

THE AIRWAYS SYSTEM

The federal airways system must be considered in two parts:

1. Navigation system relies on electronic and other aids which establish precisely the airways over which aircraft must travel to be included in the air traffic control system.

2. The ATC system itself.

The airways system is based upon electronic equipment used for navigation. The relative position of the ground based electronic fixes is accurately selected by the pilot using avionics equipment in his aircraft. This primary air navigation system depends upon an extensive network of radio fixes operating in the very high spectrum of electronic frequencies, from which bearings in all directions can be immediately detected by airborne sensing equipment. The technical name for this navigation equipment is VHF omni directional radio range, shortened in aviation usage to "VOR" or to "omni range." This type of equipment has recently been coupled with newly developed equipment which emits a signal that can be electronically interpreted aloft to show the aircraft's distance from the signal source. This is known as distance measuring equipment (DME).

Other navigation facilities include low frequency radio beacons, many of which are being phased out as the more precise VOR or VOR/DME installations are commissioned.

THE AIR TRAFFIC CONTROL SYSTEM

The air traffic control system is designed to provide guaranteed separation between aircraft on instrument flight plans while operating in actual instrument flight conditions. Thirty-five years ago all flying—military, air mail, air carrier, and private—was done only in daylight and fair weather, using the human eye both as the primary cross country navigation and traffic separation tool. As aviation matured, it became obvious that to provide any kind of scheduled flight operations for the air carriers or the military, a system was needed which would permit aircraft to operate safely under conditions of reduced or no visibility. The development of an air traffic control system had to wait until there was a reliable system of radio voice communication between the aircraft and the ground, coupled with a navigation system upon which a pattern of civil airways could be built.

No laymen can understand the problem of flying an aircraft without ground reference. It is the tragic fact that a pilot who has not been trained to control an aircraft solely with reference to flight instruments is literally committing suicide if he flies into a cloud mass and loses sight of the ground. Statistics show that under these circumstances an airplane becomes completely uncontrollable and lethal within 30 seconds. Therefore, before flying in clouds was possible, the industry first had to design a system of special flight operations, but it is only one part. The ability to follow the airways under no-visibility conditions, to compute positions and make estimates of arrivals at various points along the line, and to communicate with the ground, these are the other parts of the instrument en route flying picture. The last parts of the flight, arrival at a precise point in the terminal area and performing a landing under instrument conditions, are refinements.⁸

The key to air traffic control is the continuous cooperation between pilots aloft and air traffic control specialists on the ground.⁹ Only if the pilot has the ability and proficiency to maintain a precise course on the airways and to predict accurately his estimated time of arrival at check points along the way can the ATC controllers on the ground reliably predict traffic movements and prevent possible traffic conflicts aloft. Constant radio-telephone dialogue between the controllers on the ground and pilots in the air is required to exchange advice and information which each must have. Communications and navigation equipment

⁸ It is imperative to distinguish the difference between instrument landings under actual instrument conditions and landings in good visual conditions while still under an instrument flight plan.

⁹ The term "controller" is a misnomer. Actually the air traffic specialist on the ground exerts no control over the aircraft. The pilot is in control of the aircraft at all times. The proper relationship between pilot and controller is that of cooperative team work.