ATD-2 HITL Experiment Plans

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Outline

• Role as Experiment lead
• Role of Shadow sessions
• Example of storyboarding
• Experiment Plan for TSTR
• Experiment Plan for MATS
• Experiment Plan for ISAS
Objective

- Obtain feedback from users to enhance and improve the ATD-2 tools in the AAL Ramp, CLT ATCT, and ZDC Center for Phase 1
- Support/Lead Shadow Evaluations to obtain feedback from end users
- Design and develop a HITL simulation environment to evaluate the ATD-2 tools with end users as participants
- Represent the end user/customer in the agile software development process

Approach

- Conduct HITL at Future Flight Central (FFC) and Airspace Operations Lab (AOL)
  - Simulated traffic will include uncertainties
- Shadow Evaluations used to obtain feedback from end users on design of new features of ATD-2 tools before s/w development
- Participants include CLT AAL Ramp Controllers/Managers, CLT ATCT TMC and Controllers, and Retired Controllers/ SMEs

Highlights

- CLT EDC Evaluation & Demonstration successfully tested in Sept 2015
- Tactical Surface Ramp Tool successfully tested in April 2016
- New design of STBO Client presented to ATCT in July 2016 Shadow evaluation
- Shadow Evaluation of Ramp Tools conducted in Aug 2016
- Shadow Evaluation focusing on data integration and exchange in Sept 2016
Story Boarding
Runway Request for Operational Necessity Proposal

- **What**
  - Runways requested for operational necessity by ramp or pilot
- **Who**
  - Ramp or Tower (at pilots’ requests)
- **When**
  - As soon as it is known
- **How**
  - Ramp or Tower changes runway on aircraft that has operational necessity
  - Runway change made on RTC will be sent to STBO client and the flight will be marked both in the timeline and the flight table as having requested OpNec
- **Required capability**
  - Current procedures and ability to change runway
- **Potential stakeholders (folks who may benefit)**
  - ATCT, FAA Center, Ramp, IOC, Airport Ops
- **Required Formal Procedures**
  - TBD
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Ramp Traffic Console (RTC)

- Flight at Gate with Push Advisory
- Flight Pushback
- Flight at Gate With Advised Hold Time
- Red Border Indicates Hold & Hold Timer Counting down
Ramp enters desired choice of Runway from drop down

Double click on flight on RTC to open flight menu

AAL 1223 Flight Menu

Assign
- North Hardstand
- West Hardstand
- Mike Charlie Bypass

Edit Call sign
- Critical Flight
- Flight Cancelled
- Flight Delayed

Edit Tail Number
- Update TMI
  - EDCT
  - CFR

Scheduler Status
- Normal
- Temporarily Inactive
- Removed from Service
  - Do Not Remove Icon
  - Remove Icon

Select to add:
- Gate
- Fix
- Spot
- Runway

Operational Necessity

Select runway update here

Taxi for Operational necessity option is greyed out until a runway update is selected
Select desired choice of Runway from drop down

AAL 1223 Flight Menu

- Edit Call sign
- Edit Tail Number

Assign
- North Hardstand
- West Hardstand
- Mike Charlie Bypass

Select to add:
- Gate
- Fix
- Spot
- Runway

Scheduler Status
- Normal
- Temporarily Inactive
- Removed from Service
  - Do Not Remove Icon
  - Remove Icon

Critical Flight
- Flight Cancelled
- Flight Delayed

Update TMI
- EDCT
- CFR

Operational Necessity
- Select corrected information from drop down

Cancel  Apply
Apply Changes

AAL 1223 Flight Menu

- Assign:
  - North Hardstand
  - West Hardstand
  - Mike Charlie Bypass

- Select to add:
  - Gate
  - Fix
  - Spot
  - Runway

- Operational Necessity

- Edit Call sign
- Edit Tail Number

- Critical Flight
- Flight Cancelled
- Flight Delayed

- Update TMI
  - EDCT
  - CFR

- Scheduler Status
  - Normal
  - Temporarily Inactive
  - Removed from Service
    - Do Not Remove Icon
    - Remove Icon

- Select to add:
  - Gate
  - Fix
  - Spot

- Operational Necessity

Select Apply to make the update

Then Select this option and Apply
Taxi for Operational Necessity (Ramp)

AAL 1223
CVG-ANDYS
9
18C

Taxi for Operational Necessity Designation Displayed on RTC Along with runway change
OpNec or TFON next to the ACID?
Previous HITL work
Tactical Surface Tools for Ramp (TSTR)

- Developed a HITL simulation environment to evaluate CLT ramp operations for the following:
  - Ramp Traffic Console (RTC) and Ramp Manager Traffic Console (RMTC) functionality
  - New CLT South adaptation and North Flows
  - Procedures to transition between different flows
  - Procedures to transition between advisory and non advisory mode

Approach

- Human-In-The-Loop simulation at Future Flight Central (FFC)
- High fidelity AA Ramp operations with ATD-2 technology
- Simulated traffic – current day level in the non movement and movement area
- American Airline (AA) Ramp Controllers, AA Ramp Manager from CLT, and Retired Controllers

Highlights

- Tested with AA ramp controllers and ramp managers in the week of April 25
- Received positive and meaningful feedback from AA participants

Look Ahead

- Plans to test the CFR procedures using ATD-2 tools between tower and center in summer
HITL Experiments
Baseline Evaluation of CLT Airspace Operations

Charlotte EDC Evaluation & Demonstration (CEED)

Goals
- Develop a HITL simulation environment to test CLT ATC airspace operations
- Compare impact of current Traffic Management Initiatives (MIT & CFR) on departure and enroute operations
- Assess impact of 2 levels of compliance errors (partial/current and full) of target takeoff times on departure and enroute operations
- Evaluate operations and inefficiencies

Approach
- Human-In-The-Loop simulation at the Airspace Operation Laboratory (NASA Ames)
- High-fidelity ATC environment with current-day technology
- Simulated traffic of current-day departure push in CLT plus surrounding traffic in en route airspace
- Tested sectors with retired controllers from CLT, ZTL, and ZDC, pseudo pilots, and TMCs

Results
- HITL rated as very realistic by participants
- CFR departures led to less workload and airborne delays compared to MIT departures
- Surface delays were higher when ZDC scheduled CLT departures than when ZTL did
- However stream insertion was more efficient when ZDC controlled the departure schedule
Integration of Airspace and Surface Target Generators
Objectives for HITL

1. Shakedown to test the integration between NASA’s airspace and surface target generators
2. Evaluate the fidelity and accuracy of the Mini Tower showing CLT Tower Out of Window view
3. Evaluate the APREQ ping pong procedures using STBO and TBFM in current state
4. First opportunity to evaluate the Strategic Collaborative Decision Making (S-CDM) Tool
Tools & Equipment in HITL

- STBO: Surface Trajectory Based Operations
  - Emulation of ASDE-X display (STBO TRACON map)
- Mini Tower showing CLT ATC-T out of window view
  - 270 degree view using 6 monitors
- Voice communication
- Flight Strips
- All the equipment held constant
- CLT TRACON represented by Multi MACS
@ FFC - Airport
- One Local Center
- One Local East
- One Ground Controller
- One ATC-T TMC
- One Clearance Delivery
- Four Pseudo Pilots

@ AOL – TRACON and Center
- One Center TMC
- Two arrival controllers
  - Feeder West
  - Feeder East
  - Final ??
- Departures
  - Departure West
  - Departure East
- Five Pseudo Pilots
• South Operation with RWY 23 for arrivals
• No wind
• Clear visibility, IFR rules (can’t fly visual in this sim)
• Duration 120min
• Arrival bank followed by a departure bank
  – 82 arrivals (21 turnarounds)
  – 74 departures (10 flights with CFR)
• APREQ/CFR to DCA, PHL, EWR, LGA, JFK from ZDC
• No TMI restrictions (EDCT, MIT)
South Converging Operations

18R, 18C, 18L

Arrivals
Departures
Objective #1 testing the Airspace and Surface Target Generators
Boundary Used For Handoff Between ATG and MACS

Hard boundary between ATG and MACS defined by polygon.

Once aircraft crosses the boundary the \textit{pseudo-pilots} lose control of the aircraft.

Controllers need to hand-off control before the boundary depicted on the videomap.

Targets are still visible to both TRACON and Tower controllers on the radar display and the virtual tower.

3-D Polygon for Hand Off Boundary

MACS Controlled: Outside Polygon

ATG Controlled: Inside Polygon

3500ft

7nm from RWY threshold for arrivals
2nm from RWY threshold for departures

Runways 18R, 18C, 18L
Runway 23
Runways 36R, 36C, 36L

Acceptable Transfer Boundaries: B, C, E, F

Unacceptable Transfer Boundaries: A, D

3500f
Handoff Boundary with Traffic

- Approaches in burgundy
- Arrivals in blue
- Departures in red
- MACS ATG handoff boundary

- 7nm away from the RWY threshold
- 2nm away from the RWY threshold
Objective# 3 APREQ Procedure
• STBO Timeline used to initiate APREQ process
• Center TMC will monitor TBFM for the APREQ aircraft
• TBFM will receive RFRT and accept
• STBO will receive release time for the aircraft
• Ramp will also receive the same release time on their tools
 Objective# 4 Evaluate SCDM
SCDM Tool depicts imbalance between demand and capacity

- It will show predicted queue lengths - metered and unmetered
- It may suggest a departure metering program that needs to be evaluated
- Several inputs into the capacity of the airport can be possible
Schedule

- 08:30 – 09:30 Common briefing in Room 100
- 09:30 – 09:45 Familiarization in Tower and TRACON
- 09:45 – 11:45 Run 1 (50% traffic)
- 11:45 – 12:30 Lunch break
- 12:30 – 14:30 Run 2 (100% traffic)
- 14:30 – 15:00 Debrief