The aircraft which everyone uses fly while maintaining a safe separation in accordance with instructions from the air traffic controller. What kind of dialogue takes place between the controller and the pilot? In fact, because planes move through the sky at high speed, connection by cables, as in landline telephones, is not possible. This means that the dialogue occurs via radio communications. When flying in Japanese airspace, the plane communicates directly with a radio station on the ground using very high frequency (VHF) radio waves. On the other hand, because radio waves cannot reach the mid-Pacific, high frequency (HF) radio waves which can travel even the very long distance from the ground radio station have been used. More recently, satellite communications, which provide higher quality in comparison with HF radio waves, have also begun to be used.

In this connection, almost everyone might think of using cell phones. If cell phones can be used, communication will be possible anywhere and conversations and information can be exchanged in data form, as in text-messaging (email) and the internet. If this advanced new communications technology can be utilized in air traffic control communications, the controller and pilot can communicate efficiently and reliably, resulting in higher aviation safety and enabling a larger number of aircraft to fly safely. ENRI is engaged in research and development on a variety of communications technologies to enable use of advanced new communications technologies in air traffic control communications.
Except for long-distance communications over oceans, amplitude modulated voice communications on VHF are used in worldwide civil aviation air traffic control (ATC). However, the number of channels for ATC in the European and North American regions have become inadequate, since the air traffic volume in these areas has increased extremely. ACARS is mainly used for digital data communications between ground and air stations, but ACARS has some defects such as slow data transmission speed and low reliability. Therefore, a high speed and high reliability communications system which solves the problem of a shortage of channels has been desired. VHF digital link (VDL) is a new communications system to solve these problems. In particular, the VDL Mode 3 system can process both voice and data communications simultaneously in one system with digitized voice technology. The system also includes a variety of other functions suitable for ATC communications.

We are engaged in research to solve the various technical problems in the operation of VDL through trial manufacture and verification of a VDL Mode 3 experimental system.

The data communications used in current aeronautical communications are performed on individual data links. However, a system for performing various types of data communications on a single network like the internet by integrating these separate links has been conceived. This is called the Aeronautical Telecommunications Network, or ATN. At present, communications between air traffic controllers and pilots, which depend on voice communications, can also be performed as data transmissions on the ATN (CPDLC). VHF digital link (VDL) and aeronautical mobile satellite service (AMSS), etc. are used as air/ground data links in the ATN.

In communications using a network, it is necessary to ensure the security of communications. For example, authentication technology is used in internet communications between financial institutions and their customers. The security of communications on the ATN is also guaranteed by using similar authentication technology.

In research on the ATN, ENRI is conducting research to realize secure and efficient data communications in cooperation with the VDL and AMSS research groups.
Communication technology is progressing toward higher speeds, larger capacity, and higher reliability. The progress in communication technology can meet requirements which had been impossible until now. For example, if a high-speed and large-capacity line between aircraft and ATC ground stations is available, weather information can be transmitted in real time, which is an important merit for safe navigation of aircraft.

CDMA (Code Division Multiple Access) technology, which has also been adopted in the third-generation cellular phone networks, has attracted attention as a excellent method that provides high-speed and large-capacity lines with high level security. However, there are various problems in applying the CDMA technology used in cellular phone networks to aeronautical communication. For example, an aircraft moves much faster than the land vehicles assumed for cellular phones. The radio band used and the size of the service area are also completely different. Research on these problems will establish the basic technology for providing high-speed and large-capacity lines in future aeronautical communications.

**Aeronautical Satellite Communications System**

In maritime flight regions (oceanic airspace), where an aircraft’s position cannot be determined using ground-based radar, the plane’s position was formerly confirmed using short-wave (HF) radio communications between the controller and the pilot. However, satellite data communications (CPDLC) and a surveillance function based on positional information transmitted automatically from aircraft (ADS) are beginning to be used in some airspaces. This can improve safety and reduce the load on the controller and pilot, but accompanying the increased volume of aircraft traffic in recent years, the development of an aeronautical satellite communications technology with higher performance than at present is becoming necessary. ENRI is engaged in research and development of a next-generation aeronautical satellite communications technology with a new, higher performance transmission method and other improved features.