

Departure Enhanced Planning and Runway/Taxiway Assignment System (DEPARTS) Research

Wayne Cooper

703-983-6170 • wcooper@mitre.org

FAA/MOIE

The logo for the MITRE Technology Program, featuring a stylized graphic of stacked blocks in yellow and orange to the left of the text.

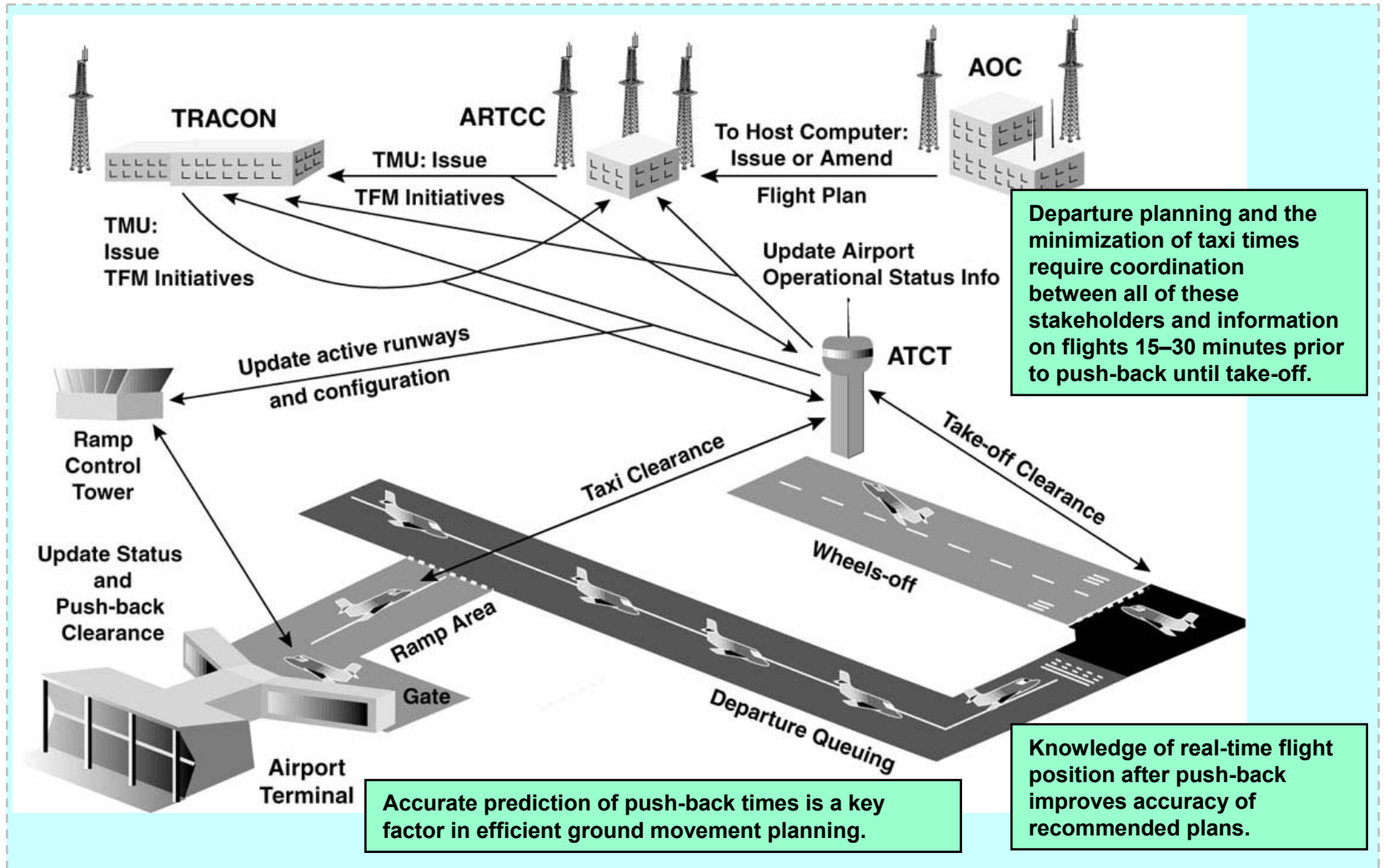
**MITRE
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Problem

- **Significant departure delays exist at major airports.**
- **At large airports, air traffic controllers must manage departures from a number of gates/spots, with a need to merge them into a balanced traffic flow across multiple departure runways, considering all constraints and priorities.**
- **Efficient departure runway load balancing and sequencing is possible with current technology.**
- **The unpredictability of ready to push-back times, traffic flow constraints, and other factors limit the effectiveness of such scheduling.**

Background



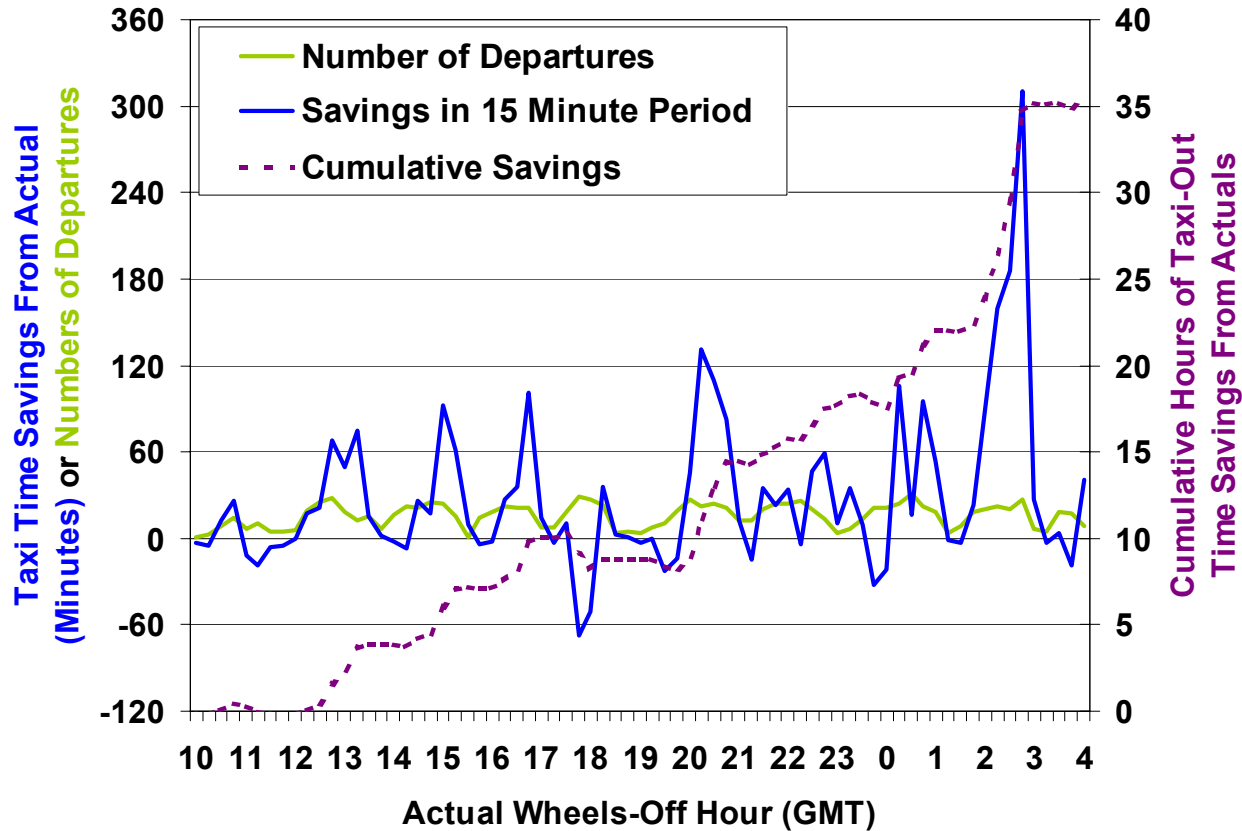
Objectives

- **FY00: Develop basic lab prototype for optimization of Atlanta departure operations**
- **FY01: Tune model; run multi-day simulations of Atlanta departure operations; estimate potential benefits as a function of data availability and predictability**
- **FY02: Develop strategy for future technology transfer of algorithms to a surface traffic management system; build capability to adapt to multiple airports and improve solution robustness**

Activities

- In FY01, completed model that optimizes departure runway assignments and departure queue sequences to minimize taxi-out times
- In FY02, adapting DEPARTS to optimize operations at Memphis as well as at Atlanta as part of building generic capability to adapt to a variety of airport/taxiway configurations
- Adding capability to recommend gate holding time, additional holding pad time and runway queue entry time, and a capability to depart flights from non-standard runway during low activity periods to improve efficiency
- Estimating potential future operational benefits of DEPARTS algorithms as part of future surface traffic management system

Highlight

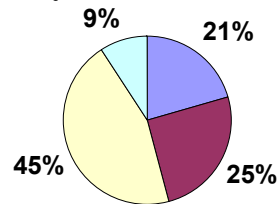


This is a comparison of simulated use of DEPARTS vs. actual Atlanta Airport Resource Management Tool (ARMT) departure data from 10:00Z on 28 August 2000 until 4:00Z on 29 August 2000. Scenario assumes that ATC has 30 minute advance knowledge of ready-to-push time. Estimated average two minute taxi-out time savings at Atlanta. Model provides larger benefits during peak departure demand periods. Benefit is reduced with decrease in predictability of ready-to-push time.

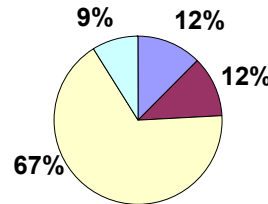
Highlight

Heavy Trailer

Optimized

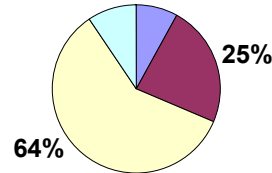


Actual

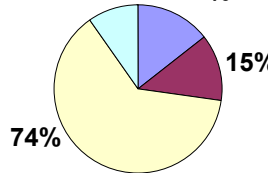


B757 Trailer

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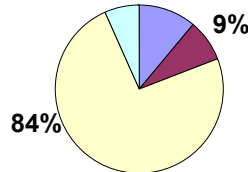


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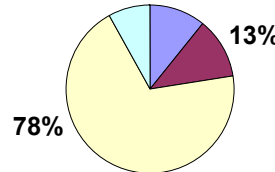


Large Trailer

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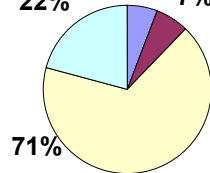


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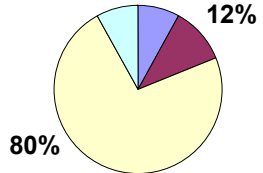


Small Trailer

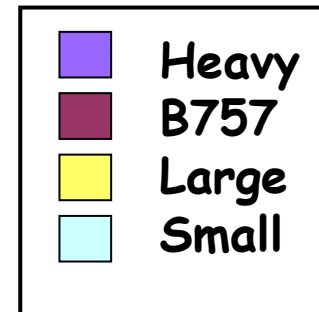
22% 6% 7%



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- Each pie chart gives the percentage of each leading weight class for a specific trailing weight class.
- Optimization increases grouping of flights by weight class in departure queue.
- Deviation from first come first served ordering is constrained in DEPARTS.



Results based on all simulation experiments and actual ARMT data for 21 and 28 August 2000

Impacts

- Answer key questions on the reliability and predictability needed to effectively schedule aircraft ground movements in advance so as to improve taxi times
- Provide benchmarking tool for simulation of future surface traffic flow management tools such as Surface Management System (SMS)
- Input to future operational concept and procedures development for collaborative departure scheduling as part of FAA/NASA SMS research
- Share results with other researchers in academic and R&D aviation community (e.g., MIT, NASA Ames)
- Departure planning algorithms for use in future surface traffic management systems

Future Plans

- **Develop independent benchmark for SMS benefits in FY03**
- **Incorporate DEPARTS algorithms in integrated CAASD ATM Modernization Lab**
- **Potential future technology transfer of DEPARTS algorithms to SMS**

