National Aeronautics and Space Administration

Trajectory Specification for High Capacity Air Traffic Control

As the demand for air transportation increases, the capacity of the current U.S. air traffic management (ATM) system will eventually be stressed to its limits. New technologies in communication, navigation, and surveillance (CNS), along with new decision support systems and an evolutionary development of the ATM system architecture, can extend the capacity of the current system for several years. However, a revolutionary new approach will be needed to meet the growing demand.

NASA has developed a new method and system, based on Extensible Markup Language (XML), that relates to control of aircraft traffic through specification of trajectory coordinates. The trajectories are composed of a series of trajectory segments. The process involves analysis and processing information on one or more aircraft flight paths, using a four-dimensional coordinates (x, y, z) and a fourth coordinate δ that corresponds to a distance estimated along a reference flight path to a nearest reference path location corresponding to a present location of the aircraft. Use of the coordinate δ, rather than elapsed time t, avoids coupling of along-track error into aircraft altitude and reduces effects of errors on an aircraft landing site.

This patented technology is available for licensing from NASA's space program to benefit U.S. industry.

Technology Details

This technology provides a four-dimensional location coordinate system, for example, (x, y, z, δ), where δ is not elapsed time but is a measured or calculated distance along an aircraft flight path. Along-track error, cross-track error, and altitude error are calculated relative to an ideal, conflict-free reference flight path. Elapsed time is monitored and used as an independent variable for computing or measuring along-track, cross-track, and altitude locations and errors. An error tube is numerically constructed around a central axis, such as the conflict-free reference flight path, with an along-track range ΔAT, a cross-track range ΔCT, and an altitude range ΔAL that may vary with the distance δ along the reference flight path. Altitude is preferably specified as a function of along-track distance δ, rather than as a function of time t. A trajectory specification will be used for communicating trajectory information between an aircraft and one or more ground systems, such as an Airline Operation Center (AOC), for scheduling, maintaining aircraft separation, and other relevant activities.

Commercial Applications

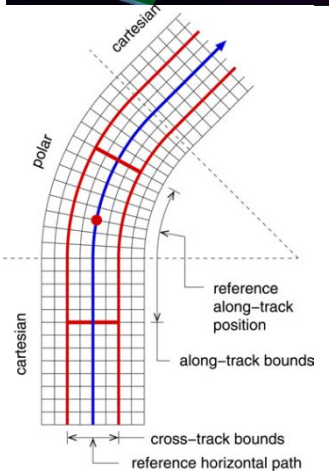
- Air Traffic Management

Patent

This technology has been patented.
U.S. Patent No. 7,650,232
(Reference No. ARC-15171-1)

Benefits

- Allows use of higher capacity of traffic in a given volume of airspace
- Define bounds on allowable along-track, cross-track, and vertical errors
- Compensate for deviations from a time schedule
- Aircraft not required to fly with unrealistic velocity or unrealistic angle parameters
- Aircraft is not required to execute a landing procedure at a location that is spaced far apart from a destination location
- Allows in-flight changes in flight parameters to take account of a changed environment



Curvilinear flightpath coordinate system with along-track and cross-track grid

Contact the Ames Technology Partnerships Office at 1-855-627-2249 or ARC-TechTransfer@mail.nasa.gov