International Civil Aviation Organization

Sixth Meeting of CNS/MET of APANPIRG

Bangkok, Thailand, 15 – 19 July 2002

Agenda Item 15: Deficiencies in the COM/NAV/SUR and Met Fields

ULTRA-WIDEBAND TECHNOLOGY

(Presented by the United States of America)

SUMMARY

This document presents the issues concerning ultra-wideband technology that the Federal Aviation Administration is addressing. These issues are of concern to international civil aviation which needs to ensure establishment of appropriate technical standards.

1. INTRODUCTION

1.1 The Federal Aviation Administration (FAA) has been involved in an issue regarding ultra-wideband (UWB) technology. The UWB systems of interest at the present time are low-powered and use very narrow pulses or impulses over a very wide bandwidth, greater than 20% of the center frequency or 500 MHz regardless of frequency. Applications of UWB systems include imaging (e.g., through-the-wall and ground penetrating) and communications devices (e.g., a local area network) with applications for consumers, businesses, and government. The Federal Communications Commission (FCC) has modified its rules for unlicensed, low-powered devices to accommodate this technology which would allow certain UWB applications to be operated across selected portions of the radio spectrum, including that used by civil aviation for safety related systems. (See the First Report and Order (FCC-02-48) and the Errata (DA-02-1289) at http://www.fcc.gov/Document_Indexes/Engineering_Technology/2002_index_OET_Order.html) These rule changes are a change in policy that currently prohibits unlicensed devices from operating in the same spectrum as certain safety services. Proliferation of UWB devices has the potential to cause harmful interference to critical aeronautical safety systems. The rules are intended to mitigate interference, however the FAA will be examining these rules to determine their impact on aeronautical systems. The Global Positioning System (GPS) is among the systems that will be re-examined, as well as the Microwave Landing System and other systems that operate below 960 MHz.

1.2 The proponents of UWB technology believe that this technology could benefit public safety, consumers and businesses. UWB technology could create new business opportunities for manufacturers, distributors and vendors that will enhance market competition. It is believed that UWB technology may enable increased use of scarce spectrum resources by sharing it where sharing among conventional narrowband technology is not feasible. It is claimed that UWB communication devices will be able to transmit very high data rates over short distances (typically less than 10 meters) without being affected by multi-path interference. These communications also have the added benefit of high security. The UWB radar imaging devices may have application in the automotive industry, for example for collision avoidance and air-bag deployment. Public safety personnel could use the devices to “see” through walls in hostage situations or to locate people trapped by fire or debris. Field disturbance devices can be used for

security. Ground-penetrating radar can be used to detect faults in a roadbed. All of the applications will not use the same spectrum, although some overlap is possible. The application will dictate where a UWB device operates in the spectrum.

2. DISCUSSION

2.1 In order to determine the signal level at which GNSS receivers can operate in the presence of UWB interference, the United States Department of Transportation (DOT) completed a test program. The FAA was closely involved with the test program. In support of the FAA, the National Telecommunications and Information Administration (NTIA) completed a program to perform electromagnetic compatibility analysis and measurement tests. The results of all the analyses and tests were considered by the FCC in the development of regulations for UWB systems.

2.2 The NTIA has completed studies on the impact of UWB systems on aeronautical systems. One is on spectral characteristics of UWB signals; another is on the compatibility between UWB devices and selected federal systems (GPS is excluded and also various GPS receivers). (See http://www.ntia.doc.gov/osmhome/osmhome.html for reports). The results of the reports indicate that depending on signal structure, separation distance, and height of the UWB device, given certain protection criteria, UWB devices can interfere with various aeronautical systems. For the scenarios evaluated, the non-GPS aeronautical systems that could be affected are distance measuring equipment, air traffic control radio beacon system, air route surveillance radars, airport surveillance radar, microwave landing system, terminal Doppler weather radar, and search and rescue satellite land user terminal. The results from the NTIA GPS report shows that UWB overlay with GPS will be challenging and require UWB signal structure dependent regulations and restrictions to ensure compatibility. This report will also be available at the website above. Analyses by the DOT indicate that interference to GPS receivers could occur from a single UWB device. The results of these tests are similar to the results in the NTIA studies.

2.3 The private sector has also performed GPS/UWB tests. Tests and analyses performed by Time Domain through the University of Texas and Johns Hopkins University/Applied Physics Laboratory indicate that interference to GPS receivers is unlikely. (See http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6512561625 to review this report.)

2.4 The FCC has considered all of the reports discussed above and adopted UWB standards and regulations for the USA on February 14, 2002 and released on May 16, 2002. The U.S. aviation community will have to evaluate carefully the rules that the FCC adopts to ensure that aviation can continue to satisfy its requirements for safety.

2.5 ICAO has submitted an ITU-R Preliminary Draft New Question regarding UWB technology to ITU-R Study Groups 1 and 8. The draft question calls for the ITU to study the characteristics of UWB technology and assess the impact it may have on civil aviation.

3. CONCLUSION

3.1 The international aviation community should carefully determine whether or not the implementation of UWB technology will cause interference to systems operated in radio spectrum used for aeronautical safety services.