



The National Transportation Systems Center

Tower Information Display System (TIDS): Human In-The-Loop Simulation



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Presentation Overview:

1. Background on the Tower Information Display (TIDS) project - human systems integration
2. Description of the feasibility analysis / human-in-the-loop simulation study
3. Simulation study results
4. Future directions for TIDS and human systems integration

Background on TIDS Project:

- Staffed NextGen Tower (SNT) concept
 - Creating equivalent visual operations capabilities for tower controllers without the requirement of costly physical towers
- Tower Information Display System (TIDS)
 - Cornerstone of SNT, providing a display of terminal traffic and electronic flight strips to controllers
- TIDS Human Systems Integration
 - Human centered design integrates tower controller feedback into design decisions

Feasibility Analysis / Human-in-the-Loop Simulation

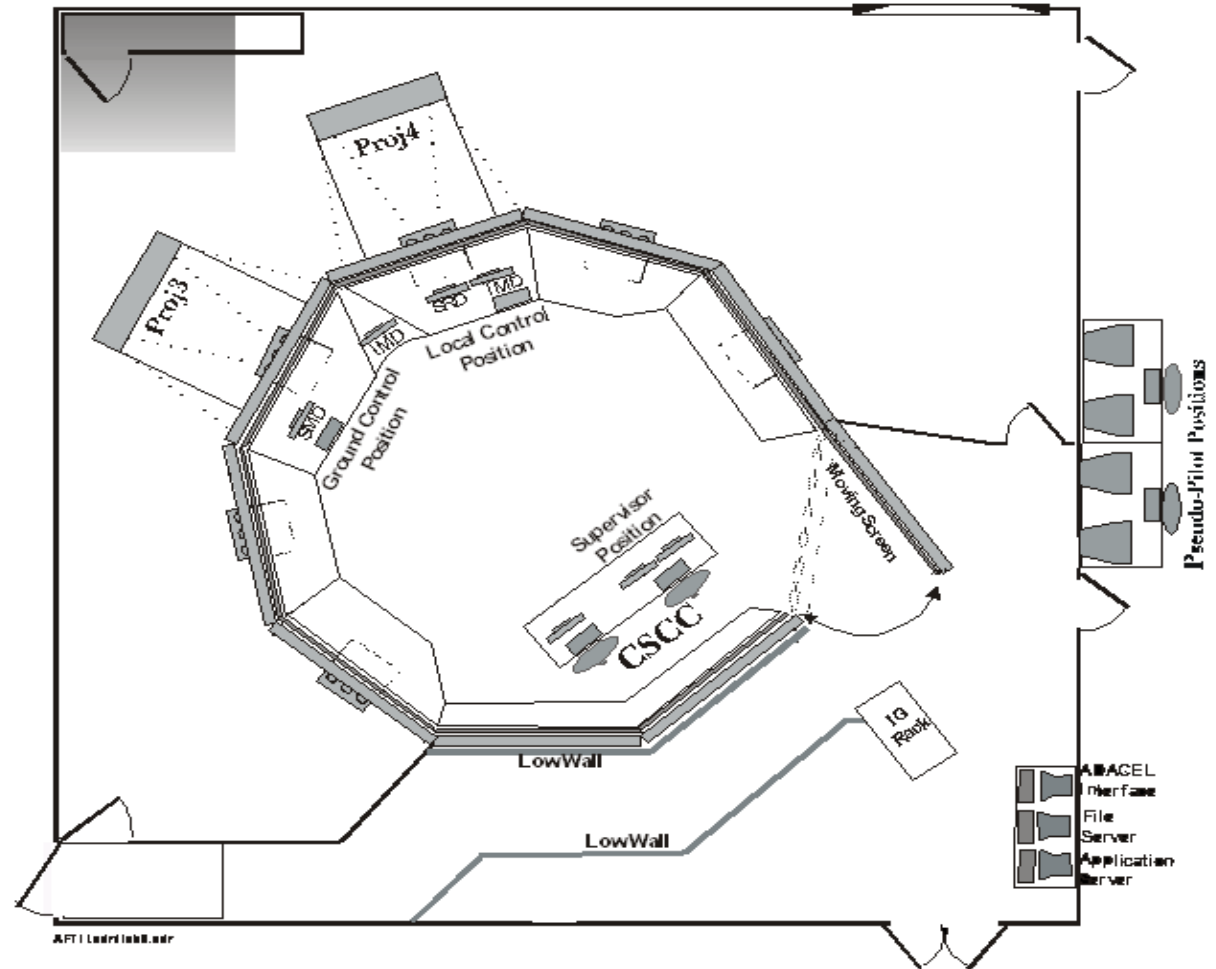
- Compare tower controller performance using a prototype TIDS system to performance with a traditional out-the-window view
- Identify aspects of TIDS that support tower operations
- Solicit feedback for improvements to TIDS

Feasibility Analysis / Human-in-the-Loop Simulation

- Participants:
 - Four retired air traffic controllers with tower and TRACON experience
 - One former FAA ATC instructor / tower controller
 - All had experience with ASDE-X and DBRITE
 - All had normal or corrected to normal vision
- Pairs of controllers were randomly assigned to the GC and LC positions during each simulation
- One controller worked as a supervisor during all simulations

Feasibility Analysis / Human-in-the-Loop Simulation

- Performed at the FAA's Airport Facilities Terminal Integration Laboratory (AFTIL) in Atlantic City, NJ in August 2007



Feasibility Analysis / Human-in-the-Loop Simulation



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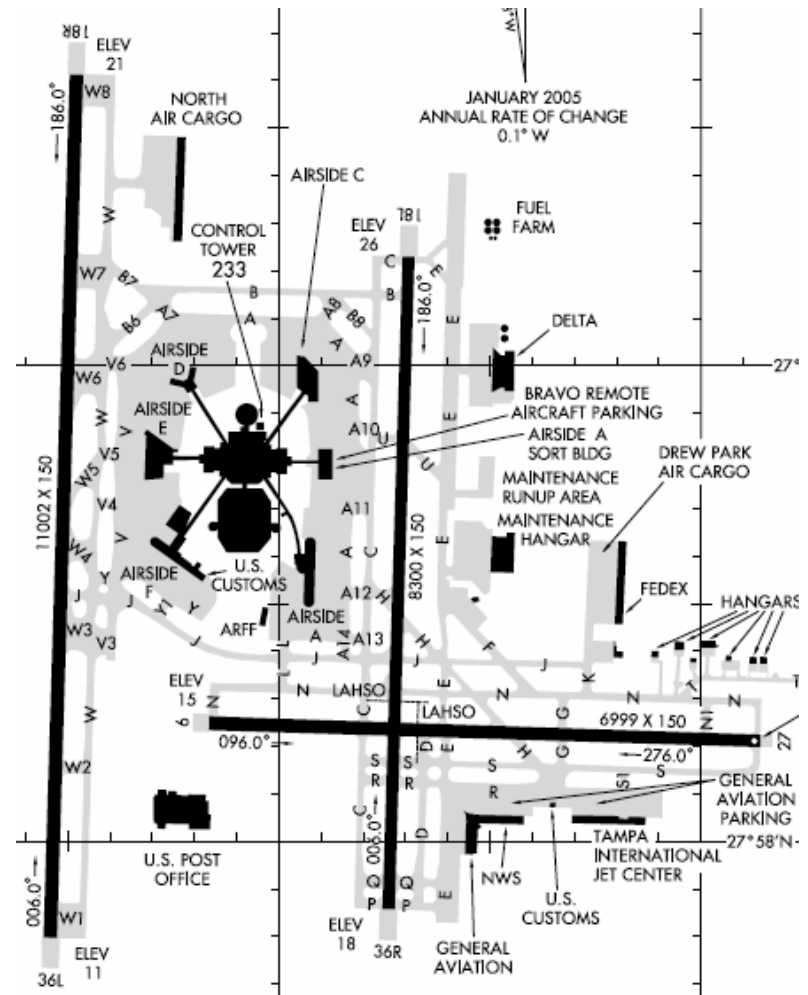
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Feasibility Analysis / Human-in-the-Loop Simulation

- Evaluation conditions:
 - VFR Scenarios
 - TIDS
 - Day - Out the Window (OTW)
 - Night - OTW
 - IFR Scenarios
 - TIDS
 - 6000' Runway Visual Range (RVR) - OTW
 - 1000' RVR - OTW

Feasibility Analysis / Human-in-the-Loop Simulation

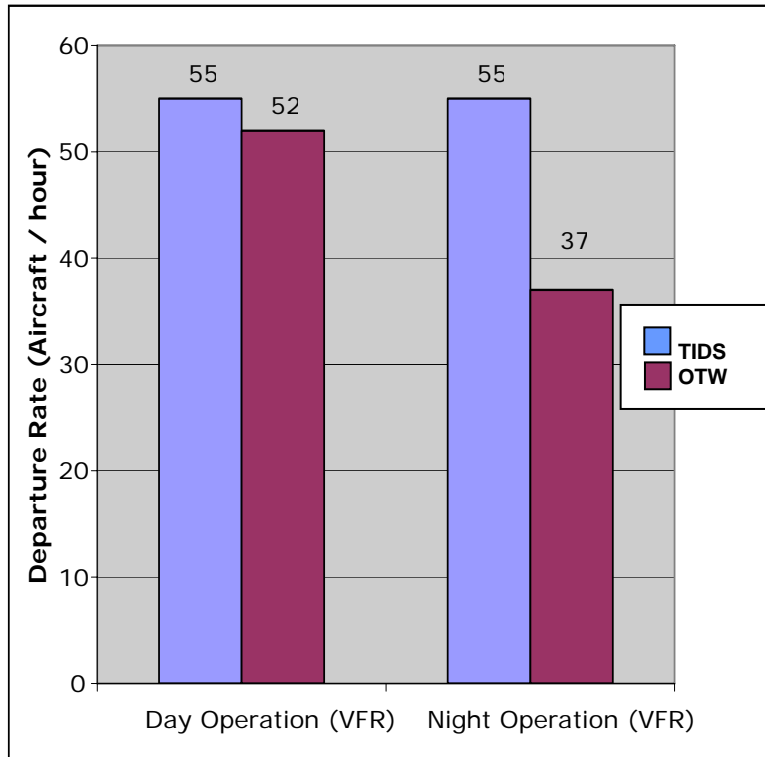
- Simulated Tampa, FL (TPA)
- VFR - simultaneous approaches and departures on 36L & R
- IFR - arrivals on 36L, departures on 36R
- Emergency operations on Rwy 27



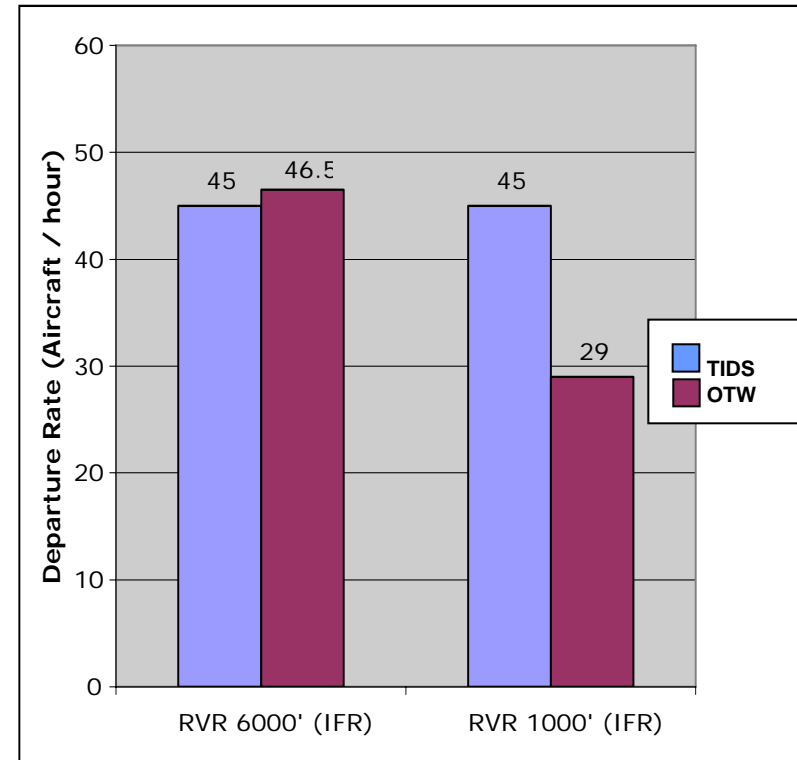
Feasibility Study Results: Study Limitations

- Small number of simulations:
 - 2 simulations for each OTW condition
 - 3 simulations for each TIDS condition
- Small number of test participants
- One facility tested in one configuration
- Results focus on qualitative differences

Feasibility Study Results: Departure Rates

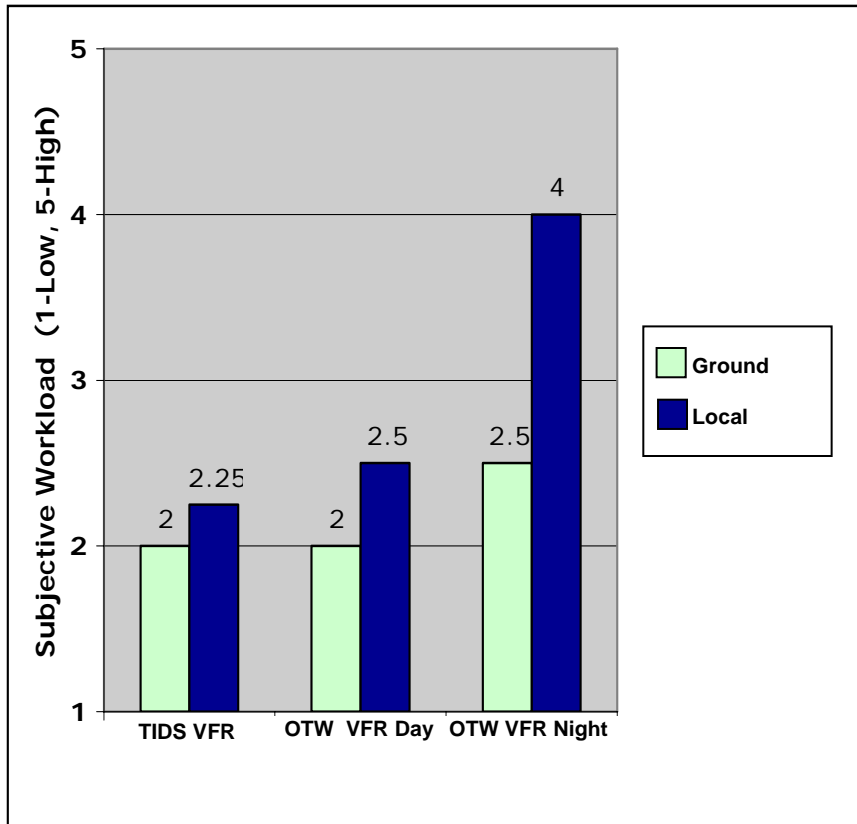


VFR Departure Rates: TIDS & OTW

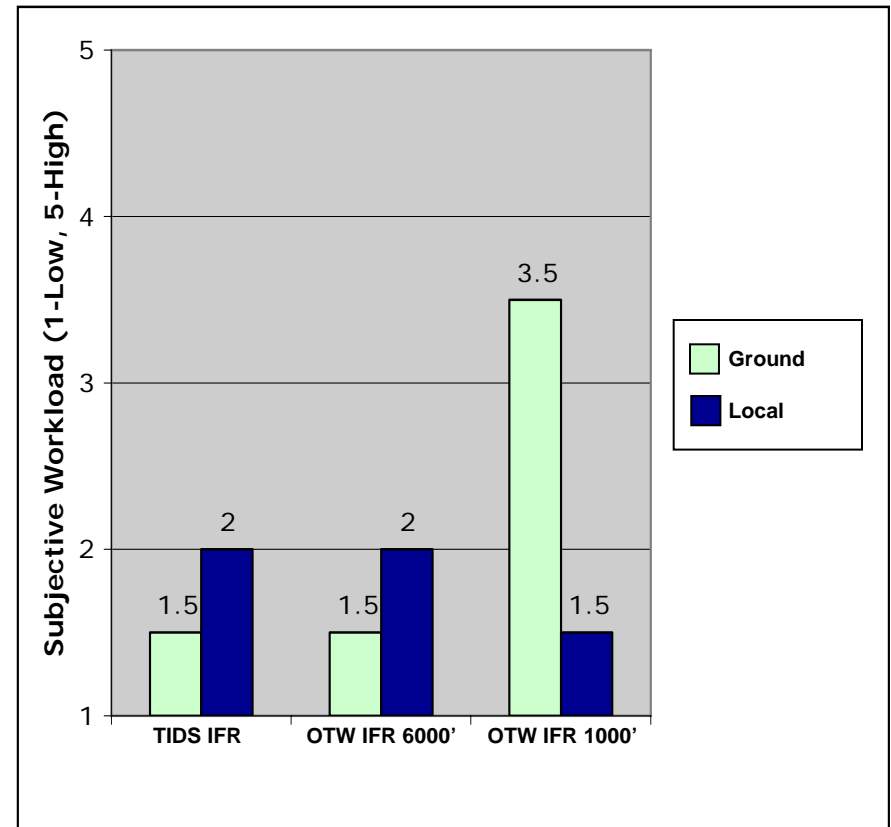


IFR Departure Rates: TIDS & OTW

Feasibility Study Results: Subjective Workload



VFR Subjective Workload: TIDS & OTW



IFR Subjective Workload: TIDS & OTW

Feasibility Study Results: Pilot-Controller Communications

	Average Number of Transmissions / Aircraft	Average Transmission Time (sec) / Aircraft
TIDS - VFR LC	5.8	17.2
OTW - VFR Night LC	6.4	14.3
TIDS - IFR GC	4.8	14.6
OTW - IFR 1000' GC	10.2	38.1

Feasibility Study Results: Expedited Departures

- Expedited departure clearance instructions* were given to:
 - 26% of OTW-VFR Night departures
(position and hold was not allowed during OTW-VFR Night operations)
 - 8.5% of TIDS VFR departures
(position and hold was allowed during TIDS VFR operations)

*e.g., take off with no delay

Feasibility Study Results: User Preferences

- Controllers unanimously preferred the TIDS to the OTW condition for both the GC and LC positions during:
 - VFR Day & Night
 - IFR 6000' and 1000' RVR
- The majority of controllers preferred TIDS to the OTW condition for:
 - Determining aircraft altitude
 - Separating aircraft
 - Determining aircraft position relative to a hold short line
 - Determining whether an aircraft is an arrival or a departure
 - Working with emergency flights

Feasibility Study Results: Summary

- Feasibility of using TIDS for controlling air traffic was demonstrated.
- Benefits of TIDS were found during:
 - IFR conditions when controllers could not see aircraft out the window and operation rates were restricted
 - Night operations when position and hold was not authorized
- Participants preferred TIDS for all conditions tested
- Concerns were expressed over use of TIDS during emergency situations (e.g., blown tire)

Future Directions for TIDS and Human Systems Integration

- User interface development for new system features, e.g.:
 - Weather
 - RVR
 - Decision Support Tools
- Extension to a more complicated facility
- Consideration of system safety issues, e.g.:
 - Detecting surface emergencies
 - Performing landing gear checks
- Expansion to larger tower staff, e.g.:
 - Additional LC and GC staff
 - Additional tower positions - Flight data, clearance delivery

For More Information, Please Contact:

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Questions?