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STATEMENT OF KENNETH M. SMITH, DEPUTY ADMINISTRATOR, FEDERAL AVIATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION, BEFORE THE SUBCOMMITTEE ON GOVERNMENT ACTIVITIES OF THE HOUSE COMMITTEE ON GOVERNMENT OPERATIONS ON 3 AUGUST 1971

Mr. Chairman and Members of the Committee:

I appreciate the opportunity of appearing here today to discuss airborne collision avoidance systems. With me are: James Mollenauer, Deputy Associate Administrator for Engineering and Development, Cliff Walker, Deputy Associate Administrator for Operations, and Robert Buck, Acting Assistant Chief of the Communications Development Division of our Research and Development Service.

Before making a brief statement about the the FAA's efforts in developing an effective airborne collision avoidance concept I would like to put that concept in perspective. The primary means of separating air traffic and avoiding in-flight collision is - and will continue to be for the foreseeable future - the Air Traffic Control System. The Department of Transportation, and particularly the Federal Aviation Administration, is devoting a significant portion of its resources to the operation, maintenance, and improvement of this system to promote the safety of flight. With the advent of the automated environment, the threat of collision will be reduced even further. In addition, we are continuing our R & D and evaluation programs aimed at improving the radar detectability of aircraft. We are continually seeking improvements in our air traffic control radar beacon system, and better primary radar detection of non-transponder aircraft, particularly the smaller, general aviation aircraft.

These efforts will also enhance the radar ATC system. Any type of airborne collision avoidance or warning system will serve primarily as a backup to the Air Traffic Control System.

In discussing the FAA's developmental program in collision avoidance a few definitions of concepts will probably be helpful. First is the distinction between "cooperative" and "non-cooperative" systems. A "cooperative" system is one which affords protection to a particular aircraft only against other aircraft equipped with similar or compatible systems. A "non-cooperative" system should provide adequate information to an aircraft relative to all other threatening aircraft, regardless of how equipped. While the ideal theoretical objective is a non-cooperative collision avoidance system, in today's state of the art the most promising airborne collision avoidance systems are of the cooperative type.

Second, airborne collision systems are generally classified in one of two categories: the true Collision Avoidance System (CAS) and the Pilot Warning Instrument (PWI). A Collision Avoidance System is an all-weather system which can detect all aircraft which represent a potential collision threat to the CAS-equipped aircraft, automatically evaluate the degree of threat, and, if necessary, indicate to the pilot a safe evasive maneuver. A Pilot Warning Instrument is a device intended to be utilized when visual flight

rule conditions prevail - to assist the pilot in visually detecting other aircraft that may offer a potential threat of collision. After visual sighting, the pilot utilizing PWI must evaluate the situation and initiate any necessary evasive maneuver.

The FAA has taken an active role in the research and development of collision avoidance concepts for many years. In 1959 we formed a Collision Prevention Advisory Group (COPAG) made up of representatives of appropriate Government agencies and selected civil aviation associations who represent the majority of the airspace users. Among the members are the Aircraft Owners and Pilots Association, National Business Aircraft Association, National Aeronautics and Space Administration, the three military services, the Air Line Pilots Association, and the Air Transport Association. Mr. Buck, as the FAA representative, is Chairman of COPAG. One of the primary functions of this group is to insure that all interested potential users and evaluators of airborne collision avoidance systems work together.

The FAA has also been directly involved in the search for a workable system. With regard to the true CAS, we have been cooperating and assisting the Air Transport Association, NASA, and industry organizations in a joint program. Specifications have been written and equipment built and flight tested. While no insurmountable technical problems remain, operation questions, impossible to adequately evaluate with the limited number of CAS equipments produced so far, still remain to be answered.

Of great concern is the potential impact of a fully developed CAS system on the Air Traffic Control System. For example, what will be the number and consequence of CAS false alarms? How will such a system, when it is functioning well or poorly, affect aircraft arrival and departure rates at terminals? What will be the effect on the Air Traffic Control System when an aircraft makes a sudden, unpredicted maneuver? Will it produce a chain reaction or other adverse effect in the system?

We are attempting to find the answers to these and many other questions in a dynamic simulation being conducted at our NAFEC facility in Atlantic City, New Jersey. By the end of calendar year 1971 we believe we will have the answers to enough questions to be able to recommend changes to the CAS or to the ATC system - or to both - which will allow safe utilization of an airborne collision avoidance system in conjunction with ATC.

The airlines have expressed a strong desire to implement a CAS system in their respective fleets on a voluntary basis. At the same time significant efforts are being made to develop a low-cost, low-weight compatible system for military and general aviation use. Efforts within the FAA are already underway to develop the ground facilities required for the joint industry CAS. The FAA's National Aviation System Plan for 1972 through 1981 reflects our intention to procure, install, and maintain the necessary ground stations.

We in the FAA are presently considering our position regarding the petition of the McDonnell Douglas Corporation requesting an FCC operational frequency license for a collision avoidance system. With the culmination of all these continuing programs and efforts we believe it is well within reason to anticipate limited CAS implementation in the airline fleet in CY 1973.

In summary, the progress toward a practical and effective CAS for airline use is steady and encouraging. However, there are two overriding features about CAS in the state of the art that indicate clearly that the technical development of CAS is not all that is needed. Those features are: cost and complexity. Although we do not yet have completely accurate production costs projections, it is our opinion that the most promising CAS may cost the user somewhere in the neighborhood of $50,000 per aircraft unit. It becomes immediately apparent that such a CAS will have very limited use outside the air carrier fleet. This fact points to even greater emphasis on the development of either a compatible low-cost CAS or a PWI, or both for the general aviation and military fleet.

Looking now at the Pilot Warning Instrument, the FAA has evaluated and rejected a number of proposed PWI concepts and equipments in the past few years. Today, our main thrust is in the investigation of the human factors problem involved in detecting intruder aircraft, so as to better define what the functional characteristics of a PWI system should be. To cite a few of the questions to be answered: How well can a pilot see and evaluate

visual warning of a potential collision threat at present day flying speeds? How much time is required to receive and evaluate this information? What is the effect of widely varying speeds on this ability? To what extent can a pilot make use of relative bearing information? These and other questions are under investigation at this moment.

While concentrating on the human factors aspect we have not been ignoring the hardware development requirements for PWI. Under a joint FAA - NASA program we are at present evaluating a PWI which utilizes the infrared detection principle to locate other aircraft. Meanwhile, our search for an acceptable PWI continues on all fronts.

In conclusion, gentlemen, we can report good progress toward a CAS for voluntary airline use. We have as yet, however, far too little experience and too many unanswered questions to be able to predict if or when such a system should become a requirement. Although we have not progressed as far in our search for a low-cost compatible PWI, this effort receives high priority in our engineering and development program.

Mr. Chairman that concludes my prepared statement. If the Committee wishes, we will discuss with you some of the technical and other aspects of the programs and systems under development.