Hybrid and Embedded Control Systems: Applications in Future Avionic Systems

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July 7-8, 2005
Air Traffic Control: Separation Assurance

Safety: 5 mile lateral, 1000 ft vertical separation

Data from NASA Ames
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

T-33 Cockpit

[DARPA/Boeing SEC Final Demonstration: F-15 (blunderer), T-33 (evader)]
Mixed Initiative Control: Autoland

Safety: state remains inside aerodynamic envelope

what the pilot sees
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.

(existing interface)

(revised interface)
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**