

# **User Manual**

## **For**

# **Global Package Courier Tracking**

**COMP 4081 Software Engineering**  
**(9 December 2014)**

**BitRunners (Team #5)**

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Version 1.1

## **Abstract**

The goal of this program is to give realistic simulation data for the optimization of FedEx airport operations. The program gives data on taxi runway activity, effect of airport storms and their duration, two different aircraft types, berthing and debirthing times and the inclusion of international and national shipping. This program gives a user interface to set simulation parameters, in order to run the simulation and a results screen to view the results.

The User Manual for APTS has information on the application itself for ease of use and general convenience.

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# **1 Introduction**

Airport Process Time Simulation, APTS is a program that models realistic FedEx import/export functions in an airport. This gives the user time projections based on various specified parameters. This user manual will help the user become familiar with APTS and how to run the simulation.

## **1.1 Audience**

The user manual will help. The user will need a basic understanding of FedEx global package courier tracking terminology and variables involved in the day to day airport shipping process. This allows the user full understanding of the simulation.

## **1.2 Applicability**

Version 1.0 of the User manual covers the respective version of the program. It is advised to use future versions of this manual for future versions of this application. This application is intended to operate on any computer running Linux with kernel 3.0 and later with a web browser that is able to run JavaScript and the latest build of PHP.

## **1.3 Purpose**

APTS is a tool designed to aid in projecting estimated airport efficiency, allows the user to simulate various airport functions and determine their downtime/uptime. APTS has a simple and intuitive user interface with an accurate simulation. This manual details the process used for running a simulation.

## **1.4 User Manual Usage**

The following sections will give detail how to run APTS. Section two gives an installation guide. Section 3 describes how to use APTS and describes each input field. Section 4 details possible error conditions.

## **1.5 Related Documents**

For additional information on APTS, the following documents can be viewed:

- DNB V1.0
- SRS V1.2
- Test Report V1.0

The documents detail the APTS creation and implementation process.

## **1.6 Conventions and Terms**

APTS uses one GUI, with an input screen, progress graphic and a results screen. User input will only be taken on the input screen and the user will have no interaction with the simulation afterwards. All results will be displayed on the results screen.

Parameters that appear on the input screen will be underlined in this document. Buttons in the program will appear in quotation marks in this document. Any file names and folder names will be italicized in this document.

## 1.7 If You Have a Problem

If there are any problems related to APTS usage contact team Bitrunners at [randomticktock@gmail.com](mailto:randomticktock@gmail.com) for help.

## 2 Installing APTS

This section will detail the installation and running of APTS.

### 2.1 Before You Begin

The recommended environment to run the application consists of the following.

- Computer running Linux with kernel 3.0 and later.
- Web Browser that is able to run Javascript(ex. Chrome or Firefox).
- The latest stable build of PHP(can be obtained at php.net)

#### Running APTS

- Install APACHE 2 and PHP 5

### 2.2 Compiling APTS

For the sake of being flexible across platforms (68-bit, 32-bit, etc.), the download provides the source files for the code, as well as a shell script that will compile it on the users respective system. To execute this shell script, you must open a shell window and change to the directory of where you unzipped the file. Once this is done, you'll need to type a command to allow permissions to execute the shell script. Example commands are given below.

```
cd "<directory location>"
```

```
sudo make install
```



### **2.3 Running APTS**

Running the application requires the user to run the program through the shell script, so that it runs in the background, and then click on the file that will open the GUI in their browser. The first step would be to open a shell window and type in these following commands.

```
cd "src/engine"
```

```
./gpct
```

Once this is done, you open the index.html file, which will open the GUI inside the respective browser.

### 3 Using APTS

This section covers the different parameters the user will interact with in order to use APTS.

The screenshot shows the 'GLOBAL PACKAGE COURIER TRACKING' interface. At the top, a header bar contains the title. Below it, a control bar includes an 'Update mode' section with radio buttons for 'None', 'Time' (selected), and 'Event', followed by a text input field containing '10'. Next to this is a 'Time between updates (milliseconds):' label and a text input field containing '1'. On the far right of this bar is a 'Start Simulation' button. The main area is divided into two columns. The left column, titled 'Regular plane parameters', contains inputs for 'Arrival rate (hours)' (10), 'Arrival rate variation (hours)' (1), 'Loading time (hours)' (5), 'Loading time variation (hours)' (1), and 'Category 3 landing gear availability (percentage)' (50). Below this is a section titled 'External plane set 1 parameters' with inputs for 'Number of planes' (5), 'Round trip time (hours)' (50), 'Round trip time variation (hours)' (5), 'Loading time (hours)' (10), 'Loading time variation (hours)' (2), and 'Category 3 landing gear availability (percentage)' (50). The right column has a 'Time' section with 'Simulation Length (hours)' (200), a 'Weather' section with 'Storm occurrence mean time (exponential RV, hours)' (48), 'Mean Storm length (hours)' (4), and 'Storm length variation (hours)' (2), and an 'Airport features' section with 'Number of berths' (4), 'Number of taxiways' (4), 'Taxiway travel time (hours)' (0.5), and 'De/berthing time (hours)' (1). At the bottom left are '+' and '-' buttons. Numbered red boxes highlight: 1. 'Regular plane parameters' title, 2. 'External plane set 1 parameters' title, 3. 'Time' title, 4. 'Weather' title, 5. 'Airport features' title, 6. 'Start Simulation' button, and 7. 'Update mode' section.

Figure 1. Input Screen

- |  |                                   |
|--|-----------------------------------|
| 1. Regular plane parameters (Section 3.1)        | 5. Airport Features (Section 3.5) |
| 2. External plane set 1 parameters (Section 3.2) | 6. Submit Button (Section 3.6)    |
| 3. Time (Section 3.3)                            | 7. Update Mode (Section 3.7)      |
| 4. Weather (Section 3.4)                         |                                   |

### **3.1 Regular plane parameters**

This section of the input screen has various fields to adjust regular plane parameters.

#### **3.1.1 Purpose**

This section allows the following fields to be modified:

- Arrival Rate (hours) - The frequency of time which the plane arrives at the airport.
- Arrival rate variation (hours) - The range of time that the arrival rate varies.
- Loading time (hours) - How long it takes for a plane's cargo to be loaded.
- Loading time variation (hours) - The range of time that the loading time varies.
- Category 3 landing gear availability (percentage) - probability that category 3 landing gear is available for this type of airplane.

#### **3.1.2 Materials**

There are no separate materials needed for this function.

#### **3.1.3 Preparations**

There are no preparations needed for the function.

#### **3.1.4 Inputs**

When specifying input to the field, a validation check will take place to ensure proper format.

#### **3.1.5 Cautions and warnings**

Because of the validation check, this section of input fields cannot invalidate the simulation.

#### **3.1.6 Invocation**

All input fields are invoked when the user hits submit.

#### **3.1.7 Suspension of operations**

This function cannot be suspended.

### **3.1.8 Termination of operation**

Once the submit button is pressed, the simulation cannot be terminated.

### **3.1.9 Output**

The corresponding section on the output GUI will show the results.

### **3.1.10 Error conditions**

There are no error conditions associated with this event.

## **3.2 External plane set 1 parameters**

This section of the input screen has various fields to adjust external plane parameters.

### **3.2.1 Purpose**

This section allows the following fields to be modified:

- Number of Planes – The number of this type of aircraft
- Round trip time (hours) – The time it takes to complete one round trip.
- Round trip time variation (hours) – The range of time that the round trip time varies.
- Loading time (hours) - How long it takes for a plane's cargo to be loaded.
- Loading time variation (hours) - The range of time that the loading time varies.
- Category 3 landing gear availability (percentage) - probability that category 3 landing gear is available for this type of airplane.

### **3.2.2 Materials**

There are no separate materials needed for this function.

### **3.2.3 Preparations**

There are no preparations needed for the function.

### **3.2.4 Inputs**

When specifying input to the field, a validation check will take place to ensure proper format.

### **3.2.5 Cautions and warnings**

Because of the validation check, this section of input fields cannot invalidate the simulation.

### **3.2.6 Invocation**

All input fields are invoked when the user hits submit.

### **3.2.7 Suspension of operations**

This function cannot be suspended.

### **3.2.8 Termination of operation**

Once the submit button is pressed, the simulation cannot be terminated.

### **3.2.9 Output**

The corresponding section on the output GUI will show the results.

### **3.2.10 Error conditions**

There are no error conditions associated with this event.

## **3.3 Time**

This section of the input screen has a field to specify simulation duration.

### **3.3.1 Purpose**

This section allows the following fields to be modified:

- Simulation Length (hours) - The duration of the simulation.

### **3.3.2 Materials**

There are no separate materials needed for this function.

### **3.3.3 Preparations**

There are no preparations needed for the function.

### **3.3.4 Inputs**

When specifying input to the field, a validation check will take place to ensure proper format.

### **3.3.5 Cautions and warnings**

Because of the validation check, this section of input fields cannot invalidate the simulation.

### **3.3.6 Invocation**

All input fields are invoked when the user hits submit.

### **3.3.7 Suspension of operations**

This function cannot be suspended.

### **3.3.8 Termination of operation**

Once the submit button is pressed, the simulation cannot be terminated.

### **3.3.9 Output**

The corresponding section on the output GUI will show the results.

### **3.3.10 Error conditions**

There are no error conditions associated with this event.

## **3.4 Weather**

This section of the input screen has a field to specify simulation weather.

### **3.4.1 Purpose**

This section allows the following fields to be modified:

- Storm occurrence mean time (exponential RV, hours) – average storm occurrence.
- Mean Storm length (hours) – average storm length.
- Storm length variation (hours) – range of time that the storm length varies.

### **3.4.2 Materials**

There are no separate materials needed for this function.

### **3.4.3 Preparations**

There are no preparations needed for the function.

### **3.4.4 Inputs**

When specifying input to the field, a validation check will take place to ensure proper format.

### **3.4.5 Cautions and warnings**

Because of the validation check, this section of input fields cannot invalidate the simulation.

### **3.4.6 Invocation**

All input fields are invoked when the user hits submit.

### **3.4.7 Suspension of operations**

This function cannot be suspended.

### **3.4.8 Termination of operation**

Once the submit button is pressed, the simulation cannot be terminated.

### **3.4.9 Output**

The corresponding section on the output GUI will show the results.

### **3.4.10 Error conditions**

There are no error conditions associated with this event.

## **3.5 Airport Features**

This section of the input screen has a field to specify basic airport features.

### **3.5.1 Purpose**

This section allows the following fields to be modified:

- Number of berths – How many berths in the airport.
- Number of taxiways- How many taxiways in the airport.
- Taxiway travel time (hours) – How long it takes the taxi to travel the taxiway.
- Debirthing time (hours) – How long it takes the airplane to be debirthed.

### **3.5.2 Materials**

There are no separate materials needed for this function.

### **3.5.3 Preparations**

There are no preparations needed for the function.

### **3.5.4 Inputs**

When specifying input to the field, a validation check will take place to ensure proper format.

### **3.5.5 Cautions and warnings**

Because of the validation check, this section of input fields cannot invalidate the simulation.

### **3.5.6 Invocation**

All input fields are invoked when the user hits submit.

### **3.5.7 Suspension of operations**

This function cannot be suspended.

### **3.5.8 Termination of operation**

Once the submit button is pressed, the simulation cannot be terminated.

### **3.5.9 Output**

The corresponding section on the output GUI will show the results.

### **3.5.10 Error conditions**

There are no error conditions associated with this event.



## **3.6 Start Simulation**

This button on the input screen will start the simulation.

### **3.6.1 Purpose**

Once this button is pressed, the simulation will start.

### **3.6.2 Materials**

There are no separate materials needed for this function.

### **3.6.3 Preparations**

There are no preparations needed for the function.

### **3.6.4 Inputs**

All parameters serve as input.

### **3.6.5 Cautions and warnings**

Simulation cannot be terminated once started.

### **3.6.6 Invocation**

All input fields are invoked when the user hits submit.

### **3.6.7 Suspension of operations**

This function cannot be suspended.

### **3.6.8 Termination of operation**

Once the submit button is pressed, the simulation cannot be terminated.

### **3.6.9 Output**

The output GUI will show the results.

### **3.6.10 Error conditions**

There are no error conditions associated with this event.

## **3.7 Update Mode**

This section of the input screen has fields decides the increment at which the program updates its status and reports it.

### **3.7.1 Purpose**

This section allows the following fields to be modified:

- Update mode (none/time/event) -
- Time between updates (milliseconds) - The range of time that that the arrival rate varies.

### **3.7.2 Materials**

There are no separate materials needed for this function.

### **3.7.3 Preparations**

There are no preparations needed for the function.

### **3.7.4 Inputs**

Any integer value.

### **3.7.5 Cautions and warnings**

Too high values will keep simulation updating slowly.

### **3.7.6 Invocation**

All input fields are invoked when the user hits submit.

### **3.7.7 Suspension of operations**

This function cannot be suspended.

### **3.7.8 Termination of operation**

Once the submit button is pressed, the simulation cannot be terminated.

### **3.7.9 Output**

The log screen will show the output.

#### **3.7.10 Error conditions**

There are no error conditions associated with this event.

## 4 Error Messages, Known Problems, Error Recovery

This section covers the errors and problems one may run into when operating the program.

### 4.1 Input Screen Error Messages and Recovery

The input screen will warn you whenever you have given an erroneous parameter by highlighting the respective field red. An example is given in the figure below.

The screenshot displays the 'GLOBAL PACKAGE COURIER TRACKING' interface. At the top, there's a header bar. Below it, the 'Update mode' is set to 'Time' (indicated by a selected radio button), with a value of '10' in the adjacent field. The 'Time between updates (milliseconds)' is set to '1'. A 'Start Simulation' button is visible on the right. The main content area is divided into three sections: 'Regular plane parameters' (blue background), 'External plane set 1 parameters' (blue background), and 'Time' (green background). The 'Regular plane parameters' section includes fields for 'Arrival rate (hours)' (10), 'Arrival rate variation (hours)' (ibiubiu), 'Loading time (hours)' (5), 'Loading time variation (hours)' (1), and 'Category 3 landing gear availability (percentage)' (50). The 'Arrival rate variation (hours)' field is highlighted in red, and a red text message 'Needs to be a positive value' is displayed next to it. The 'External plane set 1 parameters' section includes fields for 'Number of planes' (5), 'Round trip time (hours)' (50), 'Round trip time variation (hours)' (5), 'Loading time (hours)' (10), and 'Loading time variation (hours)' (2). The 'Time' section includes fields for 'Simulation Length (hours)' (200), 'Storm occurrence mean time (exponential RV, hours)' (48), 'Mean Storm length (hours)' (4), and 'Storm length variation (hours)' (2). The 'Weather' section is also visible, with fields for 'Number of berths' (4), 'Number of taxiways' (4), 'Taxiway travel time (hours)' (0.5), and 'De/berthing time (hours)' (1).

Figure 2. Verified Input Screen

The submit button is disabled during this time, until all fields contain proper parameters. The range of input for each field is as follows in terms of hours.

Number of Berths: any value greater than 0.

Number of taxiways: any value greater than 0.

External Plane #: unlimited.

Simulation Time: 720(1 month) - 87658(10 years)

Storm mean time: 48(2 days) - unlimited.

Mean Storm Length: 2 - 24

Variation in Mean Storm Length: Any positive value smaller or equal to Mean Storm Length

Taxi Travel Time: any positive value

Debirthing Time: any positive value

Plane Arrival Rate: any positive value

Plane Arrival Variation: any positive value smaller or equal to Plane Arrival Rate.

Plane Loading Time: Any positive value

Plane Loading Time Variation: Any positive value smaller or equal to Plane Loading Time.

Category 3 Landing Gear Availability Percentage: 0 - 100 (percent)

Round Trip Time: any positive value

Round Trip Time Variation: any positive value smaller or equal to Round Trip Time.

External Plane Loading Time: any positive value.

External Plane Loading Time Variation: Any positive value smaller or equal to External Plane Loading Time.

External Plane Category 3 Landing Gear Availability Percentage: 0 - 100 (percent)

## **4.2 Known Problems**

As of the current version of this program, the only problem is when inputting a decimal, you must have a leading value. So 0.25 is valid for input but .25 is not. Should any problems arise in the operation of this application, please email a description of your problem to our appointed debugger, Matthew Longley, at [randomticktock@gmail.com](mailto:randomticktock@gmail.com).

## **5 References**

BitRunners-Team 5, "Design Notebook for Global Package Courier Tracking," Version 1.0

October 26, 2014

BitRunners-Team 5, "SRS for Global Package Courier Tracking," Version 1.2 October 10, 2014.

BitRunners-Team 5, "Test Report for Global Package Courier Tracking," Version 1.1 December, 9 2014

## **6 Glossary**

This glossary has the definitions of terms and acronyms used in this User Manual.

APTS- Airport Process Time Simulator

GPCT- Global Package Courier Tracking

SRS- Software Requirements Specification

TDS- Test-Design Specification

TCS- Test-Case Specification

RTM- Requirements Traceability Matrix

## Appendix A Requirements Traceability Matrix

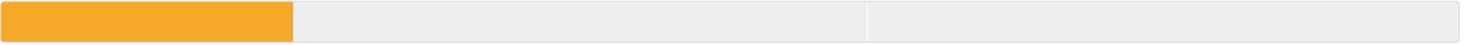
Req. ID System Level.	Req. ID Sub-system level	Req. ID Sub-Sub- system level	DFD Identifiers(s)	Module Names(s)	Verification Method	Tested
A1			1	GUI Data Processor		
	A1.1		1.1	Receive Input	T/D	
	A1.2		1.2	Validate Input	T/D	
	A1.3		1.3	Build Input String	T/D, I	
	A1.4		1.4	Write Input File	I	
	A1.5		1.5	Read Results	T/D, I	
	A1.6		1.6	Parse Results String	T/D	
	A1.7		1.7	Display Results	T/D	
A2			2	Computational Engine		
	A2.1		2.1	Read Input File	T/D	
	A2.2		2.2	Process Input	A	
	A2.3		2.3	Simlib process	A	
		A2.3.1	2.3.1	Initialize	I	
		A2.3.2	2.3.2	Insert Event	T/D	
		A2.3.3	2.3.3	Evaluate Event	A,I	
		A2.3.4	2.3.4	Delete Event	T/D	
		A2.3.5	2.3.5	Update Event	T/D	
	A2.4		2.4	Calculate Results	A	

	A2.5		2.5	Build Output String	I, T/D	
	A2.6		2.6	Write Results File	I	



## Appendix B Progress Screen

Time: 40.00/200.00



Weather (0 storms so far)



23 Arrivals, 23 Landings

18 planes at the airport.

4 planes in the runway queue.

0 planes in the berth queue.

0/4 taxiways used.

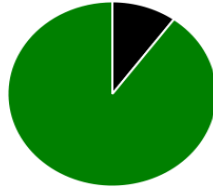
4/4 berths used.

0/4 berths reserved.

## Appendix C Results Screen

Storm Time: 20

Total Storms: 5

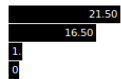


Total Arrivals: 91

Total % of time the plane landed: 84.21

No. of taxiways: 4

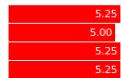
Percentage of time the different taxiways are occupied:



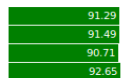
Total time taxis are occupied: 10.06

Number of berths 4

Percentage of time the different berths are reserved:



Percentage of time the different berths are occupied:



Total % of time berths reserved: 5.19

Total % of time berths occupied: 91.53

Average queue time: 5.20

Average residence time: 20.64

No. of external plane sets: 3

Plane no. 1

Percentage of time the plane landed: 100.00

Average Queue Time: 15.45

Average Residence Time: 55.33

Plane no. 2

Percentage of time the plane landed: 89.29

Average Queue Time: 23.51

Average Residence Time: 92.64

Plane no. 3

Percentage of time the plane landed: 100.00

Average Queue Time: 29.34

Average Residence Time: 79.24