# Phased-Array Satcom Antennas Developed for Aeronautical Applications

The Advanced Communications (AC) for Aeronautics research at the NASA Glenn Research Center integrates both aeronautics and space communications technologies to achieve the national objective of upgrading the present National Airspace System infrastructure by responding to the agency's aviation capacity and safety goals. One concept for future air traffic management, free flight, presents a significantly increased demand for communications systems capacity and performance in comparison to current air traffic management practices. Current aeronautical communications systems are incapable of supporting the anticipated demands, and the new digital data communications links that are being developed, or are in the early stages of implementation, are not primarily designed to carry the data-intensive free flight air traffic management (ATM) communications loads. Emerging satellite communications technologies are the best potential long-term solution to provide the capacity and performance necessary to enable a mature free flight concept to be deployed.

NASA AC/ATM funded the development of a Boeing-designed Ku-band transmit phased-array antenna, a combined in-house and contract effort. Glenn designed and integrated an Aeronautical Mobile Satellite Communications terminal based on the transmit phased-array antenna and a companion receive phased-array antenna previously developed by Boeing.

One such advanced satellite communications concept that has the potential to provide a significant increase in aeronautical communications system capacity and performance is the Ku-band phased-array antenna. In a development effort jointly funded and carried out by Glenn and Boeing, a broadband (active) antenna that can transmit at 256 kbps was developed. NASA Glenn then successfully integrated the transmit phased-array antenna and a companion receive phased-array antenna previously developed by Boeing into a mobile testbed. In preliminary demonstrations, the transmit and receive portions of the terminal were shown to function successfully, and basic antenna pointing and tracking and modem performance were verified. Successful demonstration of both transmit and receive antennas is the first step in fusing the technologies needed to support a fully digital data-based integrated communications network, including satellite and ground-based communication links, as contrasted with the primarily analog voice transmit environment of the current environment. This technology promises a 100-fold improvement in communications capability to and from a transport aircraft.

Some of the many advantages offered by these Ku-band antennas are electronic steering, which requires no moving mechanical parts, higher reliability, and a high bandwidth capability. In addition, the flat, conformal mechanical design yields a lower profile, reducing drag and increasing fuel savings. On a systems level, Ku-band phased-array antennas will reduce overall costs because of their lower recur-ring manufacturing costs. And finally, the Ku-band antenna offers a multiple, independent-beam capability; one

antenna can oper-ate with multiple satellites. From a commercial standpoint, the NASA-supported development of the transmit antenna has enabled Boeing to conceive, develop, and market an entirely new business, called Connexion by Boeing, which is the first two-way broadband communication link to commercial aircraft.

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**Programs/Projects:** ARC, AvSP (NASA Langley), AC/ATM (NASA Glenn), AATT, Aviation System Capacity, WINCOMM (NASA Glenn), WxAP, AvSP