Project: Conflict Detection

In the current aerospace system, commercial flights are controlled by Air Traffic Control (ATC) from gate-to-gate. Before a flight can take place, the complete route plan must be sent to the ATC authorities in charge of the geographical sectors crossed by the aircraft.

During the flight, even minor changes to the plan require a clearance from ATC before they can be performed. New distributed air-ground traffic management concepts are being developed to address the inefficiencies of the current system. For example, the free-flight concept allows direct flight routes without ATC intervention, and the Airborne Information for Lateral Spacing (AILS) concept allows simultaneous and independent landing on closely spaced runways.

A key aspect of these new concepts is that they shift responsibility for aircraft separation from air-traffic controllers to pilots and automation. This change is theoretically possible because recent technology such as D-GPS (Differential Global Position System) and ADS-B (Automatic Dependent Surveillance Broadcast) can provide very accurate data-flight information to pilots and on board computers. Computer systems can warn pilots when other aircraft are dangerously intruding into their own airspace.

Aircraft kinematics can be modeled using

\[
\begin{align*}
x'(t) &= v \cos(\theta(t)) \\
y'(t) &= v \sin(\theta(t)) \\
\theta'(t) &= (g/v) \tan(\phi(t))
\end{align*}
\]

where \(x, y, \theta, \phi\) are the location co-ordinates, the heading and bank angles respectively.

Given the maximum bank angle for a commercial aircraft is

\[|\phi(t)| \leq \frac{\pi}{180}.\]

Goals:
- Write an Ada95 program to carry out conflict detection
- Allow the user to create aircraft in your airspace and specify the basic flight parameters (altitude, acceleration, heading, bank)
- How would you show that your algorithm works?
- The FAA asks you for advice on a new conflict detection system. Based on the work you have carried out for this project, write a two page memo explaining the advantages and disadvantages of your system over other systems.