Hybrid and Embedded Control Systems: Applications in Future Avionic Systems

Claire J. Tomlin



Department of Aeronautics and Astronautics Stanford University

July 7-8, 2005

Air Traffic Control: Separation Assurance



Automatic Separation Assurance



Differential game formulation:

Compute the set of states for which, for all possible maneuvers (d) of the red aircraft, there is a control action (u) of the blue aircraft which keeps the two aircraft separated.



Test at Edwards Air Force Base – June 2004



F-15 (blunderer), T-33 (evader)]

Mixed Initiative Control: Autoland



Application to Autoland Interface

- Controllable flight envelopes for landing and Take Off / Go Around (TOGA) maneuvers may not be the same
- Pilot's cockpit display may not contain sufficient information to distinguish whether TOGA can be initiated



The future...

- New airborne sensors: an information-rich environment
 - GPS/WAAS
 - data-link communications
- New control strategies: quick to adapt, isolate problems, blend with human control
 - automatic collision avoidance
 - automatic routing and scheduling
 - learning models and situations from data tracks
 - Free flight?
 - Personal aviation?
- A safe, efficient, and fair system in which human controllers and automation seamlessly share authority over air traffic control