NASA Conflict Detection, Resolution, and Alerting Research

October 2008

Denise R. Jones
Crew Systems & Aviation Operations Branch
NASA Langley Research Center
Hampton, VA  23681-2199
(757) 864-2006
denise.r.jones@nasa.gov
www.nasa.gov
Objectives

• Develop and evaluate airport traffic conflict detection and resolution algorithms and alerting display concepts
  
  - Operations:
    • Low altitude air-to-air
    • Taxiway
    • Runway incursion (RI)

• Support RTCA cockpit-based conflict detection and alerting application description development
Indications and Alerting Concepts

• Indications
  – *Secondary*
    Indicates there could be a potential collision hazard in the immediate future
  – *Primary*
    Indicates runway is not usable for taxi, takeoff, or landing by ownship

• Alerting
  – *Caution*
    Alert for conditions that require immediate flight crew awareness and subsequent flight crew response. Associated with an auditory signal and the color yellow.
  – *Warning*
    Alert for conditions that require immediate flight crew awareness and immediate flight crew response. Associated with an auditory signal and the color red.
Indications Display Elements

Traffic Departing 22R

Traffic List

<table>
<thead>
<tr>
<th>Dist</th>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.2 DL223 – B747</td>
</tr>
<tr>
<td>2.</td>
<td>1.1 NASA557 – B757</td>
</tr>
<tr>
<td>3.</td>
<td>1.3 UA318 – A320</td>
</tr>
<tr>
<td>4.</td>
<td>2.5 NASA515 – B737</td>
</tr>
</tbody>
</table>

1. DL223 – B747
   - Name: Delta 223
   - Type: B747-300
   - Brg / Range: 360° / 230 ft
   - Speed: 13 kts
   - Heading: 270°
   - Route: A, A17, CS-K
   - Dest.: Gate K4
Conflict Alert Display Elements

Traffic List

<table>
<thead>
<tr>
<th>Dist</th>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>DL223 – B747</td>
</tr>
<tr>
<td>1.1</td>
<td>NASA557 – B757</td>
</tr>
<tr>
<td>1.3</td>
<td>UA318 – A320</td>
</tr>
<tr>
<td>2.5</td>
<td>NASA515 – B737</td>
</tr>
</tbody>
</table>

UAL232
45
2864

K16 > A > A18 > P > G > Z > T > T1 > 14R

Warning, Traffic Departing 22R
Conflict Scenario Simulator (CSS)

- Desk-top simulator to aide in development and evaluation of conflict detection and resolution algorithms during low altitude, runway, and taxiway operations in both real-time and fast time.

  - Deliveries
    - Version 0.1  June 2007
    - Version 0.2  February 2008
    - Version 0.3  September 2008

  - NASA Evaluations
    - Version 0.1  October 2007
    - Version 0.2  April 2008
    - Version 0.3  September 2008
Proposed CSS Enhancements

- Implement capabilities as specified in ‘Verification and Validation of Conflict Scenario Simulator Version 0.3’, 9/30/08
- Capability for ownship and traffic to take action based on resolution advisories generated by NASA algorithm
- Record ownship and traffic tracks for playback capability
- Capability to create and utilize multiple traffic feeds for other aircraft/vehicles which could be involved in potential conflicts
- Utilize traffic feeds recorded from NASA simulation and flight tests and Air Traffic Operations Laboratory (ATOL)
- Capability to simulate ADS-B for ownship and traffic
- Capability to process Indications (future)