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AIRPORT TRAFFIC CONTROL*

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Since radio was first applied to the traffic control problem of airports, all transmission from ground to aircraft has been conducted on a radio frequency of 278 kilocycles. The transmitter power output has always been definitely limited by Federal Regulation to 15 watts in the antenna. The frequency of 278 kilocycles was first chosen because it was the only available frequency in the 200 to 400 kilocycle band, allocated to aviation navigation use and, further, because this band was covered by all aircraft beacon receivers, permitting the aircraft to receive this additional safety service without the addition of any apparatus. So long as only a few major air terminals employed radio traffic control and relatively slow aircraft operated during fair weather, this frequency served the requirements fairly well. But, as aircraft speeds and bad weather flying increased, it became necessary for the airport to communicate further out to continue a satisfactory service and at this point the frequency of operation and the definite limitation of power output become disturbing factors. In the earlier days of traffic control by radio, the allowable maximum of 15 watts power was not always necessary for satisfactory operation due to the then comparatively slow speeds of aircraft. But as speeds increased and airports found it necessary to communicate consistently over a 30 mile radius due to the increasing speeds of aircraft, users of airport radio traffic control transmitters began increasing the power output of their transmitters to the allowed maximum. Interference then began to occur, particularly between closely adjacent fields—such as Newark, N. J. and Floyd Bennett, L. I., or Cleveland and Akron, Ohio. But, worst of all, additional desirable traffic control installations could not be projected due to certain interference bound to result at neighboring busy terminals. The conditions of expansion of airport radio traffic control became further complicated by development of our present airways traffic control system.

As no other or additional frequencies were available in the 200 to 400 kilocycle band, due to the number of radio beacon-

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weather stations employing that band, the industry had to give serious consideration to moving all traffic control to the ultra high frequencies where sufficient frequencies were available and room for expansion existed. Many problems arose in contemplating such a radical move. Not many years ago we worried only over the scheduled airliner. Today, we worry as much or more about the itinerant. The itinerant presents a real economic problem to a change of this kind for he often cannot carry on his smaller aircraft the radio apparatus required to provide him and others the maximum of safety offered by airport and airways traffic control. He may be willing to pay the price to certain limits but those limits are quite definite. He must now carry a radio beacon-weather receiver to get along the airways and, in addition, a transmitter, if he contemplates any bad weather flying. Careful study of the frequency band of 200 to 400 kilocycles indicates it is impossible to hope to continue a national satisfactory traffic control service in this band. The ultra high frequencies appear to offer the only opportunities of expansion. But, this means additional apparatus on the aircraft to receive these frequencies—and, considering the present state of development of the radio art, this indicates the additional receiver apparatus required may at first be of objectionable size, weight, and cost. However, history has shown remarkable steps in the reduction of size, weight and cost of radio apparatus for aircraft when need for such existed. So we can only hope for a repetition of the past. The Federal Communications Commission, in announcing very recently the allocation of frequencies from 30,000 to 300,000 kilocycles to commercial and government services, carefully provided, after months of study and cooperation with the Radio Technical Committee for Aeronautics, for airport radio traffic control and its future expansion. They have allocated 126,540; 127,020; 127,500; 127,980; 128,460 and 128,940 kilocycles—six specific channels—to government airport radio traffic control. These are intended for military fields only. They have allocated 129,300; 129,780; 130,300; 130,860; 131,420 and 131,840 kilocycles—six additional specific channels—to commercial and private airports for radio traffic control. The long study of airport radio traffic control made by the Radio Technical Committee for Aeronautics, who suggested the allocation of six traffic control channels to military aviation and six other traffic control channels to commercial aviation, indicated that these allocations and their proper development would take care of expansion for many years to come. It is not conceivable that San Francisco, Chicago or New York will each have more than six major commercial terminals and six major military airdromes within a thirty to fifty mile radius for many years to come. It is proposed that each field within the radio interference area be allocated its own specific operating frequency. Due to the normal propagation characteristics of these new frequencies, these frequencies may be duplicated without risk of interference beyond 30 to 50 mile distances. Those various frequencies assigned to the airports in the New York area may, for example, be repeated at Philadelphia, Washington, Cleveland, Pittsburgh, etc., without any interference between stations. The aircraft employing the future traffic control network proposed to operate on these newly assigned frequencies will find it necessary to carry an additional receiver apparatus—an ultra high frequency receiver apparatus, capable of covering this band of 126 to 132 megacycles. While it is too early to hazard a guess as to the complete design of such aircraft receivers, it should be borne in mind that this receiver required for traffic control will, in all probability, serve also for reception of the new "Z" or Positive Beacon Cone of Silence Marker Transmitters and also for the Fan Marker Transmitters proposed as part of the development of better airway navigation aids and airways traffic control. It may well be that the same receiver will later also serve for reception of the glide path and outer and inner marker transmitters of an instrument landing system. In few words, it appears that the day is close at hand when all aircraft, other than purely local flight type of instruction or pleasure craft, will carry, in addition to its present beacon-weather receiver and standard transmitter, an additional ultra high frequency receiver which may first be required for airport traffic control but which may later expand in usefulness to provide reception of marker transmitters and instrument landing transmitters. The airlines will doubtless lead the way in development and application of such new receivers for they will be the first to employ the new airways "Z" and Fan Markers. This trend should lighten the burden of the itinerant to some degree and may thus offer the economic answer to overall cost of ship apparatus. These developments mean also that airports must shortly provide themselves with ultra high frequency transmitter apparatus to carry on the traffic control work so completely necessary to safe operations. Preliminary work by development agencies indicate this new transmitter will probably be of 100 watts power capability in the 126 to 132 megacycle band. The transition from 278 kilocycle to ultra high frequency operation may include a period of time variously estimated at from 2 to 5 years during which the airport will require a transmitter or transmitters capable of operating on both frequencies individually or simultaneously, for, during the transition, the airport control officer will not always know whether the itinerant aircraft he desires to communicate with has ultra high frequency receiver apparatus and must therefore be prepared to call the itinerant on both bands unless certain of the itinerant's receiver equipment—although constantly lessening the use of 278 kcs. until that day when a 100% change-over to the ultra high frequencies becomes an economic reality.

The airport receiver problem should not change materially for some time to come for there are no indications on the horizon to indicate any change from the present. Aircraft will doubtless continue transmission on the present 2,000 to 6,500 kilocycle band until later development of ultra high frequency operation proves an economically desirable reason for some change.

In summarization, it appears to me that the agency now planning on airport operation to reach maximum usefulness within the next five years must include consideration of a radio system comprising the following:

1. A group of conventional crystal controlled, remotely located and controlled airport receivers. A minimum of one such equipment for each scheduled service to be operated from this port, plus two such equipments for itinerant service. A spare is, of course, highly desirable.
2. An ultra high frequency transmitter of approximately 100 watts power output capacity, crystal or equivalent frequency stability control, capable of 100% modulated voice transmission on some one frequency between 126 and 132 megacycles.
3. A transmitter capable of delivering a full 15 watts of 100% voice modulated power into the conventional in-efficient antenna practical of construction on or near an airport on the frequency of 278 kilocycles. This may be a component part of and an additional facility of Item 2 above, the ultra high frequency transmitter.
4. Direct wire connections and necessary components to provide direct wire communication with each airline and itinerant hangar activity of the particular port plus similar communication with the Weather Bureau, Bureau of Air Commerce radio facilities, and Airways Traffic Control.
5. Duplicate power supply capable of furnishing power to operate Boundary, Flood and Obstruction lights, as well as power for all radio equipment on the airport.