Nearly 4,000 transponders are in general aviation aircraft today, although many radar facilities on the ground still do not have interrogation equipment which makes them effective. But transponders are not infallible. They, too, have system peculiarities: side-lobe interrogation, SSR shadowing (and resultant loss of blip), reflection problems, and garbling. FAA is now installing parametric amplifiers and side lobe suppression (SLS) modifications, but the false target problems and others caused by mixing electronic pulses from different aircraft are yet to be solved.

As the transponder comes into greater usage, new problems are developing in this technical field. Frequently upon arriving at terminal areas, pilots are directed to "squawk standby," which means "turn off the transponder." Thus we are right back to operating on raw radar primary returns. The busier the hub airport, the greater is the likelihood of being told to turn off the transponder.

II. Adequacies and Inadequacies of Today's System

Obviously today's system has demonstrated its overall adequacies in practical use, with few exceptions. The 10 busiest airports served by the carriers are suffering greatly because the carriers are transporting more passengers through them than anyone ever anticipated. The problem is complicated by the fact that the air carriers, in order to meet the demand of the traveling public, schedule their flights competitively to meet this demand. The problem of peaking is not unique to aircraft; it faces every mode of public transportation: trains, intercity busses local busses, and taxicabs.

However, except for these 10 locations neither the air traffic problem nor the passenger handling problem in the terminals is really acute, yet. However, there is a real concern by all users of the airspace that the situation will become acute in the very near future.

In the hypothetical flight plan from Washington to New York above, it can be seen that the ATC "system" works perfectly for a relatively few aircraft. But the ATC system, like a chain, is only as strong as its weakest link. In aviation the weak link is the saturation level of the system, including the airport acceptance rate and approach system saturation under actual minimum instrument approach conditions. All reasonable air carrier scheduling must be based on this criterion. It is imperative that the difference between operating under these restricted circumstances and operating under visual conditions be always separated when considering the problem.

All federal airways must begin and end at an airport. Some airports absorb a load that no one could have imagined 25 years ago.

The New York area, for instance, with three airports served by U.S. and foreign flag carriers, is literally a target at which airplanes are fired from all parts of the world 24 hours a day, 365 days a year. Air travelers stream in from places like Miami, Atlanta, Dallas, Las Vegas, Los Angeles, San Francisco, Chicago, Ottawa, London, Paris, Rome, Tokyo, and many other great urban centers. Every airplane arriving, from any direction, must be handled by New York ARTCC, which under actual instrument flight conditions guarantees them airspace separation. The burden carried by the human being who man the New York Center is incredible. It is easy to understand why the New York Center every so often must report that the system is saturated and that it therefore cannot accept any more traffic. Under actual instrument conditions there is, all too frequently, simply no airspace left.

Airplanes approaching the New York area (and New York is only an example—every one of these cities mentioned can have the same problem) must then be told to "hold" at a certain designated holding point because the air traffic control system is incapable of affording them protection in the final approach and landing phase of the flight. By weather restrictions, the actual airport acceptance rate can be reduced from 120 movements (the acceptance rate under good weather conditions) to 40 or 50. The situation is similar to the familiar one on an expressway when cars moving at 50 mph find themselves in an immense traffic jam because someone at the head of the line is driving 30 mph. The ATC system, both en-route and for controlling approaches, is handled on an individual controller-to-pilot "hand holding" basis. Each pilot is personally directed to fly at a certain altitude and along a course that will insure him separation. Every aircraft movement must be manually directed and controlled by human beings on the ground. This individual handling system will not be adequate to handle the instrument flight traffic volume in a few years. The answer is computerized automation, a subject that seems too much like Jules Verne