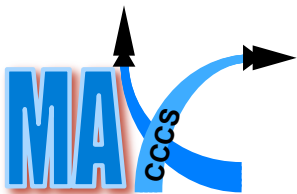




Michigan-AFRL Collaborative Center in Control Sciences, MACCCS (MAX)

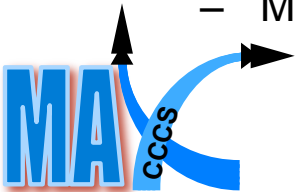
Anouck Girard
University of Michigan, PI

September 23, 2009

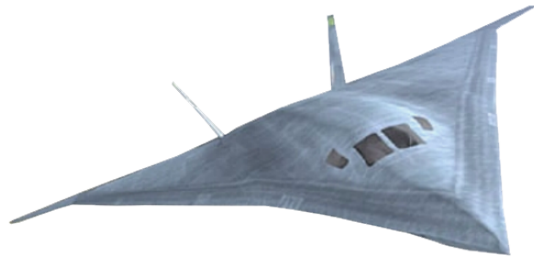
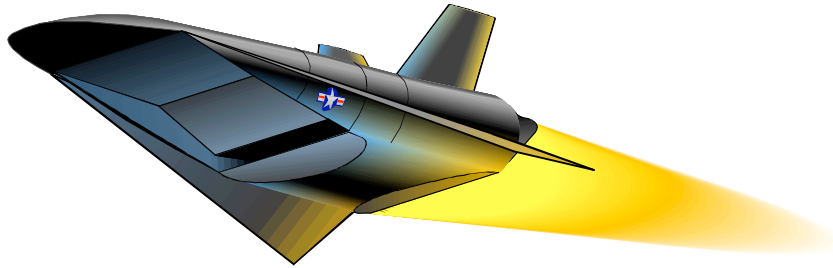


MACCCS

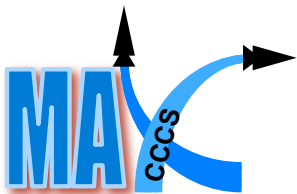
- An ongoing partnership between:
 - The University of Michigan, Ann Arbor
 - The Massachusetts Institute of Technology, and
 - The Control Science Center of Excellence in the Air Force Research Laboratory's Air Vehicles Directorate
 - ONR and Boeing
- Initial focus:
 - Cooperative control of unmanned air vehicles
 - Modeling and control of hypersonic vehicles
- Center team:
 - Anouck Girard (UM)
 - Carlos Cesnik (UM)
 - James Driscoll (UM)
 - Emilio Frazzoli (MIT)
 - Nadine Sarter (UM)
 - Missy Cummings (MIT)
 - Corey Schumacher (Team Lead, AFRL)
 - David Doman (Team Lead, AFRL)
 - AFRL Center of Excellence Team



Hypersonic Vehicles



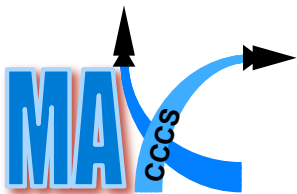
- Development of simple low-order models that can characterize the main aerothermoelastic effects coupled with propulsion in a 6 DOF flight dynamics simulation of HSV
- Determination on how to appropriately modify vehicle configuration to improve dynamic controllability without compromising vehicle performance



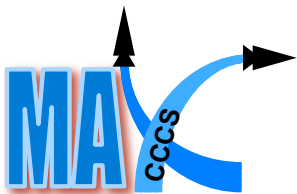
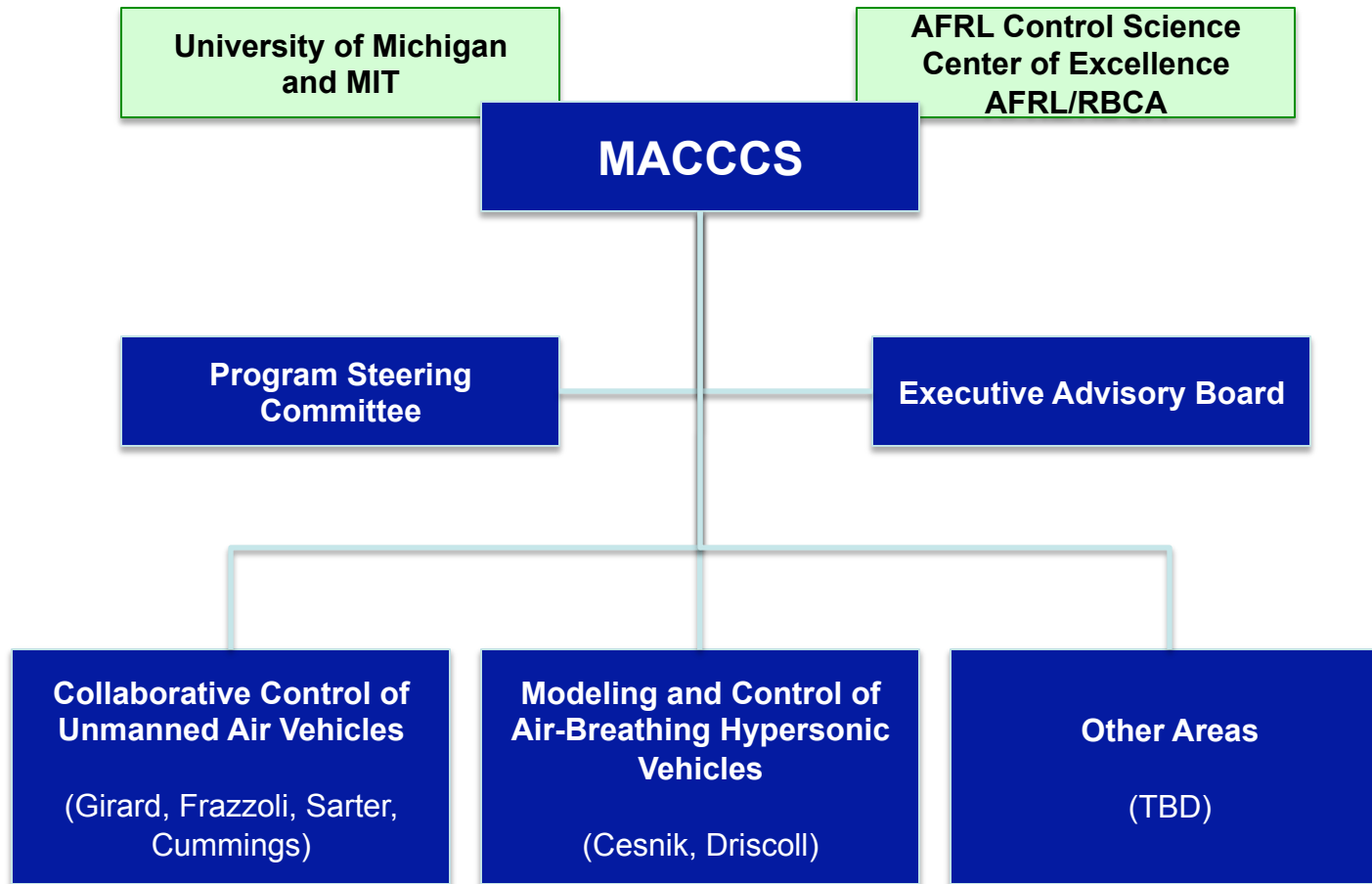
Cooperative Control of Unmanned Air Vehicles



- Supervision and control for collaborative heterogeneous systems
 - Mixed-initiative operations
- Dynamic mission planning
 - Provably efficient, scalable and robust

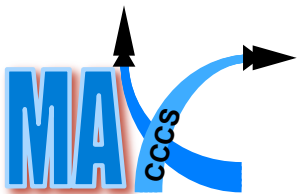


Management



Collaboration Plan

- Regular visits, including summer visits
 - 2 students and 1 faculty at AFRL, Summer of 2007
 - 4 students at AFRL, Summer of 2008
 - 3 students at AFRL, Summer of 2009
 - Many visits
- Control and Aero Seminars at UM and MIT
- Scientist in residence
 - Tal Shima, Summers of 2008, 2009
- Post-doctoral researchers
 - MIT/UM post-doc exchange

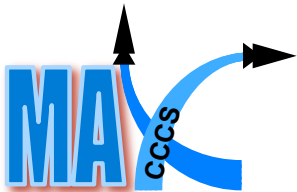


Highlights

- 15 conference papers presented in Year 1
- 5 journal papers and 26 conference papers in Year 2
- Several (at least 7) journal papers under preparation or submitted

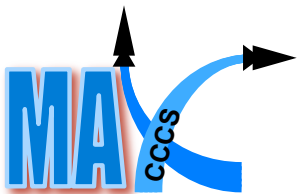
- 8 MAX papers at GNC 2009

- 16 graduate students funded in Year 2 (some partially)
- 11 undergraduate students funded partially
- 1 PhD student graduated (Andy Klesh, 2009).
- 3 post-doctoral fellows
- 1 scientist in residence
- Emilio Frazzoli granted tenure at MIT and voted associate fellow of AIAA



Leveraged Funding

- Leveraged funding:
 - \$735K (3-years at UM) for a total of \$1,242K (OSU + UM)--from NASA NRA
 - Students on DOD Fellowships: Driscoll, Girard (x2)
 - ONR Addition to MAX: \$300,000 total (3 years and \$100K/yr)
 - Boeing addition to MAX: \$100K/yr (start date TBD)
- Papers, videos and presentations available from:
 - <http://www.umich.edu/~arclab/max/>



Year 2 Review

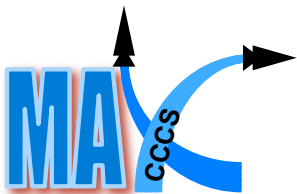
Wednesday, September 23nd (Campus Inn)

- 8:30 Welcome (Banda)
- 8:45 Center Overview (Girard)
- 9:00 Hypersonic Vehicles Modeling – Overview and Technical Topics (Doman, Cesnik, Driscoll)
- 11:30 Coffee Break
- 12:00 Board Reflection Time

- 1:00 Lunch

- 2:00 UAV Cooperative Control – Overview and Technical Topics (Girard, Frazzoli)
- 4:00 Coffee break
- 4:30 AFRL Perspective on UAV (Schumacher)
- 5:00 Human Factors Research (Sarter)
- 5:30 Human Factors Research (Cummings)
- 6:00 Board Reflection Time

- 6:30 Reception



Year 2 Review

Thursday, September 24th (McDivitt Room, FXB)

- 9:00 Executive board panel discussion (closed)
- 11:00 Executive board panel feedback to steering committee
- 12:00 Adjourn

