

FORCES: Foundations Of Resilient CybEr-physical Systems

Testbeds: Air Transportation

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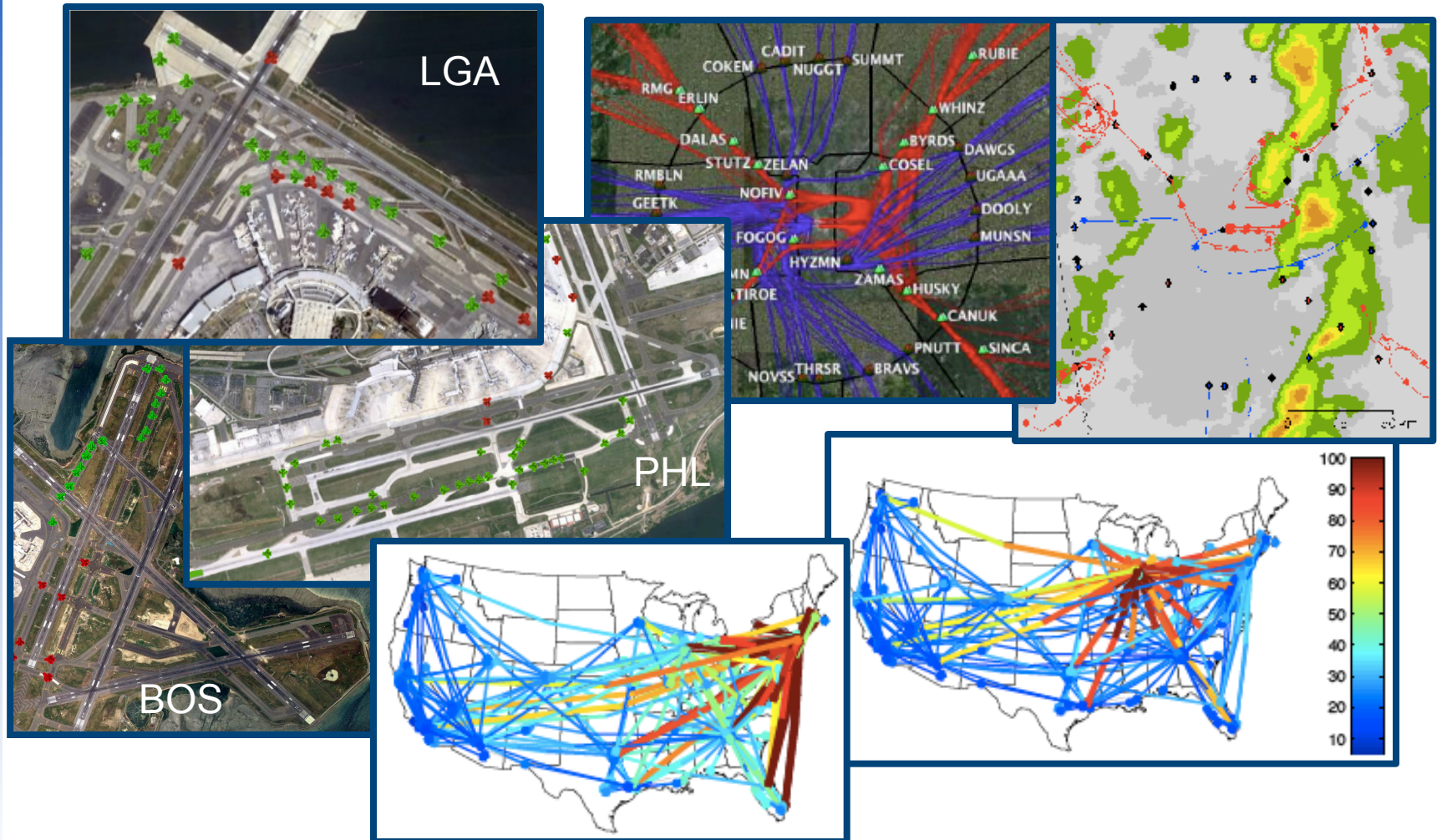
Kick-Off Meeting

April 12, 2013 | Washington, DC



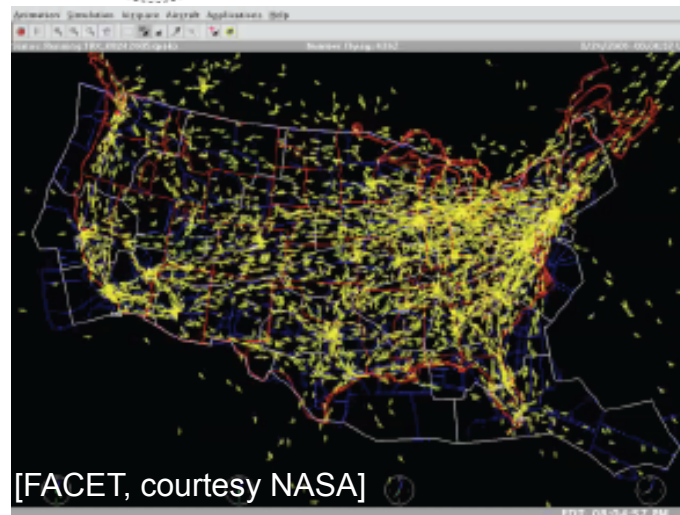
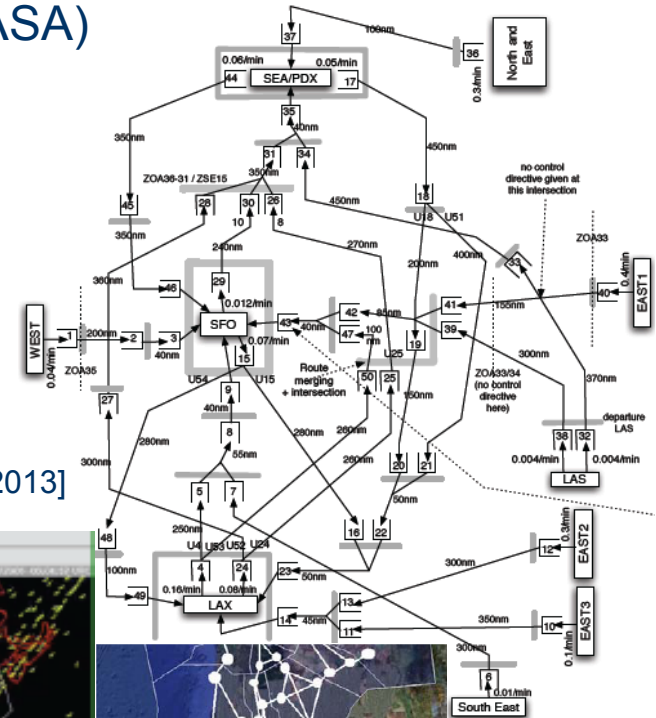
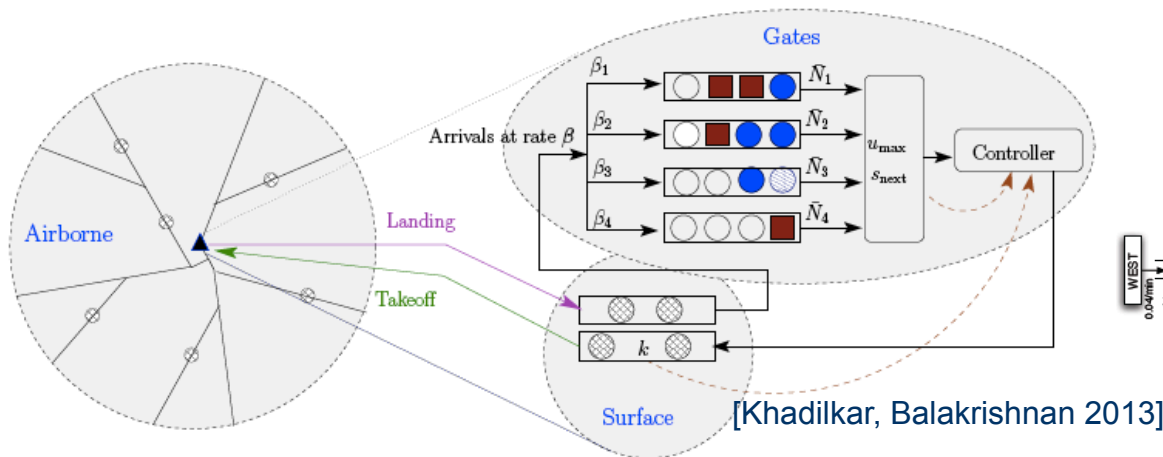
Data sources

- Airport, airspace, delays, weather data archives



Simulation environments

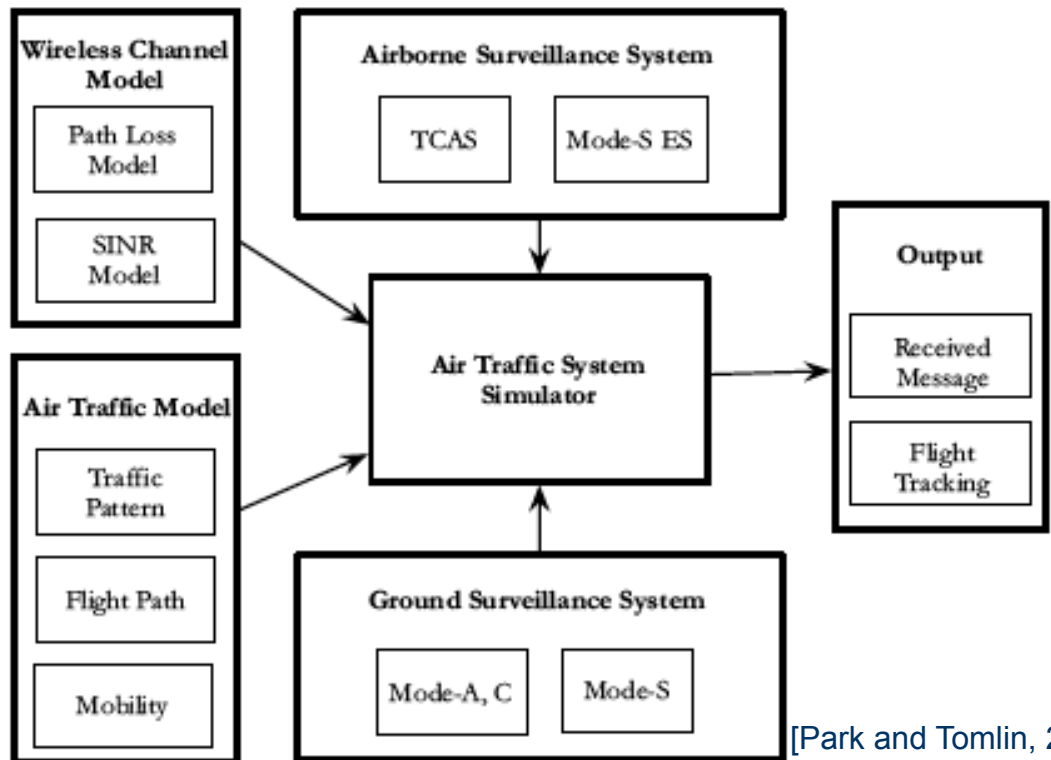
- Validated fast-time simulations of airport and airspace operations
 - In-house, SIMMOD (ATAC/FAA), FACET (NASA)



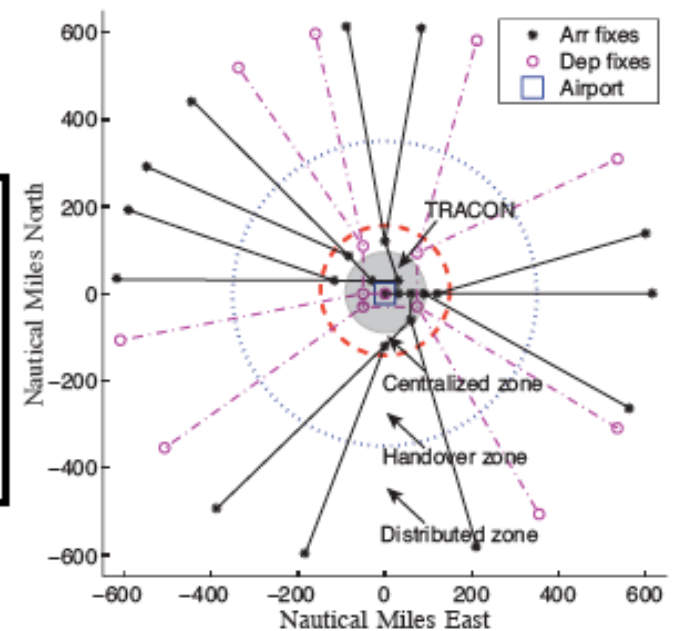
[Le Ny, Balakrishnan 2010]
[Kannan 2009]

Control-communication interactions

- Simulations of interactions between air traffic control (e.g. conflict detection & resolution algorithms) and communication, navigation and surveillance (CNS) systems
 - Interactions of new technologies (e.g. ADS-B) with legacy infrastructure (e.g. beacon radars)
 - Tradeoffs in centralized vs. distributed control strategies



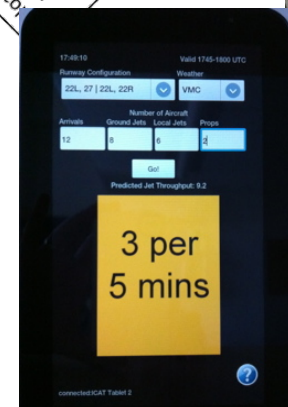
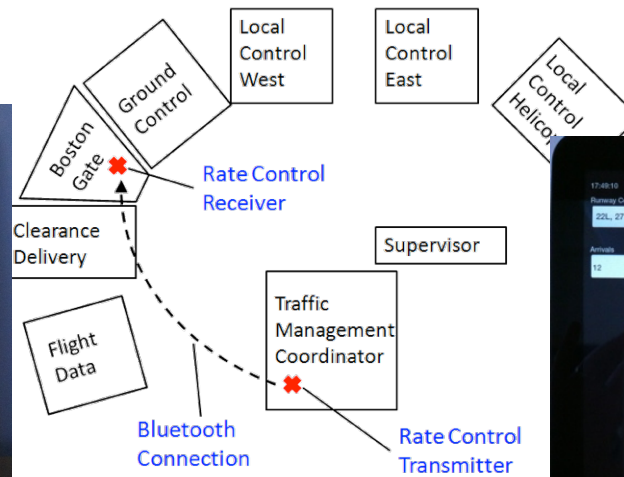
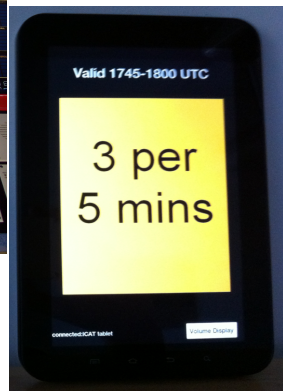
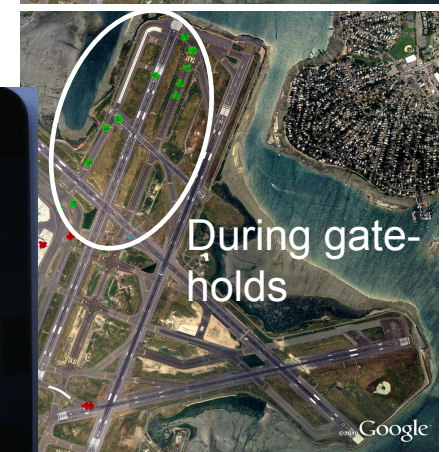
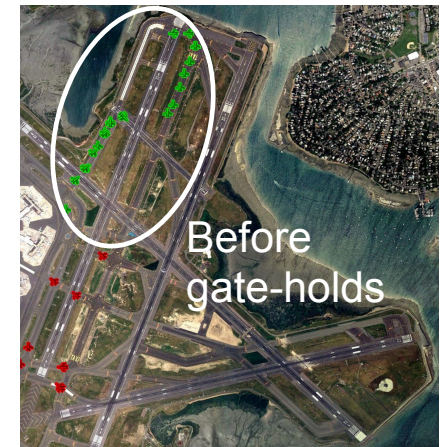
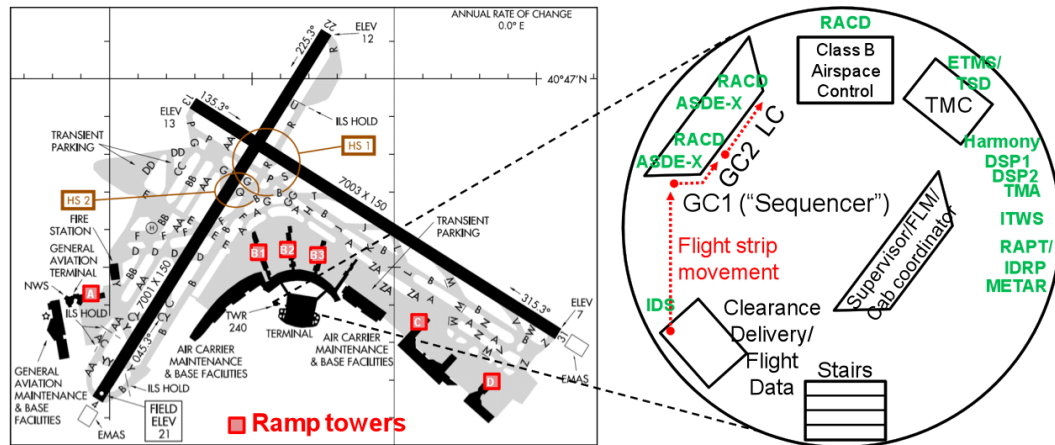
[Park and Tomlin, 2012]



[Park et al. 2013, submitted]

Field-testing opportunities

- Design and field-testing of airport congestion management algorithms (BOS in 2010-2011, ...)



Open questions

- EI + RC integration for resource allocation
 - Improve overall system efficiency
- Risk assessment and incentives for information-sharing
 - Collaborative Decision Making in the current system only considers incentives for information sharing, but neglects risks
 - Design of strategies to incentivize equipage
 - Identification of “true” utility functions of human elements
- Resilient & secure ATC and CNS protocols
 - Evaluation of ADS-B protocols
 - Layered, adaptive security for NextGen
 - Safe integration of unmanned aircraft into the civilian airspace
- Algorithms for secure, resilient and efficient air traffic control