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TRANSCONTINENTAL AIR TRANSPORT, INC.

TAT PLANE TALK



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TAT WEATHER SERVICES

SEVERAL phases of the preliminary organization of Transcontinental Air Transport, Inc., including its financial structure, airport development and communications system have been described in the three previous issues of "Plane Talk." This issue is devoted to the weather bureau organized by the Company.

Purpose

THE weather hazard, without question, has been one of the most costly hindrances to the development of air transportation. Weather conditions, obviously, cannot be controlled, even to a slight degree, but areas of adverse conditions can be avoided if their location and direction of movement is known. With this in mind TAT has organized a system of weather reporting stations along its entire route which will place before the pilot an exact picture of conditions surrounding him.

By means of the tele-type and two way radio communications system the pilot can be informed of adverse conditions lying ahead of him and advised to detour through more favorable areas.

Normal weather conditions along the route selected by TAT offer no obstacles to passenger transport. Adverse conditions, however, sometimes appear between the pilot's take off, and arrival at his destination. If the pilot can be informed immediately of these conditions he can fly around or above them, or, in extreme emergencies, return to his starting place. In other words, the weather hazard is reduced to its minimum.

The TAT weather bureau is, without exception, the most elaborate and detailed that has been attempted. It is owned and controlled entirely by the Company and is not a part of the Department of Commerce communications system as are the radio and tele-type systems. So far as is known, TAT is the only air transport company which owns and operates such a bureau.

Organization



THE final plans for the service were perfected last month through the active co-operation of Pennsylvania and Santa Fe officials, and employees, and the generous assistance of the United States weather bureau. Weather recording instruments and equipment are now being installed, personnel has been chosen and is being instructed and tele-type and radio installations will be made as soon as building construction permits. The entire service will be ready prior to date of operation.

The service has been designed to answer four questions and the answers are presented to the pilot just before he takes off from each station and transmitted to him aloft as occasion demands. The pilot wishes to know:

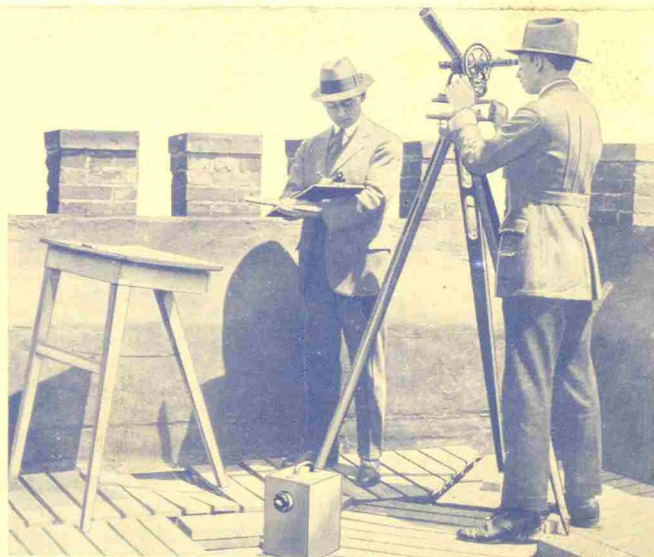
1. What weather conditions prevail at destination.
2. What conditions will be encountered along the route.
3. What, when and where changes may occur.
4. At what altitude will the most favorable flying conditions be found.

To answer the questions, observations must be taken along his route, at his destination and at varying distances on either side of the route. Off-line observations inform the pilot if unfavorable conditions

are likely to cross his line of flight, or if more favorable conditions might be found by deviating from the direct route. Off-line stations have been located at such distances from the airway that a plane may reach its destination or an emergency landing field, before being overtaken by a moving storm center. The distances were selected with the knowledge that a storm center seldom moves at more than thirty miles an hour. A knowledge of upper air conditions is obtained by means of pilot balloon "soundings."

Location

TEN of the main landing fields, namely: Columbus, Indianapolis, St. Louis, Kansas City, Waynoka, Clovis, Albuquerque, Winslow, Kingman, and Los Angeles, are being equipped with a complete installation of regulation weather bureau instruments. Each field has its own meteorologist of experience. The weather bureau



Taking a pilot balloon "sounding." Actions of the balloon observed through the theodolite make possible calculations of upper air currents.

office adjoins the office of the Field Manager and is in constant contact with the radio station by a direct wire. Twice daily two hundred U. S. Weather Bureau reports are received by them and weather maps are drawn and studied. These particular reports are augmented by a mid-day report from all TAT observers. The U. S. Weather Bureau observations cover the entire United States and provide general weather information, while the mid-day report covers the territory traversed by TAT planes and furnishes more concentrated data.

In order to provide current information, seventy-two observation points have been selected in addition to the above fields, both on the airway across the country and to either side. Those on the airway are located approximately fifty miles apart. Those off the route are approximately one hundred miles apart and about seventy-five miles or more from the line of flight. Most of these points are Santa Fe or Pennsylvania railway stations. The

observers are the railroad operators. In sections where neither railroad operates, TAT has employed its own observers who report their observations by telegraph to the collecting points. Several U. S. Weather Bureau stations are also included in the off-line network.

Equipment

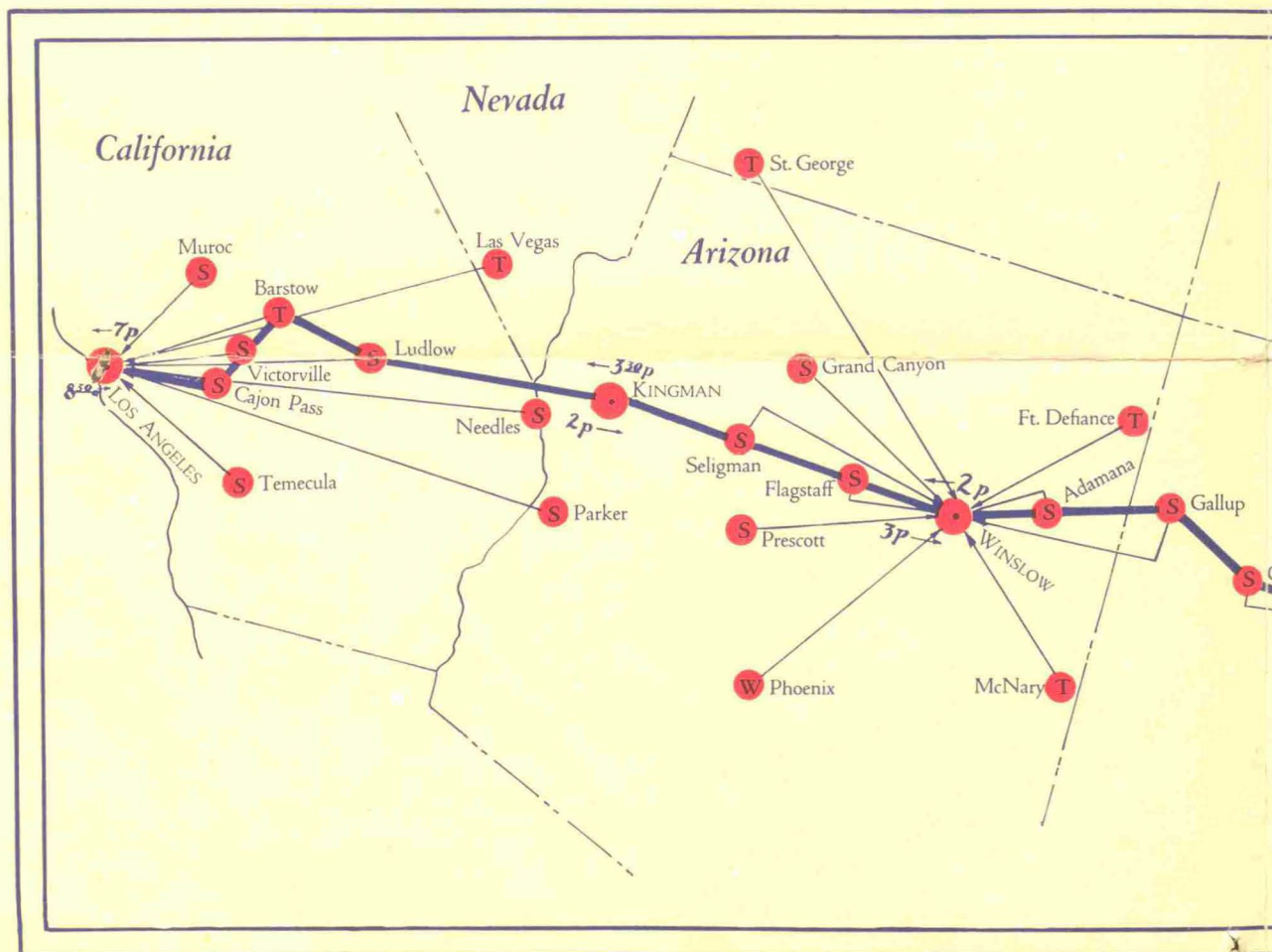
INFORMATION must be accurate and in great detail, and complete equipment and careful observations are essential. The meteorological instruments provided the seventy-two intermediate points consist of a thermometer for temperature readings, a psychrometer for calculating humidity and dewpoint, an aneroid barometer for reading atmospheric pressure, a wind vane for observing wind direction, and an anemometer for reading wind velocity. There are also the necessary forms, code books, instruction sheets, maps, tables, etc.

The ten TAT meteorological stations

are naturally more completely equipped, since weather changes must be studied, particularly in their own sectors. The above mentioned instruments are included, and in addition, automatic graphing instruments for recording pressure, temperature and wind velocities. Also balloon ascension paraphernalia is employed. This consists of balloons, hydrogen tank, scales, theodolite, charts and tables. A balloon run is for the purpose of obtaining ceiling height, and the direction and velocity of winds at higher altitudes. The tabulations select for the pilot the proper altitude to fly in order to take advantage of most favorable winds, or to avoid headwinds.

At the twelve stops, tele-type installations will be made both at the railroad stations and at the fields. Radio for transmitting and receiving to and from the pilot will be installed adjacent to the field. Descriptions of this equipment and its use appeared in the March issue of "Plane Talk."

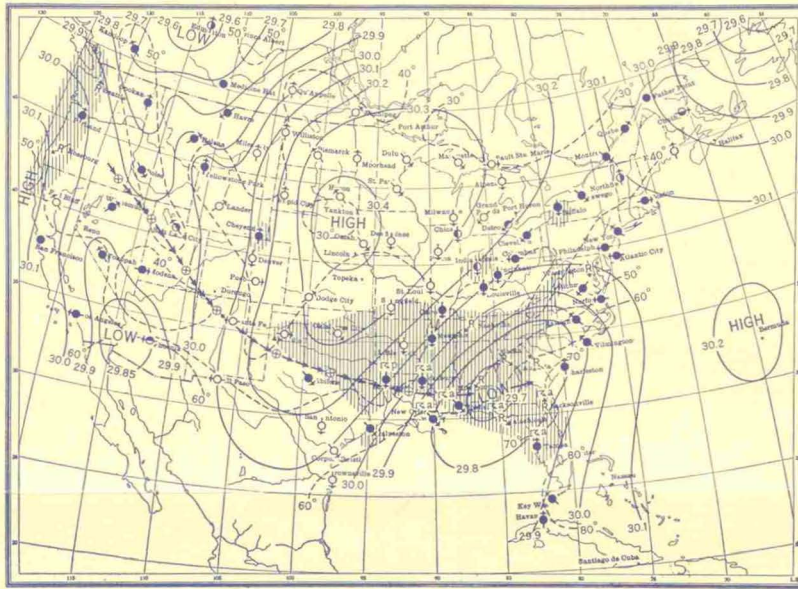
The accompanying map of TAT weather bureau stations shows graphically how observers' reports originate at stations along the route or to the north and south of the route and are transmitted to the main meteorological bureaus. The stations shown with T are TAT observation stations, those shown with W are U. S. Weather bureau stations, those with P are observation stations maintained by the Pennsylvania railroad, and those with S are similar stations maintained by the Santa Fe railroad. The cities shown in the larger circles are the meteorological bureaus.



TAT

Code Reports

WITH the above equipment, the observers are able to report in eight or ten code words complete information as to the state of weather. In addition to the reading of instruments they are instructed in the making of visual observations. This last includes height of ceiling, horizontal visibility, state of weather and cloud data. The complete report then covers wind direction and velocity, visibility, weather, pressure, temperature, humidity, dewpoint, cloud altitudes, formations and movements. The ten meteorologists report the



Above is a typical U. S. Weather Bureau map, showing high pressure (favorable) areas and low pressure (unfavorable) areas. The solid lines connect points of equal barometric pressure; the broken lines, equal temperature. Small black circles indicate sky entirely clouded; those half black, half white show half clouded skies; white circles indicate clear skies. The small arrows point wind direction. Shaded areas indicate rainfall.

same data and, in addition, the winds aloft.

A typical observer's report as it appears in code on the tele-type follows:

BHDOF DFOOB
DHOEH EFOF
FBBOW

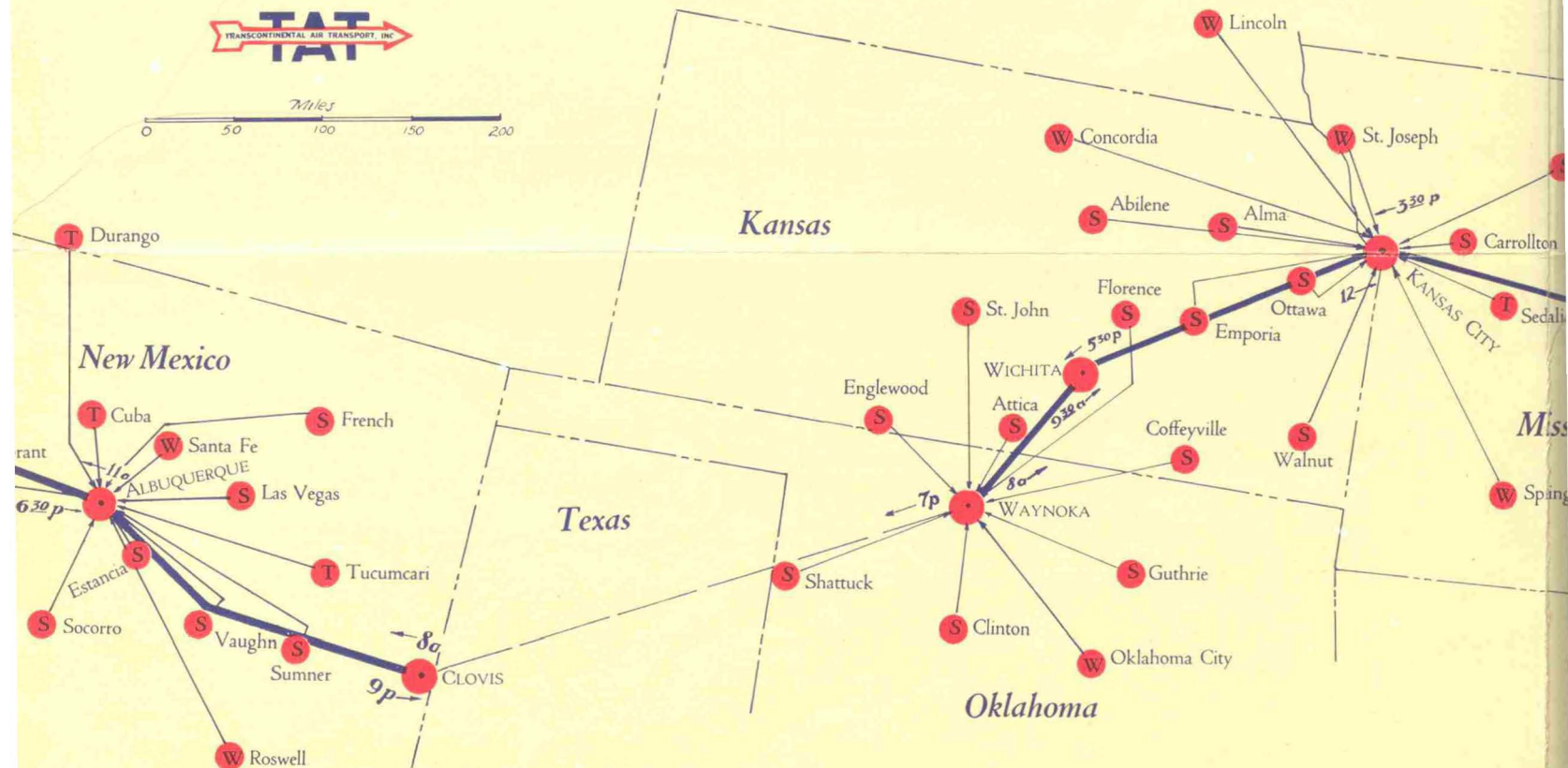
Decoded, the various code groups give the following information:

Group 1. A light breeze is blowing from the Northwest. The sky is partly cloudy.

Group 2. Horizontal visibility is six miles. Barometric pressure 30.02 inches.

Group 3. Temperature is 48.4 degrees above zero. Wet bulb de-

WEATHER OBSERVATION STATIONS AND METEOROLOGICAL BUREAUS



pression is 5.8 inches. (Humidity is obtained from calculations of the wet bulb depression.)

Group 4. Six-tenths of the sky is obscured by Alto-Stratus cloud formations at an altitude of 6,000 feet.

Group 5. Two-tenths of the sky is obscured by Strato-Cumulus cloud formations at an altitude of 2,000 feet.

In a ten word telegram there remains in addition to the code groups, space for five words of explanation in plain English.

Communication

THIS department of the service must be prompt and reliable. The communications was the most serious problem confronting the Company when the weather bureau was conceived. From a meteorological standpoint, all apparatus and methods of obtaining weather information was quite standardized and TAT

accepted both as a result of years of study and effort by others. The network of observation points, with the more important problem of transmitting messages, was the indeterminate factor. The most modern methods are necessary. Any number of observations are of no value if they are not where they are needed when they are needed.

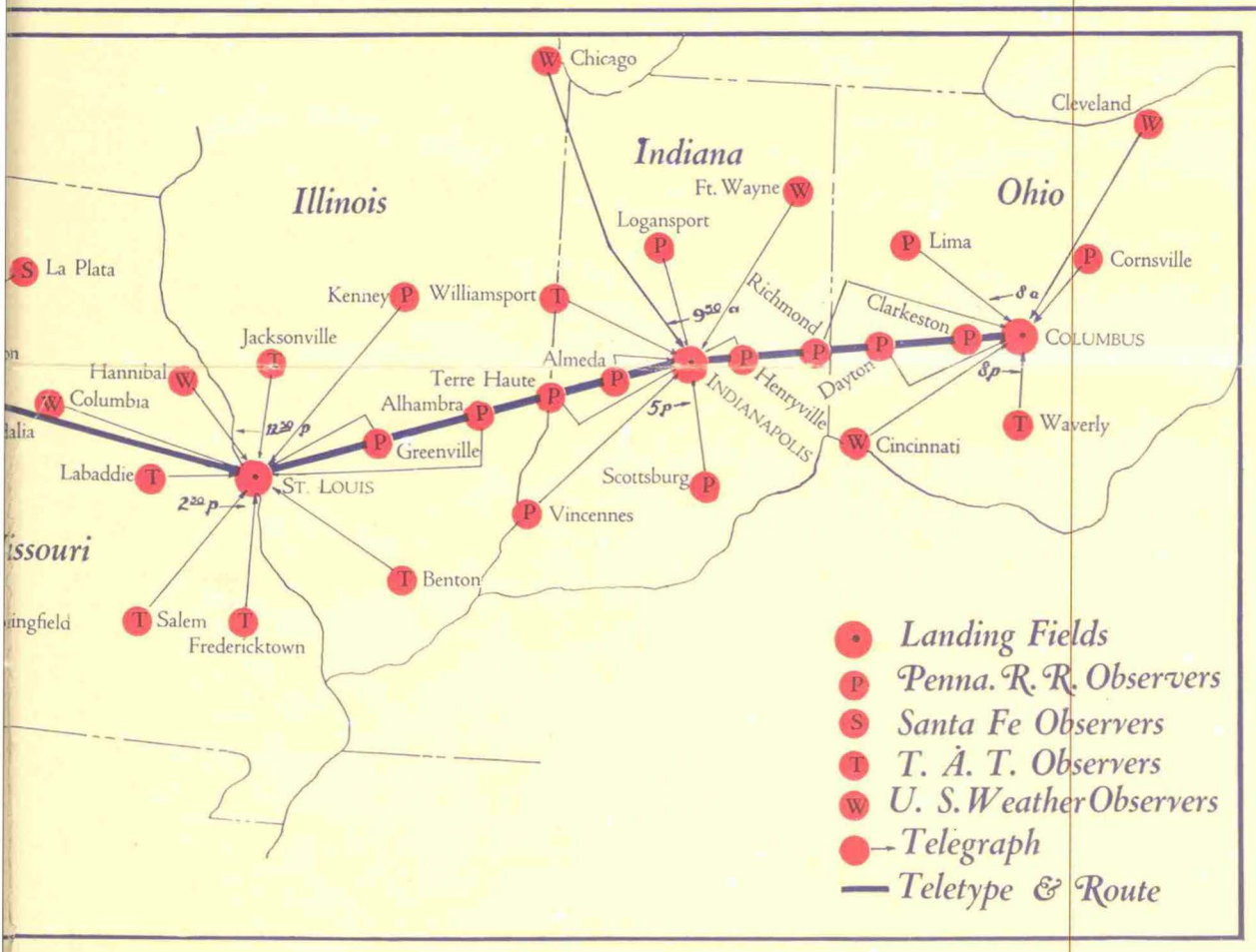
The transmission of messages is accomplished by telegraph, tele-type and radio. The seventy-two observers make their observations when scheduled, and send them by railroad wire to the station operators in those cities where the main fields are located. The station operators relay the messages on tele-types installed in their offices. Tele-type receivers at all fields automatically receive and print the reports. The twelve TAT field stations add their observations; the message is taken from the tape by the meteorologist, and after checking and study, is placed in the hands of the pilot just before departure. Additional information received later, is radioed by voice or code to the pilot during the

flight, if it is of a nature to cause him to change his course.

Personnel

IN developing such a system the entire area as shown by the map below has been divided quite naturally into control sectors. The messages are routed economically and logically to the nearest field. Thus, not only is the work of handling reports by operators well divided throughout the service, but each meteorologist is able to assume direct responsibility for all observers in his area. The organization of the meteorological division follows logically: the Chief Meteorologist, located at St. Louis, and Associate Meteorologist at Columbus, responsible for the Eastern division, and an Associate Meteorologist at Los Angeles, as Western Division supervisor, and the Junior Meteorologists at the nine landing fields, responsible for some eight or ten observers in their respective territories.

EAUS



A report from an outlying station is transmitted over telegraph and tele-type wire to the meteorological bureau and from there by tele-type and radio to the pilot. The TAT route as well as the tele-type system following the route is shown in the heavy blue line. The figures on the map denote the time of plane departures. Reports are compiled daily at 72 off-line stations and at 10 bureaus on the route.

In order for the meteorologist to receive a continuous and uninterrupted story of the weather when it is desired, the messages must be transmitted and then re-transmitted in order, and timed to the minute. The tele-type handles but one message at a time, thus the observations and sending of messages must be scheduled in such a manner as to include all

necessary observations and at the same time last minute information. With but two flights daily eastward and westward for the opening months, reports will be so timed as to travel across the country in both directions, always preceding the plane's flight by an hour or less. When additional flights are inaugurated additional reports will be secured as necessary.

condition is of sufficient importance to interfere with safe flying the pilot may change his course to avoid it or make an emergency landing.

Daily Maps

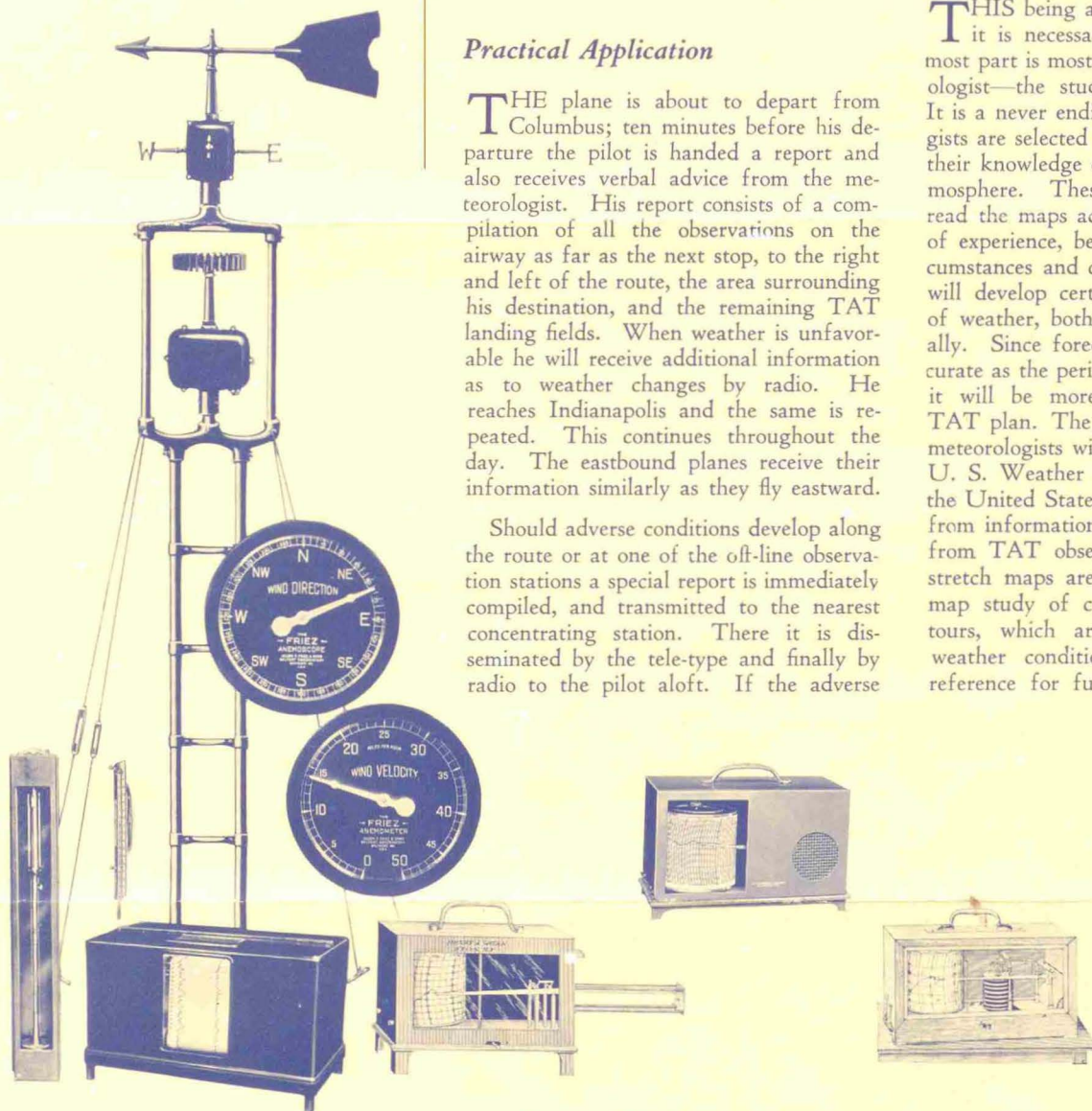
THIS being a non-technical discussion, it is necessary to omit what for the most part is most important to the meteorologist—the study of the weather map. It is a never ending study, and meteorologists are selected and employed because of their knowledge of that science of the atmosphere. These men must be able to read the maps accurately, and from years of experience, be able to judge what circumstances and combination of conditions will develop certain changes in the state of weather, both locally and more generally. Since forecasting becomes more accurate as the period of prediction shortens, it will be more dependable under the TAT plan. The available maps for TAT meteorologists will be two, and later four, U. S. Weather Bureau reports from all the United States, as well as those drawn from information received during the day from TAT observers. The general and stretch maps are studied together. This map study of continually changing contours, which are later checked against weather conditions, establishes constant reference for future applications.

The Company has placed no restrictions or limitations on the planning or developing of its meteorological service. At the outset the Company retained Dr. Carl G. Rossby, meteorological adviser to the Daniel Guggenheim Fund for the Promotion of Aeronautics, and professor of meteorology at the Massachusetts Institute of Technology, to supervise the organization of the service. Since weather at best is decidedly uncertain, a variable factor exists that results in difficulty in deciding at what point to stop in selecting observation stations, their number, and distances

Practical Application

THE plane is about to depart from Columbus; ten minutes before his departure the pilot is handed a report and also receives verbal advice from the meteorologist. His report consists of a compilation of all the observations on the airway as far as the next stop, to the right and left of the route, the area surrounding his destination, and the remaining TAT landing fields. When weather is unfavorable he will receive additional information as to weather changes by radio. He reaches Indianapolis and the same is repeated. This continues throughout the day. The eastbound planes receive their information similarly as they fly eastward.

Should adverse conditions develop along the route or at one of the off-line observation stations a special report is immediately compiled, and transmitted to the nearest concentrating station. There it is disseminated by the tele-type and finally by radio to the pilot aloft. If the adverse



The meteorological instruments shown above are those with which TAT observation stations and main bureaus will be equipped. Readings of the instruments provide immediate and accurate information regarding every phase of weather conditions such as wind direction and velocity, temperature, barometric pressure, and humidity and indicate changes which may take place within the next few hours. At the top of the stand is the weather vane which indicates wind direction. Just below the vane is an anemometer for learning wind velocity. Both wind direction and velocity are indicated on the two dials and are recorded electrically for day to day comparison on the box-like instrument at the bottom of the stand. The larger instrument at the left of the stand is a mercurial barometer, showing barometric pressure, and the smaller one is a thermometer. The three instruments shown separately to the right of the stand are, from left to right, a hydograph for recording changes in humidity, a thermograph for recording changes in temperature and a barograph for recording changes in barometric pressure. Readings from each instrument are compiled into the code report which is transmitted by telegraph and tele-type to all stations on the route and later by radio to pilots aloft.

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apart, the frequency of observations, and other details. It is felt, however, that the

NEW GENERAL OFFICE

THE permanent general offices of TAT will be opened in the Syndicate Trust Building, Tenth, Olive and Locust streets, St. Louis, on April 29. Communications regarding Company business should be addressed there.

present plan is elaborate only to a point of sufficiency, and will prove successful. With no similar service existing on such a wide scale the TAT meteorological service will be a decided forward step in the advancement of aviation.

The Company gratefully acknowledges

The purpose of this bulletin is to keep T. A. T. stockholders, directors, railroad officials and others who may be interested informed as to the development and operation of T. A. T.

Additional names will be placed on the mailing list for this bulletin upon application to the Traffic Department, Transcontinental Air Transport, Inc., Carlton Hotel (temporary headquarters), Washington, D. C.

the assistance of the Guggenheim Fund and of the U. S. Weather Bureau. Much valuable weather information has been gained from the experiments of these two agencies in California.

PROGRESS CHART

BELOW is the TAT Progress Chart indicating the status of the Company on April 15. Charts published in previous editions of "Plane Talk" have indicated the condition in February and March. Areas in black represent steps completed.

Areas cross-hatched indicate phases of the work undertaken by municipalities or airport operators. When this work is completed it will be shown in black. Areas in white indicate work necessary but not completed. Black or cross-hatched areas be-

tween cities indicate the status of work on air-way lighting between those cities. When all the units of the chart can be shown in black TAT will be ready to operate. The chart, brought up to date will appear in future editions of "Plane Talk."

