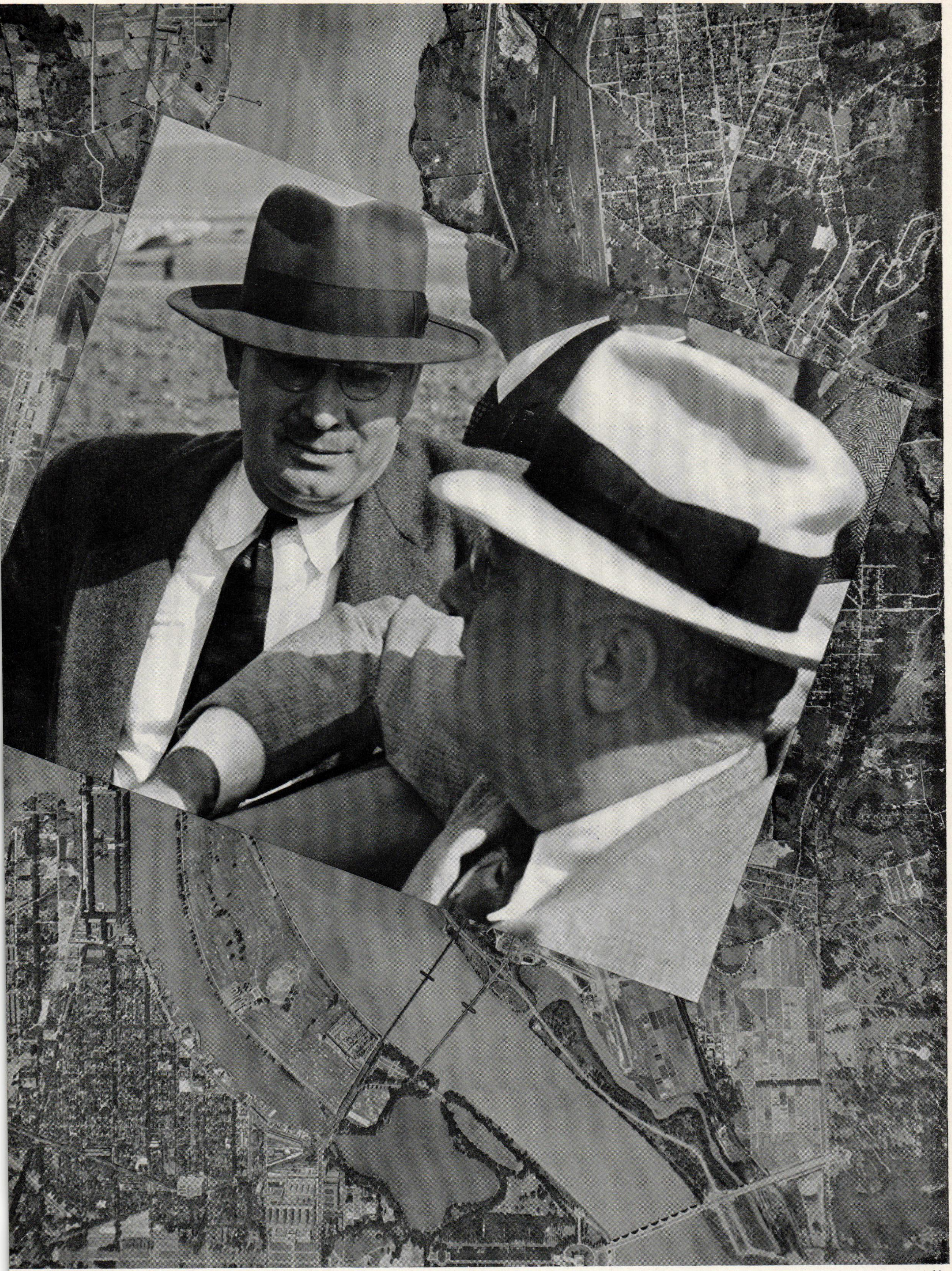


Ackley

THE PRESIDENT AND COLONEL SMITH AT THE DEDICATION OF
THE WASHINGTON AIRPORT

Ac

CLOSE-UP OF TERMINAL BUILDING
From landing field, showing control tower.

MEMBERS AND ALTERNATES OF THE INTERDEPARTMENTAL ENGINEERING COMMISSION, WHO WERE THE FINAL ARBITERS ON THE DESIGN OF THE AIRPORT.

From left to right—Seated: B. M. Harlow, W. E. Reynolds, Col. R. S. Thomas, Robert H. Hinckley, Col. Sumpter Smith, Col. F. C. Harrington, Brigadier General Donald S. Connolly, Fred E. Schnepfe, Lt. Col. E. H. Leavey. Standing: Major James B. Newman, Thomas G. Early, Capt. W. N. Leaf, H. H. Houk, H. P. Heavenor, Walton C. Clark.

Ackley

VIEW OF TERMINAL BUILDING

From the landing field

Ackley

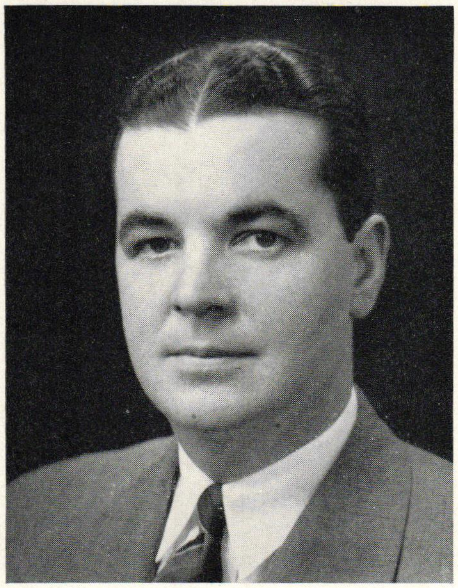
CLOSE-UP OF TERMINAL BUILDING
From landing field

THE Civil Aeronautics Administration is appreciative of the interest of "THE FEDERAL ARCHITECT" in devoting an issue to the new Washington National Airport and to the growth of aviation as it is very proud of the new airport and believes that it will contribute substantially to improved traffic and terminal control. It proposes to operate the new airport as a laboratory or model station to develop information which will be helpful to the municipalities throughout the United States also engaged in airport operation.

The Washington National Airport represents a cooperative enterprise as its construction was undertaken under the general direction of the Civil Aeronautics Administration by the Federal Works Agency through the Public Buildings Administration, the Public Roads Administration and the Work Projects Administration, the War Department through the Corps of Engineers and with the valuable advice of the National Capital Park and Planning Commission. I like to think that this example of cooperative enterprise is significant of the spirit in which the new airport will be operated as a national airport to provide satisfactory services for the airlines and for private aviation, the patrons of the airlines and the general public. The architects and engineers have teamed together to provide not only a beautiful airport but also a fully useful airport from every standpoint. It represents a step forward in airport planning and is worthy of the national capital.

DONALD H. CONNOLLY,
Administrator of Civil Aeronautics Administration

PCA PRESIDENT SAYS WASHINGTON AIRPORT FINEST IN THE WORLD



By C. Bedell Monro
President Pennsylvania-Central Airlines

THE inauguration of air service to the new National Airport at Washington, D. C., is certainly a milestone in the history of commercial aviation in America. As the president of one of the three air lines serving Washington, it is a pleasure to add my voice to others in congratulating the government, the architects, engineers, contractors and the airport management on one of the most remarkable and foresighted airport construction developments this country has yet witnessed.

Washington's new airport is one of which we all may be proud. Equipped to take care of the greatest volume of airplane traffic with the greatest smoothness, efficiency and safety, the new airport will compare more than favorably with the great airports serving the capitals of other nations: Croydon at London, LeBourget at Paris, Tempelhof at Berlin and Schipol at Amsterdam. It is the first federally-owned and federally-operated commercial airport in the United States, and it is the last word in what the modern airport must be.

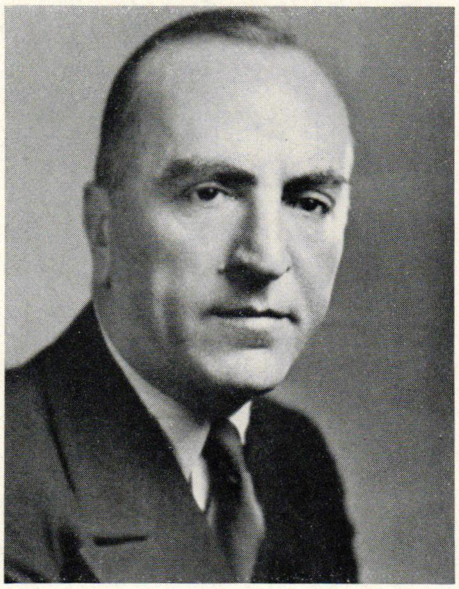
As a company which has been identified with commercial aviation in our national capital for more than a decade, Pennsylvania-Central is indeed proud to operate from this finest airport in the world. In 1930 our company offered air service from Washington in only one direction: to Pittsburgh and Cleveland. Today PCA daily carries hundreds of passengers to and from Washington in three directions: west to Pittsburgh, Akron, Cleveland, Detroit, Milwaukee and Chicago; north to Baltimore, Harrisburg and Buffalo; and south to Norfolk, Raleigh, Greensboro, Knoxville, Chattanooga and Birmingham.

In these critical days in our national history, the

(*Continued on page* 39)

WASHINGTON NATIONAL AIRPORT

Most Significant Development of the Year



By Capt. E. V. Rickenbacker
President and General Manager, Eastern Air Lines, Inc.

WASHINGTON National Airport is easily the nation's most significant air transport development of the year. That it is destined to take its place among the famous national airports of the world—London's Croydon, Paris' Le Bourget and Berlin's Templehof—is a certainty. That it will serve as the model for airport construction the world over, is a belief possessed by every person associated with the project.

In the Washington National Airport there is more than meets the eye. For example, the airport is a citizen's airport; it is an engineer's airport; it is an architect's airport and—what is more important than all these—it is a pilot's airport.

A citizen's airport: because of its splendid proximity to downtown Washington, its great parking facilities and its opportunities for dining and sightseeing both indoors and out.

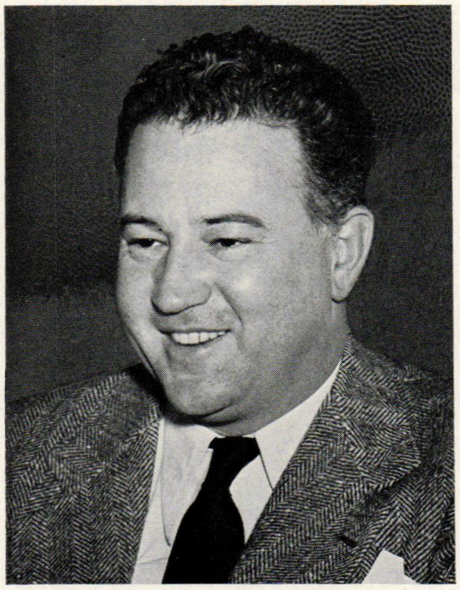
An engineer's airport: because no detail has been overlooked by the best engineering talent in the nation, to render the airport *functional*. Planning of the sort that has caused all battery starter equipment and plane air conditioners to be placed underground; planning that has provided plane turntables at the ramps; planning that will give the facility utmost usefulness.

An architect's airport: because the terminal building and all field structures keep faith with aesthetic obligations, reflecting the Mount Vernon influence.

A pilot's airport: because the location and construction of the runways was determined by schedule air line pilots who made certain that Washington National Airport would offer the utmost in safety and utility as a facility for the more than 200 daily landings and takeoffs to be made there at its inception.

(*Continued on page* 39)

AVIATION'S PROBLEM CHILD DONS LONG TROUSERS



By Jack Frye
President Transcontinental & Western Air, Inc.

COMPLETION of Washington's National Airport marks the transition of aviation's problem child—the air terminal—from the romper stage to mature, manhood.

For this milestone in progress, commercial aviation owes an everlasting debt of gratitude and we of Transcontinental & Western Air, Inc., wish to be among the first to salute the Civil Aeronautics officials and other government representatives who made this outstanding achievement possible. This airport, started in 1938 under the able guidance of the Civil Aeronautics Authority, has many advantages over others in this country.

The architects and engineers have incorporated into this project the best features of the world's most modern airports and have thrown in additional innovations for good measure, contributing substantially to the art and science of airport design.

Washington's new airport is a monument to the vision, ingenuity and resourcefulness of these men and marks an important forward step in a fast-growing industry. The airport problem has opened a field of brand new thinking among the nation's engineers and architects and the new terminal is a shining example of their working knowledge of aviation.

Because of the growth of airplane travel in the last few years, it has been a gigantic task to draft a program for an air terminal that would not be out-of-date within a short time. The planning for future expansion on this project shows the far-sightedness of its designers. It stands out as a model for air terminals which should dot the entire nation.

Millions of people will be using the airplane as millions now are using the automobile and many more such airports will be needed to accommodate them.

(*Continued on page* 52)

By C. R. Smith
President, American Airlines, Inc.

THE opening of the Washington National Airport at a crucial period of our nation's development is an answer to the critics of Democracy and democratic governmental functionings.

In the Spring of 1941, Washington has one of the finest airports in the world. Washington has this airport at a time when uninterrupted air transport service to and from the National Capital is of paramount importance.

Several years before any emergency was considered, the need for the airport was foreseen by the air transport industry, the architects and engineers, the traffic analysts associated with the aviation industry, as well as by those charged with the administration of our defenses.

From the visualization of a huge, well-equipped airport came the detailed construction plans. To various industrial enterprises went these plans. Their work was integrated, specialized and technical. Working schedules were drawn up, consultation with the government engineers in charge of the construction gangs were held, and from the seeming chaos there arose a mighty symbol to democratic cooperative endeavor—the new airport.

All the scientific knowledges which are freely taught in democracies have been applied in the eventual completion of the Washington National Airport.

Geology, meterology, electricity, physics, chemistry, aerodynamics, calculus, have been applied by the scores of engineers, architects, accountants, and contractors, the great majority of whom have learned their professions in this country. The unhampered educational systems which flourish in democracies bear fruit in the form of engineering triumphs of which this new airport is representative.

Academic freedom allows the individual to think and plan for himself, not to be completely enslaved by a controlled ideology which stultifies his mental advancement. The democratic educational program

(*Continued on page* 52)

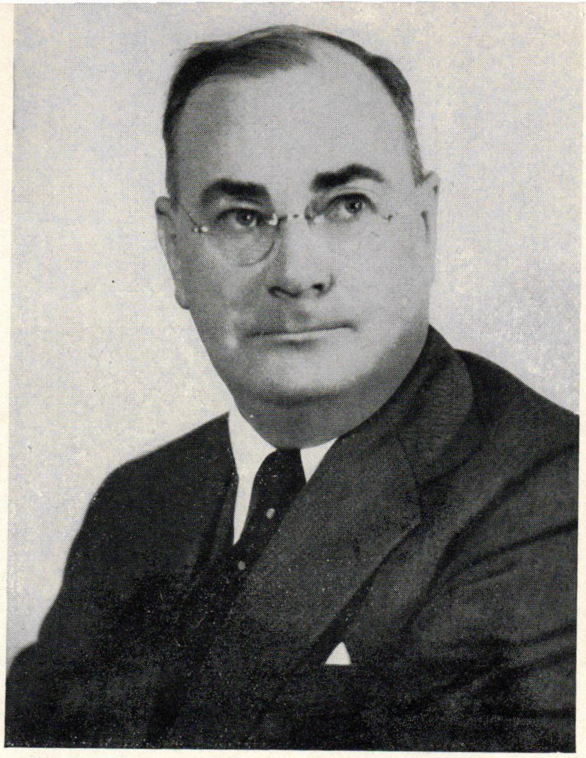
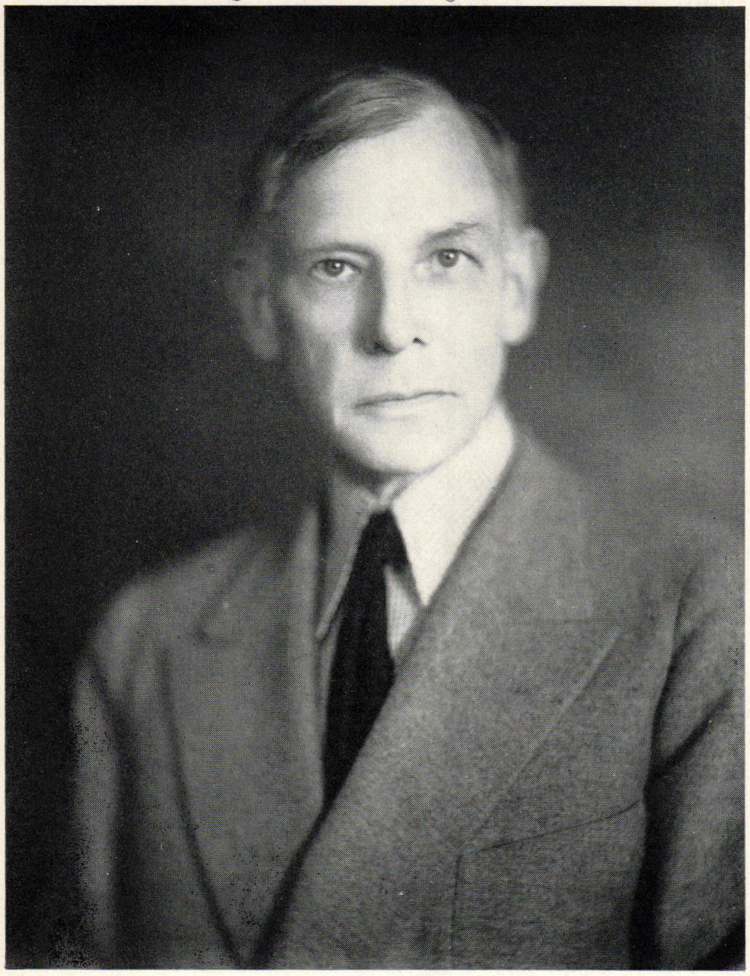


Photo by Hal

HONORABLE JOHN M. CARMODY
Administrator of the new Federal Works Agency.

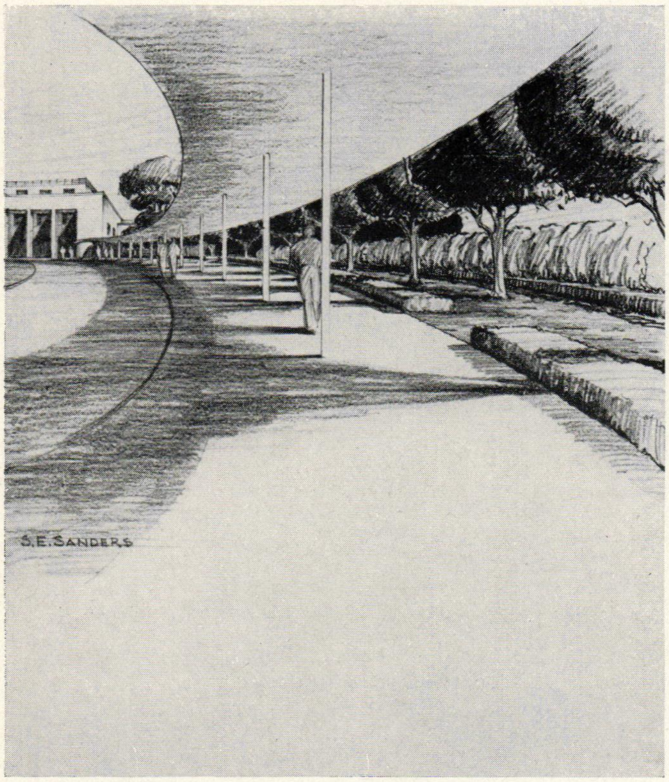


LOUIS A. SIMON
Supervising Architect,
Public Buildings Administration,
Federal Works Agency

Under his personal control the architecture of the airport was designed.

Ackley

W. G. NOLL
Chief of Architecture in the Supervising Architect's Office.



COVERED WALK AT ENTRANCE

The WASHINGTON NATIONAL AIR-PORT

by JOHN STUART

Reprinted from Pencil Points by permission.

UNDER the able guidance of Colonel Sumpter Smith of the Civil Aeronautics Authority, who is Chairman of the Interdepartmental Engineering Commission in direct charge of the design and construction of the new Washington National Airport, the CAA project begun in November 1938 is rapidly nearing completion. Members of the Commission, other than Colonel Smith, are Colonel R. S. Thomas, District Engineer of the Corps of Engineers, U. S. Army; W. Engelbert Reynolds, Commissioner of Public Buildings, Public Buildings Administration; Fred E. Schnepfe, Director of the Federal Projects Division of the PBA; and Major B. M. Harloe, Assistant Commissioner and Safety Engineer of the Works Progress Administration.

H. H. Houk of the Civil Aeronautics Authority is the Resident Engineer in charge and Howard Lovewell Cheney is the Consulting Architect directly responsible for the planning and design of all building structures being erected on the site by the PBA. The Landscape Architect is Henry N. Boucher of the PBA, assisted by S. E. Sanders of the same organization.

The result of the labors of these men and all those associated with them promises to be the finest metropolitan air terminal in the world, considered both technically and aesthetically. Through careful study of all earlier international experience with airport design and operation the designers were enabled to incorporate into the project the best features of the world's most modern terminals. By the exercise of their own ingenuity they have added to these a number of improvements which contribute substantially to the advancement of the art and science of airport design.

The flying field itself has many advantages over others in this country. Approaches may be made to any runway at a gliding angle as shallow as 40 to 1, providing twice the safety factor in this respect as compared with the prevailing condition at most airports where 20 to 1 has been considered a sufficiently small angle. From most directions the approaches will be made over water.

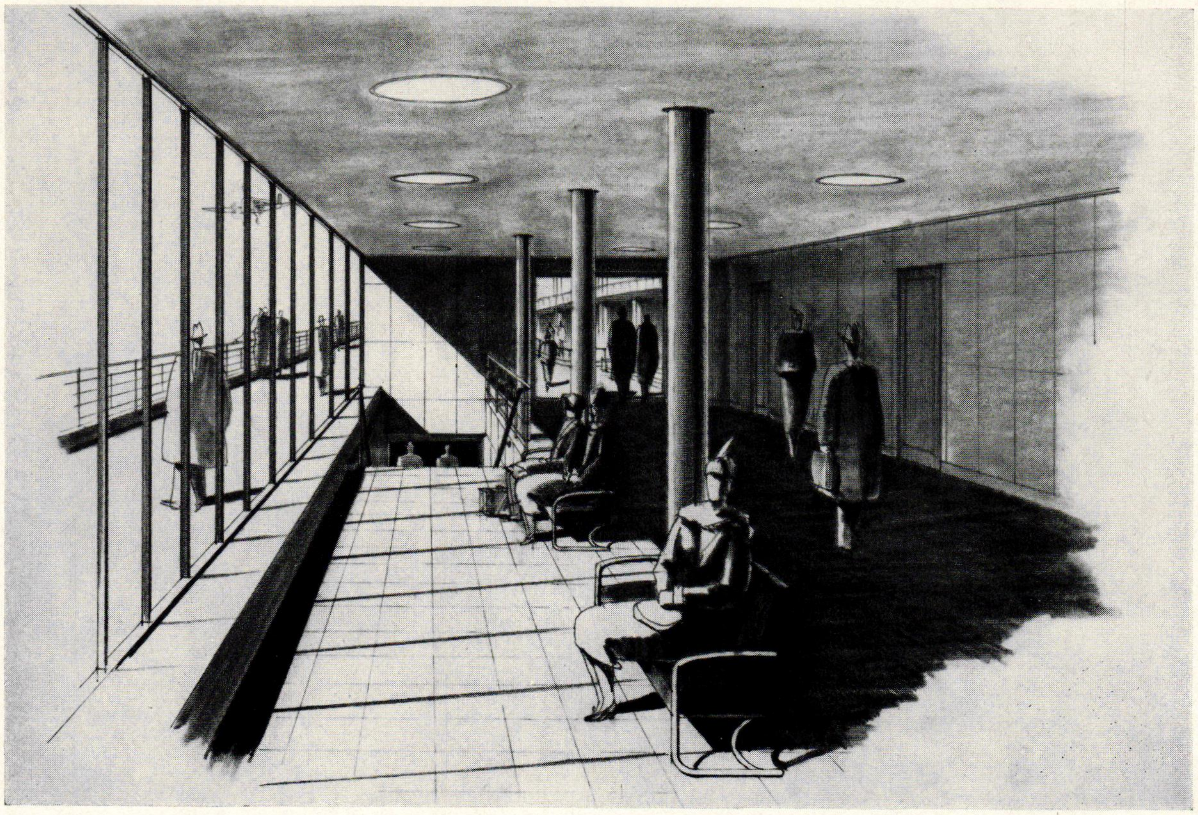
Four runways are provided, the shortest of which is longer than the longest at the old Washington Airport. Runway sizes are as follows: North-South, 6,875 feet long, 200 feet wide; Northwest-Southeast, 5,300 feet long, 200 feet wide; Northeast-Southwest, 4,820 feet long, 150 feet wide; East-West, 4,200 feet long, 150 feet wide. The two longest, in the direction of the prevailing winds, will take care of 70% of the traffic. Future expansion has been planned for.

The Terminal Building and hangars are contemporary in design spirit, functional and appropriate in form to the modern mode of transportation they serve. Evolved through a long series of studies, Mr. Cheney's final design was approved in model form by more than twelve federal agencies directly or indirectly concerned, including both the National Capital Park and Planning Commission and the Commission of Fine Arts.

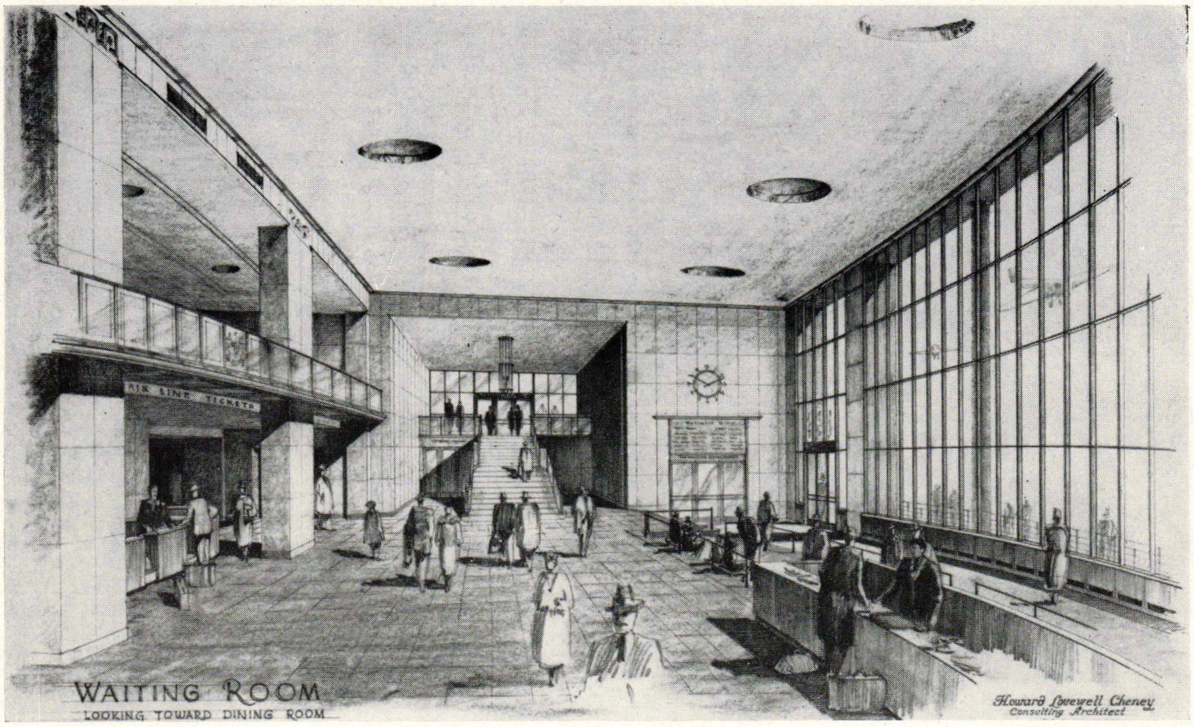
Public entrance to the terminal building is from the west, passengers and visitors arriving at a large circular plaza whence they pass under protecting canopies to either of two doorways leading into the waiting room at a level one story above the field. Sightseers will normally be directed from the plaza across the footbridges at either end of the building to the observation terrace extending, at a level several steps lower, the length of its field side. Here they will be able to see the arrival and departure of all planes without interfering in any way with passenger traffic or with views from within the building.

Along the west wall of the two-story-high waiting room are located the ticket offices and counters, to be occupied for the immediate future at least by three airlines—Eastern, American and Pennsylvania-Central. The east wall of this room, toward the field, is all of glass, an expanse 200 feet long through which people inside may see the major portion of the field.

Along the field side of the waiting room, and inside the window, the floor level is several steps lower for a width of about 15 feet. This lower level continues out to the passenger concourse which extends north and south the full length of the building, a total of 540 feet. From the concourse, stairs at four points lead down to the ground level loading stations. Circulation of passengers from ticket offices to concourse to



OBSERVATION TERRACE



WAITING ROOM

loading stations and planes is thus easy and direct. In anticipation of futue growth of traffic, loading ramps of two level design are being studied. These will provide for ground level loading of present types of planes plus high level loadings from the passenger concourse to the newer tricycle landing gear planes which have loading doors as high as ten feet above the ground.

Initially, there are to be fourteen loading stations. Passenger concourses are so arranged, however, that they can be extended in future to the south for 500 feet and to the north for a quarter of a mile or more, which will provide for all reasonably anticipated growth.

At each plane loading station, service pits will be installed to house outlets for telephone, pneumatic tube, air-conditioning, and gasoline, thereby eliminating need for mobile service trucks on the field. Turntables at each station will make possible easy maneuvering of even the largest planes.

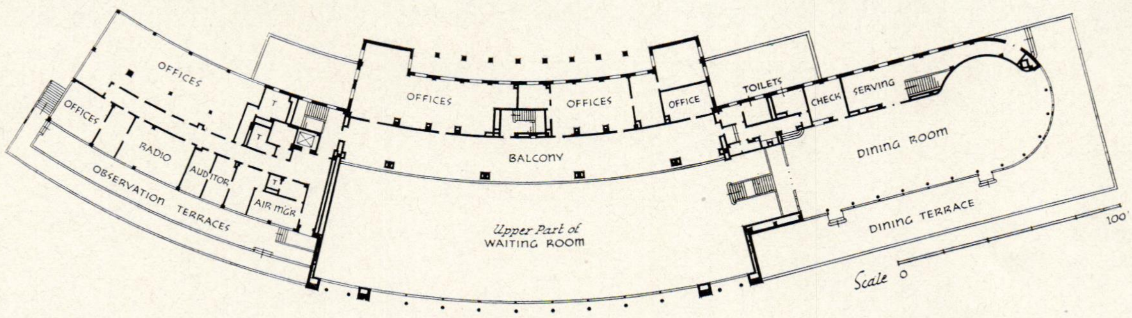
To the south of the waiting room on the first floor are grouped various public conveniences while to the north a large coffee shop (down a few steps) and a spacious dining room (up a short flight) are available to handle the problem of adequately feeding the great numbers of visitors expected. The dining room, continuously glazed along the side and end towards the field and towards Washington, will command a magnificent view. Its broad outdoor terrace, several steps lower, provides accommodation for open air diners without interfering with the view from tables inside. Together, these facilities will very likely come to be the most popular meal-time rendezvous of the whole Washington region.

On the second floor also is a broad balcony, extending along the west wall of the waiting room and giving access to a group of airline offices. The south wing of this floor is devoted to the airport manager's suite and additional airline office space.

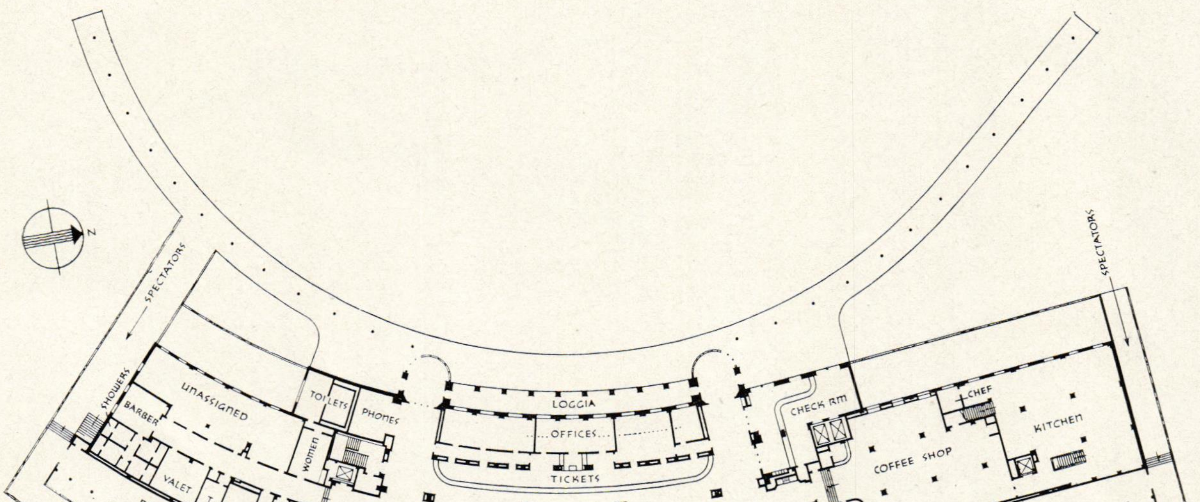
The third floor will house a large Weather Bureau staff, the Civil Aeronautics Airway Traffic Control, and Communications offices. Above this story will be the glass enclosed control tower of most advanced design which will give a clear, unobstructed view of every portion of the landing area and aprons as well as of the entire 360 degrees of sky.

The ground floor is devoted entirely to service facilities. Outbound baggage rooms for each airline receive baggage which is chuted down from the ticket offices above after it has been weighed and tagged. At the south end, the post office department has ample facilities for receiving and handling mail. Air express has a separate loading platform and work space next to the baggage rooms. Mechanical services, employees' conveniences, kitchen service, storage and receiving rooms, and an employees' cafeteria are at the north end of the ground floor.

Extending the full length of the building on its west side is a wide and continuous motor driveway for trucks and deliveries. Also running the full length, just west of the offices that adjoin the field side at the ground level, is a trucking concourse for hand or electric trucks which transfer mail, express, and baggage to and from planes. Note that there is

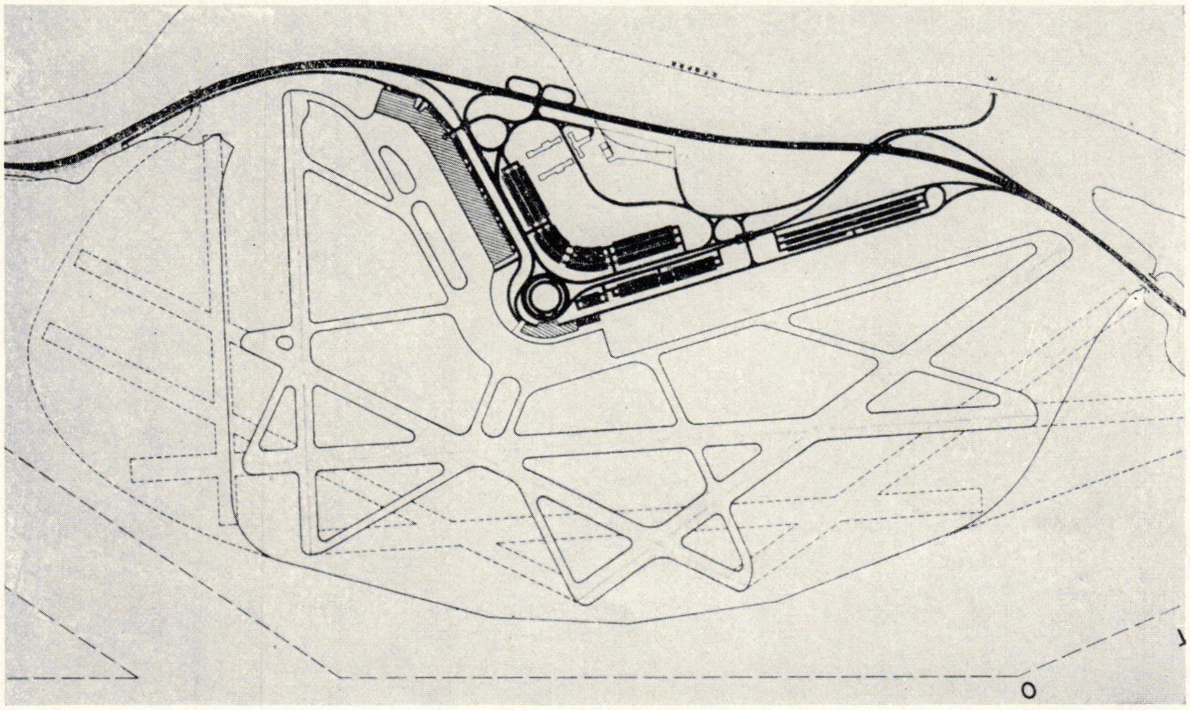


SECOND FLOOR



FIRST FLOOR

BIRDSEYE SKETCH OF AIRPORT



PLAN FOR FUTURE EXPANSION OF AIRPORT

Dotted lines show future runways.

no interference by these trucks with the course of passengers at loading gates.

Incoming baggage from planes is handled up from the ground level receiving room by elevators which deposit it at the check room just north of the waiting room near the doorway out to the traffic circle. Passengers on their way out to cabs, buses, or autos can pick their bags up with no waste motion.

Along the field side of the ground floor are located the offices of the dispatchers and crews of the airlines, offices for the airport superintendent, and airline equipment rooms. A pilots' clubroom is also provided. The four passenger entrances along the field side have convenient public telephones, toilets, and lobbies.

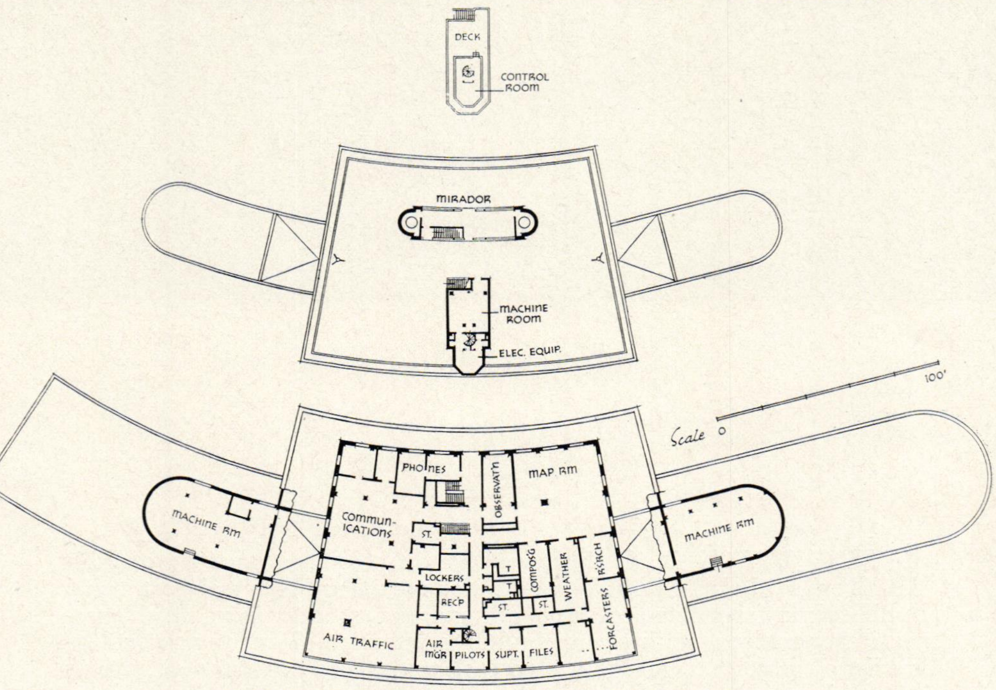
Throughout the building, the latest and best equipment of every type has been called for. Air-conditioning is being provided in the waiting room, passenger concourse, coffee shop, dining room, offices, and control tower. The building is of reinforced concrete and completely protected against fire.

The Washington National Airport is one of the first projects of its kind in which specialists in "land use design" have worked collaboratively with architects and engineers in the adaptation of the site to its intended function. The site has consequently been studied from a somewhat different point of view than that of a purely engineering development. The alignment of the roadways, the profiles of the roadways, the design of parking areas, the moulding and grading of the land, the location of future buildings, the elimination of grade crossings, and the general unification of all these factors have been, as a result, skilfully coordinated to take fullest advantage of the site in adapting it to the purposes of the project.

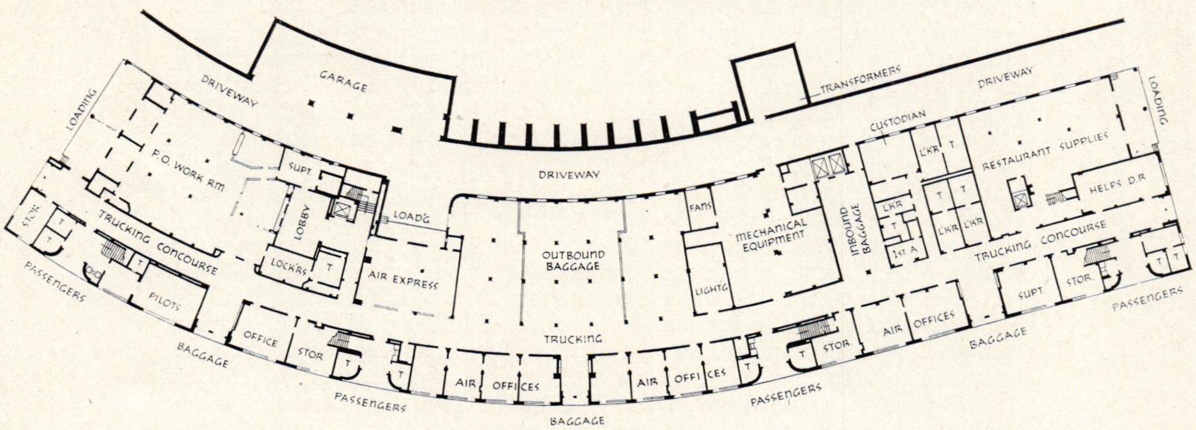
The site adjoins the Mount Vernon Memorial Parkway, 3½ miles from the center of Washington. It thus takes advantage of the most desirable traffic route to the various government offices and the business district. The landing area comprises 556 acres, largely hydraulic fill, and the area devoted to buildings, approaches, parking, etc., consists of 173 acres, formerly the river bank of uneven topography. The hilly character of this part of the site was used to advantage in arranging the approaches to the Terminal Building and in the disposition of field observation parking. The rotary and approach roads are about 15 feet above the landing field level, allowing ample room for underpasses and terracing.

Robert H. Hinckley, former Chairman of the Civil Aeronautics Authority, now Assistant Secretary of Commerce, recently stated: "This airport was conceived as much more than a service to the Nation's Capital City. It was conceived as a model for what other such terminals may be.

"Washington, of course, was fortunate in the possession of a site capable of developing so close to the city. But that very proximity imposed aesthetic obligations never before incurred in airport construction in this country. Those aesthetic obligations are met for the present and for as far into the future as our knowledge of aeronautics can reach."



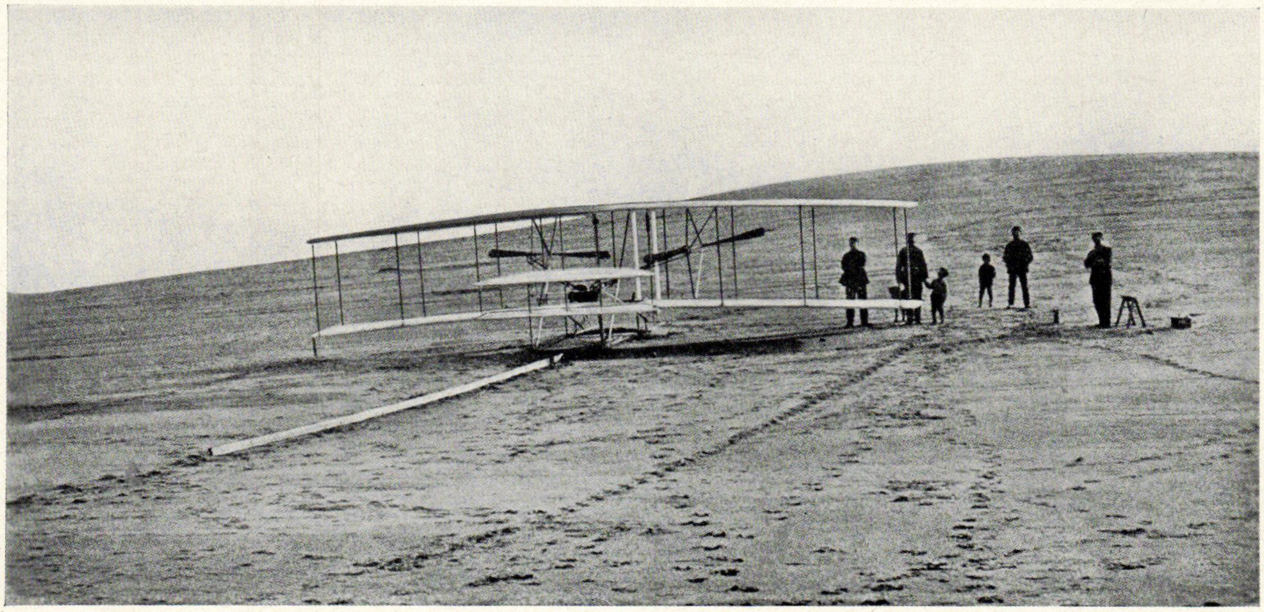
THIRD FLOOR AND CONTROL TOWER



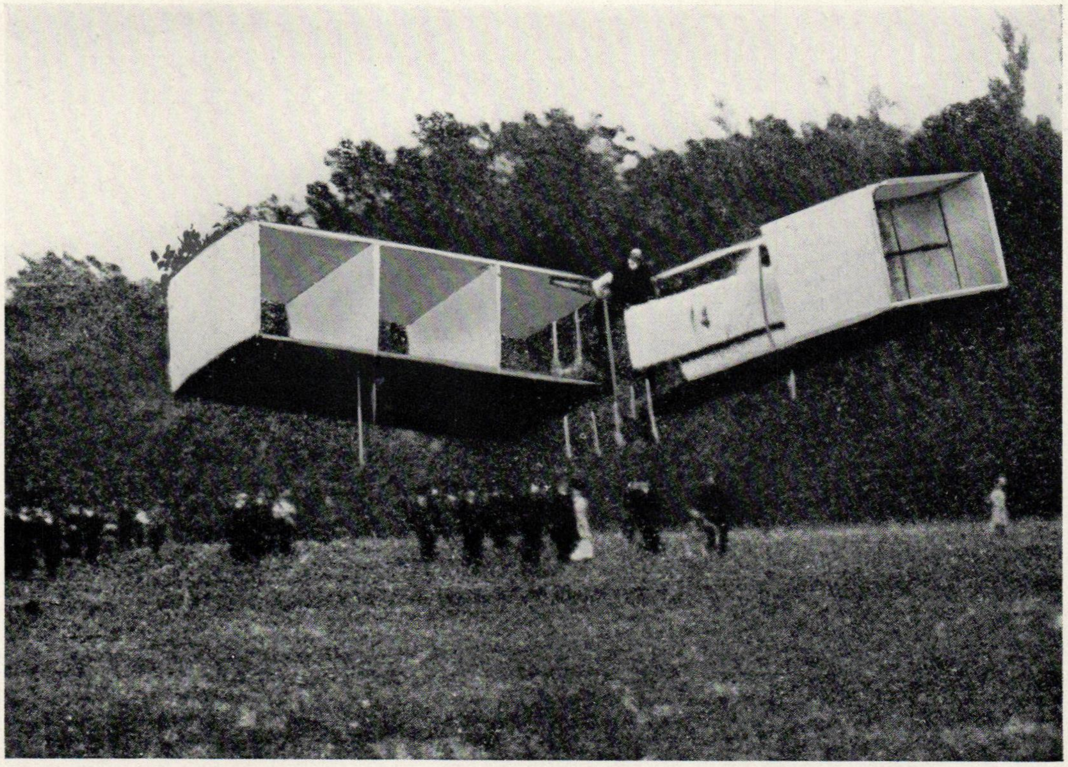
GROUND FLOOR

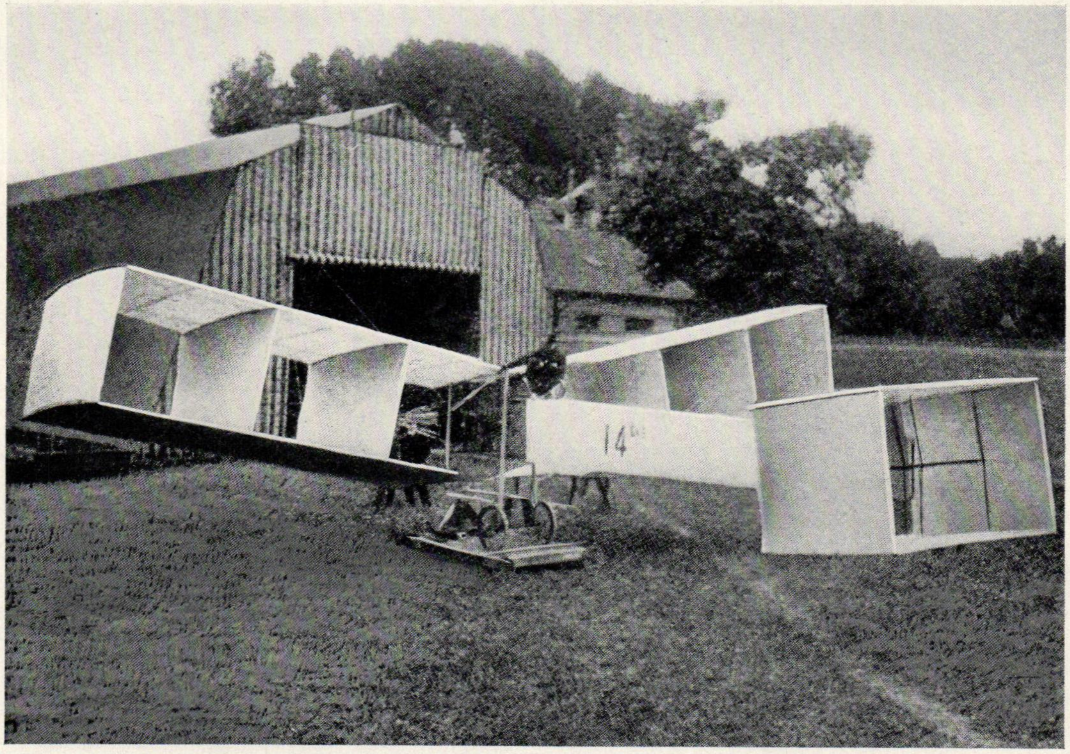
THE DEVELOPMENT OF AIR FIELDS

Prepared by the Smithsonian Institution (Paul E. Garber, Curator of Aeronautics)



KITTY HAWK, N. C. Showing Wright aeroplane on slope of Kill-Devil Hill, Dec. 14, 1903. A definition regarding the first airport would be difficult to formulate because in one analysis any area from which aeronautical operations took place might fill the definition. Thus any chronological list of airports might have to go back to the earliest balloon ascensions and fields where experiments were conducted. However, it is perhaps appropriate to begin any list of airports with a reference to Kitty Hawk, N. C. Even today despite a modern road and bridge connecting it with the mainland, Kitty Hawk is a rather bleak area chiefly identified by large sand dunes varying from low mounds to as much as 90 feet high. The greatest of these is called Kill-Devil Hill. The Wright Brothers chose Kitty Hawk for their early air experiments because it offered good natural facilities and freedom from bothersome onlookers. Having developed gliding to a fine art through three years of experiments, they constructed their fourth machine as a powered flier. The construction, controls, and power represented years of study and experiment. When completed, the first test of their aeroplane was made on Dec. 14, 1903 with a monorail track laid near the bottom of Kill-Devil Hill. Wilbur won the first chance by the toss of a coin but in the take-off he over-controlled and the ship stalled into a bad landing. Three days were required for repairs and on the 17th with Orville piloting, the actual first flight was accomplished. Kitty Hawk, therefore, as an airport was chosen primarily because of its natural advantages and the only man-made improvements were the hangar for the plane and a crude shelter adjoining for the Wright brothers to live in and a monorail track for the little launching car.





BAGATELLE, France. A typical example of adapting an available open area or public park to use as an air field. The year was 1906 and the occasion was the first flight in Europe by an airplane. It was accomplished by Alberto Santos-Dumont with the duration of six seconds.

COLLEGE PARK, Md. The first military demonstrations of an airplane were made by the Wright brothers at Fort Myer, Va. in 1908 and 1909. Following acceptance by the Signal Corps, an airport was established at College Park, Md. It was here that the first military pilots were trained and that many important flights were performed. Several pioneer fliers including Emile Berliner, Rex Smith, Fred Fox, Dr. W. W. Christmas, Harry Orme and others conducted their pioneer experiments at College Park. The air mail, following its first establishment by the Army on May 15, 1918, was taken over by the Post Office on Aug. 12 of the same year and operated from College Park for three years. This famous and historic air field is still in use.

BOSTON Airport, 1924. Photographed by the U. S. Army Air Service at the time when the Army's World Flight landed there during the first circumnavigation of the world.

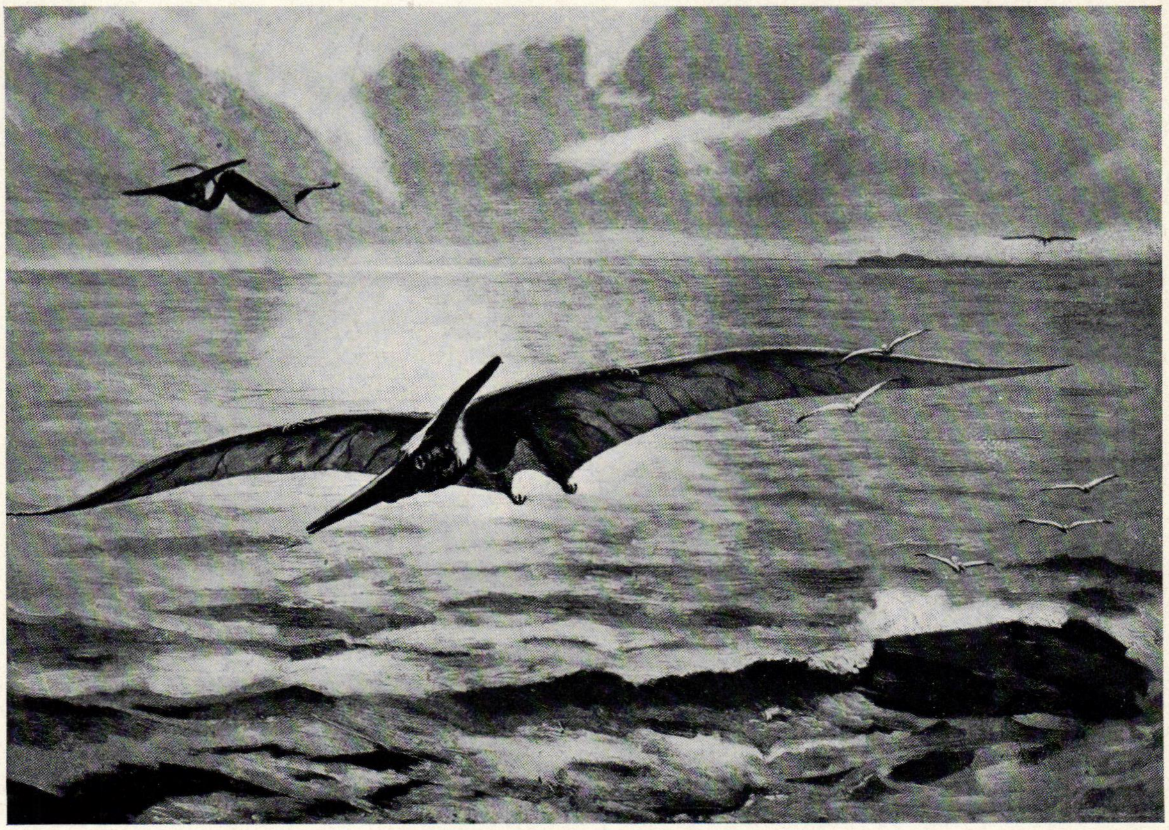
WASHINGTON AIRPORTS
Naval airfield and Bolling Field are at the bottom; Washington National Airport in center, and Washington Airport (present airport) at right center.

SYNOPSIS OF AERONAUTICAL DEVELOPMENT

A pictorial history of flying prepared by the Smithsonian Institution

(*Paul E. Garber, Curator of Aeronautics*)

All photographs in this article are from the Smithsonian Institution U. S. National Museum.

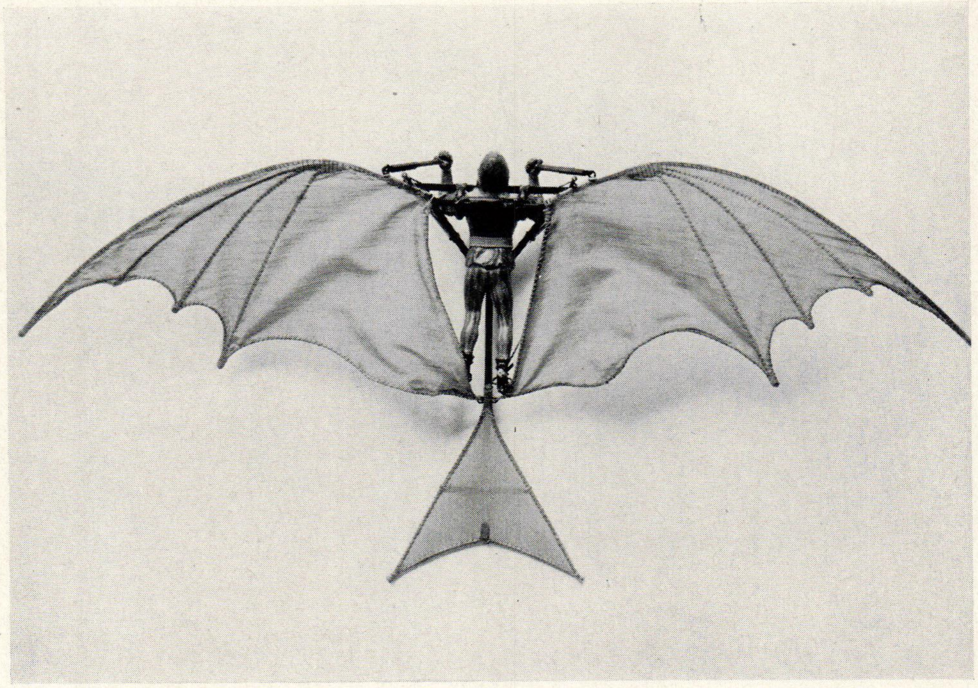


FLIGHT began in nature. Today we know that there are over 20,000 kinds of flying birds, over 250,000 kinds of flying insects, several types of flying fish; there are lizards and squirrels which can prolong their jumps to glides by stretching out membranous folds of skin, and there is even one mammal which can fly—the bat. The illustration above shows the greatest flying creature that ever lived. It existed about 90 million years ago, had a wing span of about 20 feet, yet weighed less than 30 pounds. It was the ptereodactyl.

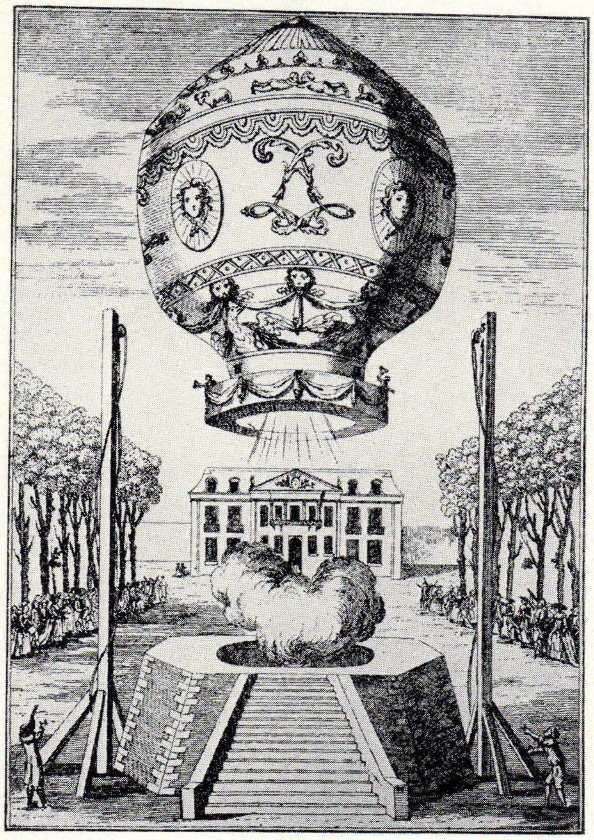
MAN expressed his belief that flight was an ideal means of transportation by thinking that his gods being all-wise and all-powerful would surely have the ability to fly. There are many examples of winged dieties; that of the Roman Mercury, similar to the Greek Hermes, is familiar to all. He was the messenger to the gods and also the god of commerce. The original of this piece of sculpture is in the rotunda of the new National Gallery of Art, Washington, D. C.

THE fantasy of flight. Even during the Middle Ages when knowledge was stifled by superstition and warfare, men continued to think of flying although in a decadent form. It was then that fairy rings, flying demons, witches on broomsticks, and other Hallowe'en-like fantasies were imagined.

LEONARDO DA VINCI, 1490. This great genius who excelled in many forms of learning and accomplishment believed that human flight was possible and even constructed mechanical wings, helicopters and ornithopters. His designs were based on dissections of birds and sound mechanical principles but he lacked the light power which would have made actual flight possible. He endeavored to operate his mechanisms by his own muscle, but failed, yet his observations and writings constitute the beginning of practical aviation.

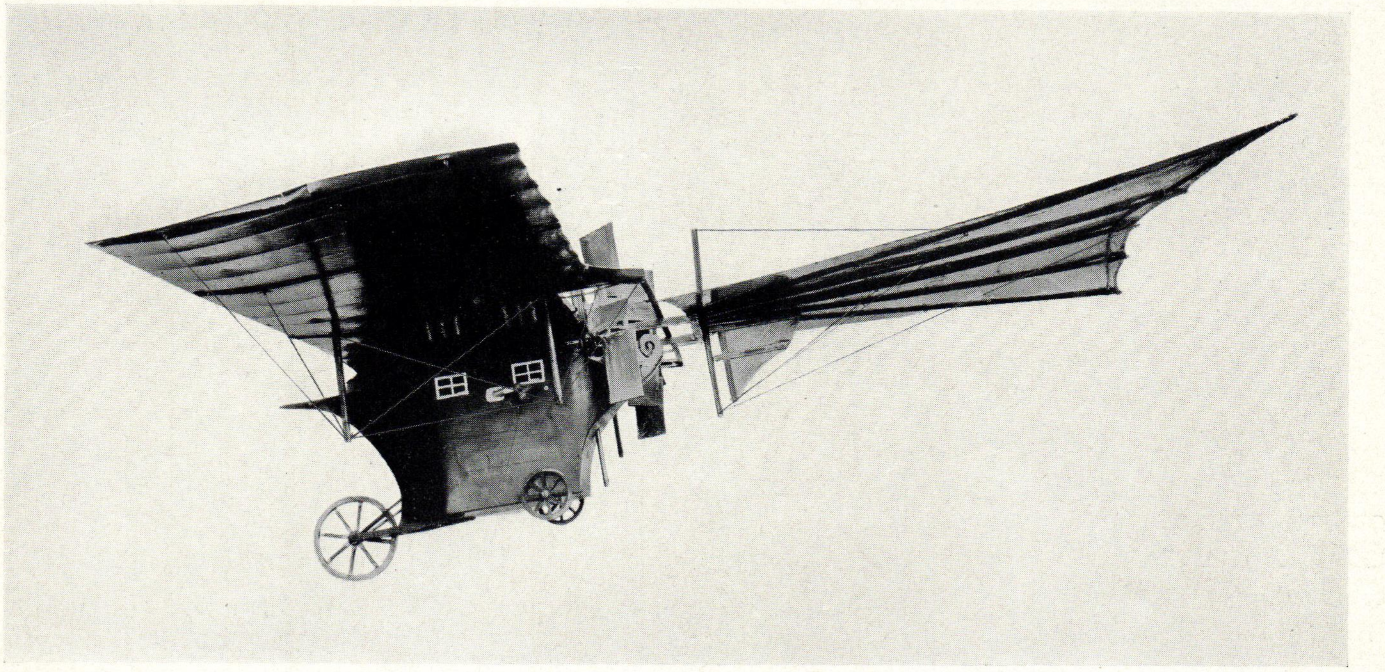


ORNITHOPTER OF
LEONARDO DA VINCI
circa 1490
(*Model by Paul E. Garber*)

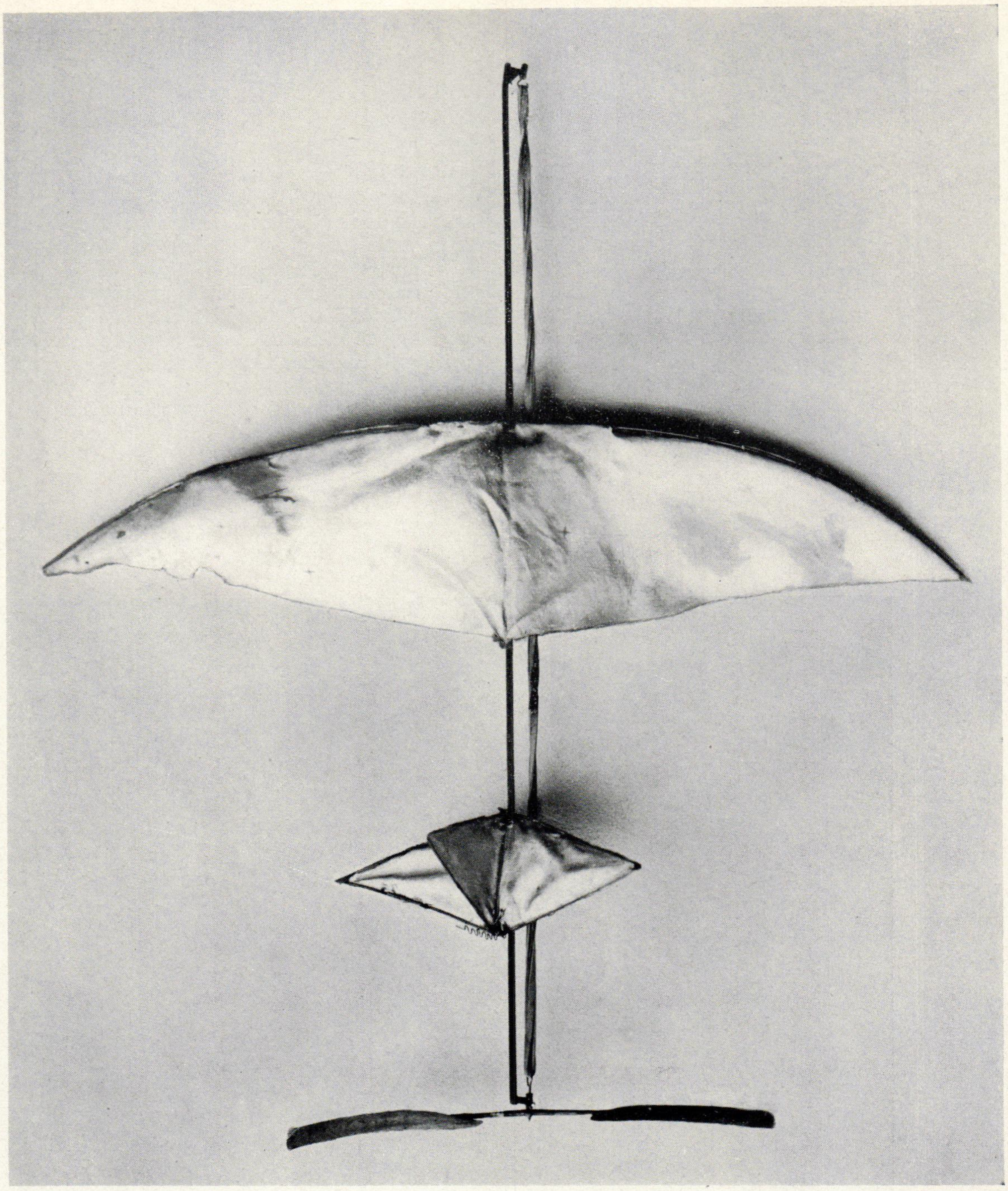


TOWARD the close of the 18th century, the Montgolfier brothers of France who were impressed by the fact that smoke rose upward, imprisoned some smoke in a huge paper bag thereby creating a hot air balloon. A development of this was the first vehicle to carry man aloft in a free ascent. Benjamin Franklin was then our emissary to France. His letters contain interesting descriptions and prophesies regarding aeronautics and the use of aircraft in warfare. The first air voyage made by Jean Francois Pilatre de Rozier and his friend, Marquis de Arlandes was across the City of Paris. It lasted about 20 minutes and covered about 8 miles, Nov. 21, 1783.

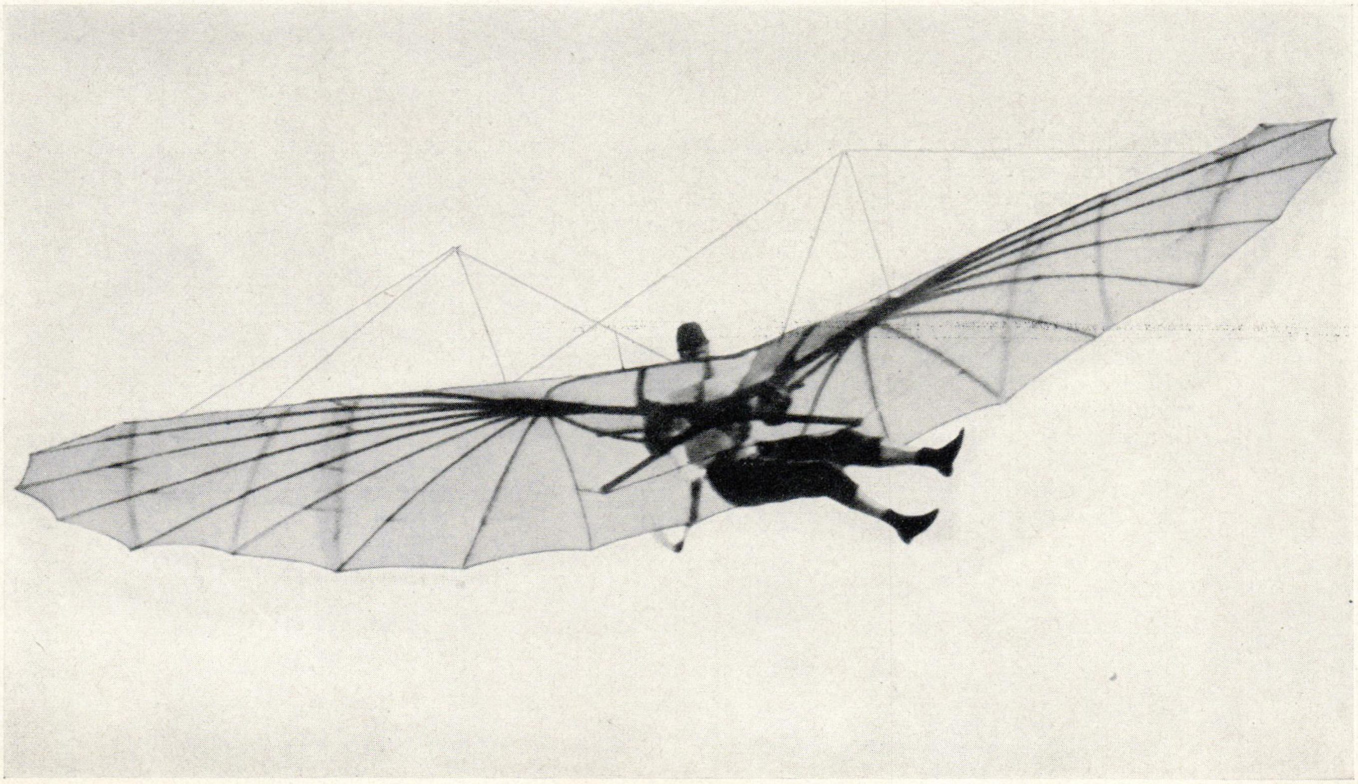
HENSON'S "Ariel," 1842. Sir George Cayley of England, whom many regard as the real father of aviation—he actually made a glider as early as 1810—condemned balloons as mere floating bags and argued that the true solution of human flight would be accomplished by imitating the birds. His countryman, W. S. Henson, probably inspired by Cayley's arguments, designed a huge air liner (below) which embodied many features of the present-day airplane. He proposed to organize air lines connecting all parts of the British Empire. He prophesied transatlantic flying, speeds of 100 miles an hour and air mail. A model of his design failed to fly. The subsequent ridicule and lack of public support discouraged him. His huge air liner was never built, but his partner and successor, John Stringfellow, continued experiments after Henson left for America and Stringfellow succeeded in making his model—about 10 feet in span powered with a steam engine—fly. The distance was only about 40 yards but it was the first actual demonstration of dynamic flight.



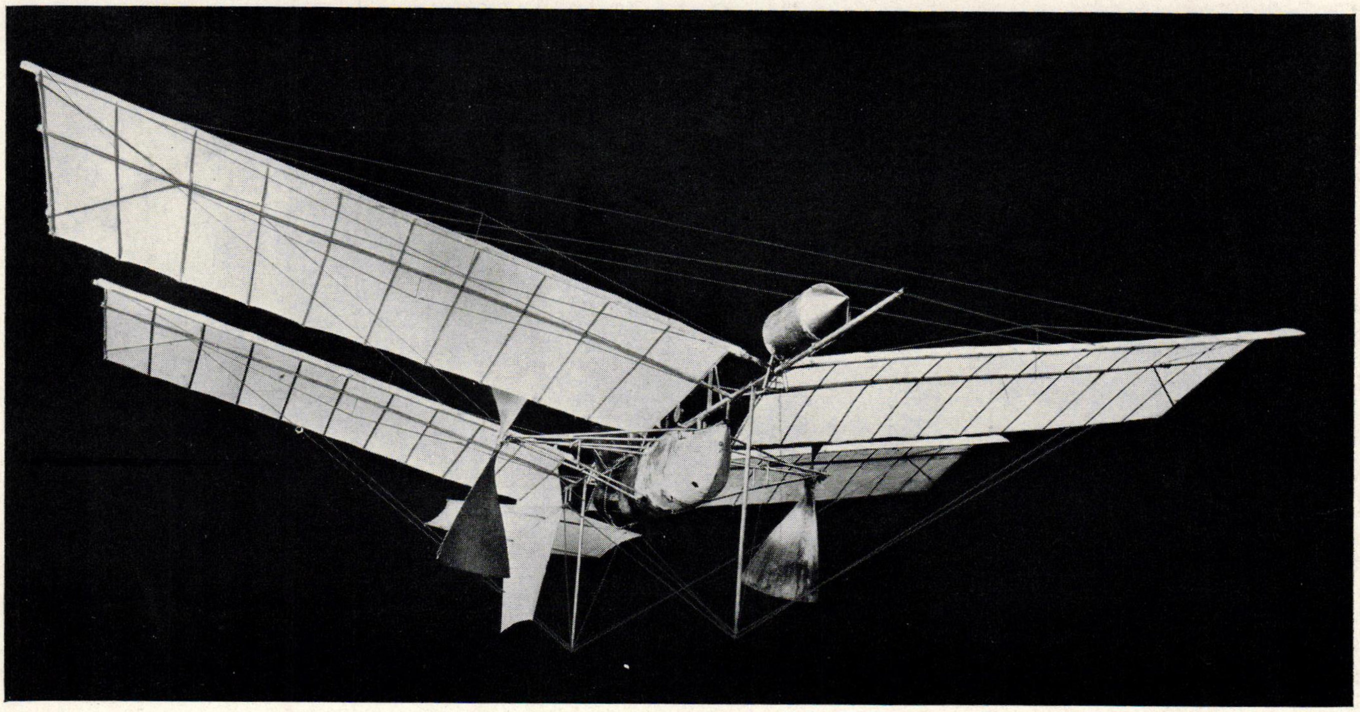
ALPHONSE PENAUD of France was one of the greatest geniuses in the history of aeronautics. Although a youth, he constructed models of helicopters, ornithopters and airplanes which were successful. He was the originator of the rubber band powered model airplane which he called a planaphore. He designed a machine of man-carrying dimensions which was remarkably prophetic in its details but he became discouraged by adverse criticism. Moreover he was constantly suffering a great deal from a painful injury. In one of his moods of discouragement he committed suicide before he was 30 years of age, thus ending a career which might have meant more to areonautics.



LILIENTHAL'S glider, 1894 (below). Following the success with models, some experimenters sought to increase the size of those successful craft with the hope of carrying a man but, still lacking power, and being unfamiliar with means for control, there were numerous failures and fatalities. As a result experimenters decided to brace the wings rigidly with struts or wires and to learn how to coast on the air without mechanical power. Lilienthal of Germany was the most successful of these gliding pioneers. He controlled his glider by swinging the weight of his body.



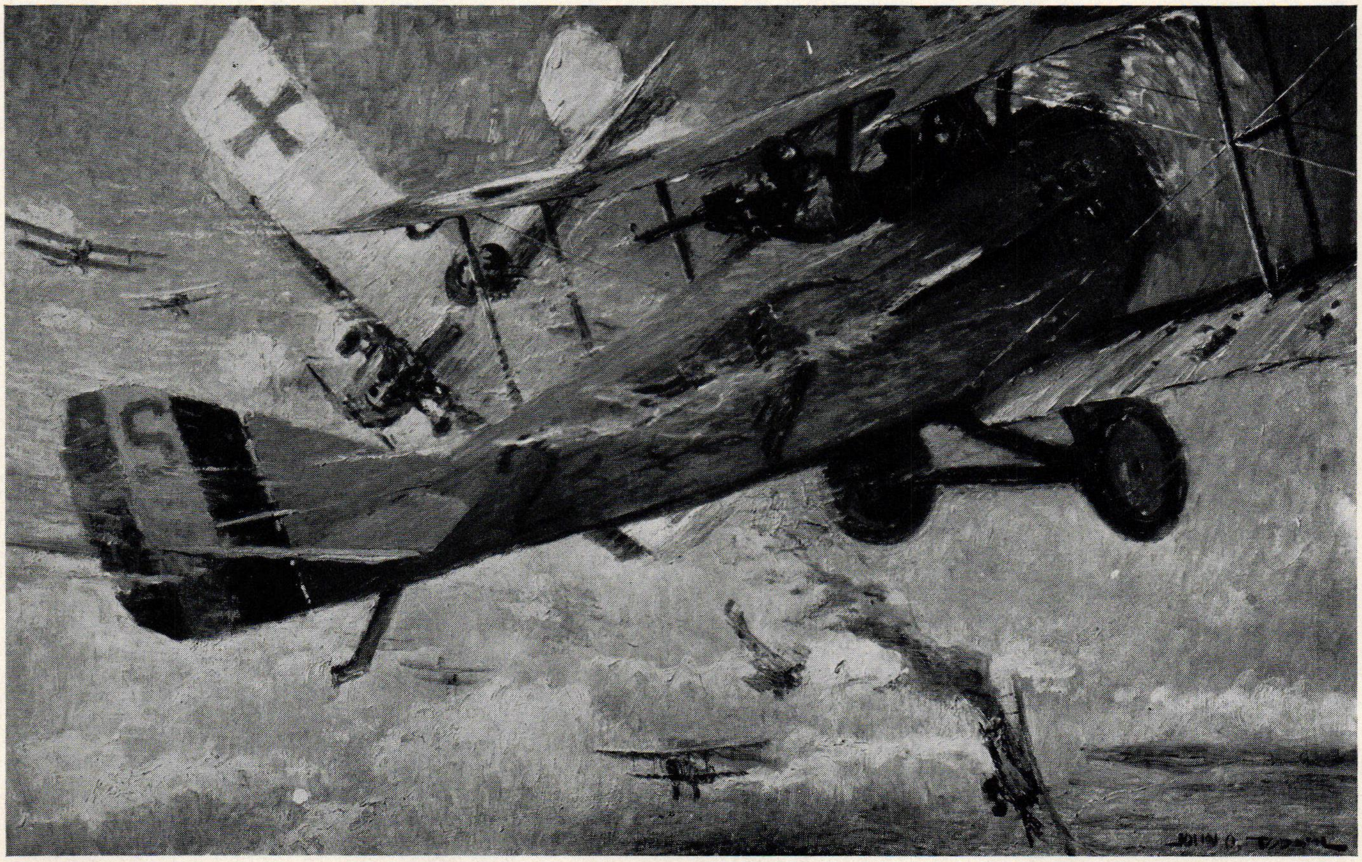
PROFESSOR S. P. Langley conducted experiments in aeronautics for many years beginning with the testing of various aerodynamic shapes on a whirling arm at the Allegheny Observatory in Pennsylvania, 1887. Upon becoming Secretary of the Smithsonian Institution the next year he continued, devising over a hundred small model aircraft, each one embodying some feature which he thought would solve the secret of flight. He finally concluded that he would have greater likelihood of success if his models were larger and thus able to carry an engine with greater duration than the rubber bands which he had been using. With "No. 5" of this larger series unusual success was attained. The model had a span of about 13 feet, weighed 26 pounds and was powered with a one horsepower steam engine. When launched by a catapult from a houseboat on the Potomac it flew, unmanned but inherently stable, for a distance of nearly three-quarters of a mile and for a duration of a minute and a half. This surpassed the best efforts of any previous model by more than ten times.

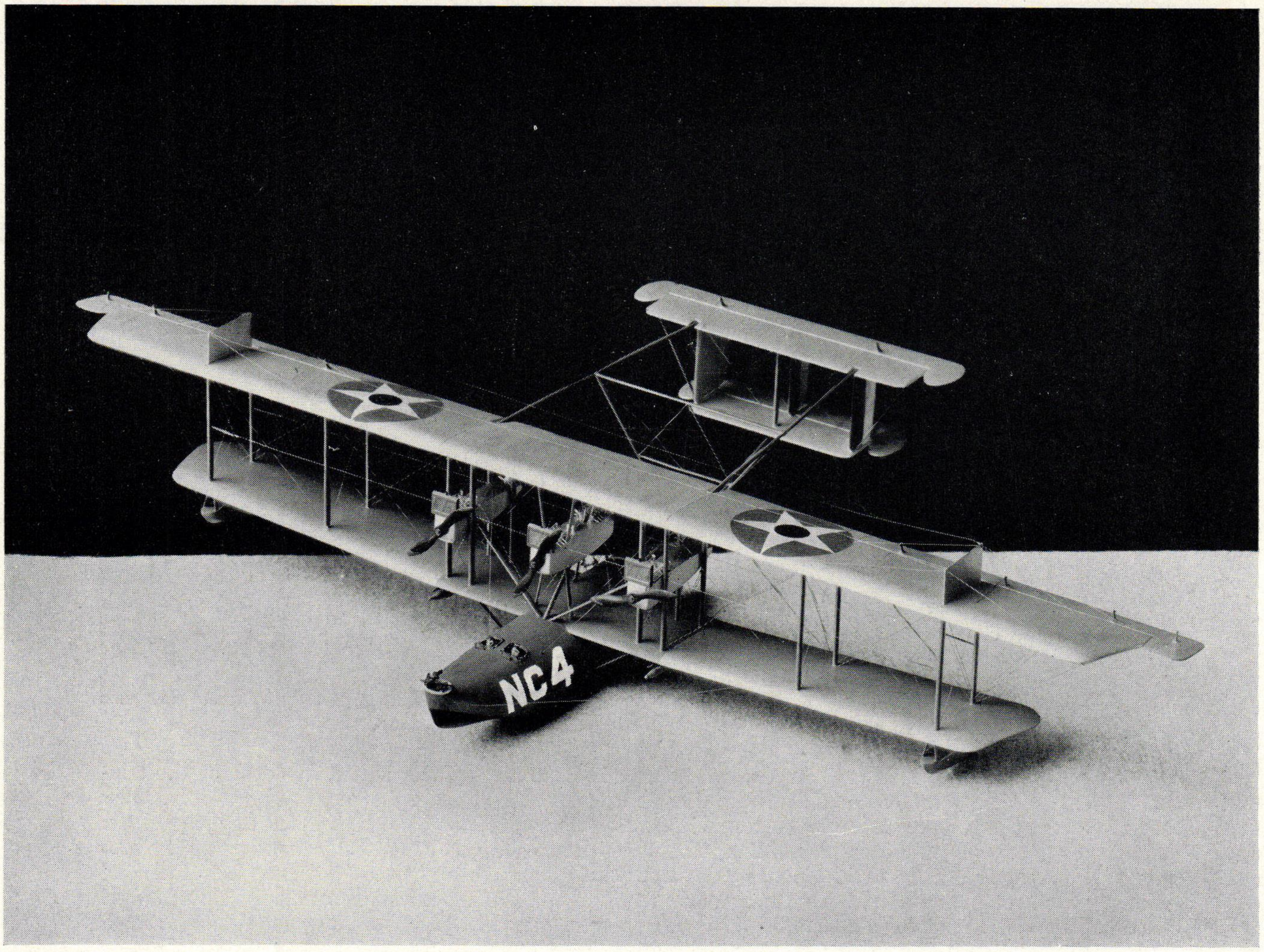


THE Wright brothers, 1903. Orville and Wilbur Wright began their active experimenting in aeronautics as the result of reading about Lilienthal's glides. They took up the study of flying and actual gliding as an avocation from their bicycle business in Dayton, Ohio, but became so interested in the science of flying that they devoted as much time to it as their limited finances would permit. In 1900 with their first glider they went to Kitty Hawk and tested it but decided upon improvements which were incorporated in their glider of 1901. Although an improvement upon their first effort, this second glider did not perform in conformity with their data which was largely based upon the computations of others. Their next step, therefore, was to prepare detailed tables of air pressures, resistances, and reactions based upon experiments with a wind tunnel and many scale models of airfoils and fusiforms. The third glider based upon this scientific data was remarkably successful and convinced them that actual flight could be accomplished with power. The fourth machine, their aeroplane of 1903, embodied the results of their years of research, their successful three-axial system of control, and was powered with an engine of their own construction, driving propellers of their own design. On December 17, 1903 at 10 a.m. it rose from the ground in free flight.

GLENN CURTISS. In 1907 at the invitation of Alexander Graham Bell, inventor of the telephone, Glenn Curtiss joined a group of experimenters who were trying to learn how to fly. They began with a glider, then constructed several powered machines for which Curtiss built the engines. When this group of experimenters disbanded Curtiss formed a company which has developed into one of the greatest in the world. Curtiss' own accomplishments as a pilot of his machines included winning the first International Air Race, 1909; the Albany to New York flight, 1910; the first Naval air operations, 1911; and the development of the flying boat, 1912. The photograph shows him seated in a Curtiss type of 1910 which is now in the National Museum. This type became famous in the hands of Curtiss' pupils among whom Lincoln Beachey, Eugene Ely, and John Towers (now Chief of the Bureau of Aeronautics) were prominent.

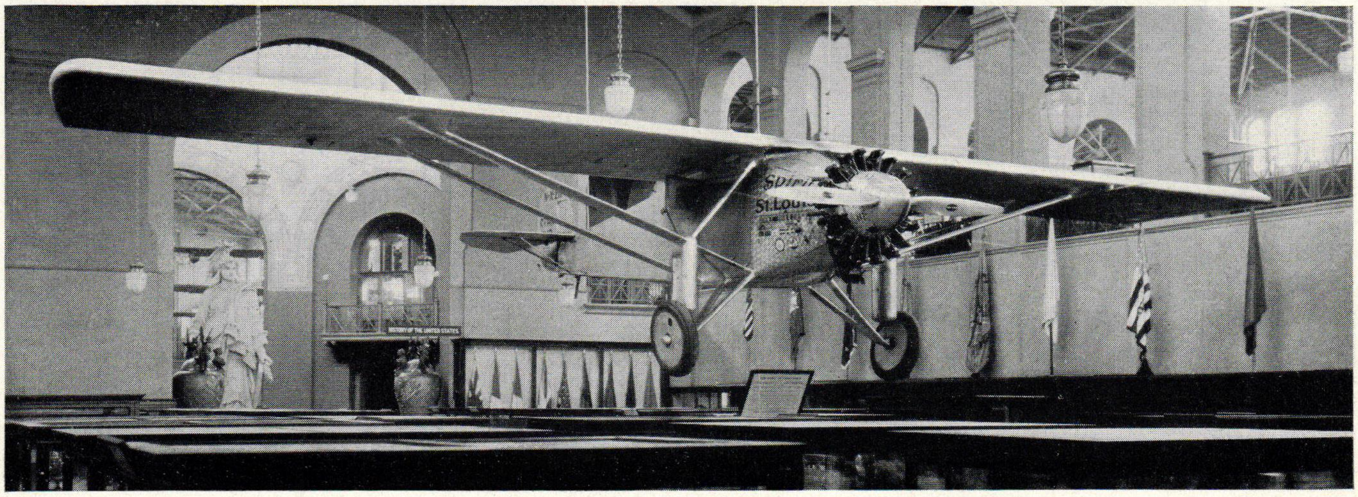
THE World War 1914-18. The four years of great conflict forced rapid development of the airplane. The performance records at the close of this war practically doubled those of 1913. The painting below by John Todahl illustrates a conflict between a French Spad in the foreground and a German Albatross.

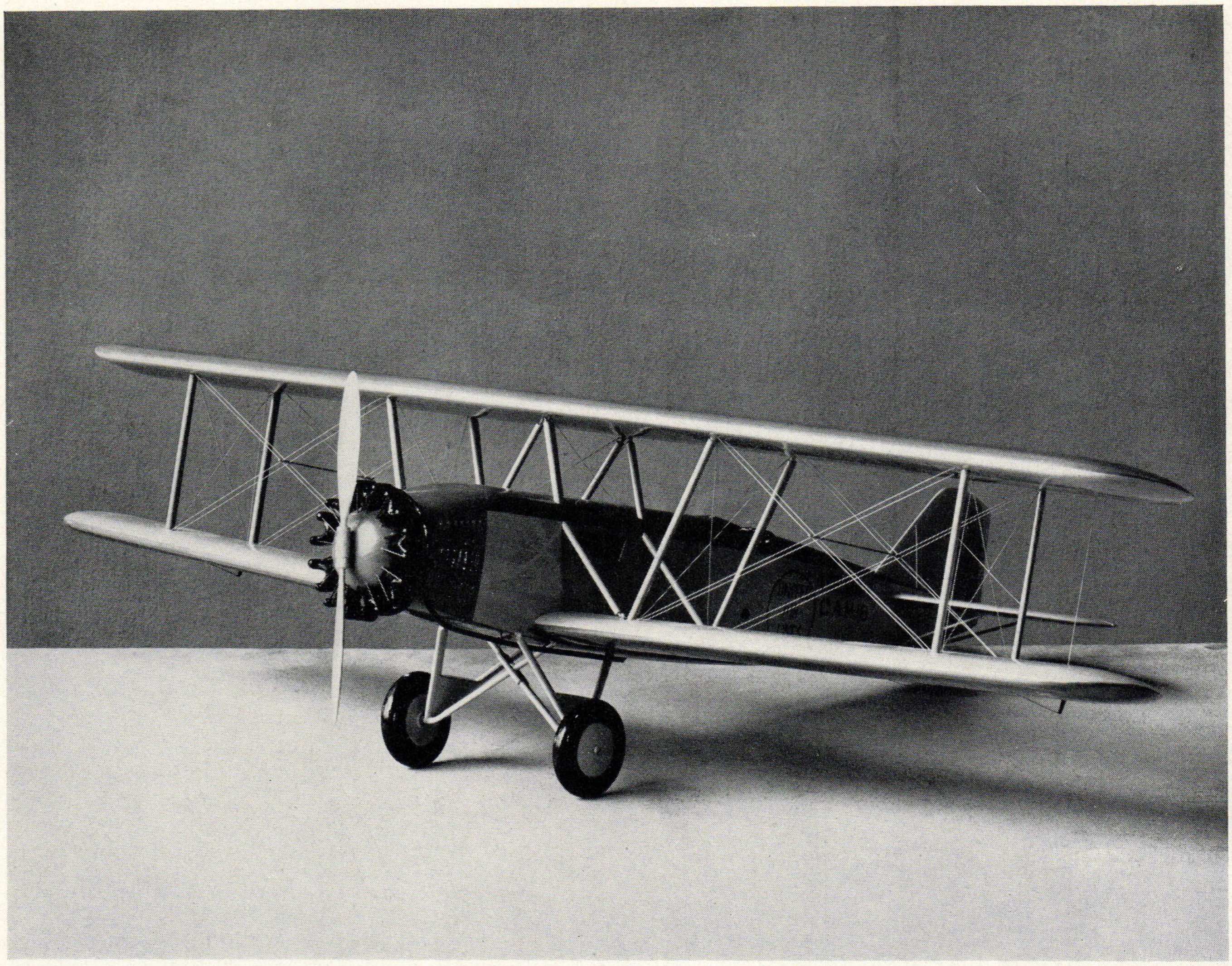




THE impetus given to aeronautics by the World War stimulated a number of remarkable flights. America was prominent in this progress and achieved the first flight across the Atlantic Ocean (U. S. Navy Curtiss NC-4, May 8-31, 1919); the first non-stop flight across the North American continent (U. S. Army T-2 May 2-3, 1923); the first flight around the world (U. S. Army Douglas Cruisers April 6-September 28, 1924). These great flights together with the progressive development of the air mail service which had been started in 1918 between New York and Washington and gradually expanded westward, laid the foundations for commercial aviation.

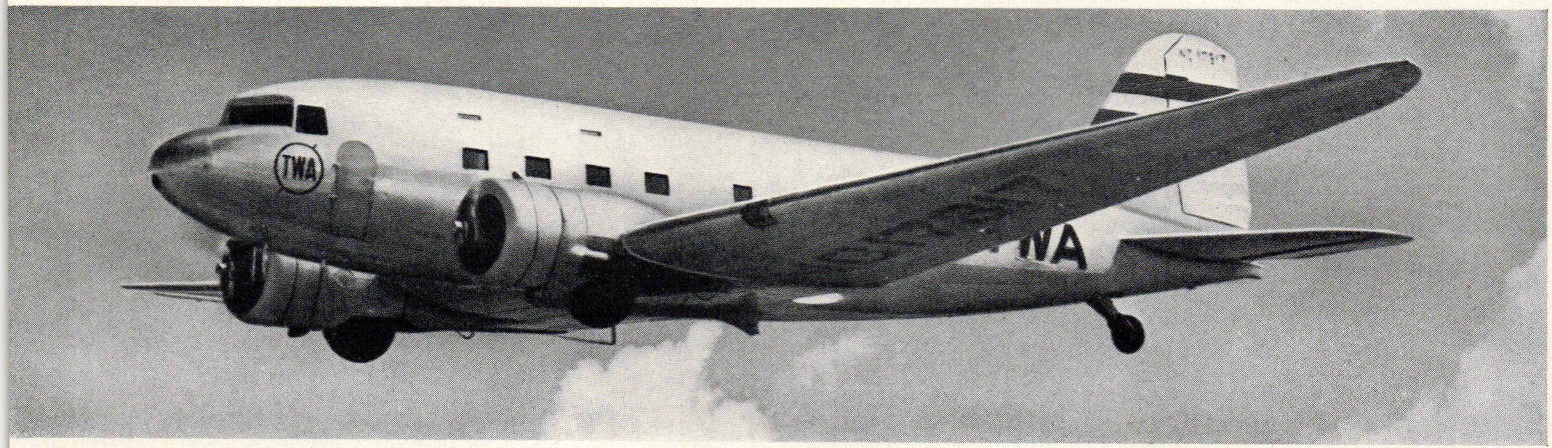
SPIRIT OF ST. LOUIS, 1927 (below). The fundamental training which enabled Colonel Lindbergh to pilot the first solo flight from New York to Paris was attained by his graduation from the Army flying school in Texas and as an air mail pilot. Although his Atlantic flight was not, as many believe, the first across the Atlantic, it was the first solo flight across that vast body of water and was made in such an unpretentious manner, that it excited universal admiration. The effect was greatly to increase public interest and confidence in aviation.





BOEING-40. In 1926 the Kelly Bill was passed by Congress and permitted the Post Office Department to contract with private carriers for flying the mails. This provided the financial stimulation which the young air companies needed. The Post Office got out of the air mail business and transferred the routes to private hands. Those companies which were then started were the foundation for the great air lines of today. The photograph illustrates one of the first types to be employed for continental service although its accommodations were cramped and the passenger sometimes had to share the space with the mail bags.

THE magnificent aircraft (below) which criss-cross our continent and carry our commerce across the oceans are the descendants of the many ships of the sky which have gone before and incorporate the brains of countless pioneers who devoted all of their interest and often gave their lives in the effort that you and I might fly.



STATISTICS OF WASHINGTON NATIONAL AIRPORT

GRAVELLY POINT, D. C.-VIRGINIA

Number landings and takeoffs for 1939 51,822
Number landings and takeoffs for 1940 70,522
Scheduled commercial landings and takeoffs per day .. 150
Largest number of landings and takeoffs on any one day was July 4, 1937, during Boy Scout Convention 523
Total cost of airport, including six hangars $16,000,000
Floor of each hangar capable of storing six standard commercial air transports (DC-3)
Average number of passengers landing and taking off from the field each day (estimate based on 21 seats per plane, with 60% occupancy) 1,890
Airlines now serving Washington:
- Eastern Airlines, Inc.
- Pennsylvania Central Airlines Corp.
- American Airlines, Inc.

CONSTRUCTION

CONSTRUCTION PERIOD

Work began ....May 27, 1940

Estimated Time of Completion ....April 15, 1941

DISTANCE & TIME

(From Benjamin Franklin Post Office ..3½ mi. & 10 min.

AIRPORT AREA

Landing Area ....556 acres
Building Area ....173 acres

TOTAL ....729 acres

RUNWAYS

	Length	Width
North-South	6,855 ft.	200 ft.
Northwest-Southeast	5,210 ft.	200 ft.
Northeast-Southwest	4,892 ft.	150 ft.
East-West	4,100 ft.	150 ft.

PAVING

(Runways, Taxiways, and aprons) ....677,000 sq. yds.

HYDRAULIC FILL

Leased Dredges	15,634,000 cu. yds.
Government Dredge	2,845,000 cu. yds.
TOTAL	18,479,000 cu. yds.

DRY EXCAVATION AND FILL ......2,165,000 cu. yds.

TERMINAL BUILDING

Length	540 ft.
Width	90 ft.

Height of antennae pole—above river 109.5', above ground 91'

Floor Area

Ground floor	58,000 sq. ft.
First floor	44,672 sq. ft.
Second floor	22,500 sq. ft.
Third floor	16,740 sq. ft.
TOTAL	141,912 sq. ft.

Piling ......43,700 linear ft.

HANGARS

Depth	208 ft.
Width	240 ft.
Height	55 ft.
Floor Area (Ground floor and shops)	49,920 sq. ft.
Garage Area (42' x 215')	9,300 sq. ft.

Office Area

At back of hangars (29' x 240')	6,960 sq. ft.
Above garage (42' x 29')	1,218 sq. ft.
Balconies (Two—172' x 21' each)	7,224 sq. ft.

Doors (30' x 175', sliding type with additional 10' x 40' section in center).

Dining room—seats	300
Dining Terrace—seats	350
Coffee shop—seats	100
Spectators—seats	2,000

PARKING AREAS

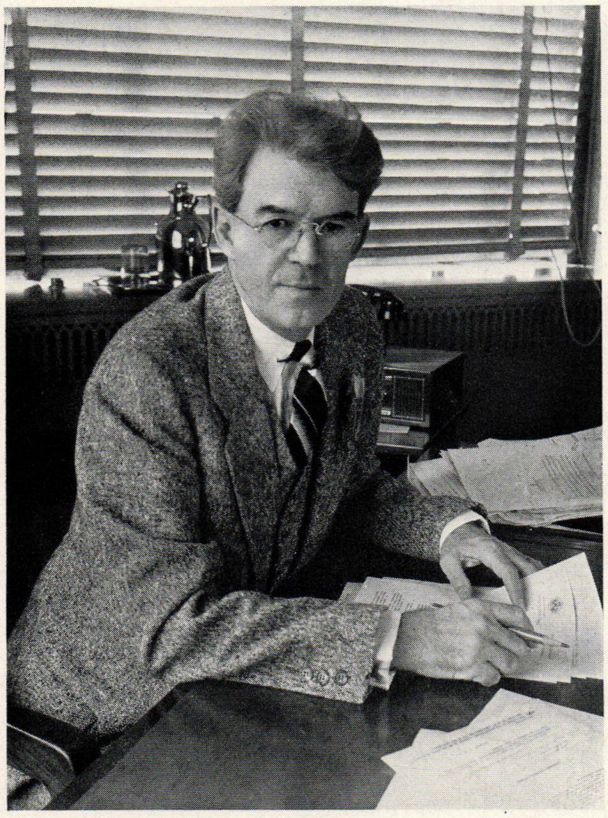
	No. Cars		
Observation	661		
Observation (overflow)	325	986	
Storage	1,524		
Storage (overflow)	975	2,499	
Miscellaneous		1,515	5,000

GRADE SEPARATION & HIGHWAY STRUCTURES 4

BRIDLE PATH (Around circumference of airport)

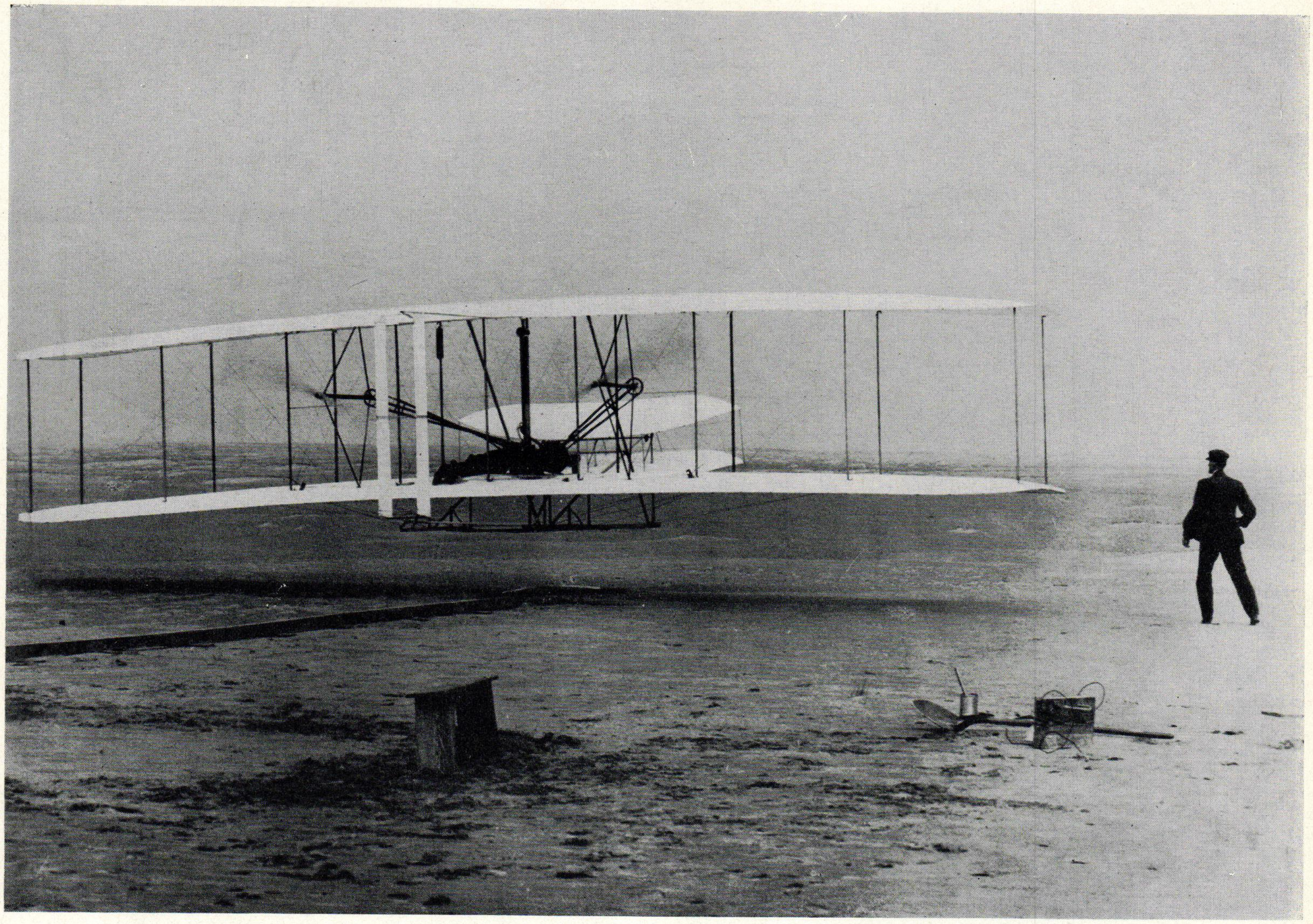
Approximate length ......12,000 linear ft.

NOTE: The Washington National Airport was constructed at Gravelly Point, D. C., Va., under the authority of the ADMINISTRATOR of the CIVIL AERONAUTICS AUTHORITY, CORPS OF ENGINEERS, PUBLIC BUILDINGS ADMINISTRATION, PUBLIC WORKS ADMINISTRATION and WORK PROJECTS ADMINISTRATION, with the cooperation of the WAR DEPARTMENT, FEDERAL WORKS AGENCY, DEPARTMENT OF JUSTICE, NATIONAL CAPITAL PARK & PLANNING COMMISSION, NATIONAL PARK SERVICE, COMMISSION OF FINE ARTS, PUBLIC ROADS ADMINISTRATION and other Federal agencies.



Supervising Engineer
Public Building Administration
NEIL A. MELICK

Construction Engineer in Charge of Airport
GEORGE B. SHELDON



THE FLIGHT AT KITTY HAWK

as told by Orville Wright

Reprinted from "Aviation"

DURING the night of Dec. 16, 1903, a strong cold wind blew from the north. When we arose on the morning of the 17th, the puddles of water, which had been standing around camp since the recent rain, were covered with ice. The wind had a velocity of 10 to 12 m./sec. (22 to 27 mi./hr.). We thought it would die down before long, and so remained indoors the early part of the morning. But when 10 o'clock arrived, and the wind was as brisk as ever, we decided that we had better get the machine out and attempt a flight. We hung out the signal for the men of the Life Saving Station. We thought that by facing the machine into a strong wind, there ought to be no trouble in launching it from the level ground about camp. We realized the difficulties of flying in so high a wind, but estimated that the added dangers in flight would be partly compensated for by the slower speed in landing.

We laid the track on a stretch of ground about one-hundred feet north of the new building. The biting cold wind made work difficult, and we had to warm up frequently in our living room, where we had a good fire in an improvised stove made of a large carbide can. By the time all was ready, J. T. Daniels, W. S. Dough, and A. D. Etheridge, members of the Kill Devil Life Saving Station; W. C. Brinkley, of Manteo, and Johnny Moore, a boy from Nags Head, had arrived.

We had a "Richard" hand anemometer with which we measured the velocity of the wind. Measurements made just before starting the first flight showed velocities of 11 to 12 m./sec., or 24 to 27 mi./hr. Measurements made just before the last flight gave between 9 and 10 mi./sec. One made just after showed a little over 8 m./sec. The records of the Government Weather Bureau at Kitty Hawk gave the velocity of the wind between the hours of 10.30 and 12.00 o'clock, the time during which the four flights were made, as averaging 27 mi./hr. at the time of the first flight and 24 mi./hr. at the time of the last.

With all the knowledge and skill acquired in thousands of flights in the last twenty years, I would not think today of making my first flight on a strange machine in a twenty-seven-mile wind, even if I knew that the machine had already been flown and was safe. After these years of experience I look with amazement upon our audacity in attempting flights with a new and untried machine under such circumstances. Yet faith in our calculations and the design of this first machine, based upon our tables of air pressures, secured by months of laboratory work, and confidence in our system of control developed by three years of actual experience in balancing gliders in the air had convinced us that the machine was capable of lifting and maintaining itself in the air, and that, with a little practice, it could be safely flown.

Orville's First Flight

Wilbur, having used his turn in the unsuccessful attempt of the 14th, the right of the first trial now belonged to me. After running the motor a few minutes to heat it up, I released the wire that held the machine to the track, and the machine started forward into the wind. Wilbur ran at the side of the machine, holding the wing to balance it on the track. Unlike the start on the 14th, made in a calm, the machine, racing a 27-mi. wind, started very slowly. Wilbur was able to stay with it till it lifted from the track after a 40 ft. run. One of the Life Saving men snapped the camera for us, taking the picture just as the machine had reached the end of the track and had risen to a height of about two feet. The slow forward speed of the machine over the ground is clearly shown in the picture by Wilbur's attitude. He stayed along beside the machine without any effort.

The course of the flight up and down was exceedingly erratic, partly due to the irregularity of the air, and partly to lack of experience in handling this machine. The control of the front rudder was difficult on account of its being balanced too near the center. This gave a tendency to turn itself when started; so that it turned too far on one side and then too far on the other. As a result the machine would rise suddenly to about 10 ft., and then as suddenly dart for the ground. A sudden dart when a little over 100 ft. from the end of the track, or a little over 120 ft. from the point at which it rose into the air, ended the flight. As the velocity of the wind was over 35 ft./sec. and the speed of the machine over the ground against the wind 10 ft./sec., the speed of the machine relative to the air was over 45 ft./sec., and the length of the flight was equivalent to a flight of 540 ft. made in calm air. This flight lasted only 12 sec., but it was nevertheless the first in the history of the world in which a machine carrying a man had raised itself by its own power into the air in full flight, had sailed forward without the reduction of speed, and had finally landed at a point as high as that from which it started.

With the assistance of our visitors we carried the machine back to the track and prepared for another flight. The stinging wind, however, had chilled us all through, so that before attempting a second flight, we all went to the building again to warm up.

Wilbur's First Flight

At twenty minutes after eleven Wilbur started on the second flight. The course of this flight was much like that of the first, very much up and down. The speed was faster than the first flight, due to the lesser wind. The duration of the flight was less than a second longer than the first, but the distance covered was about 75 ft. greater.

Twenty minutes later the third flight started. This one was steadier than the first one an hour before. I was proceeding along pretty well when a sudden gust from the right lifted the machine up 12 to 15 ft. and turned it up sidewise in an alarming manner. It began a lively sidling off to the left. I warped the wings to try to recover the lateral balance and at the same time pointed the machine down to reach the ground as quickly as possible. The lateral control was more effective than I had imagined and before I reached the ground the right wing was lower than the left and struck first. The time of this flight was fifteen seconds and the distance over the ground a little over 200 ft.

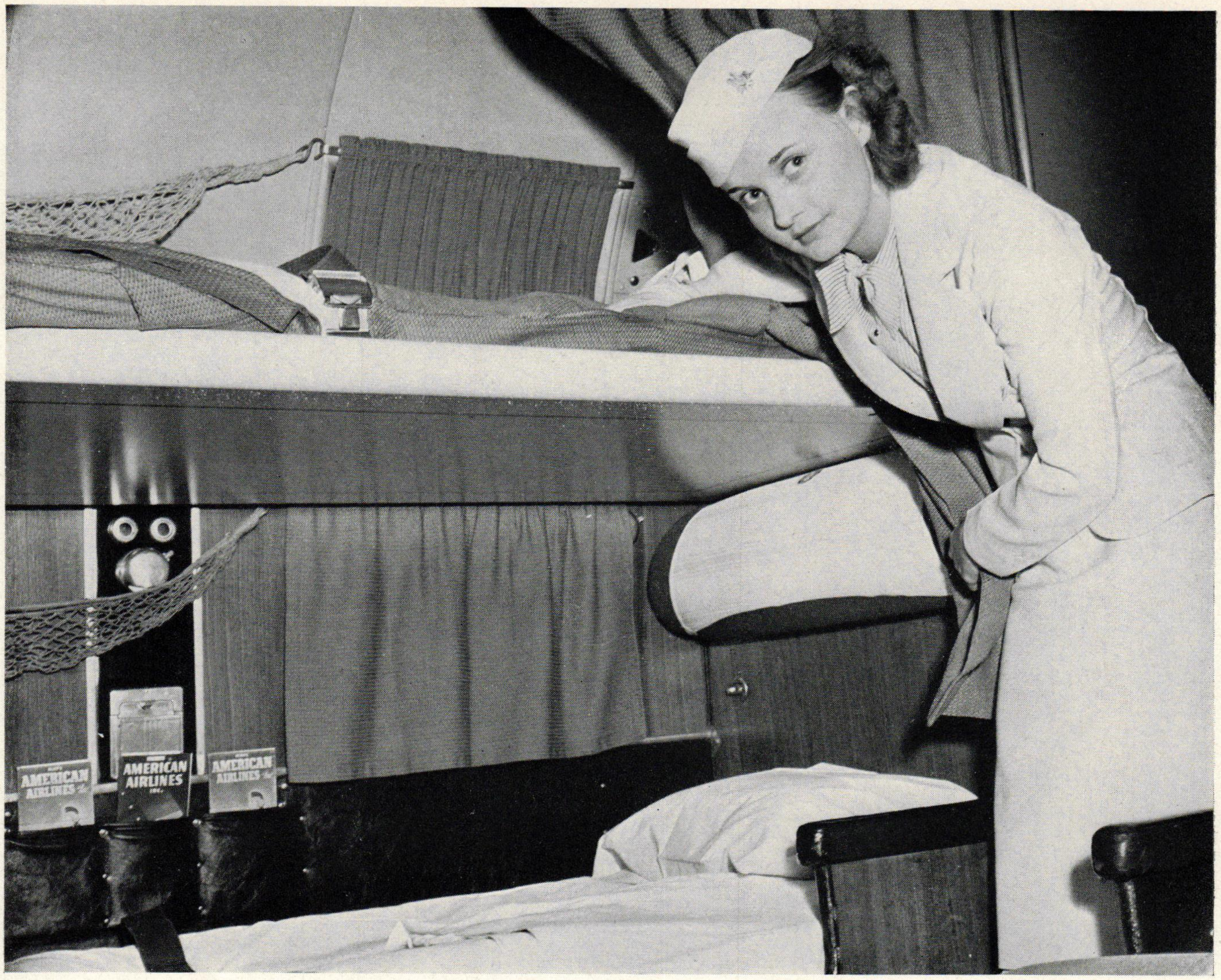
Wilbur started the fourth and last flight at just 12 o'clock. The first few hundred feet were up and down as before, but by the time 300 ft. had been covered, the machine was under much better control. The course for the next four or five hundred feet had but little undulation. However, when out about 800 ft. the machine began pitching again, and, in one of its darts downward, struck the ground. The distance over the ground was measured and found to be 852 ft.; the time of the flight 59 sec. The frame supporting the front rudder was badly broken, but the main part of the machine was not injured at all. We estimated that the machine could be put in condition for flight in a day or two.

While we were standing around discussing this last flight, a sudden strong gust of wind struck the machine and began to turn it over. Everybody made a rush for it. Wilbur who was at one end, seized it in front, Mr. Daniels and I, who were behind, tried to stop it by holding to the rear uprights. All our efforts were in vain. The machine rolled over and over. Daniels, who had retained his grip, was carried along with it, and was thrown about head over heels inside the machine. Fortunately he was not seriously injured, though badly bruised in falling about against the motor, chain guides, etc. The ribs in the surfaces of the machines were broken, the motor injured and the chain guides badly bent, so that all possibility of further flights with it for that year were at an end.

PLANE PARADE ON THE OCCASION OF THE DEDICATION OF THE WASHINGTON AIRPORT, SEPTEMBER, 1940

A PENNSYLVANIA CENTRAL PLANE

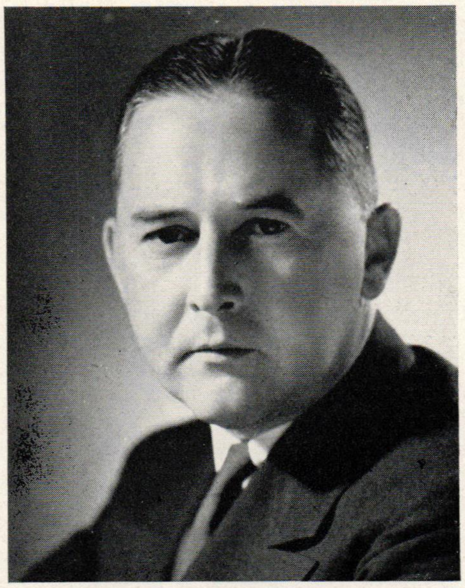
HOSTESS



BERTH READY ON
A SLEEPER PLANE

CONTROL TOWER
AT NEWARK AIR-
PORT

Photograph by W. C. Clark



By W. A. Patterson
United Air Lines

COMPLETION of the new airport at Washington is symbolic of the growing economic and social importance of air transportation to our country.

Improvements in transport and communication are reflected in our welfare. Every speeding up of transportation and communication has effected direct benefits in many ways. These benefits have brought about an ever-stronger, more closely knit union.

The opening of the new airport at Washington will add emphasis in this important area to the part air transportation is playing in our current defense program.

Operating over the network of airlines that links our 48 states with service so fast that it is but an overnight flight from coast to coast, hundreds of transport planes are carrying persons and goods whose fast movement is essential to the acceleration of our defense program.

Government officials, industrialists, and others charged with the responsibility of saving every minute in the production of defense materials are using scheduled air transportation as a matter of course. Also emergency air express and air mail shipments are doing their part to expedite production.

Capt. E. V. Rickenbacker

(Continued from page 12)

Traditionally, Washington has been important in the history of Eastern Air Lines' development. On May 1, 1928, Pitcairn Aviation, Inc., "mother" and predecessor company of Eastern Air Lines, carried the first air mail from New York to Atlanta, Ga., via Washington, D. C. In February, 1933, Ludington Air Lines, first to fly passengers between New York and the nation's capital, was purchased by Eastern Air Transport. Since that time, the New York-Washington service of Eastern Air Lines, successor company of Eastern Air Transport, has gained a reputation as the most frequent air passenger service between any two cities by any air line in the world. Currently, Eastern Air Lines operates 25 round-trip flights between New York and Washington.

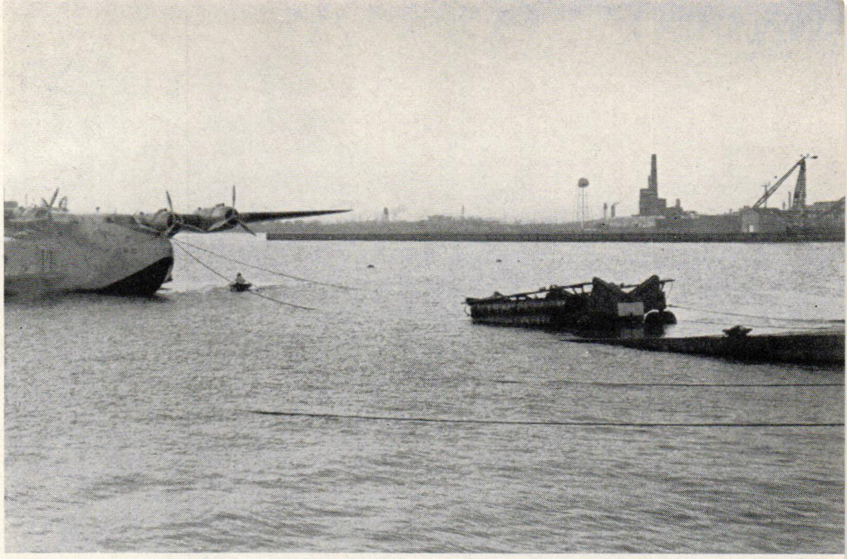
We of the Eastern Air Lines Family, of personnel and patrons, welcome this splendid monument to the progress of the nation's air transport system.

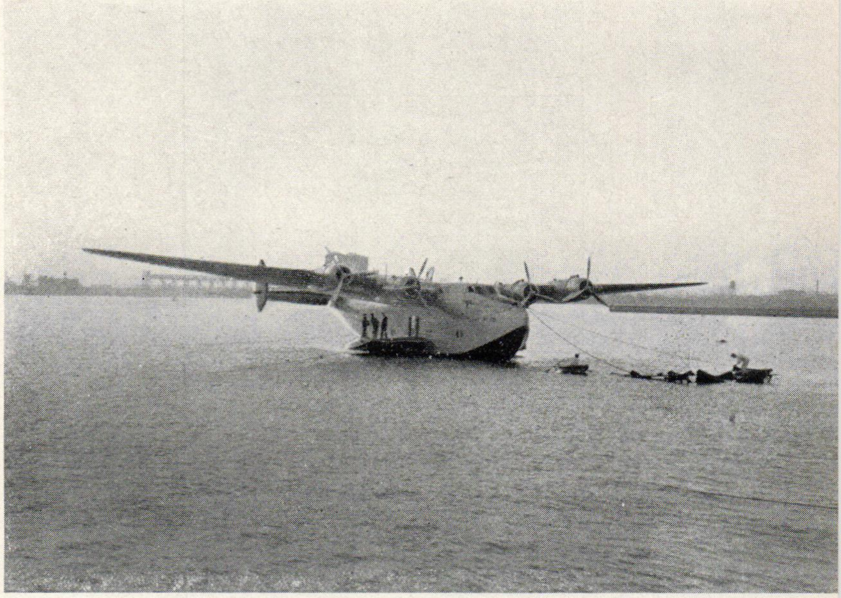
C. Bedell Monro

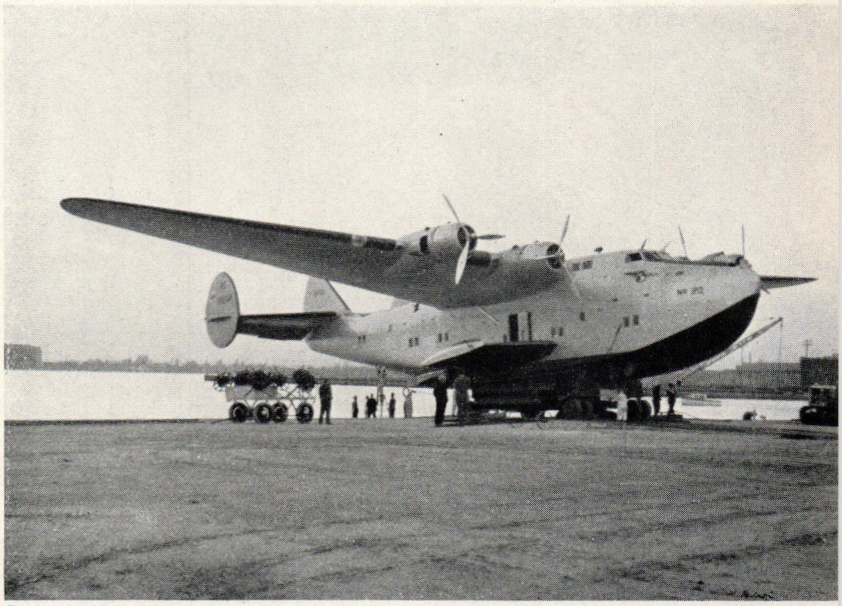
(Continued from page 12)

inauguration of air service to Washington's National Air port takes on added importance. PCA has the distinction of connecting the capitals of industry with the nations' capital, since more than half of the vital defense orders now are being filled in cities which our airlines serve. Pittsburgh, Buffalo, Cleveland, Detroit, Chicago, Milwaukee, Grand Rapids, Baltimore, Akron, Birmingham are all great names in America's gigantic national defense program—and Pennsylvania-Central Airlines is proud to provide a dependable air service connecting them all with the national capital.

On the occasion of the opening of this great new airport, we of Pennsylvania-Central Airlines pledge again our determination to provide an air service to and from Washington which will be second to none—now more than ever because of the vital necessity of our national defense effort.







Photographs by W. C. Clark

LANDING OF THE CLIPPER SHIP, "THE FLYING HOTEL," AT BALTIMORE

Note the cradle in the upper picture, which in the second picture has been placed under the keel of the clipper and in the final picture has been drawn by cable up the slip carrying the giant plane upon itself.

CAPITAL AIRPORT SERVICE

by MERLE J. OELKE
American Airlines

ON the opening of the new Washington National Airport, the Nation's Capital has again added another "Must" for visitors to see.

Aviation has come a long way in the past decade. Its development has been amazing. Rapid progress has caused us to face the problem of handling increased traffic in the best way possible while making plans for an even bigger future. America's air traffic continues to grow. The carrying of government officials who are traveling for the various defense projects has further brought about an "all out" effort to speed them on their way and make every minute of their time count for the good of our Country. Larger airports are needed as well as increased office space and working facilities. The new Washington National Airport is one answer.

Let us check the stepping stones upon which this progress was made.

When, for example, in 1933 American Airlines added Washington as a stop on their Southern Transcontinental Route, the old airport was good enough. The equipment at that time was not fast nor were the schedules as frequent as at present, and only five men comprised the personnel of the Company in Washington. For many years there was a highway running directly across the airport. It was necessary to have a flagman stop the traffic while airplanes took off or landed. The removal of that highway was a step forward and an improvement to the airport.

Those were the days when the co-pilot stepped back to the cabin with a "Hello" and a box lunch or maybe just a cheese or ham sandwich for each passenger. Probably that was the last you saw of him until you arrived at your destination. The planes then were noisy, the ventilation was poor, and the seats were uncomfortable. The pilots were so busy flying that no service was given the passengers. They did not have the dots and dashes known as the radio beam to aid in navigation. It was not available at that time. Weather reports were scarce, and the nation had few government and airline meterologists to send in periodic weather reports as they do today.

What a contrast that type of service is with the service offered today. The change was made possible when larger, faster day planes and Sleeper planes were put into use. The high development of aircraft instruments has made it possible to keep dependable schedules. By the use of radio the pilot receives the latest weather reports, the direction and strength of the winds aloft, so that it is usual today for a pilot to radio his arrival time, right to the minute, even though he is 50 miles from his destination. If the pilot is above the clouds, he follows the radio beam, known as the air highway of sound. The Captain and first officer of today can spend all of their time in the pilot's compartment and yet know the passengers will be well taken care of by the stewardess. It was an all important step forward in air line service when stewardesses were brought into the picture.

The special seven weeks schooling these personable registered nurses receive before taking to the air has meant a lot in the development of personalized service. From the first class of fifteen the number has grown to 250. You people who fly know their duties. For those who are not acquainted, it might be well to list a few of the things a stewardess does to make your flight so enjoyable. She takes your coat and hat as you enter the airplane, and sees that you have the newspapers and magazines you want. She may point out the places of interest, or act as a fourth at bridge. She serves your meals and makes you comfortable in every way. If you wish to snooze, she will adjust your seat to the most comfortable position and get you a blanket and pillow. If you are on a Sleeper, she will make up your berth. Occasionally the stewardess goes up to the pilot's compartment and returns with a flight information plan. This is a record of your flight. It will tell you where you are, how high you are flying, how fast you are traveling, when you can expect to reach your destination, and anything of particular interest about the flight or country below.

Sleeping in bed is an old American custom. Sleeping in a plane in a full-sized berth is also an American custom. Sleeper planes, of which American was the pioneer, were designed for the night comfort of the air traveler. You can leave Los Angeles at night, and when the stewardess serves you breakfast the following morning as you approach Washington, D. C., you marvel at the speed, the smoothness and restful atmosphere of air transportation today.

Speaking of food, that's just one more splendid service that is offered. It's on the house. When you consider that 65,000 meals were served out of Washington last year, you will understand that eating aboard airliners is a favorite pastime. What do you eat? The menus are in strong contrast to the oldtime co-pilots box lunch. For instance, if you were to board a Flagship in Washington for New York, at or near the dinner hour the stewardess would serve you Tomato Bisque shortly after you circled the Washington monument. It would take you 160 miles to eat your dinner, and by the time you are finished smoking your cigarette, the skyline of New York would be in view.

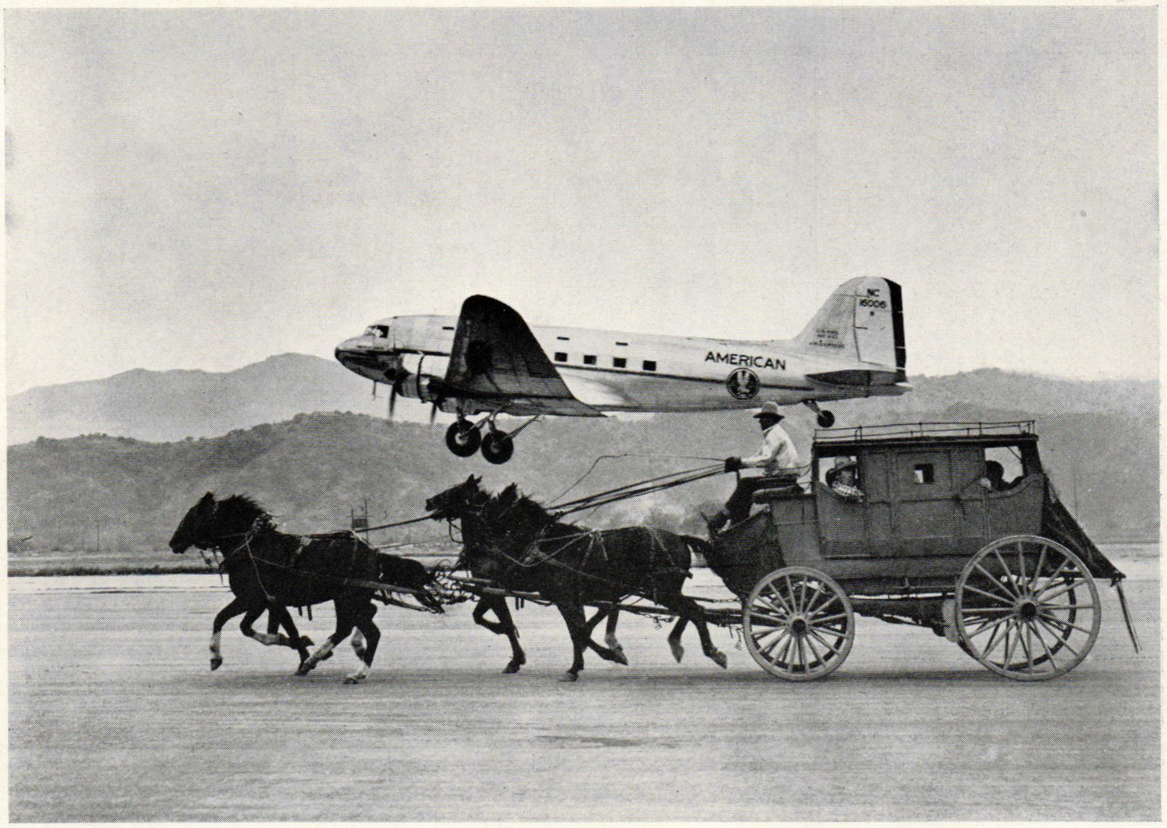
It is not difficult to understand the growth of air travel. Its time-saving advantages have been proven time and again. It's a matter of going late and arriving early. An astonishing increase in schedules is indicative of the growing demand. For example, American Airlines started a few years ago with two regular trips through Washington; today they have 32.

The increased use of air travel has necessitated several innovations which the Washington National Airport will feature. These will tend to speed up the various necessary operations required for arrivals and departures. The apron at the new airport will be the neatest of any in use today. In fact, owing to its efficiency many of the old typical airport scenes will be missing.

The air conditioning trucks, the gas trucks and the battery cart have all passed from view. While these services are still used, the equipment is hidden. It is placed in underground pits, directly underneath the nose of the plane. Messages formerly carried back and forth by dashing passenger agents will be sent from the ramp to the operations office by pneumatic tubes.

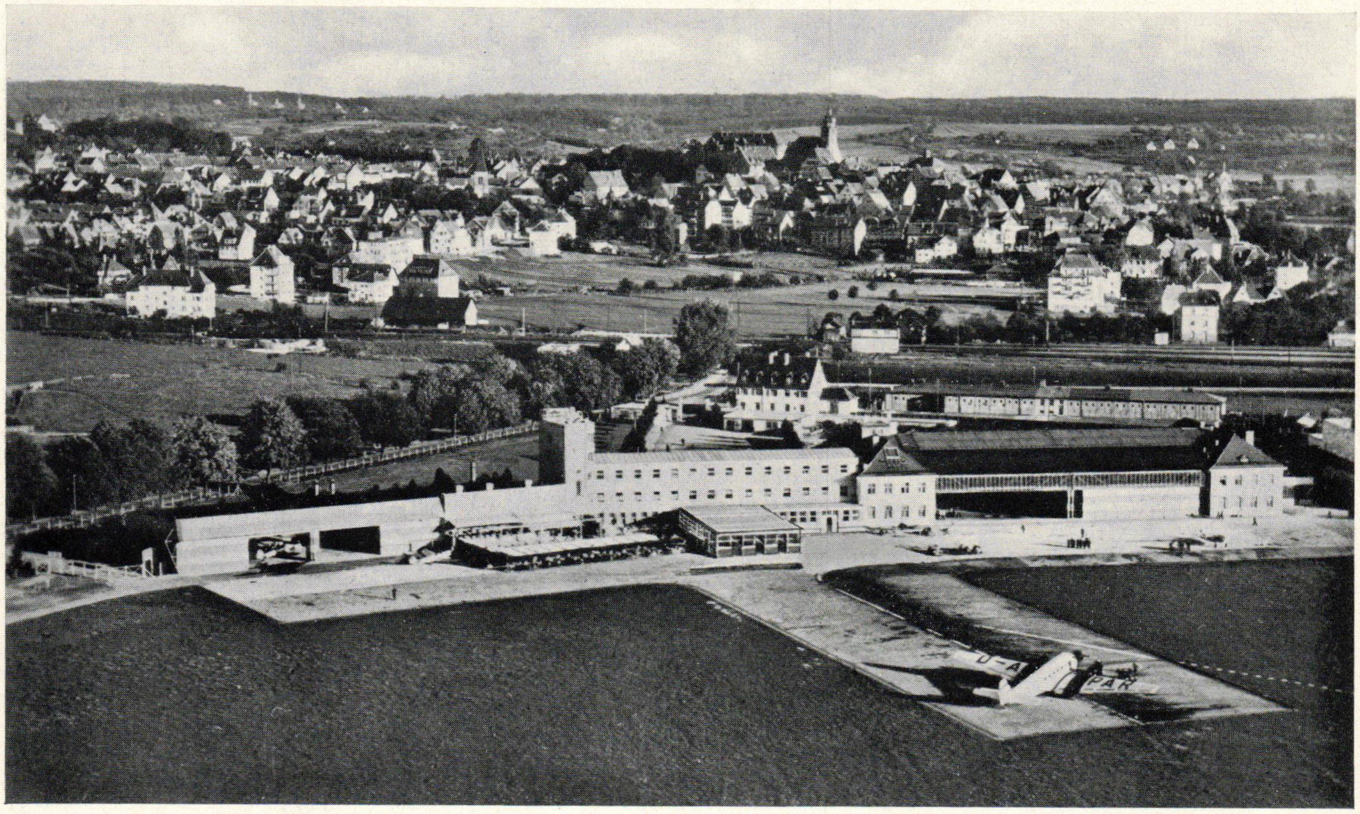
Though much of the familiar activity will be lacking, service will be speeded up immeasurably, and for the visitors on the promenade and the upper decks of the terminal building there will be plenty to see. The Washington National Airports location overlooks all of the favorite scenes and inspiring views of the Nation's Capitol. One sweep of the eye will include the Lincoln Memorial, Washington's Monument, the Capitol Dome, the Potomac River and Bolling Field.

Remember this is a ground view. Far more thrilling is the view from the air. Hop into a Flagship and let the countryside unfurl before your eyes. Discover for yourself that "Flying is Fun."

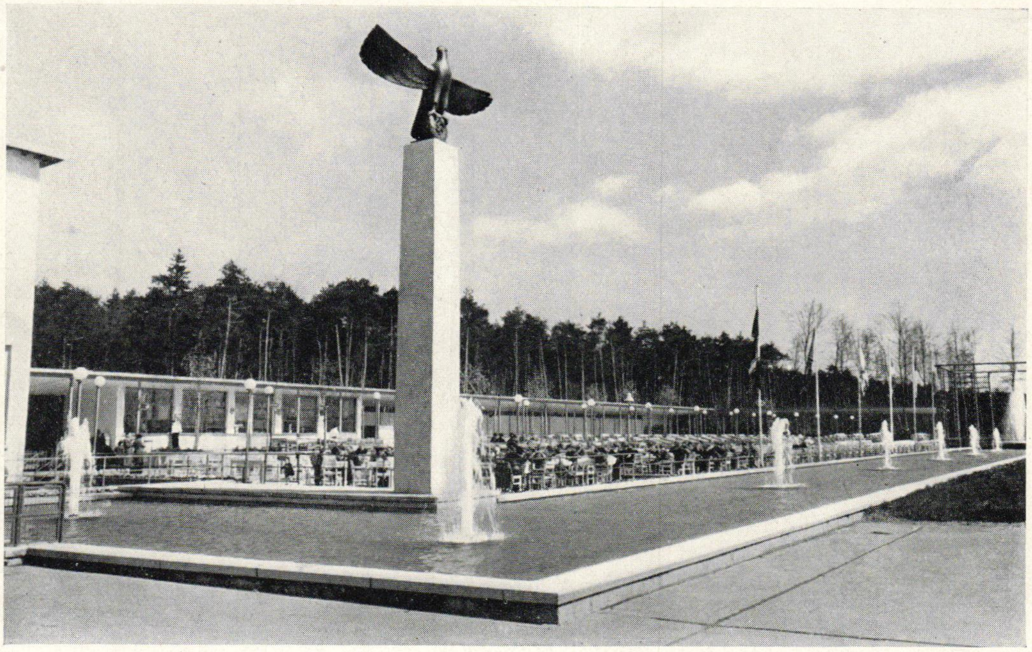


FOREIGN AIRPORTS

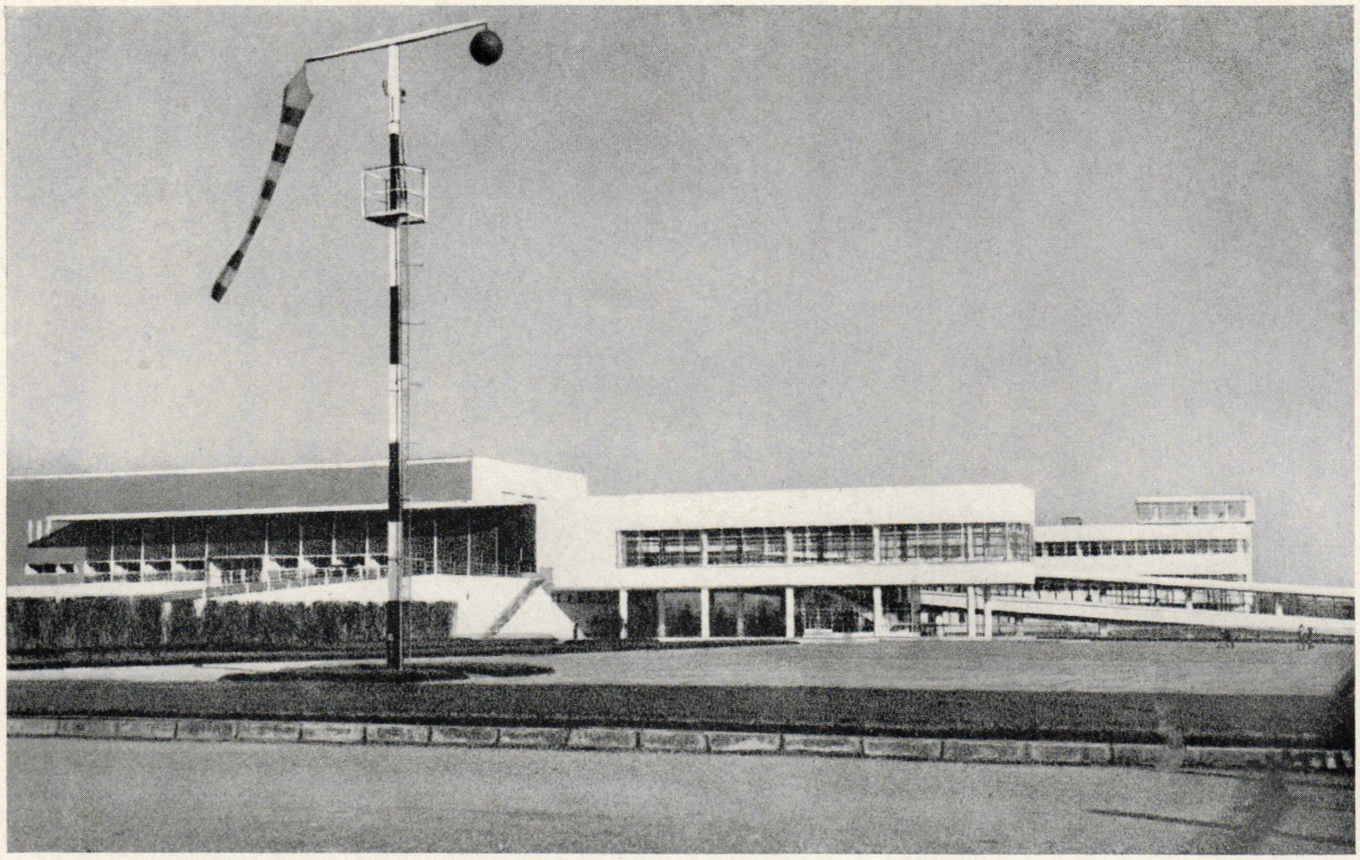
This is as they were in the spring of 1939. Note the recreational and social side of the lay-outs. The town folks assembled at the airports to eat, drink, watch the planes and mingle with their friends.



Stuttgart



Frankfurt



Milan

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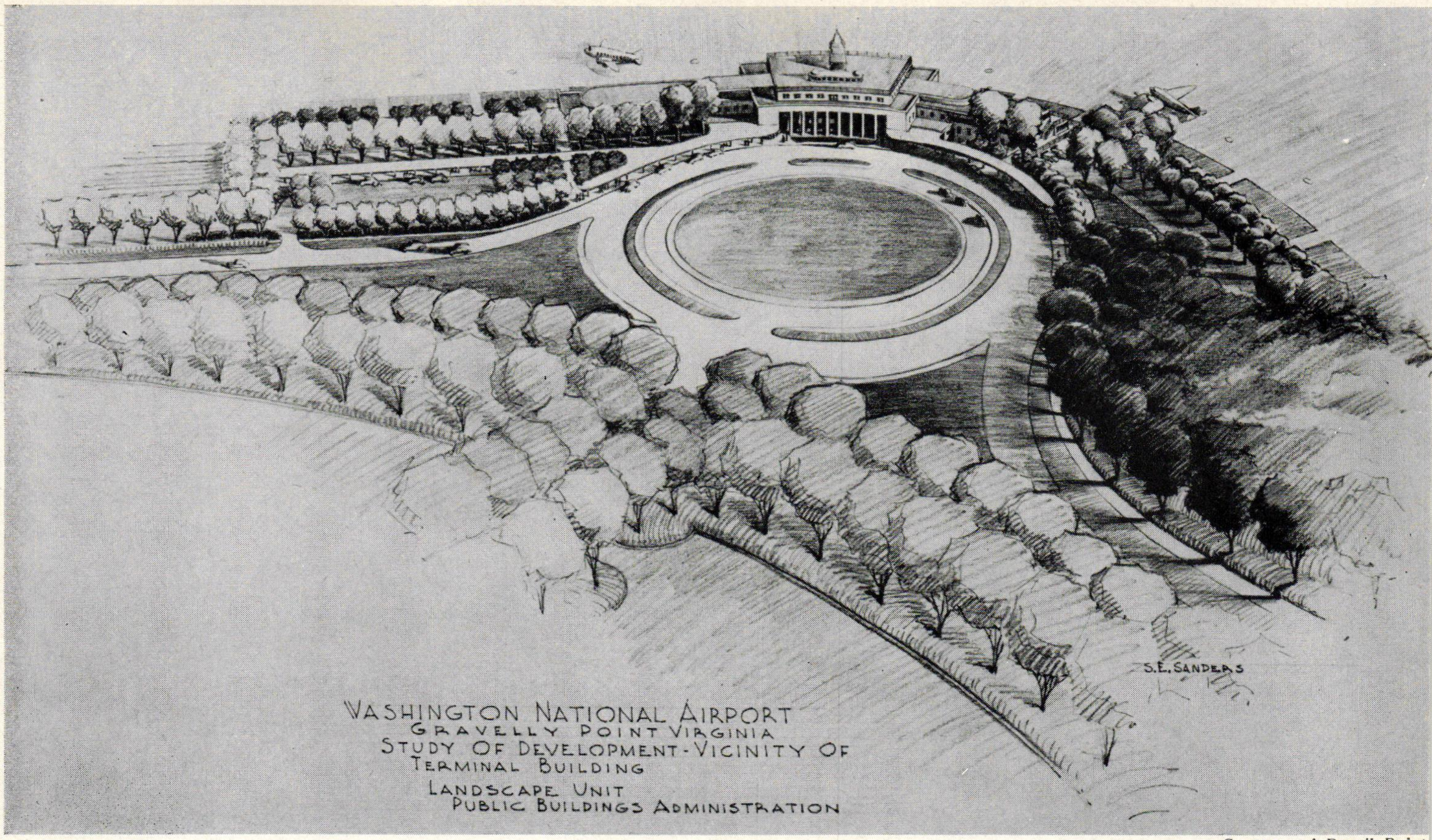


Courtesy of Pencil Points

THE CONCRETE WORK AT THE WASHINGTON NATIONAL AIRPORT

ADDRESS BY W. E. REYNOLDS, COMMISSIONER OF PUBLIC BUILDINGS, TO THE THIRTY-SEVENTH ANNUAL MEETING OF THE AMERICAN CONCRETE INSTITUTE.

Delivered by George B. Sheldon

The Washington National Airport is being financed largely from funds of the Public Works Administration and the Work Projects Administration. Its construction is being carried forward under the direction of the Civil Aeronautics Administration, working through various government agencies, such as the Corps of Engineers, the Public Roads Administration and the Public Buildings Administration. These agencies in turn cooperate with the National Park Service, the National Capitol Park and Planning Commission and the Fine Arts Commission in the development of the project. For purposes of administration, the Civil Aeronautics Administration appointed an interdepartmental engineering commission for advice and counsel. This commission has done an exemplary job.

The design and supervision of construction of the terminal building and hangars, together with the planning of approach roads to these structures, were assigned to the Public Buildings Administration. Due to the proximity of the hangars to the Mount Vernon Memorial Highway, these structures in themselves were required to have real architectural merit. Because of the large door opening requirements, and low height limitations, the superstructure is structural steel. The foundations, floors, sides and rear of the hangars are in reinforced concrete.

Great study was directed toward the design of the terminal building as a serious mistake here could not be condoned. Available data on comparable airports throughout the world were studied. An engineer was sent to Europe to examine at first hand the actual operation of the larger airports. The commercial airlines serving Washington placed at the government's disposal their most able technicians. The technical staff of the Civil Aeronautics Administration rendered valuable assistance. The consulting board of architects and the consulting board of engineers, on regular assignment with the Public Buildings Administration, followed closely the development of the plan. Finally, the architectural conception of the building met the critical review of the Fine Arts Commission. Surely, enough talent was employed to secure a satisfactory structure.

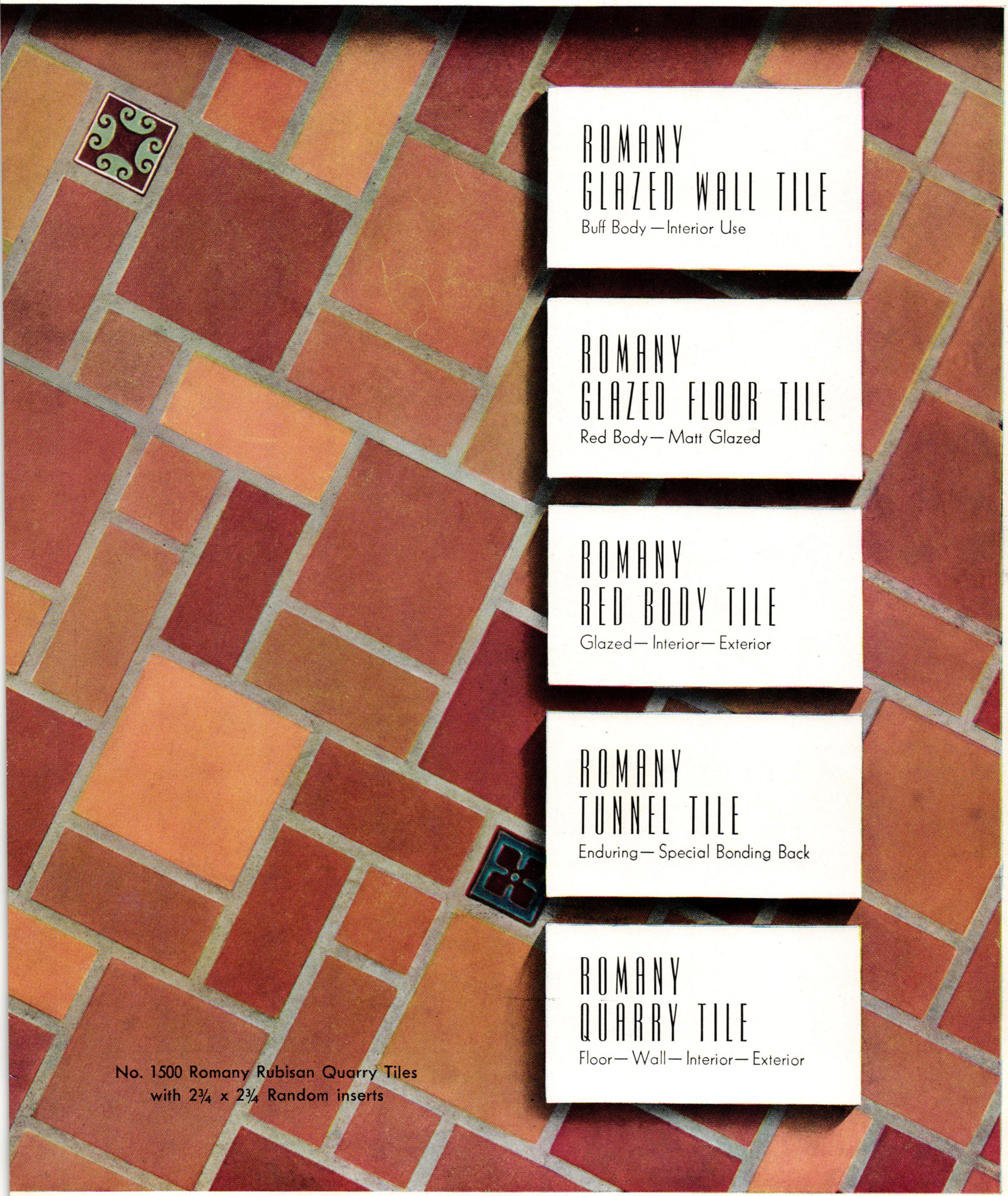
I am sure the group assembled here today is interested in details of construction, rather than the planning of the structure itself. With that thought in mind, the following observations may be of interest.

Construction joints are an eyesore, so means must be found to conceal them. The installation of reinforcing steel must be provided for. Sufficient clearance for placing and working the concrete must be allowed. Adequate expansion and weakened plane joints must be provided. All joining, symmetry of panels, mitering of joints, etc., must be contained in the design—not left to chance, or the contractor's conscience.

Since the architectural effect depends not only on line, but also on color, it was necessary to determine beforehand the definite mix to be used, assuring a sufficient amount of paste to fill the voids in the aggregate. The concrete must be sufficiently plastic to permit easy placing. This latter, of course, may be provided for by an increased cement and fine aggregate admixture, proper grading of sizes of aggregates, and absolute control of water-cement ratio. The color is obtained by the use of different brands of cement, permanent color pigments and different aggregates, so no variation or change in mix, or source of materials can be permitted if a uniform tone is to be had.

The finished concrete will look just like the interior of the form, so the form lining had to be considered. It has been found that board marks of the backing show through the thin lining material, and that the nails in the lining must be placed so no nail heads will show in the finished surface. The type, thickness and construction of the lining must be deter-

UNITED STATES QUARRY TILE CO.



GENERAL OFFICES CANTON · OHIO

mined. Joints must be neat and tight to prevent "bleeding," as "bleeding" causes honeycombing. All vertical joints should be made on studs. Interior joints should be mitered, and all cracks closed with a plaster patching material.

The proportions of the materials to be used also must be predetermined, as well as the amount and position of the reinforcing steel. Reinforcement should be of sufficient area and proximity to the finished face to prevent cracking, but enough space must be provided to allow for placing the concrete between steel and forms.

As designed, and almost completed, the terminal building is a three story, combination reinforced concrete and structural steel building, designed in accordance with the provisions of A. C. I. and A. I. S. C. building codes. The building is 540 feet long and 90 feet wide, with the center portion and one end having a radius of 412 feet. It rests on a foundation of cast-in-place concrete piles, figured for a maximum load of 30 tons per pile.

The outstanding structural features of the building are:

(1) Reinforced concrete cantilever balcony in the main waiting room, with a 20′6″ overhang and a length of about 180′.

(2) Second floor and high roof are reinforced concrete flat slab construction without drop panels or capitals. This was necessary to obtain a flat ceiling with the minimum of depth in floor construction.

(3) The third floor construction over the main waiting room is of the cellular steel type, supported on built up steel girders 4′0″ deep, with a span of 57′. The cellular steel type was used to provide adequate electrical distribution. To permit maximum window area on the field side of the waiting room, the girders were supported at that end by steel pipe columns filled with concrete; and, to avoid excessive bending on these columns due to girder deflections, the girders bear on rocker arms which rest on top of the round columns.

The usual custom in this locality, when building forms, is to use studs 12″ to 16″ on center; but, on the west coast where the best concrete structures have been erected, experience has shown that forms built with studs that wide apart permit a cupping of the sheathing. To eliminate that cupping, it is necessary to move the studs closer together. On this project the contractor was allowed to use studs 12″ on center if the plywood were ¾″ thick, or 8″ on center if the plywood were ⅝″ thick. He chose to use ⅝″ plywood and studs 8″ on center, which would permit a general sharpening of the lines of the form work. The wales are 24″ on centers, and all studs and wales are made of 2″ x 4″ stock in order to allow flexibility in alignment. The corners were firmly braced to prevent slippage of the formwork.

In looking at a new structure, the eye immediately picks up the lines; and, if they are true, minor imperfections escape notice. If the lines are not true, then the eye goes on critically to pick out every imperfection in the structure—hence the value of perfect alignment.

It was found that new and used material, either lacquered or oiled, gave different textures to the finished surface, depending on the absorptive properties of the material. New lacquered plywood produced a hard, non-absorbing, compact surface texture; while new, oiled material showed considerable absorption and gave splotches of a darker color, on account of the more porous texture of the form surface. Oil has a tendency to dry before the concrete is placed, and does not produce a non-absorptive surface to form work. The sample submitted for approval should show the desired texture of the finished surface; and, as the texture affects the tone of the color, no change in form lining material can be permitted from that used in the approved sample.

After experimentation, it was found that plywood forms treated with one light application of special form lacquer proved to produce satisfactory results. The re-use of the forms was permitted once, with light oiling. A second coat of lacquer is most unsatisfactory, as the second application tends to melt into the first coat, and both remain tacky. However, on any given wall area, the forms had to be made of either all new pieces, or all re-used pieces in order to get uniform results in texture and appearance. Having been used twice for architectural concrete, the forms could not again be used for that purpose, but they could be, and were used many times for the structural concrete slabs, unexposed walls, etc.

On curved surfaces, the sill was cut to pattern, with the studs set to this line and then sheathed. The panels for exposed concrete ceilings were all laid out symmetrically rather than at random, which gave a very satisfactory effect.

Waste molds were used for cornices, and also for models. These waste molds were made locally, and erected in the forms with studs and wales continuous across the molds in order to produce continuity of alignment. It was found that wales, or studs that were spliced, or offset at the joints between waste molds and wood forms adjacent, allowed the lines to break and wave.

The use of steel chairs to support steel was discontinued, as the bottoms of the chairs were exposed on the finished face of the concrete, and rusted. This makes no difference when the surface is interior, and painted; but shows rust stains and discoloration when the surface is exterior, unpainted, and exposed to the weather. Precast concrete blocks of the same mix as the pour were used to support steel in lieu of steel chairs.

The items that are considered necessary to architectural concrete are:

(1) An excess of cement paste to insure complete filling of voids.

(2) Admixture, when sufficient fines are not present, to give increased plasticity.

(3) Proper grading of fine aggregates to obtain the necessary fines.

(4) Absolute control of the water.

Class A concrete, with 5.2 sacks of bulk cement per cubic yard, was specified; and, at the request of the construction engineer, this was increased to 6.0 sacks per yard in order to produce the necessary excess cement paste. This job was fortunate in having both the aggregate and batching plants on the site. This allowed absolute control of the washing and grading of the aggregate, and produced the necessary fines. Being obtained as a residue from the dredging operations, the sand was a bit dirty, but was not washed too thoroughly for fear that all desirable fines would be lost. The gravel was crushed when necessary to reach the required grading with a maximum size of one inch.

The moisture content of the aggregate was checked at the stock piles, and water was measured and placed in the mixing trucks at the batching plant. This gave absolute cement-water ratio control for all concrete.

Having been measured by weight at the batching plant, the sand, gravel and water were placed in mixer trucks of 3.5 cu. yd. capacity, and the cement was added from another chute located a short distance from the batcher plant. The concrete, delivered in the transit mix trucks, produced a uniformly satisfactory mix. A five inch slump was allowable, on account of the nice workability and plasticity of the mix.

The concrete was handled with buggies, which practically eliminated segregation of materials; and, in combination with the use of tremies, also prevented "spatter" on forms above the pour which, if it dries before completion of the pour, leaves the surface pitted. The concrete generally was vibrated. Both gasoline and electric machines were used, and the electric type was found superior to the gasoline. In some locations there was not enough clearance to use vibrators, and the forms were malletted from the outside by *experienced* workmen, so that the results obtained equalled those obtained with vibrators. Hose lines were kept available to wash the seepage of the pour away, and prevent staining the work previously poured below.

The wall ties used were designed to incorporate spreader action by nailing the rods to the studs on each side. Holes are provided in these rods for this purpose, but the device did not prove successful, as it is not possible to control the spacing of studs so that they occur close enough to the wall ties to be nailed to. Unless ties are nailed in contact with studs, the spring of the nail allows variation in the thickness of the wall. Precast concrete spreaders incorporated with the ties will give positive spreader action. These spreaders, of course, have to match the color of the wall.

The concrete was cured at least six days—although in some cases it was necessary to remove the forms in four days, in which case the contractor covered the concrete with burlap, and kept it wet for the remainder of the required curing period. The tie rod holds were grouted immediately upon stripping, in order to secure proper bond.

The mix for the wash was determined experimentally on the sample to ascertain what mix and color would even out the variations in colors and patching. It was found that the wash must be the same color as the poured concrete, since the applied finish, or wash, does not cover or mask the poured concrete enough to allow for any deviation from the basic color of the material poured. Lighter or darker colors fill up board marks and rough surfaces only, and show undesirable contrast.

The wall was given a coating of a mixture composed of 20% white Portland cement, 30% standard Portland cement, and 50% sand passing 80 mesh. This coating was wiped on to a thickness of 1/8 inch. Thirty minutes later the coating was scraped off with a steel trowel, then rubbed with burlap. No rubbing with carborundum stone was done, except in smoothing out rough spots at patches, which amounted to practically nothing considering the size of the job.

There are one or two outstanding features of the terminal building that I should like to mention: It was found that by making the joints at the top of the rustication, two very desirable effects were obtained. First, the rustication was made sharper, and then the joints were more easily and effectively concealed. Another feature is the lettering on this building, which compares very favorably with any of the carved stone lettering to be found in the city. The letters are sharp and clear, and very legible at considerable distance from the building.

In short, we are quite delighted with the results obtained through the use of architectural concrete in this instance. This medium of construction permits long flowing lines and curved surfaces so suitable for a building serving our newest form of transport. It also reflects the feeling that a building servicing such a rapidly changing industry should have good taste without extravagance.

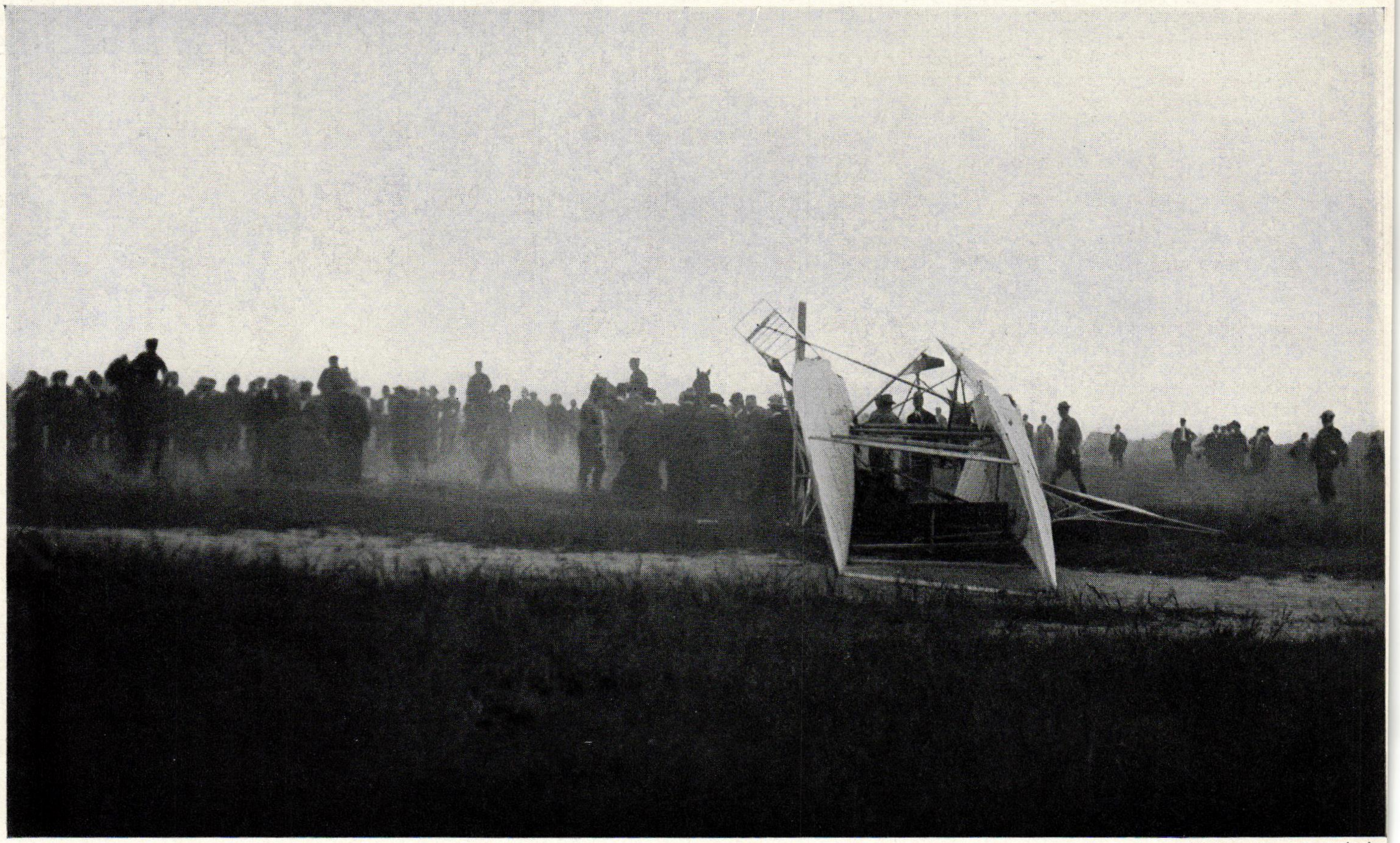
The architectural concrete columns for the loggia of the terminal building are two feet square, and 25 feet high, enclosing a ten inch structural steel column. Built into each column is a continuous flush lighting fixture, eight inches wide, extending from eight feet above the floor to one foot below the top of the column to provide indirect illumination for the loggia. Each fixture had internal bracing to resist the hydrostatic pressure of the concrete during the pouring process.

The reinforcement of the columns was of typical fireproofing design, composed of hoops and vertical rods. The forms were worked from 5/8 inch plywood such as is used for ping pong table tops and which is available in sheets five feet by nine feet. Horizontal joints were placed at the third points. The plywood was backed up vertically at the corners and third points with 2 x 4 inch material laid flat. The corners of the columns were not chamfered, but particular care was taken to hold the plywood together firmly to prevent any leakage. The column clamps were spaced from four inches at the bottom to ten inches at the top.

After lining up the forms, they were braced to the wall of the building, and also to each other. On account of the difficulty of placing the concrete in columns 25 feet high, and with structural steel and electric fixture obstructions, the mix was changed by omitting one-half of the gravel used in regular architectural concrete mix. The slump did not exceed six inches.

The concrete was poured at the rate of six feet per hour, puddled with rods and also with agitation of the reinforcement from above. The forms were thoroughly malletted on the outside as the pour progressed. No tremies were used, as the rate of pour and the prevailing moist atmospheric condition prevented spatter from setting up inside the forms ahead of the pour. The richness and workability of the mix, as well as the thoroughness of puddling and malletting prevented segregation of the aggregates.

The results were highly satisfactory for the reason that there was no honeycombing, no leakage at external angles, no sand streaks, and less than the average number of air holes.



Photograph by Malcolm

THE PLANE CRASH IN WHICH LIEUTENANT SELFRIDGE, THE FIRST MARTYR TO AVIATION, WAS KILLED— IN THE FALL OF 1908

The sub-base was brought to grade and all unstable material was excavated and replaced with selected material. It was then scarified and harrowed and cobbles were removed. Binder soil was spread by hand in pre-determined quantities, cut in and harrowed, placed to 9-inch depth, and repeatedly harrowed to obtain thorough mixing, adding water as necessary. Another grading was followed by compaction rolling, shaping, smooth rolling, hand grading where needed, and finish rolling, with occasional applications of water.

A light bituminous primer was applied on the stabilized base. Aggregates available from the hydraulic fill were also utilized in preparing the hot mix asphaltic concrete paving. The paving consisted of a base course 2 inches thick and a wearing course 1½ inches thick. During the paving season of 1940, approximately 550,000 square yards of paving were laid, which is equivalent to a 22-foot paved highway extending from Washington 42 miles to Baltimore.

Utilities and Services

Pipe mains for domestic water, fire protection system, and condenser water, ducts for electric power, and telephone and sewer pipe lines, were installed to serve the terminal building and hangars.

Services for each of the twelve loading points on the apron at the terminal building consist of a telephone and pneumatic tube pit, an air conditioning pit, a water and battery pit, a gasoline and oil pit, and an airplane turntable. These pits are all supplied by underground services to eliminate trucks and other vehicles normally used to supply the requirements for airplane servicing.

The domestic water is supplied through an 8-inch main from the Arlington County Water System. The sanitary sewer consists of gravity lines terminating in a pump station and thence through a 12-inch force main to the Arlington County Sewerage System. There are two 18-inch mains from a fire pump station constructed on the river which serve the fire system throughout the airport grounds and the air conditioning unit.

The electric power duct system is carried through a 4-inch conduit serving the various units from a substation supplied with 25,000 volts and other smaller voltages.

The telephone duct system consists of a 9-way tile duct conduit branching out to serve the respective buildings.

Landscaping

The runway shoulders adjacent to the pavements are fine graded, topsoiled, fertilized, and seeded to produce sodded landing strips. Cut and fill portions of the upland area are treated in a similar manner. The planting of the terminal building area with trees and shrubs is being accomplished to the extent permitted by available funds.

Jack Frye

(*Continued from page* 13)

Looking to the future, the designers have provided for expansion, which is sure to come. In addition, they have profited from lessons Europe learned on how to change airports from money losers to money makers.

The Schiphol Airport at Amsterdam, in the Netherlands, was switched from the red to the black side of the ledger by catering to air-minded sightseers. Experiments revealed that a certain level of fees charged the visiting public at the field actually increased instead of diminished the number of visitors. Sightseeing tours and de luxe restaurant and other public services resulted in an airport profit, permitting a reduction in many of the rental charges against aviation operations. Similar experiments at other European airports produced the same results.

Airplanes have appealed to the imagination of the American public since the day the Wright brothers made their first flight. This enthusiasm can be used to help airports become self-supporting. The number of visitors who daily jam La Guardia Field is proof of that.

The new Washington airport provides ample accommodations for the air-minded public and the designers deserve commendation for providing the excellent observation terraces, and restaurant, the latter so designed that diners may always have an unobstructed view of the field. The service pits, housing outlets for telephones, air-conditioning and gasoline, thereby eliminating the need for mobile service trucks on the field, also mark an important step forward.

The aviation industry calls for ingenuity and vision. The designers of Washington's National Airport have proved they are qualified to meet the industry's challenge.

C. R. Smith

(*Continued from page* 13)

cannot fail to bring forth leaders with vision, competent workmen, skilled designers, and thoughtful coordinators of our efforts to build a better civilization.

Washington National Airport is a thrilling answer to those who charge America with being short-sighted in defense preparations; it is a monument to the democratic freedom in education and government; it is a stirring tribute to our way of life.

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Made of 16-ounce Anaconda Copper for standard 8″ and 12″ walls, these flashings are stocked by leading sheet metal supply houses in 8′ lengths, together with unique one-piece corner flashings which provide effective and easy assembling. Also available in special widths with various selvages.

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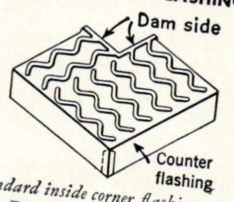
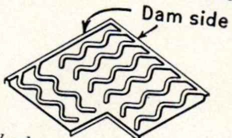
INSIDE CORNER FLASHING



Standard inside corner flashing unit. Dam on inside, drains out.

OUTSIDE CORNER FLASHING



Standard outside corner flashing unit. Dam on outside, drains in.

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"PITTSBURGH" stands for Quality Glass and Paint

Here is a reception lobby in an office building which shows the design possibilities of Carrara Glass. Ivory and Forest Green Carrara are used to create attractive, reflective walls. Note that Carrara can be bent, as at the end of the built-in divan. There are ten appealing Carrara colors to choose from.

CARRARA
The modern Structural Glass
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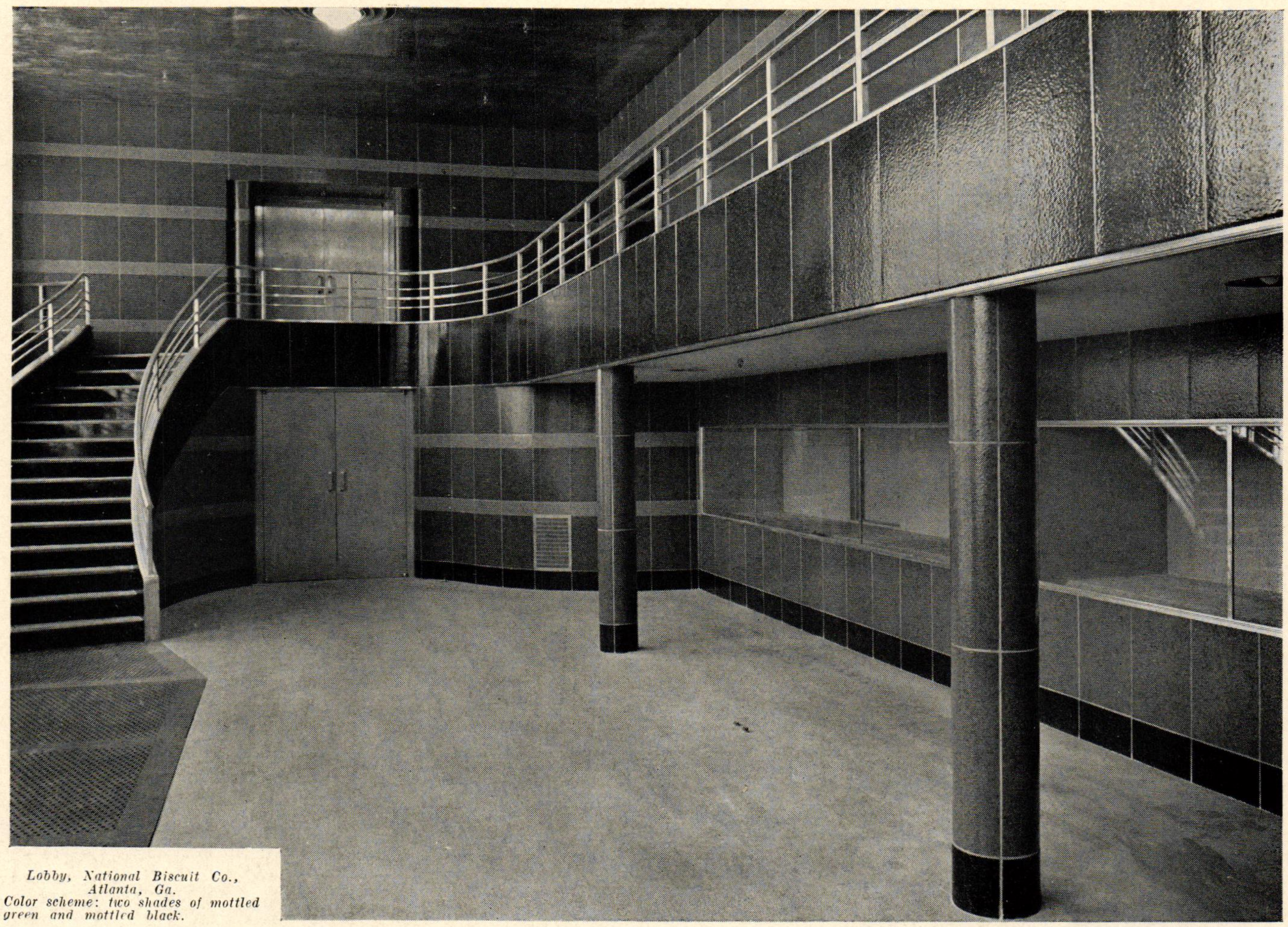

Lobby, National Biscuit Co., Atlanta, Ga.
Color scheme: two shades of mottled green and mottled black.

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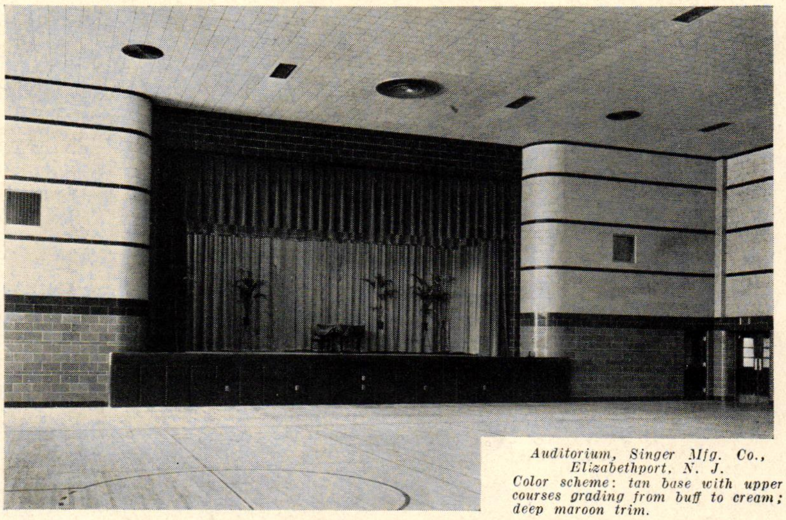

Auditorium, Singer Mfg. Co., Elizabethport, N. J.
Color scheme: tan base with upper courses grading from buff to cream; deep maroon trim.

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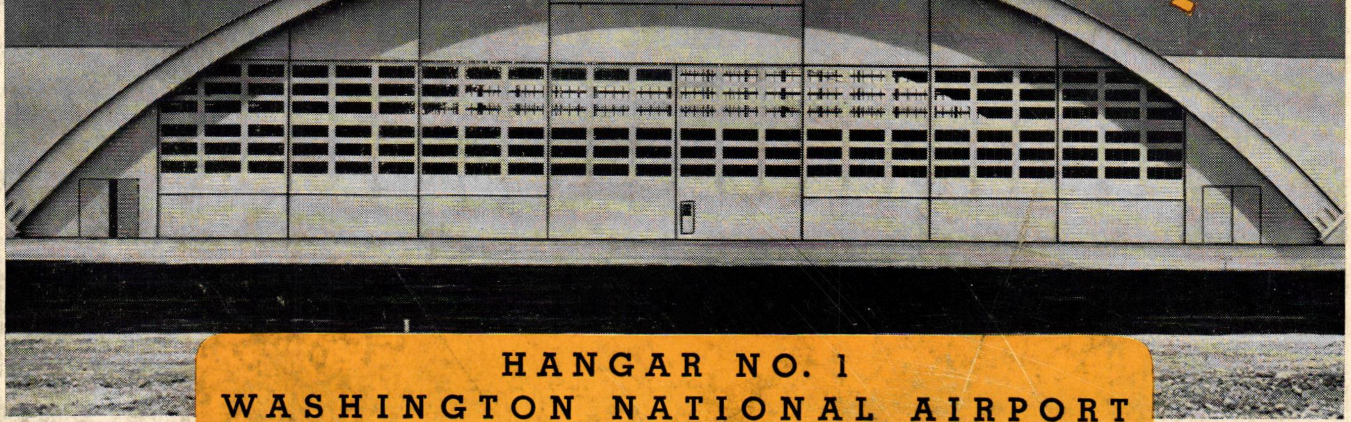

HANGAR NO. 1
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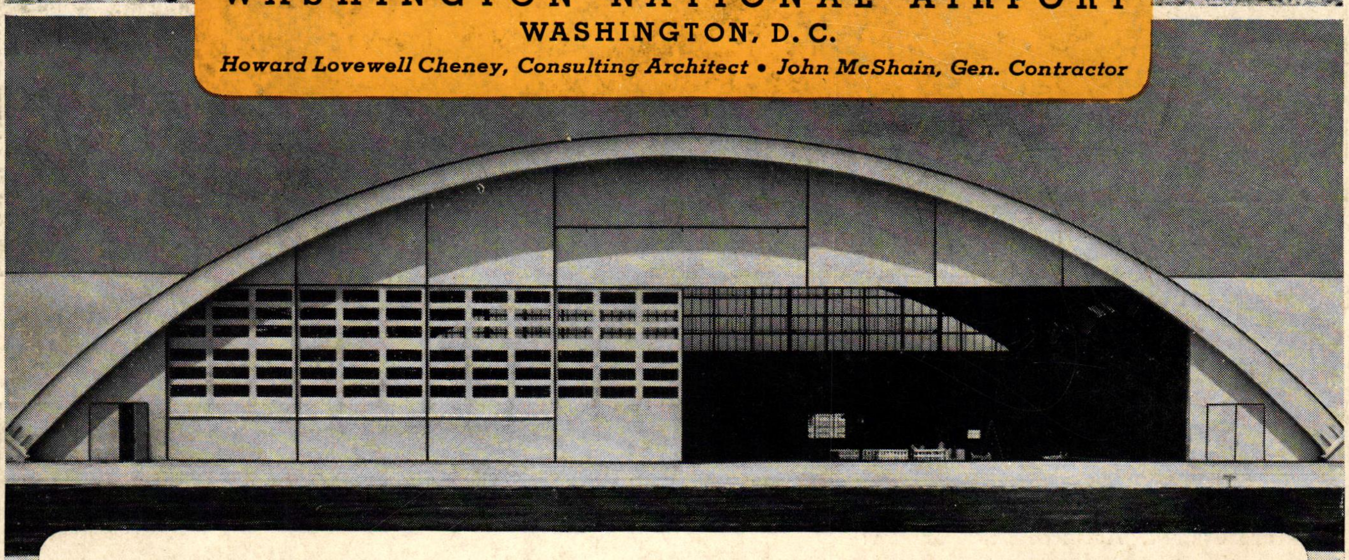

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