STATEMENT OF SIEGBERT B. PORITZKY, DIRECTOR, SYSTEM STUDIES AND COOPERATIVE PROGRAMS, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS, CONCERNING THE USE OF ADVANCED SATELLITE SYSTEMS FOR GLOBAL AIR TRAFFIC CONTROL AND NAVIGATION--SEPTEMBER 24, 1986

Mr. Chairman and Members of the Subcommittee:

I welcome this opportunity to review for you FAA's involvement in advanced satellite technology for air traffic control and navigation.

Nearly 30 years after the launch of the first satellite and nearly 25 years after FAA became active in the study of satellite applications, the great potential of satellite services to civil aviation may soon begin to be realized. The FAA believes that satellites are likely to play an important role in the improvement of air traffic services around the world.

We are close to achieving international agreement on a satellite communications architecture and system structure which may permit aircraft, using the same airborne devices, to receive satellite services anywhere around the globe. We have come far in providing the technical foundation for a new service called Automatic Dependent Surveillance (ADS) which, in its first application, may provide aircraft flying over oceans

a surveillance and communications service nearly equivalent to that available from radar when they fly over domestic airspace such as the United States.

FAA's involvement in satellite technologies for aviation began in the very early 1960's. The first practical application development of satellites for air traffic control air/ground communications dates back to 1964, when FAA worked with the Air Transport Association of America (ATA) and Pan American World Airways in a pioneering experiment. There is not time to go into detail about FAA's involvement in satellite activities, but I can provide the Subcommittee with a detailed summary for the record. Suffice it to say that a large number of studies and developments, analyses, and tests, as laid out on the vu-graphs (VG-1, 2, and 3), were conducted. In addition, many other pioneering studies and tests were conducted by the National Aeronautics and Space Administration and industry.

Virtually all of the studies showed that satellite applications to air traffic control were technically feasible and could yield benefits, but cost projections were so high that the aviation community was not motivated to move forward.

In the early 1970's, several experimental programs showed that satellites could be used for air/ground communications. There

also was a view that the skies over oceans would become filled with airplanes, that there would be serious navigation and communications problems, and that the dramatic growth of operations, particularly with the anticipated large number of supersonic transports, would require a dramatic change in oceanic air traffic control services.

FAA felt that satellite communications would become attractive and strove to have a satellite communications service in place before the expected problem became acute. After negotiation, an agreement was developed in 1974 among European states (represented through what is now the European Space Agency), Canada, and the United States, to plan, develop, and evaluate a hybrid VHF/L-Band experimental oceanic (Atlantic) aeronautical satellite communication system, called AEROSAT.

As work progressed, estimates of costs rose sharply. The prospect of large numbers of aircraft, including SST's, having to operate with inadequate navigation and inadequate communications diminished. Communications improved with the introduction of the High Frequency Single Side Band. Navigation improved markedly with the introduction of inertial navigation systems.

A difficult question revolved around who would pay, and how, for a potentially expensive satellite communications and surveillance service. Airlines, initially enthusiastic, became

increasingly concerned. Not everyone was saddened by this development. Congress subsequently chose not to appropriate AEROSAT project funds and directed FAA to reexamine the requirements.

With the termination of the AEROSAT project in the late 1970's, an international group, the Aviation Review Committee, was formed to review the requirements for new systems and new technologies for over-ocean operations, especially satellite technologies. This group solicited the support of international airlines, along with experts from many countries. The committee identified a number of improvements, especially to oceanic operations, which could yield higher efficiency to the air transport system. They believed that satellite services, because of their unique capabilities, would have a place in the aviation system, that the capacity requirements for over-ocean air traffic control satellite communications were real but modest, and that the most viable way to achieve such services probably would be by sharing with other prospective satellite users to constrain costs.

With the strong lead of the United States and support from the international aviation community, the International Civil Aviation Organization (ICAO) established the Future Air Navigation Systems (FANS) Committee to help implement the several major recommendations which grew out of the Aviation Review Committee.

It had become apparent that improved oceanic communications and automatic dependent surveillance (ADS) services, initially over oceans, could have a major positive impact on the safety and efficiency of aircraft operations, and that a uniform worldwide standard satellite communications method would be required to use automatic dependent surveillance beneficially. (Automatic dependent surveillance is a function in which aircraft automatically transmit data derived from on-board navigation systems via data link to an air traffic control facility.)

Major progress has been made in the development of the concept, the operational use, and the technical characteristics for automatic dependent surveillance, or "pseudo-radar," for first use over the oceans. FAA has worked closely with the Airlines Electronic Engineering Committee (AEEC), which is already developing avionics standards to include the automatic dependent surveillance capability in aircraft systems. FAA is also hard at work on a program to provide this new and potent capability to the controllers.

Progress has also been made on the development of an internationally agreed standard satellite communications architecture and system structure. In the effort to achieve an ICAO FANS agreement, FAA and the aviation community recognized several important factors:

- A basic satellite communications structure and system architecture must be agreed to internationally if aircraft are to be able to take benefit from such services.

- While it might be possible to achieve agreement on a satellite navigation system operated by one country or group of countries, communications and surveillance services are likely to be provided by regional groupings. Acceptance of an international satellite communications system standard is likely to be possible only if any country or group of countries has the opportunity to provide such services.

It has been recognized from the beginning that communications satellite services would be used for a variety of purposes, including air traffic control services, data link and voice communications.

Because of the rapidly evolving satellite communications industry and the growing competition between countries in providing such services, along with the new prospect of reasonably priced services, the United States must move rapidly to achieve agreement on a satellite system structure. FAA mounted a major effort to achieve U.S. agreement first and then agreement in ICAO FANS. The basis for FAA's work is the accumulated knowledge from the many studies I mentioned earlier.

FAA Administrator Engen has expressed his conviction that 1) FAA should help airlines obtain such services effectively and soon, 2) FAA should stimulate beneficial competition in the provision of satellite services within a compatible structure, and 3) FAA should strive for a satellite system structure which has the capabilities described and has a chance for international agreement and standardization.

The intention is to establish a satellite system structure which can efficiently meet, or can evolve to meet, the requirements and needs of aviation as already established by the ICAO FANS Committee. This system must permit evolution from relatively simple applications to the more complex--a concept in which all elements of aviation can participate, from general aviation to air carrier and military, and which can serve areas from lowest density remote areas to oceanic use to high-density domestic terminal airspace. The system must have the capability to work compatibly and efficiently with terrestrial services, which will no doubt remain in the picture, and must lead to the simplest practical avionics suite for the future. The goal is to achieve an international system which permits aircraft to take advantage of satellite communications services efficiently from a variety of providers based on an internationally agreed system architecture--a service which can meet the requirements of the air traffic control services as well as the uses to which air transport operators may wish to put such a system.

It was recognized early that if different, noncompatible systems grow, implementation of useful satellite capabilities might be difficult.

The situation has been complicated by uncertainties about the frequency spectrum available to aviation. The recent action by the Federal Communications Commission (FCC) requires sharing of the spectrum with other services.

In our attempt to achieve a single U.S. proposal for a satellite system structure, we have worked closely with the major user organizations. FAA also asked for and generously received technical support from interested prospective U.S. providers of satellite services. The approach has been to create a system capable of sharing and of providing the nonsafety services on a secondary basis.

Early this year, FAA established a group of Government experts from various agencies to provide advice and input to FAA and to the FANS Preparatory Group to help assure an optimum system structure and architecture to serve aviation's needs.

There is reason to hope that it may be possible to reach substantial agreement on a system architecture and structure at the November 1986 full ICAO FANS meeting.

The initiatives described lead to another matter--the question of future institutional and management arrangements for aviation services.

While ICAO Regional Plans for implementation of facilities and services have been used for more than 35 years, implementation has been far from uniform. In many parts of the world, services desired and needed by air transport operators simply have not been implemented because of lack of funds, lack of trained personnel, and other reasons. The question is whether the institutional arrangements which have been in use for so many years need to be reexamined. The matter is complex. While countries can now provide services almost autonomously, the capabilities of new systems, particularly satellite systems with their broad coverage, will require new levels of cooperation if the systems are to be used beneficially. The desire of most air transport operators to make national boundaries transparent and the possibility of using satellite services in areas where services have been unavailable make the examination of the institutional and management issues important.

New technology and, to some degree, existing technology could help leapfrog a number of problems. For example, satellite earth stations for communications and possibly position location could obviate the need for locally operated sophisticated telephone or radar systems. Satellite navigation

would obviate the need for an extensive network of ground navigation aids. It is conceivable that new technology systems could reduce the extent of maintenance/operations/logistics infrastructures and eliminate the need for land lines, buildings, etc.

Yet, the very regions of the world where such services would be of greatest value are also areas where money is scarce, while areas of the world which might be able to afford such services already have adequate, primarily ground-based systems.

A whole series of problems arise. While countries where services are now limited could leapfrog current technology by the use of satellite sensor systems, the new systems might well be technically incompatible with existing systems in wide use in other parts of the world unless a clear and attractive transition method can be achieved.

FAA therefore believes that the implementation of new capabilities and services must be done in such a way that the user communities themselves recognize their importance. Methods would then need to be found to transition from existing services and capabilities to these new technologies.

It is not a foregone conclusion that satellite services must be provided by the Government. Our efforts are intended to reach

agreement domestically and internationally on the minimum technical standards that such new technology systems must meet in order to be viable elements of the air traffic control service. We look to a healthy competition by both domestic and international entities in the actual provision of the services. While most of the states of ICAO believe that the actual control of aircraft must be under the jurisdiction of the cognizant air traffic control authority, technical systems which provide the basis for control may be provided by international commercial entities. The FAA encourages such competition.

Up to now, I have spoken little about navigation. There is a major U.S. investment in the Global Positioning System (GPS), a multi-satellite, high-quality navigation system. FAA has been studying GPS for a number of years and we believe it has a bright future in civil aviation. It overcomes the line-of-sight restrictions of many of our present navigation aids. It is expected that a global satellite navigation system, such as GPS, will be able to provide accurate information and coverage from essentially ground level to the highest altitudes at which we expect aircraft to operate. GPS, in its present state, is not able to provide navigation capability to serve as the "sole means" of air navigation, but we expect that the evolution of this system in the next few years will permit its use as such, and we will work to that end. President Reagan, shortly after

the tragic downing of the Korean Airlines Flight 007, stated that GPS services would be made available to world civil air transportation, and it may come to serve as the basis for the Automatic Dependent Surveillance service. While we believe that GPS has a bright future in civil aviation, others are at work on similar systems. The Soviet Union is developing a system which has the appearance of being similar to GPS--a system called GLONASS--and studies of other, similar navigation satellite systems are underway in Europe. We continue to work both internationally and with the Department of Defense to help make GPS a viable, sole-means navigation system for the future.

We believe satellite technology will have an important role in the future civil system and we continue our research, development and analysis efforts to find the best, most cost-effective ways to take benefit from these new capabilities. We think the days of basic research are past; our work will concentrate on assessing the best ways to utilize the technology in a system evolution which permits taking benefit from the new systems without disadvantaging the present system capability.

Our planned work will concentrate on the work remaining to support utilization of GPS in the National Airspace System. We will work to obtain the best information necessary for the most beneficial and technically sound use of satellite-based air/ground communications systems to be used for air traffic

control voice and data communications. Satellite communications relay services between FAA facilities are already in use, usually provided through leased services. We will continue to explore satellite-based technology for interfacility point-to-point communications. We will, of course, concentrate also on the technologies beyond those now available. We will work to examine the best mixes of satellite and terrestrial communications in the aviation system of the future.

I would like to close with two observations. FAA has been at work for several years on a major system modernization--the National Airspace System Plan. It is moving forward aggressively and it will provide a major modernization to the benefit of the flying public and the operators who use the National Airspace System. Modernizations are underway as well in a number of other parts of the world. These modernizations form the foundation on which the new technologies may be exploited, <u>they are not a substitute for the modernization</u>. In the formulation of the NAS Plan, FAA was aware that new technologies were coming along, not only satellites but also computer technology and fundamental changes in communications technology. Our NAS Plan forms the essential base on which the new technologies can be beneficially used.

The second point, equally important, is a recognition of the role satellite technology or the other new technologies can play in the evolution of the air traffic control system. (VG-4)

They are not a panacea, but will work best in a synergistic partnership with terrestrial systems. It is sometimes asserted by enthusiastic advocates that satellites might be used instead of the automation of the air traffic control system. Both are required. Satellite communications and surveillance, and perhaps navigation, all improve the information flow between aircraft and the air traffic control system and permit the air traffic control process to be made more efficient. In our modernization efforts we will continue to consider cost effective and beneficial application of satellite and other technologies to enhance the eyes and ears of our air traffic control system.

Mr. Chairman, that concludes my prepared statement. I would be pleased to answer any questions which you or other members of the Subcommittee may have.