# 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 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.

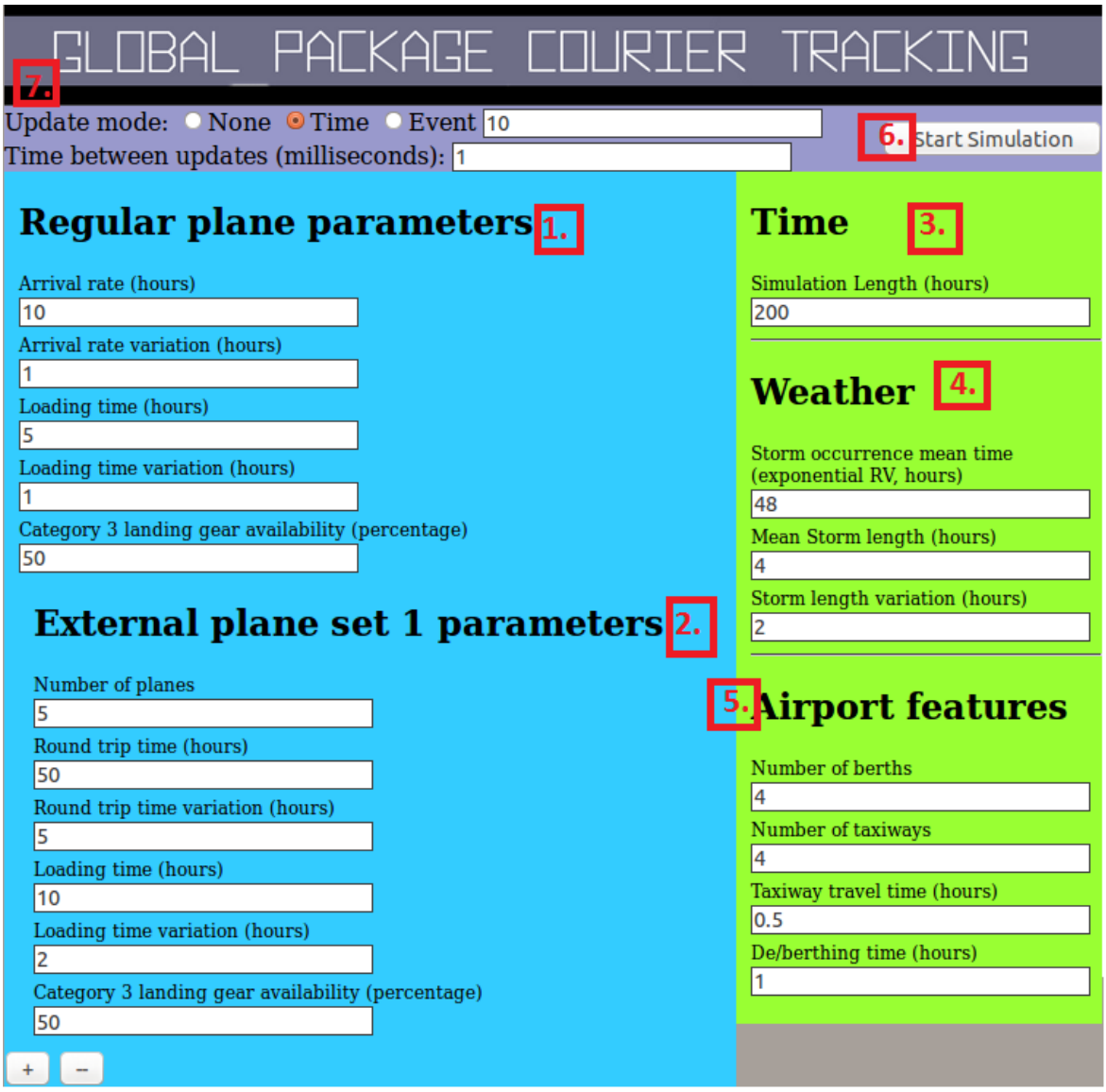



Figure 1. Input Screen

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

### 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 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.


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.

# 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

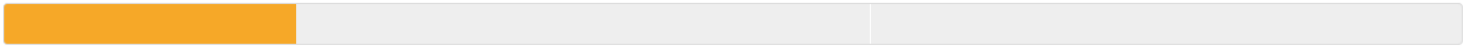
# Appendix A Requirements Traceability Matrix

| 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

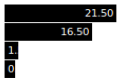
Total Storms: 5

Total Arrivals: 91

Total % of time the plane landed: 84.21

No. of taxiways: 4

Percentage of time the different taxiways are occupied:

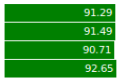



Total time taxis are occupied: 10.06

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