Needed CNS Capabilities in Major Terminal Areas

Dr. Tom Becher
Director, Aviation Concept of Operations & Research
The MITRE Corporation
Airport Environment
Current/Some Future CNS Capabilities

GPs III

"You are cleared…"

DATALINK

Acknowledgment
Highlighting Three Airline & Airport Needs

- **Capacity**
- **Resiliency**
- **Safety**

<table>
<thead>
<tr>
<th>Airport</th>
<th>Location</th>
<th>Total Passengers in 2017</th>
<th>Number of Runways</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hartsfield-Jackson</td>
<td>Atlanta, GA (USA)</td>
<td>103,902,992</td>
<td>5</td>
</tr>
<tr>
<td>Beijing Capital</td>
<td>Beijing (China)</td>
<td>95,786,296</td>
<td>3</td>
</tr>
<tr>
<td>Dubai International</td>
<td>Garhoud (Dubai)</td>
<td>88,242,099</td>
<td>2</td>
</tr>
<tr>
<td>Tokyo International</td>
<td>Tokyo (Japan)</td>
<td>84,956,964</td>
<td>4</td>
</tr>
<tr>
<td>Los Angeles International</td>
<td>Los Angeles, CA (USA)</td>
<td>84,557,968</td>
<td>4</td>
</tr>
<tr>
<td>O’Hare International Airport</td>
<td>Chicago, IL (USA)</td>
<td>79,828,183</td>
<td>8</td>
</tr>
<tr>
<td>Heathrow Airport</td>
<td>London (UK)</td>
<td>78,012,825</td>
<td>2</td>
</tr>
<tr>
<td>Hong Kong International Airport</td>
<td>Hong Kong (China)</td>
<td>72,867,000</td>
<td>2</td>
</tr>
<tr>
<td>Shanghai Pudong International Airport</td>
<td>Pudong, Shanghai (China)</td>
<td>70,001,237</td>
<td>5</td>
</tr>
<tr>
<td>Paris Charles de Gaulle Airport</td>
<td>Roissy-en-France (France)</td>
<td>69,471,442</td>
<td>4</td>
</tr>
<tr>
<td>Amsterdam Airport Schiphol</td>
<td>Haarlemmermeer (Holland)</td>
<td>68,515,425</td>
<td>6</td>
</tr>
<tr>
<td>Dallas/Fort Worth International Airport</td>
<td>Dallas-Fort Worth, Texas</td>
<td>67,092,224</td>
<td>7</td>
</tr>
</tbody>
</table>

Graphic: University of Richmond

Airline Photos: Sergey Kustov
Terminal Capacity Research Needs

How will the evolution to time-based management and trajectory based operations envisioned to contribute to increasing airport throughput?

1. Will time-based separation enable recapturing unused capacity?

2. How can performance-based navigation and surveillance enable reduced aircraft separation?

3. How will ADS-B enable relative spacing be paired with absolute spacing procedures?
Airport Surface Safety Research Needs

**What contributions can CNS capabilities make toward increased runway safety as arrival and departure operations increase?**

1. **How can low cost surveillance sensors be leverage for surface movement?**

   - **Long Range**: 174 meters
   - **FOV**: +/-10 degrees
   - **Update Rate**: 50 milliseconds
   - **Range Rate**: -100 to +25 m/s

2. **How can surveillance information improve speech recognition performance?**

3. **How can speech inputs improve safety logic performance?**

Approved for Public Release; Distribution Unlimited. Case Number 18-1282
Resiliency in the Terminal Area

What new capabilities are envisioned to enable airports to maintain high levels of operation and mitigate technology outages?

1. What applications of high bandwidth wireless networks improve surface capability?

2. How can modern network protocols and digital switches overcome failures/outages?

3. What technologies and techniques will mitigate GPS interference impacts?
Going Forward

- Imposing limits can encourage a creative response. Excellent work can emerge from uncomfortable or seemingly untenable circumstances.
- Engaging with exceptionally hard problems forces us to think differently.
- Our job [as managers] in creative environments is to protect new ideas from those who don’t understand that in order for greatness to emerge, there must be phases of not-so-greatness. Protect the future, not the past.
MITRE is a not-for-profit organization whose sole focus is to operate federally funded research and development centers, or FFRDCs. Independent and objective, we take on some of our nation's—and the world's—most critical challenges and provide innovative, practical solutions.

Learn and share more about MITRE, FFRDCs, and our unique value at www.mitre.org