MEETING AGENDA

RE: Taxiway and Apron Network
Technical Advisory Committee Meeting #1

Date of Meeting: December 3, 2019

Time of Meeting: 8:00 a.m.

SEH No.: 150733 16.00

Location of Meeting: Duluth International Airport, Amatuzio Room

Attendees:
- Duluth Airport Authority
- SEH
- City of Duluth
- Minnesota Air National Guard 148th Fighter Wing
- Duluth International Airport Tenant Association (DIATA)
- Cirrus Aircraft
- Military Affairs Committee – Duluth Chamber of Commerce
- Hermantown Chamber of Commerce
- Federal Aviation Administration (FAA)
- Minnesota Department of Transportation (MnDOT)
- Citizens Committee for Environmental Concern
- Airport commercial operators (airlines and cargo carriers)
- Lake Superior College
- General aviation tenants
- Lake Superior Helicopters

I. Existing taxiway network and aprons – current conditions and use
   A. Introduction to the DLH taxiway and apron system
   B. How do users use the taxiway system?
      1. What segments are heavily used?
      2. Which segments are used by large aircraft?
      3. For aircraft exiting the runway, which connectors are most frequently used
         (when landing on each end, considering various aircraft types)?
   C. How do you use the apron system?
      1. How is each ramp used? By who, what types of aircraft?
      2. Where do large aircraft park?
   D. Vehicle operations on the airport

II. Stakeholder feedback on taxiway and apron system
   A. What wouldn’t you change?
   B. Are there areas where stakeholder needs are not being met?
   C. Are there areas of congestion?
   D. What areas, if any, are confusing to aircraft or vehicles?
   E. Could any taxiway connectors be better utilized if relocated? Or are there additional connectors that are needed?
   F. Is there sufficient aircraft parking?
   G. General discussion/feedback on taxiway and apron system
III. **Taxiway and apron design standards**
   A. Introduction to taxiway and apron design principles
   B. DLH design standards evaluation summary

IV. **Next steps**

This is an in-person meeting. However, if you are unable to attend in person, a call-in number and GoTo meeting have been set up. The login information is included below.

DLH Taxiway and Aircraft Parking TAC Meeting #1
Tue, Dec 3, 2019 8:00 AM - 10:00 AM CST

Please join my meeting from your computer, tablet or smartphone.
https://global.gotomeeting.com/join/270797925

Join the conference call:
Date/Time: Tuesday, December 3, 2019 8:00am (Central Time)

External Call in Number: 612.284.1533 (Toll Free: 855.838.6933)

External Audio Conference Room: 3

External and Internal Pass Code: 369#

New to GoToMeeting? Get the app now and be ready when your first meeting starts:
https://global.gotomeeting.com/install/270797925
Duluth Airport Master Plan
Taxiway Network and Apron Parking
Technical Advisory Committee (TAC)
Meeting #1

December 3, 2019
Introductions

Tom Werner C.M.
Executive Director
Duluth Airport Authority
twerner@duluthairport.com

Kaci Nowicki
Project Manager/Sr. Aviation Planner
SEH
knowicki@sehinc.com
Introductions

- Name
- Organization
- Role
Kick off meeting agenda

- Welcome and introductions
- Taxiway and apron network
  - Existing condition & use
  - Stakeholder feedback discussion
  - Design standards review

**Meeting Goal:** Identify problems/challenges that need to be solved.
DLH Taxiway & Apron Network
Existing Condition and Use
Taxiway Network Overview
Apron Parking Overview
Pavement Condition
What segments are heavily used?
What segments are used by large aircraft?
Runway 9/27 - Connector taxiway usage

Runway 9 – What connectors are used the most by?

- Small aircraft
- Jet GA aircraft
- Commercial aircraft
- Military aircraft (various types)

Are there locations where an additional connector would be beneficial?
Runway 27 – What connectors are used the most by?

- Small aircraft
- Jet GA aircraft
- Commercial aircraft
- Military aircraft (various types)

Are there locations where an additional connector would be beneficial?
Runway 3/21 - Connector taxiway usage

Runway 3 – What connectors are used the most by?
- Small aircraft
- Jet GA aircraft
- Commercial aircraft
- Military aircraft (various types)

Are there locations where an additional connector would be beneficial?
Runway 3/21 - Connector taxiway usage

Runway 21 – What connectors are used the most by?

- Small aircraft
- Jet GA aircraft
- Commercial aircraft
- Military aircraft (various types)

Are there locations where an additional connector would be beneficial?
Vehicle Operations on Taxiways and
DLH Taxiway & Apron Network Stakeholder Feedback
Discussion

DULUTH INTERNATIONAL AIRPORT
OVERVIEW
DLH Runway Incursion & Surface Incidents

• **Runway Incursion:** the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take off of aircraft.

• **Surface Incident:** an unauthorized or unapproved movement within the designated movement area (excluding runway incursions) or an occurrence in that same area associated with the operation of an aircraft that affects or could affect the safety of flight.
DLH Runway Incursion & Surface Incidents

• Operational Incident:
  • Action of an Air Traffic Controller that results in less than required minimum separation between 2 or more aircraft, or between an aircraft and obstacles, (vehicles, equipment, personnel on runways) or clearing an aircraft to take off or land on a closed runway

• Pilot Deviation:
  • Action of a pilot that violates any Federal Aviation Regulation

• Vehicle/Pedestrian Deviation:
  • Pedestrians or vehicles entering any portion of the airport movement areas (runways/taxiways) without authorization from air traffic control
DLH Runway Incursion & Surface Incidents

Operational Incident (OI)
Action of an Air Traffic Controller that results in:
- Less than required minimum separation between 2 or more aircraft, or between an aircraft and obstacles, (vehicles, equipment, personnel on runways) or clearing an aircraft to take off or land on a closed runway.

Vehicle/Pedestrian Deviation (VPD)
Pedestrians or vehicles entering any portion of the airport movement areas (runways/taxiways) without authorization from air traffic control.

Pilot Deviation (PD)
Action of a pilot that violates any Federal Aviation Regulation Example: a pilot crosses a runway without a clearance while enroute to an airport gate.

Legend
Type of Incident | Number of Incidents
---|---
Operational Incident (OI) | 1
Pilot Deviation (PD) | 2
Vehicle/Pedestrian Deviation (VPD) | 3

Note: - Airport geometry in this area changed as of September 2019.

Source: FAA/FAA data, airport maps, and flying incidents.

SEH Building a Better World for All of Us

DULUTH INTERNATIONAL AIRPORT
TOWN OF DULUTH, MINNESOTA
VISION 2040
Runway Safety Action Team (RSAT) Recent Action Items

Taxilane & Vehicle Roadway Intersection
- Fence can obscure view
- Vehicle stop sign added (2018)

Apron & Vehicle Roadway Intersection
- Aircraft have incorrectly used vehicle roadway as taxilane
- Pavement markings added (2018)
Additional Feedback?

DULUTH INTERNATIONAL AIRPORT
OVERVIEW
Taxiway Design Standards
Introduction
Airplane Design Group (ADG) and Taxiway Design Group (TDG)
Aircraft Design Group (ADG) & Taxiway Design Group (TDG) Influence Design

- **Aircraft Design Group** (wingspan & tail height) influences separation standards

- **Taxiway Design Group** (main gear width & cockpit to main gear distance) influences pavement width and fillets

See Figure 7 in your packet
Cessna Grand Caravan – ADG II / TDG 1A

12.66' 12.17'
CRJ-700 – ADG II / TDG 2

49.24'  16.37'

1/5/2020
C-130 – ADG IV / TDG 2

Cockpit to Main Gear (Feet): 40.42’
Main Gear Width (Feet): 15.91’
KC-135 – ADG IV / TDG 3

45.67'

26.35'
Taxiway Design Group (TDG) Comparison

**C-130 (TDG 2)**

**KC-135 (367) (TDG 3)**
Boeing 777-300ER – ADG V / TDG 6

100.43’

42.32’
Taxiway Network – Aircraft Design Group
Taxiway Network – Aircraft Design Group

WINGTIP TRACK AND SAFETY MARGIN

TAXIWAY A - ADG V

GATE 1A
B737 2/3/4/5/6/7/8/9
B767 2/3
A318/320/321
CRJ"J
GROUND BOARD ONLY
NO REMOTE PARKING AT H51A/B AND HS2 WHEN IN USE.

FUT SPOT 1
CRJ2/7/9
ERJ135/145/175

FUT APRON EXPANSION

FUT APRON EXPANSION
Taxiway Network – Aircraft Design Group
Taxiway Design

• Good design practices keep taxiway intersections simple.
• Complex layouts increase the possibility of pilot error.
• Three-node concept – A pilot has no more than 3 choices at an intersection – ideally, left, right and straight ahead.
• Intersection angles – Design turns to be 90 degrees wherever possible.
Design to Reduce Runway Incursions

- Increase situational awareness, keep taxiway systems simple.
- Avoid wide expanses of pavement.
- Limit runway crossings.
- Avoid “dual purpose” pavements.
- Avoid “high energy” intersections (middle 1/3 of the runway).
- Avoid direct access to runways.
- Increase visibility – Right angle intersections provide the best visibility.
Problematic Taxiway Design - *Examples*

- **Wide expanse of pavement:** Reduces pilot’s ability to see visual cues (signs, etc.)
Problematic Taxiway Design - *Examples*

- Direct access from Ramp to Runway: May create false expectation of a parallel taxiway prior to the runway.
Problematic Taxiway Design - *Examples*

- Greater than 3-node intersection: May lead to pilot confusion. Difficult to properly locate signs.
Problematic Taxiway Design - *Examples*

- Intersection at other than 90 degrees. Does not provide best visual perspective to a pilot.
Problematic Taxiway Design - *Examples*

- Short taxi distance from ramp to runway. Pilots must complete the same number of checklist items in a short distance. Chances of incursions increase in that head-down period.
Problematic Taxiway Design - *Examples*

- **Unexpected hold line location:** The placement is unexpected and pilots may ignore/not expect the hold position point, increasing the chance of a runway incursion.
DLH Taxiway & Apron Standards Review
Hot Spot 1 – Complex Intersection

Hot Spot: History or potential risk of collision or runway incursion
## DLH - Design Standards Review

### Non-Standard Taxiway Design Features

<table>
<thead>
<tr>
<th>Area</th>
<th>Non-right-angled runway/vehicle intersection</th>
<th>Wide expanses of pavement</th>
<th>Direct Access (Apron to Runway)</th>
<th>Runway Centerline to Taxiway Centerline &lt; 45°</th>
<th>Non-Standard Holding Bay</th>
<th>Complex Geometry</th>
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**Legend**

- **Non-Standard Taxiway Design Features**
- **High-energy runway area**
- **Middle 1/3 of the runway**
Next Steps

• Documentation of problems to solve
• Alternatives development
• TAC Meeting #2
Questions and Discussion
Thank You!
Runway 9/27 Landing Distances

- 2,233' (Taxiway A2)
- 5,475' (Taxiway A3/B)
- 7,292' (Taxiway A4)
- 8,709' (Taxiway C)
- 9,302' (Runway 3/21)
- 10,591' (Taxiway A5/E)

Runway 27 Landing Distances

- 10,591' (Taxiway A1)
- 8,347' (Taxiway A2)
- 5,113' (Taxiway A3/B)
- 3,286' (Taxiway A4)
- 1,887' (Taxiway C)
- 1,294' (Runway 3/21)
Runway 3 Landing Distances

- 862' (Taxiway D)
- 1,856' (Taxiway A)
- 2,441' (Runway 9/27)
- 4,212' (Taxiway C1)
- 5,719' (Taxiway C)

Runway 21 Landing Distances

- 1,484' (Taxiway C1)
- 3,265' (Runway 9/27)
- 4,843' (Taxiway D)
- 5,719' (Taxiway C)
- 3,850' (Taxiway A)
Airplane Design Group (ADG) - based on Tail Height and Wingspan

<table>
<thead>
<tr>
<th>ADG</th>
<th>Example Aircraft</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADG I</strong>&lt;br&gt;Tail Height: &lt;20'&lt;br&gt;Wingspan: &lt;49'</td>
<td>Cessna 172</td>
<td><img src="image" alt="Cessna 172" /></td>
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<tr>
<td>Other Examples: Cessna 310, Cirrus SR22, F-16 Falcon, Piper Cub</td>
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<tr>
<td><strong>ADG II</strong>&lt;br&gt;Tail Height: 20' - &lt;30'&lt;br&gt;Wingspan: 49' - &lt;79'</td>
<td>King Air 350</td>
<td><img src="image" alt="King Air 350" /></td>
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<tr>
<td>Other Examples: Cessna 208, CRJ-200, ERJ-145, Gulfstream G400</td>
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<tr>
<td><strong>ADG III</strong>&lt;br&gt;Tail Height: 30' - &lt;45'&lt;br&gt;Wingspan: 79' - &lt;118'</td>
<td>Airbus A319</td>
<td><img src="image" alt="Airbus A319" /></td>
</tr>
<tr>
<td>Other Examples: Boeing 737-900, MD-88, CRJ-900, Gulfstream G650</td>
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<tr>
<td><strong>ADG IV</strong>&lt;br&gt;Tail Height: 45' - &lt;60'&lt;br&gt;Wingspan: 118' - &lt;171'</td>
<td>Boeing 757-300</td>
<td><img src="image" alt="Boeing 757-300" /></td>
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<tr>
<td>Other Examples: Airbus A300, Boeing 787-400ER, MD-11, C-130</td>
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<tr>
<td><strong>ADG V</strong>&lt;br&gt;Tail Height: 60' - &lt;66'&lt;br&gt;Wingspan: 171' - &lt;214'</td>
<td>Airbus A330-300</td>
<td><img src="image" alt="Airbus A330-300" /></td>
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<tr>
<td>Other Examples: Airbus A340, Boeing 777-200, Boeing 767-900</td>
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<tr>
<td><strong>ADG VI</strong>&lt;br&gt;Tile Height: 66' - &lt;80'&lt;br&gt;Wingspan: 214' - &lt;262'</td>
<td>Boeing 747-800</td>
<td><img src="image" alt="Boeing 747-800" /></td>
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<tr>
<td>Other Examples: Airbus A380-800, Antonov AN-124</td>
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</tbody>
</table>

Taxiway Design Group (TDG) - based on Main Gear Width (MGW) and Wheelbase

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<thead>
<tr>
<th>TDG</th>
<th>Example Aircraft</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>TDG 1A</strong>&lt;br&gt;Other Examples: Cessna 208, Cirrus SR22, F-16 Falcon, Piper Cub</td>
<td>Cessna 172</td>
<td><img src="image" alt="Cessna 172" /></td>
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<td><strong>TDG 1B</strong>&lt;br&gt;Other Examples: Cessna Citation III</td>
<td>CRJ-200</td>
<td><img src="image" alt="CRJ-200" /></td>
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<td><strong>TDG 2</strong>&lt;br&gt;Other Examples: CRJ-900</td>
<td>King Air 350</td>
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<td><strong>TDG 3</strong>&lt;br&gt;Other Examples: Airbus A319, Boeing 737-900</td>
<td>KC-135</td>
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<td><strong>TDG 4</strong>&lt;br&gt;Other Examples: MD88</td>
<td>Boeing 757-300</td>
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<td><strong>TDG 5</strong>&lt;br&gt;Other Examples: Antonov AN-124, C-5, C-17</td>
<td>Boeing 747-800</td>
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<td><strong>TDG 6</strong>&lt;br&gt;Other Examples: Airbus A340-600, Boeing 787-10, MD-11</td>
<td>Boeing 777-300ER</td>
<td><img src="image" alt="Boeing 777-300ER" /></td>
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<td><strong>TDG 7</strong>&lt;br&gt;Other Examples: Airbus A380-800</td>
<td>Airbus A380-800</td>
<td><img src="image" alt="Airbus A380-800" /></td>
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Figure 5

DLH Incursion Data (2015-2019)
Date: 11/2019; Project: DULAI 150733

No reported incidents outside this area.

Key Map

Legend
Runway Incursion and Surface Incidents
1/1/2015 to 11/24/2019

- 1
- 2
- 4
- 6

Incidents include loss of separation on approach or aircraft not complying with instructions.

Note: Current taxiway naming is shown. Actual location of incident is shown, however, the narrative report for each incident may reflect old taxiway naming.
Operational Incident (OI)
Action of an Air Traffic Controller that results in:
Less than required minimum separation between
2 or more aircraft, or between an aircraft and
obstacles, (vehicles, equipment, personnel on
runways) or Clearing an aircraft to take off or land
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Vehicle/Pedestrian Deviation (VPD)
Pedestrians or vehicles entering any portion of the
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Pilot Deviation (PD)
Action of a pilot that violates any Federal Aviation
Regulation Example: a pilot crosses a runway without
a clearance while enroute to an airport gate

Legend
Type of Incident | Number of Incidents
--- | ---
Operational Incident (OI) | 1
Pilot Deviation (PD) | 2
Vehicle/Pedestrian Deviation (VPD) | 3

Source: FAA Aviation Safety Information Analysis and Sharing (ASIAS)
Figure 7

Runway 9/27 (10,591' X 150')

Runway 3/21 (5,719' X 150')

Figure 2-10

Figure 2-11

Figure 2-12

Legend
- Aircraft Design Group (ADG) I - (C172)
- Aircraft Design Group (ADG) II - (CRJ-200)
- Aircraft Design Group (ADG) III - (A319)
- Aircraft Design Group (ADG) V - (A330)
- Taxiway/Taxilane Object Free Area (TOFA)

Aircraft Design Group (ADG) I - (C172)
Aircraft Design Group (ADG) II - (CRJ-200)
Aircraft Design Group (ADG) III - (A319)
Aircraft Design Group (ADG) V - (A330)
Taxiway/Taxilane Object Free Area (TOFA)
Figure 10

Legend
- Aircraft Design Group (ADG) II - (CRJ-200)
- Aircraft Design Group (ADG) V - (A330)
- Taxiway/Taxilane Object Free Area (TOFA)

Legend Details:
- Aircraft Design Group (ADG) II - (CRJ-200)
- Aircraft Design Group (ADG) V - (A330)
- Taxiway/Taxilane Object Free Area (TOFA)

Key Dimensions:
- CRJ 700
- ADG II
- ADG V

Runway 9/27 (10,691' x 150')
Non-Standard Taxiway Design Features

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Legend
- Non-Standard Taxiway Design Features
- High-energy runway area (middle 1/3 of the runway)