Airport Departure Flow Management System (ADFMS)

System Requirements Document

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Prepared by: Team AirportDFM

Douglas Disinger
Hassan Hameed
Lily Tran
Kenneth Tsang
Stirling (Chip) West

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Course Professor: Dr. Kathryn Laskey
Project Sponsor: Dr. Lance Sherry

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1. Requirements

1.1 Functional Requirements

1.1.1 System Input and Request Capability

1.1.1.1 The ADFMS shall have a pre-populated data containing aircraft type, airline information for users to select from instead of manually entering the information.

1.1.1.2 The ADFMS shall provide users a capability to request for a departure slot.

1.1.1.3 The ADFMS shall provide the airlines a capability to input the flight schedules into the system.

1.1.1.4 The ADFMS shall detect and notify the user of an invalid request for departure slot.

1.1.1.5 The ADFMS shall be capable of accepting departure slot request 100 days prior to the actual departure date.

1.1.1.6 The ADFMS shall be capable of allowing users to adjust the business rules of the system.

1.1.2 System Acknowledgement and Notification Capability

1.1.2.1 The ADFMS shall provide an acknowledgment message to the user within 5 seconds upon receiving a valid request.

1.1.2.2 The ADFMS shall notify and alert the user of a change in the updated request status within 60 seconds upon the system receiving the change.

1.1.2.3 The ADFMS shall notify and alert the user of a change in the wait time of the virtual queue within 60 seconds upon the system receiving its updated status.

1.1.2.4 The ADFMS shall notify and alert users when the virtual queue has an open slot that is available for reservation.

1.1.2.5 The ADFMS shall notify and alert the AOCs of assigned departure slots.

1.1.2.6 The ADFMS shall notify and alert the Station Managers of the expected pushback time and updated expected pushback times.

1.1.2.7 The ADFMS shall notify and alert the Station Managers of the assigned taxi-path.

1.1.2.8 The ADFMS shall notify and alert the Station Managers of all trading transactions.

1.1.3 System Departure Queuing Capability

1.1.3.1 The ADFMS shall implement the departure queuing slots using virtual queue system.

1.1.3.2 The ADFMS shall assign an aircraft a departure slot based on the aircraft's flight schedule, aircraft's flight status, runway configuration, aircraft's gate position, and aircraft's taxi path.

1.1.3.3 The ADFMS shall assign an aircraft slot such that the time between pushback time and the actual departure time is minimized.

1.1.3.4 The ADFMS shall update the virtual queuing slot and notify the users that have been placed in the virtual queuing every 60 seconds until the user is no longer in the virtual queuing.

1.1.3.5 The ADFMS shall minimize the time difference between the departure request time and the actual departure time.

1.1.3.6 The ADFMS shall be capable of adjusting the slot in the virtual queue to allow an emergency request to either enter or leave the queuing slot.

1.1.3.7 The ADFMS shall be capable of allowing users to trade up or trade down the slot position in the virtual queue with other users.

1.1.3.8 The ADFMS shall predict and provide the Station Manager with the expected pushback time once an aircraft has been assigned a departure slot.

1.1.3.9 The ADFMS shall prevent more than two aircraft simultaneously approaching at the entrance of the runway for take off.

1.1.3.10 The ADFMS shall support at least three taxi-paths for aircraft approach to the entrance of the runway for take off.

1.1.4 Aircraft Tracking and Monitoring Capability

1.1.4.1 The ADFMS shall provide a near real-time situational awareness map tracking all aircraft at the ramp, apron, taxiway and runway. Near real-time is defined as a 5 second delay from the actual time.

1.1.4.2 The ADFMS shall track and monitor the status of each aircraft that has been entered in the virtual departure queue.

1.1.4.3 The ADFMS shall track and monitor the status of each aircraft that has been entered in the departure physical queue.

1.1.4.4 The ADFMS shall update aircraft position every 10 seconds.

1.1.4.5 The ADFMS shall provide aircraft positions to users upon request.

1.1.4.6 The ADFMS shall predict an aircraft taxi out time within +/- 60 seconds of the actual taxi out time.

1.1.4.7 The ADFMS shall predict an aircraft expected pushback time within +/- 60 seconds of the actual pushback time.

1.1.4.8 The ADFMS shall be capable of providing the ramp traffic status upon user request.

1.1.4.9 The ADFMS shall compute the taxi-path for the aircraft.

1.1.5 System Search Capability

1.1.5.1 The ADFMS shall allow users to query the database using key words, time, date, airline, pilot name, aircraft flight number, aircraft type, pushback time, and departure slot.

1.1.5.2 The ADFMS shall allow users to sort the database.

1.1.6 Trading and Exchanging Slots

1.1.6.1 The ADFMS shall keep a record of each airline's trading slot transactions. A record shall contain at the minimum of the following data: date, time, original queue slot, new queue slot, trading party, number of points exchanged, reason for trading.

1.1.6.2 The ADFMS shall keep track of points for each airline and update the points within 30 seconds of the transaction.

1.1.6.3 The ADFMS shall check for expired points and automatically update the point records for each airline.

1.2 Performance Requirements

1.2.1 System Response Requirements

1.2.1.1 The ADFMS shall respond to a delay notification within 30 seconds.

1.2.1.2 The ADFMS shall be capable of assigning a slot with the departure rate of 10 flights every 15 minutes.

1.2.1.3 The ADFMS shall respond to a user request for service within two seconds.

1.2.1.4 The ADFMS shall be capable of processing 50 transactions per second.

1.2.2 System Capacity

1.2.2.1 The ADFMS shall be capable of storing three months of departure slots data.

1.2.3 System Update and Refresh

1.2.3.1 The ADFMS shall update the departure queue at every 30 seconds and notify all impacted users of the status.

1.2.3.2 The ADFMS shall automatically refresh the system every 30 seconds.

1.3 Interface and Interoperability Requirements

1.3.1 Existing Communication Links

1.3.1.1 The ADFMS shall not interfere with the existing radio systems at PHL.

1.3.1.2 The ADFMS shall interface with the existing communication systems used by aircraft, airlines, Station Managers, Ramp Controllers, and ATCT.

1.3.2 Existing Hardware Systems

1.3.2.1 The ADFMS shall be capable of interfacing with the ASDE-X system to integrate the data into ADFMS.

1.3.2.2 The ADFMS shall be capable of interfacing with existing ATC systems.

1.3.2.3 The ADFMS shall be capable of interfacing with the AOCnet system**.**

1.4 Operational Requirements

1.4.1 Graphical User Interface

1.4.1.1 The ADFMS shall provide graphical user interface to users.

1.4.1.2 The ADFMS shall provide a web-based system to users.

1.4.2 Printing Capability

1.4.2.1 The ADFMS shall support the printing capability to allow users to print data.

1.5 Security Requirements

1.5.1 System Accessibility

1.5.1.1 The ADFMS shall implement a security mechanism to prevent unauthorized users from accessing the system.

1.5.1.2 The ADFMS shall implement a security mechanism to prevent unauthorized users from making modifications to the system.

1.5.1.3 The ADFMS shall implement a security mechanism to prevent unauthorized users from transferring data off the system.

1.5.2 Security Alert

1.5.2.1 The ADFMS shall alert and notify the system administrator when malicious activity is detected.

1.5.2.2 The ADFMS shall alert and notify the system administrator when a predefined number of unsuccessful logon attempts are exceeded.

1.5.3 Data Encryption

1.5.3.1 The ADFMS shall encrypt all data residing on the system.

1.5.3.2 The ADFMS shall encrypt all data being transferred off the system.

1.5.4 Data Backup

1.5.4.1 The ADFMS shall automatically backup data daily based on user specified time.

1.5.4.2 The ADFMS shall store the backup data in a separate hard-drive that is not used for the primary data.

1.6 Reliability Requirements

1.6.1 The ADFMS shall be accessible to the users 24 hours a day.

1.6.2 The ADFMS shall be capable of performing self-system diagnostics check test.

1.6.3 The ADFMS shall be operable without crashing or locking up the system at least 99% of the time.

1.7 Maintainability Requirements

1.7.1 The ADFMS shall support remote access for system maintenance and upgrade.

1.7.2 The ADFMS shall provide self-system troubleshooting procedures to the system maintainer.

1.8 Safety Requirements

1.8.1 The ADFMS shall incorporate the safe separation distance of aircraft into the prediction of aircraft expected pushback time.

1.8.2 The ADFMS shall notify and alert the Ramp Controllers when an aircraft has exceeded the safe separation distance in the airfield.

1.8.3 The ADFMS shall comply with FAA safety regulations.

2. Requirements Verification Methods

Team AirportDFM defined four verification methods to be used in requirements verification testing. These methods are inspection, demonstration, test and analysis.

- Inspection (I): Inspection is the examination of an item to determine whether it conforms to the specified requirements. This verification method includes the inspection of compliant certificate and documentation.

- Demonstration (D): Demonstration is the actual operation of an item to provide evidence that the required functions were accomplished under specific scenarios.

- Test (T): Test involves scientific principles and procedures that applied to determine the properties or functional capabilities of items.

- Analysis (A): Analysis uses established technical or mathematical models or simulations, algorithms, charts, graphs, circuit diagrams, or other scientific principles and procedures to provide evidence that the item meets its specified requirement.

Section	Requirements Name	Verification Method
1.1.1	System Input and Request Capability	
1.1.1.1	The ADFMS shall have a pre-populated data containing aircraft type, airline information for users to select from instead of manually entering the information.	D
1.1.1.2	The ADFMS shall provide users a capability to request for a departure slot.	D
1.1.1.3	The ADFMS shall provide the airlines a capability to input the flight schedules into the system.	D
1.1.1.4	The ADFMS shall detect and notify the user of an invalid request for departure slot.	D
1.1.1.5	The ADFMS shall be capable of accepting departure slot request 100 days prior to the actual departure date.	D
1.1.1.6	The ADFMS shall be capable of allowing users to adjust the business rules of the system.	D
1.1.2	System Acknowledgement and Notification Capability	
1.1.2.1	The ADFMS shall provide an acknowledgment message to the user within 5 seconds upon receiving a valid request	D
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1.1.2.4	The ADFMS shall notify and alert users when the virtual queue has an open slot that is available for reservation.	D
1.1.2.5	The ADFMS shall notify and alert the AOCs of assigned departure slots.	D
1.1.2.6	The ADFMS shall notify and alert the Station Managers of the expected pushback time and updated expected pushback times.	D
1.1.2.7	The ADFMS shall notify and alert the Station Managers of the assigned taxi-path.	D
1.1.2.8	The ADFMS shall notify and alert the Station Managers of	D

	all trading transactions.	
1.1.3	System Departure Queuing Capability	
1.1.3.1	The ADFMS shall implement the departure queuing slots using virtual queue s	D
1.1.3.22	The ADFMS shall assign an aircraft a departure slot based on the aircraft's flight schedule, aircraft's flight status, runway configuration, aircraft's gate position, and aircraft's taxi path.	D
1.1.3.33	The ADFMS shall assign an aircraft slot such that the time between pushback time and the actual departure time is minimized.	T
1.1.3.44	The ADFMS shall update the virtual queuing slot and notify the users that have been placed in the virtual queuing every 60 seconds until the user is no longer in the virtual queuing.	D, T
1.1.3.5	The ADFMS shall minimize the time difference between the departure request time and the actual departure time.	T, A
1.1.3.6	The ADFMS shall be capable of adjusting the slot in the virtual queue to allow an emergency request to either enter or leave the queuing slot	D
1.1.3.7	The ADFMS shall be capable of allowing users to trade up or trade down the slot position in the virtual queue with other users.	D
1.1.3.8	The ADFMS shall predict and provide the Station Manager with the expected pushback time once an aircraft has been assigned a departure slot.	D, T
1.1.3.9	The ADFMS shall prevent more than two aircraft simultaneously approaching at the entrance of the runway for take off.	D, T
1.1.3.10	The ADFMS shall support at least three taxi-paths for aircraft approach to the entrance of the runway for take off.	D
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1.5.3	Data Encryption	
1.5.3.1	The ADFMS shall encrypt all data residing on the system.	D, I
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1.5.4.1	The ADFMS shall automatically backup data daily based on user specified time.	D, T
1.5.4.2	The ADFMS shall store the backup data in a separate hard-drive that is not used for the primary data.	D, I
1.6	Reliability Requirements	
1.6.1	The ADFMS shall be accessible to the users 24 hours a day.	I, A
1.6.2	The ADFMS shall be capable of performing self-system diagnostics check test.	D, A
1.6.3	The ADFMS shall be operable without crashing or locking up the system at least 99% of the time.	T, A
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Figure 1: System Requirements