University of Southampton

COMP2211: Software Engineering Group Project

Deliverable 4:
Increment 3

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1 Response to Feedback

1.1 Update to runway grass

As suggested by our second supervisor, we have updated the runway grass to a lighter shade of green.

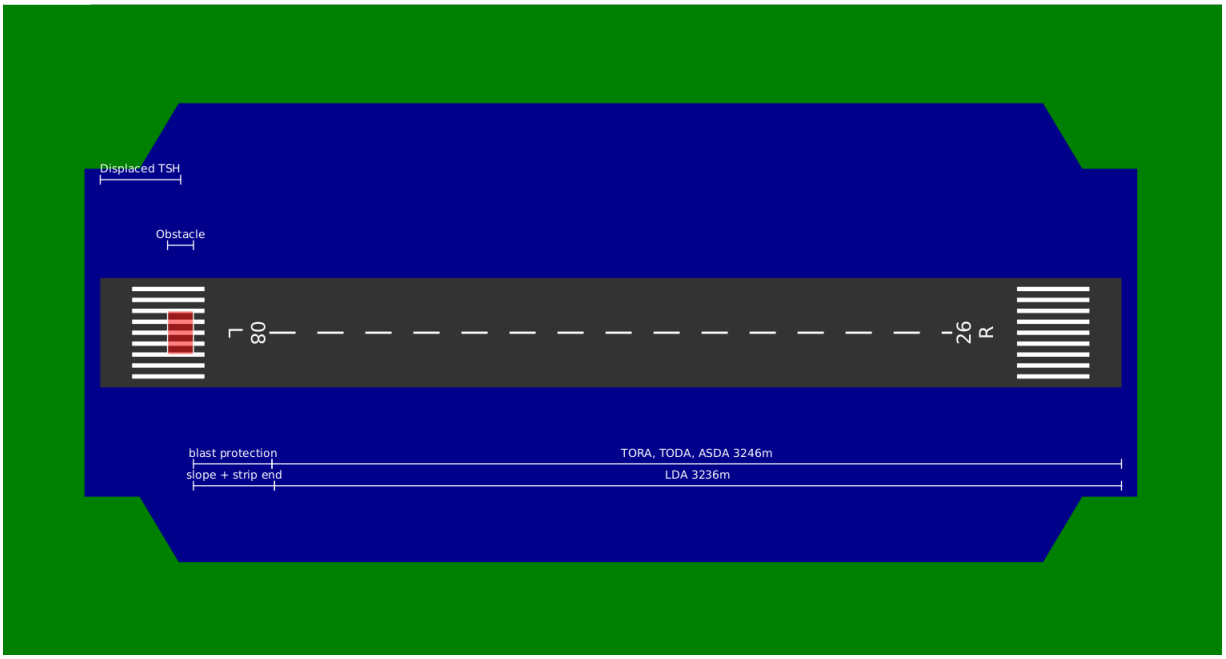


Figure 1: Before

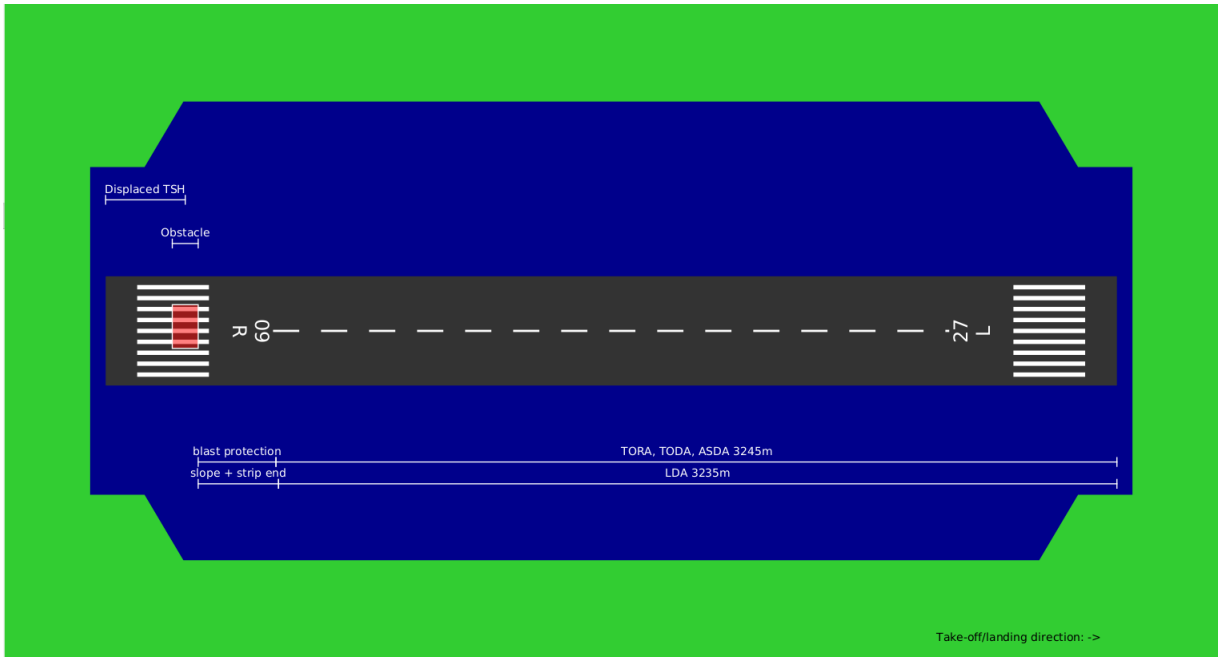


Figure 2: After

1.2 Left padding

As suggested by our supervisors, we have added padding to the left-side of our main window in order to make text more readable.

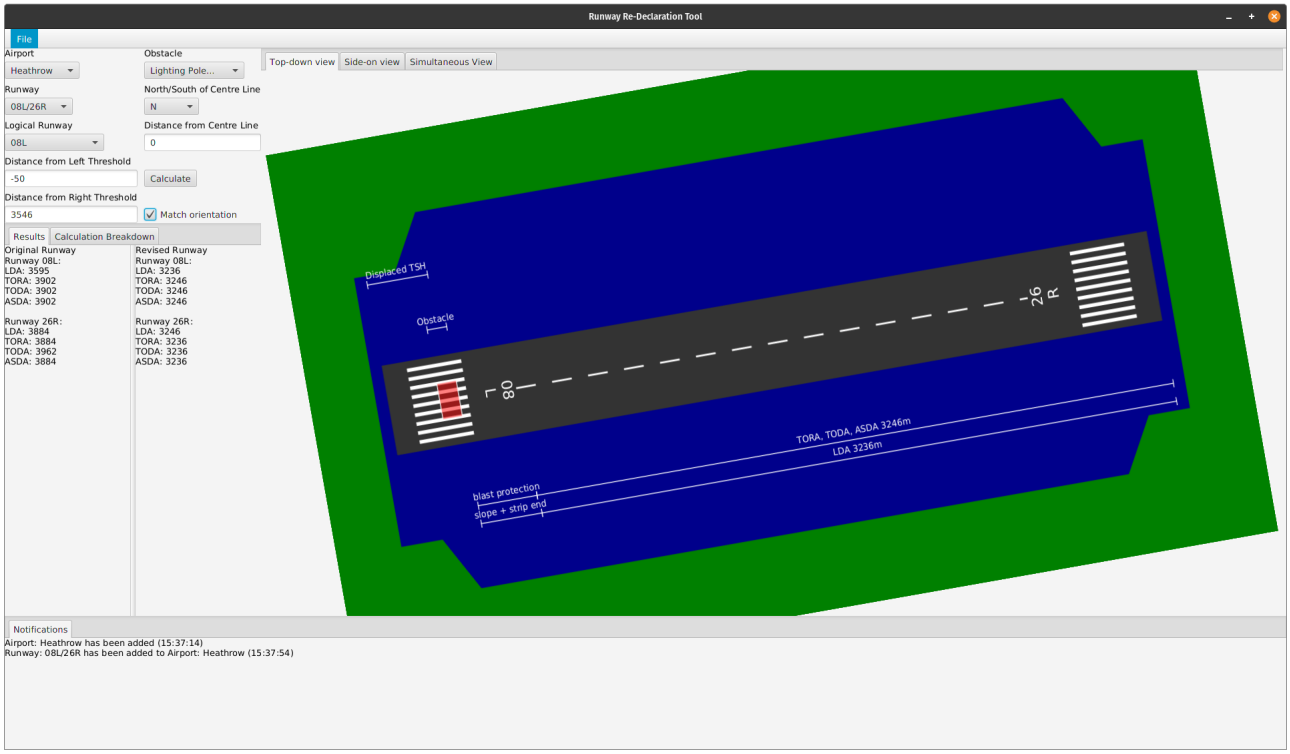


Figure 3: Before

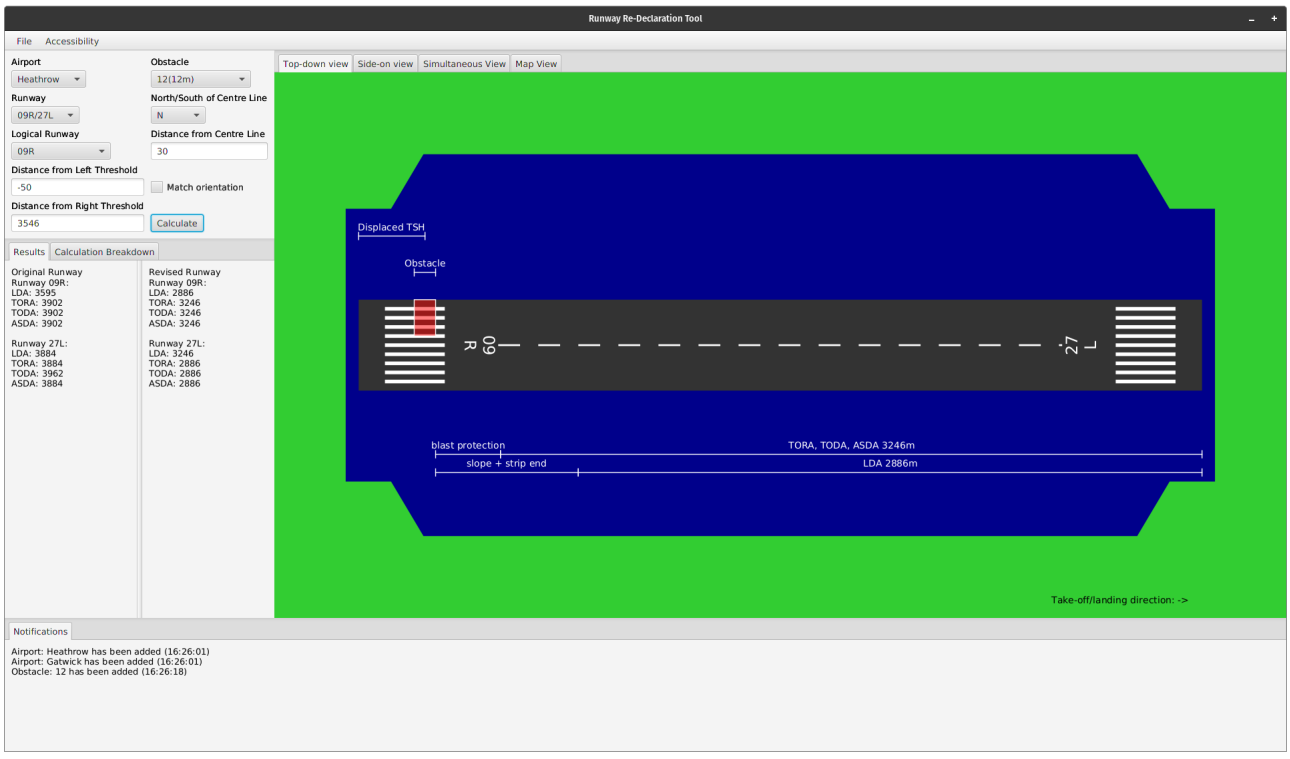


Figure 4: After

1.3 Relationship between tests and user stories

There was an apparent lack of evidence showing a direct relationship between our unit test and our user stories. Therefore, we have created a table that establishes that relationship. Any story that isn't covered by the automated testing has been manually tested (e.g. XML import and Export).

ID	Name	Description	Priority	Test Coverage
SEG-22	Airport Definition	As a Runway Technician I want to be able to declare a new Airport so that I can store its runways within it.	MUST	TC6, TC15, TC16
SEG-6	Predefined Obstacle List	As a Runway Technician I want to have access to a list of predefined obstacles so that I don't spend as much time defining the size of the obstacle on the runway.	MUST	TC9
SEG-1	Obstacle Placement	As a Runway Technician I want to be able to declare the exact position of the obstacle on the runway so that the revised runway is as accurate as possible.	MUST	TC9
SEG-24	Obstacle Notification	As a Runway Technician I want to receive a notification from the system so that I know that I have added an obstacle.	MUST	TC8
SEG-7	Successful Runway Revision Notification	As a Runway Technician I want to receive a notification from the system so that I know that I have successfully a revised a runway.	MUST	
SEG-25	Runway Update Notification	As a Runway Technician I want to receive a notification from the system so that I know that runway values have changed.	MUST	
SEG-2	Obstacle Definition	As a Runway Technician I want to be able to define a new obstacle so that it can be placed on the runway for use in the calculations.	MUST	TC8, TC10, TC11, TC17, TC18, TC19, TC20, TC21
SEG-3	Runway Definition	As a Runway Technician I want to be able to define a new runway so that I can use it in calculations that may be required to determine if a runway should be re-declared or closed.	MUST	TC7, TC12, TC22, TC23, TC24
SEG-4	Revised Runway Calculations	As a Runway Technician I want to be able, given a runway and an obstacle, to calculate revised runway dimensions so that my manager can decide whether we should proceed with official calculations.	MUST	TC1, TC2, TC3, TC4, TC9, TC25, TC26
SEG-26	Obstacle Saving	As a Runway Technician I want to be able to save obstacles so that I can reuse it and save time in the future.	MUST	TC8
SEG-8	Input Error Checking	As a Runway Technician I want the system to check my input errors so that I don't end up producing incorrect results.	MUST	TC15, TC16, TC17, TC18, TC19, TC20, TC21, TC22, TC23, TC24, TC25, TC26
SEG-27	XML Airport Import	As a Runway Technician I want to be able to import details of the airport via an XML file so that I do not have to manually define it every time I use the system.	MUST	
SEG-28	XML Obstacle Import	As a Runway Technician I want to be able to import obstacles via an XML file so that I do not have to manually define them every time I use the system.	MUST	
SEG-29	XML Data Import	As a Runway Technician I want to be able to import other data via an XML file so that I do not have to manually define it every time I use the system.	MUST	
SEG-30	XML Obstacle Export	As a Runway Technician I want to be able to export details of obstacles in an XML format so that I can use that data on other systems.	MUST	
SEG-31	XML Airport Export	As a Runway Technician I want to be able to export details of airports in an XML format so that I can use that data on other systems.	MUST	
SEG-32	XML Data Export	As a Runway Technician I want to be able to export other data in an XML format so that I can use that data on other systems.	MUST	
SEG-5	Data Comparison	As an Airfield Operations Manager I want to be able to view the re-calculated values and the originals so that I can more easily make a decision about runway re-declaration.	MUST	TC9
SEG-9	Calculation Breakdown	As an Airfield Operations Manager I want to be able to view a breakdown of the calculations so that I can compare them with the calculations made by my qualified personnel.	MUST	TC9
SEG-35	Runway Sideways	As an Airfield Operations Manager I want to be able to visualise the runway with the obstacle from a sideways perspective so that I can decide whether official calculations are necessary or the runway should be closed.	MUST	
SEG-36	Runway Bird's-eye	As an Airfield Operations Manager I want to be able to visualise the runway with the obstacle from a bird's-eye perspective so that I can decide whether official calculations are necessary or the runway should be closed.	MUST	
SEG-50	Simultaneous View Runway	As an Airfield Operations Manager I want to be able to visualise the runway from both a sideways and bird's-eye view simultaneously so that I can compare both perspectives to help determine whether to close the runway or re-declare it.	MUST	
SEG-37	Change Thresholds	As an Airfield Operations Manager I want to be able to select different runways and thresholds so that I can see how the obstacle may obstruct taking-off and landing operations.	MUST	TC9, TC25, TC26
SEG-38	Runway Rotation	As an Airfield Operations Manager I want to be able to automatically rotate the top-down view to the appropriate angle based on the compass heading so that I am able to easily visualise the runway re-declaration.	MUST	
SEG-51	Clear and Graded Area	As an Airfield Operations Manager I want to be able to see the clear and graded area on the bird's-eye view of the runway so that I can determine if official calculations are required dependent on if the obstacle is located in that area.	MUST	
SEG-33	System Accessibility - Screen Reader	As a Runway Technician I want to be able to use a screen reader so that I can use the system properly if I have impaired vision.	SHOULD	
SEG-34	System Accessibility - Colour Scheme	As a Runway Technician I want to be able to change the colour scheme of the visual representation of the runway so that if I were colour-blind, there is no mistake when viewing the visualisation.	SHOULD	
SEG-43	JPEG Runway	As an Airfield Operations Manager I want to be able to export the displays in a JPEG format so that I can use the generated visualisation outside of the system.	SHOULD	
SEG-44	PNG Runway	As an Airfield Operations Manager I want to be able to export the displays in a PNG format so that I can use the generated visualisation outside of the system.	SHOULD	
SEG-45	GIF Runway	As an Airfield Operations Manager I want to be able to export the displays in a GIF format so that I can use the generated visualisation outside of the system.	SHOULD	
SEG-46	Runway Colour Scheme	As an Airfield Operations Manager I want to be able to change the colour scheme of the visual representation of the runway so that if I were colour-blind, there is no mistake when viewing the visualisation.	SHOULD	
SEG-47	Screen Reader	As an Airfield Operations Manager I want to be able to use a screen reader so that I can use the system properly if I have impaired vision.	SHOULD	
SEG-39	3D Runway View	As an Airfield Operations Manager I want to be able to view the airfield in 3D so that I can more easily judge the severity of an obstruction caused by an obstacle.	COULD	
SEG-40	Print Visual Representation	As an Airfield Operations Manager I want to be able to print out visual representations of redeclared runways so that information that is more understandable to most can be transferred around more quickly.	COULD	
SEG-41	Real-World Overlay	As an Airfield Operations Manager I want to be able see a map view that overlays the runway diagram over a real-world image of it so that I am more easily able to visualise the obstacle(s) and proposed re-declaration.	COULD	
SEG-42	Extra Visual Control	As an Airfield Operations Manager I want to have the ability to zoom and pan in any of the views so that I can examine certain details of the scenario more closely.	COULD	
SEG-43	Print Result	As an Airfield Operations Manager I want to be able to print out the results of the current simulation so that I can easily physically show or share this information with other people.	COULD	

2 Design

2.1 Artifacts

We have updated our class and sequence diagrams so that they reflect our latest additions.

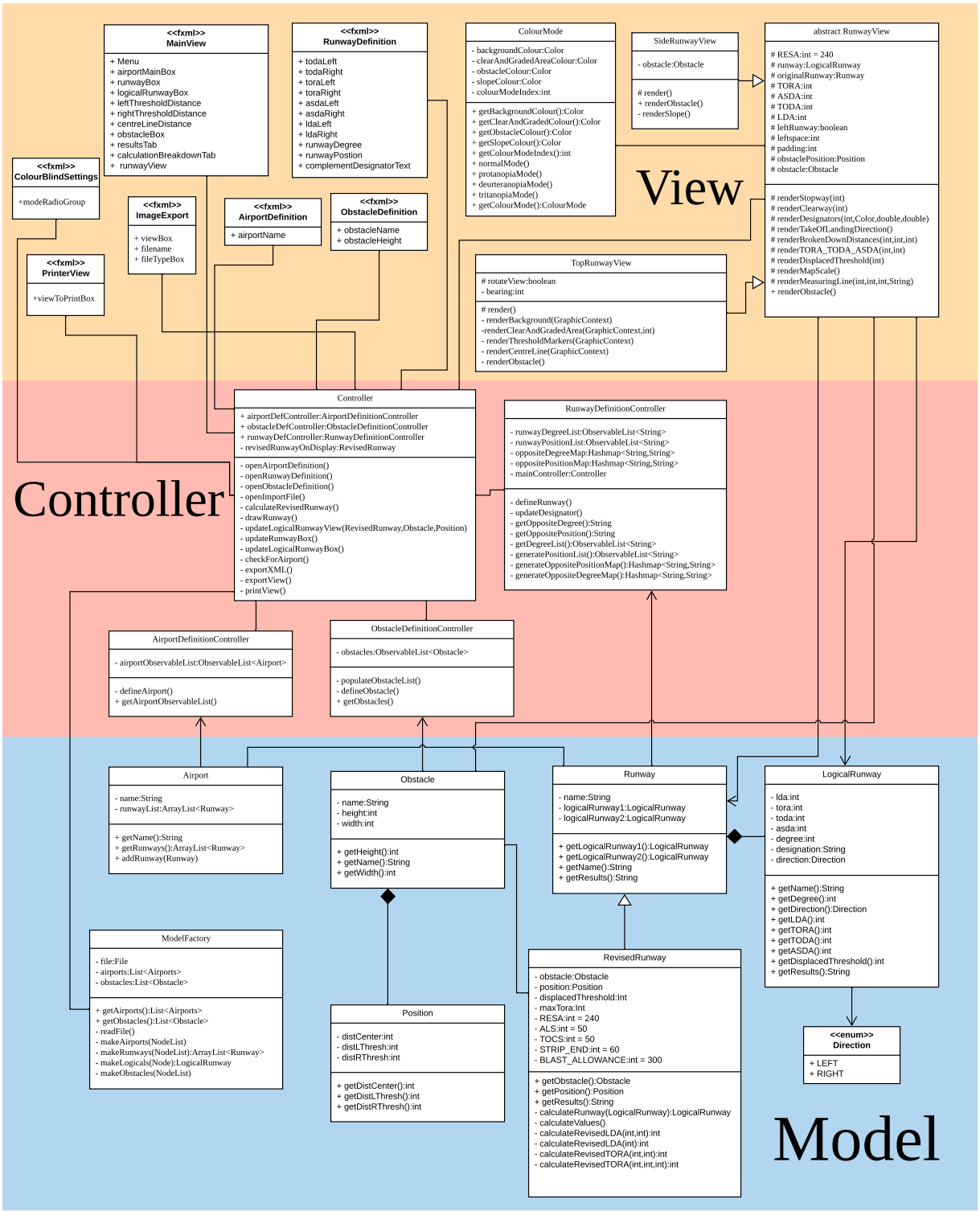


Figure 5: Class Diagram

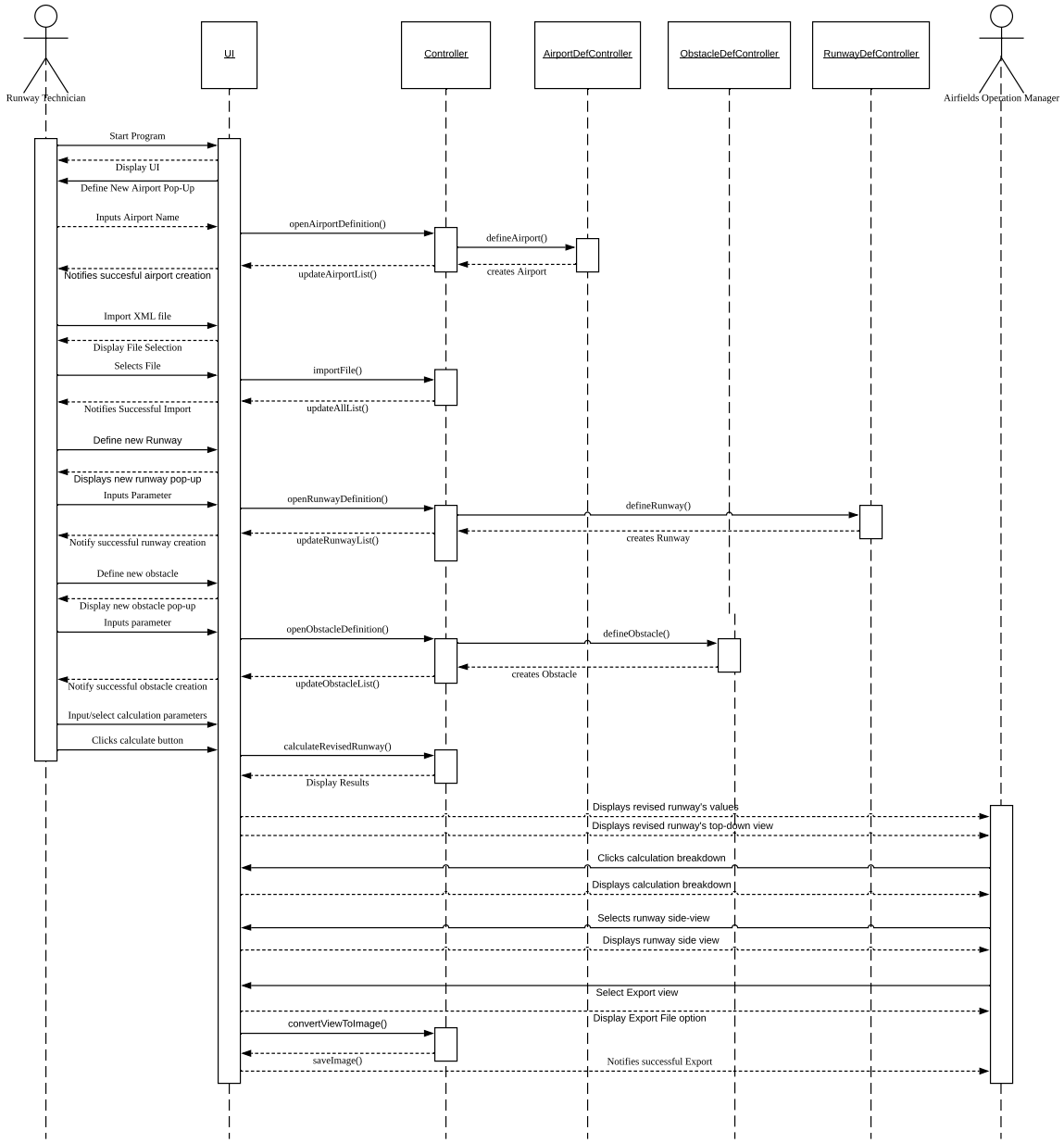
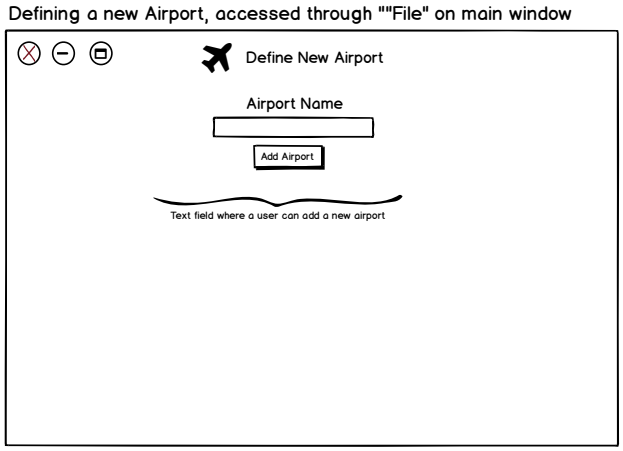
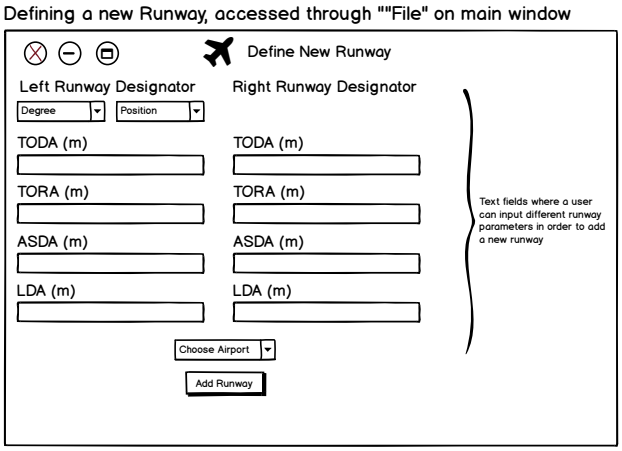


Figure 6: Sequence Diagram

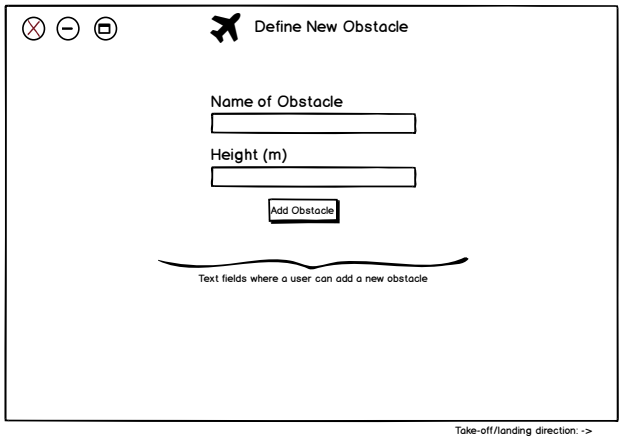
2.2 Storyboards

Storyboards have been update to reflect the new dialogues and view that haven been added in this increment.

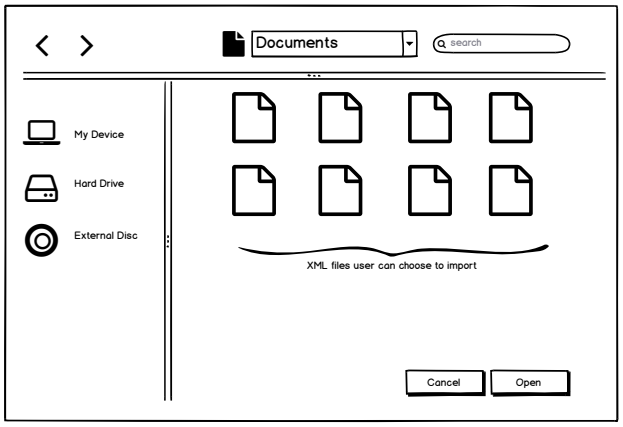




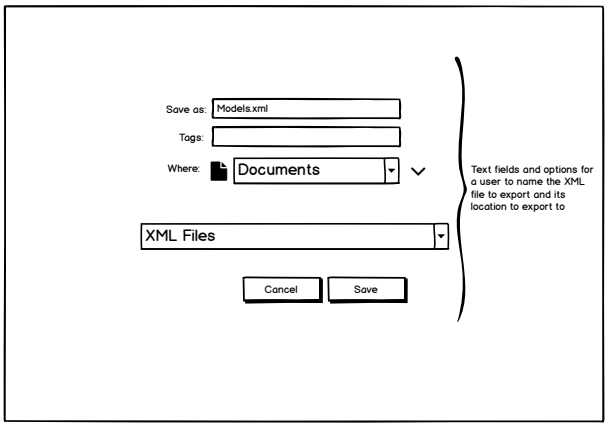
Defining a new Obstacle, accessed through ""File" on main window



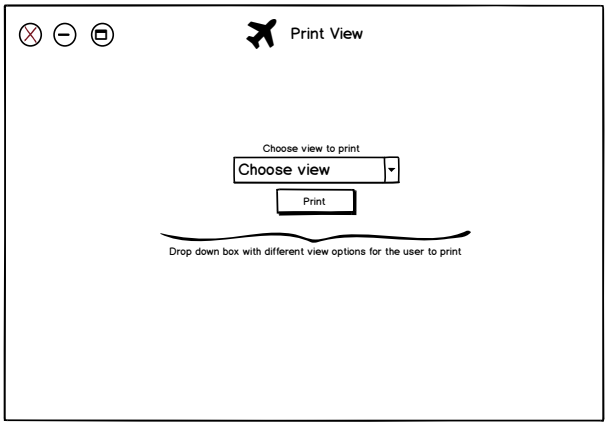
Importing an XML file, accessed through "File" on main window



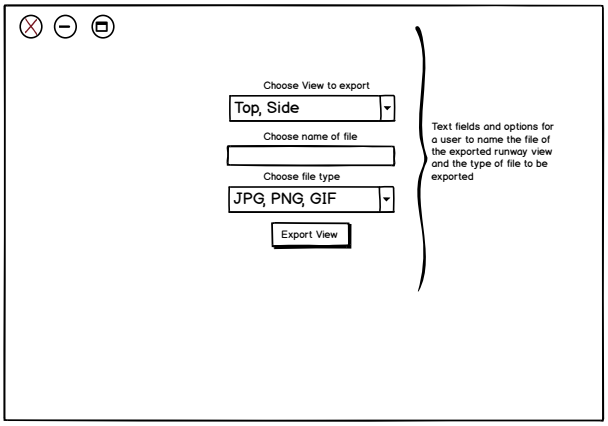
Exporting an XML file, accessed through "File" on main window



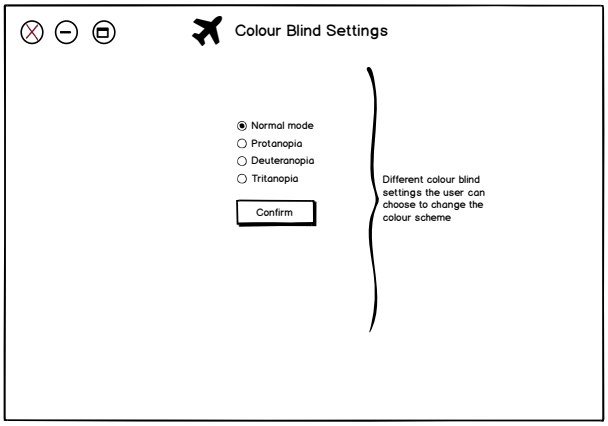
Printing a Runway View, accessed through "File" on main window



Exporting an Runway View, accessed through "File" on main window

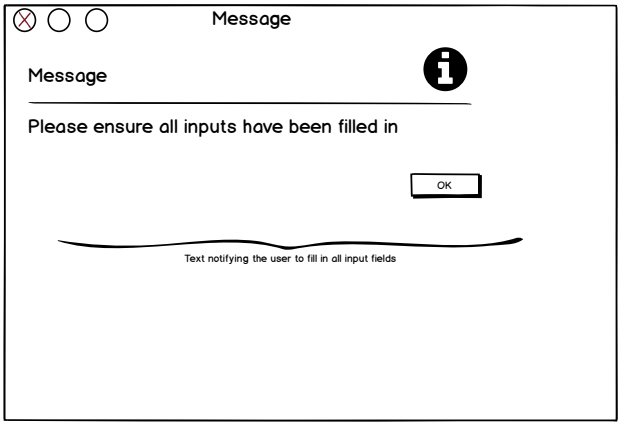


Colour blind settings, accessed through "Accessibility" on main window

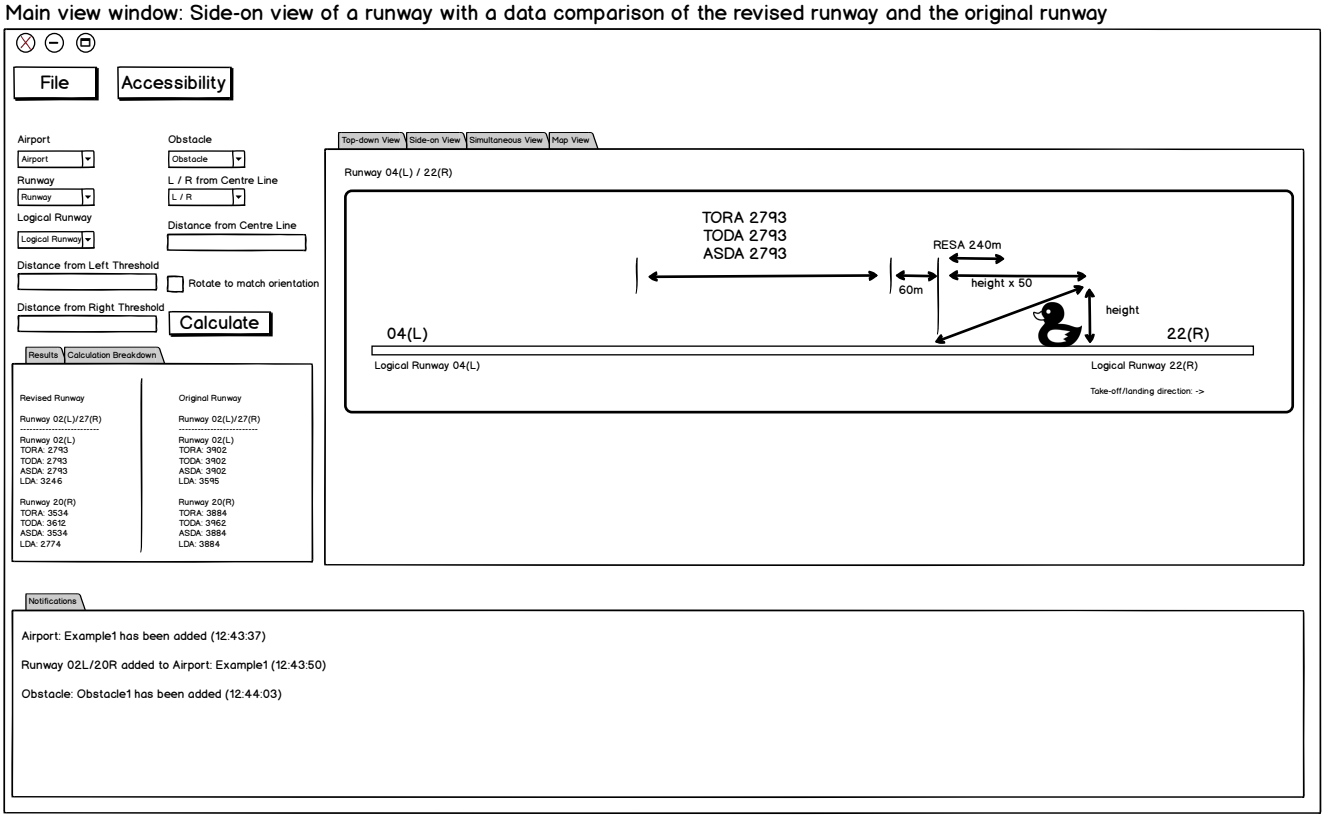


Automatic pop up if there are no airports when the tool is first run

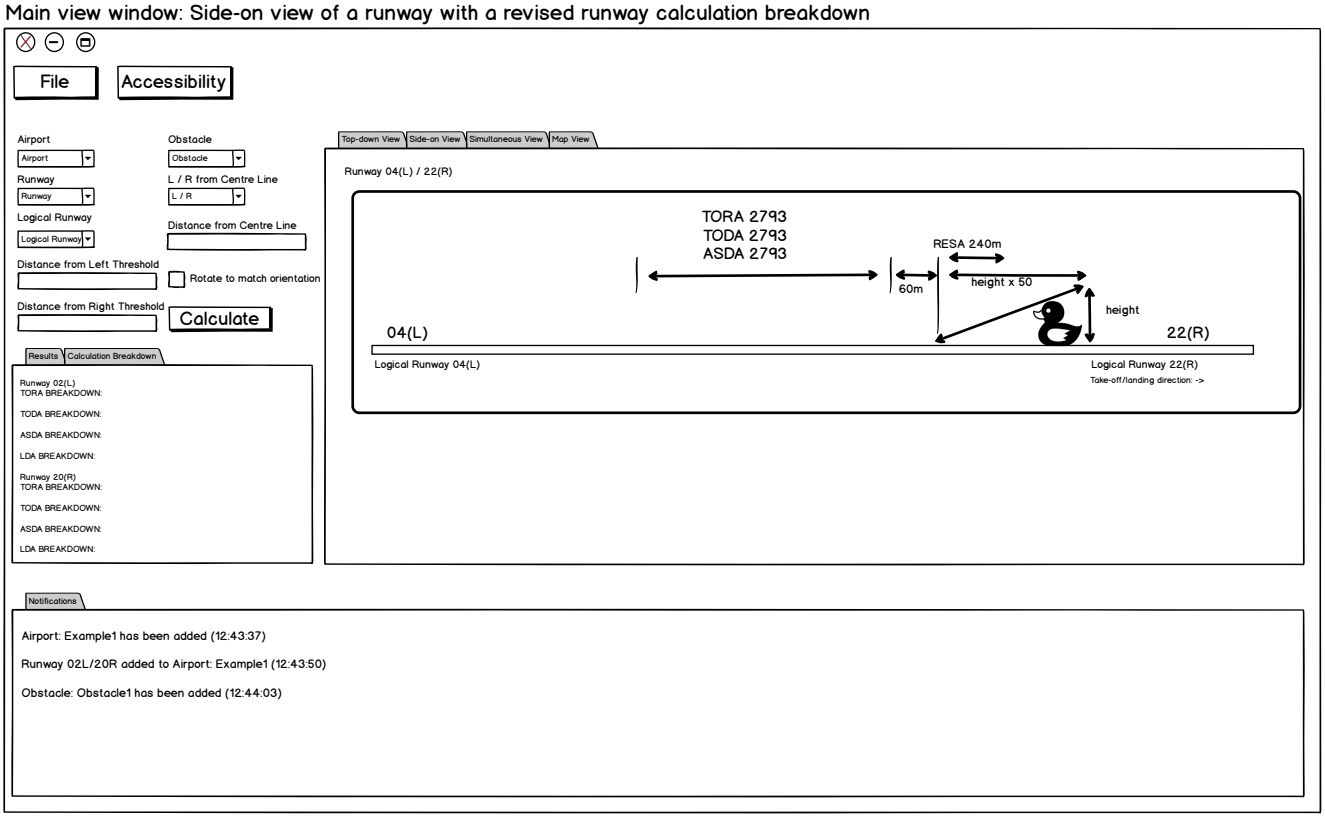
Automatic pop up if there are incomplete text fields that need to be filled



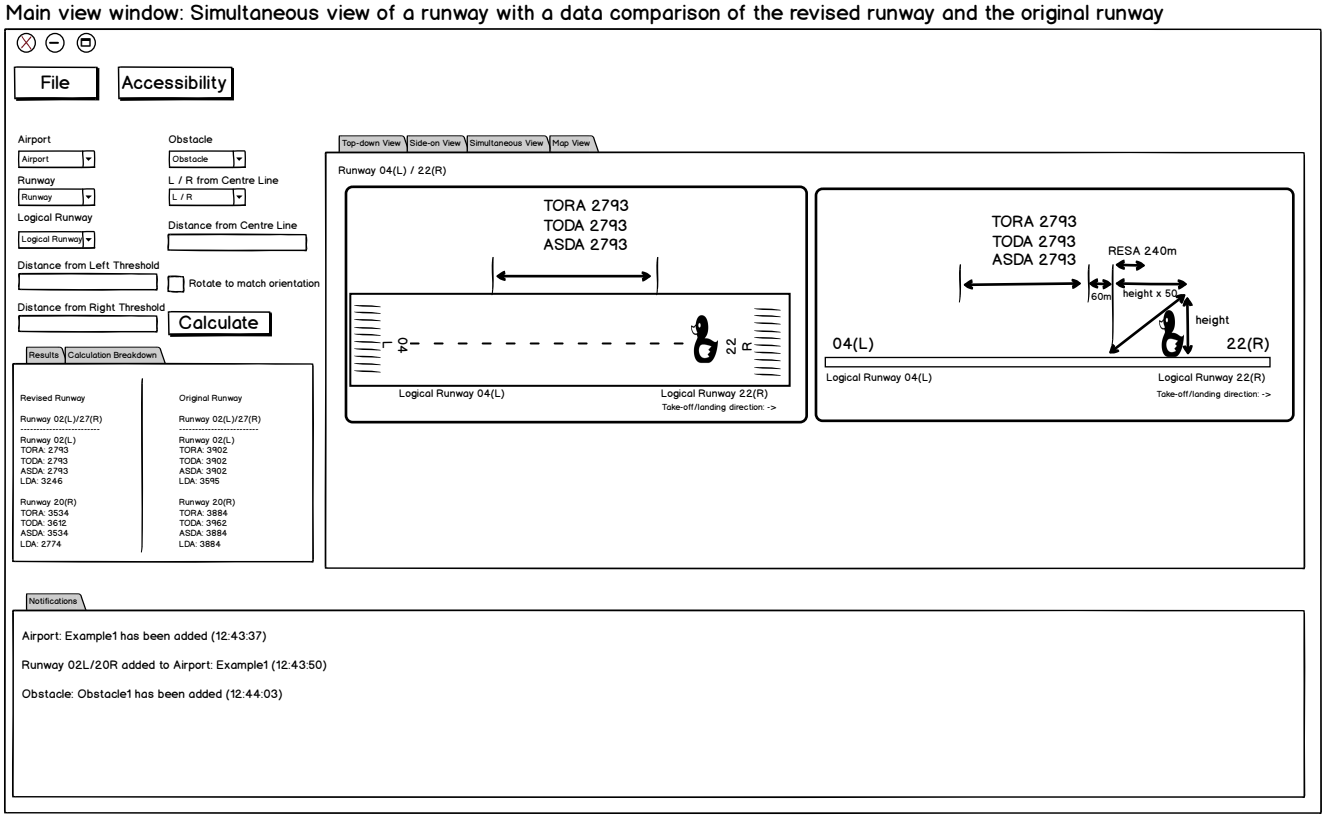
Main view window: Side-on view of a runway with a data comparison of the revised runway and the original runway



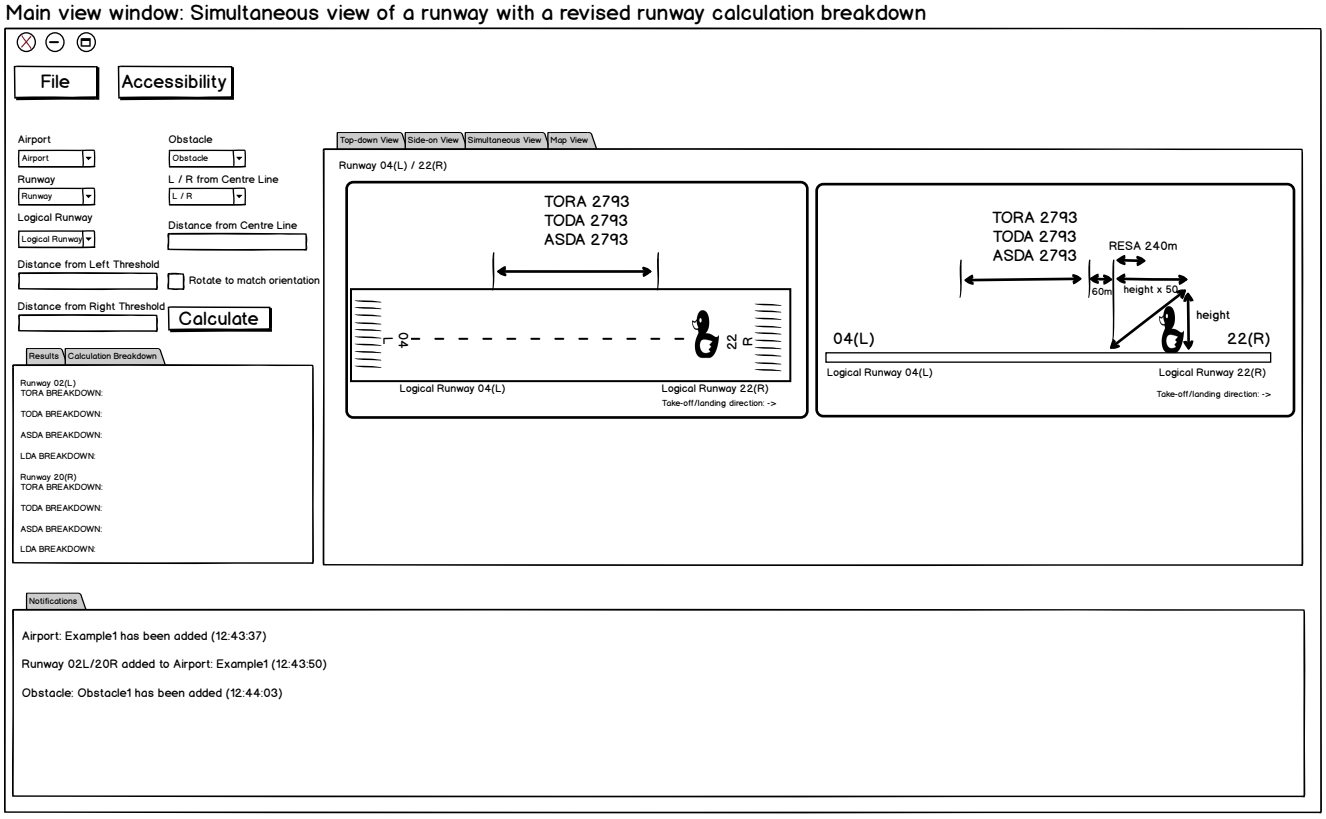
Main view window: Side-on view of a runway with a revised runway calculation breakdown



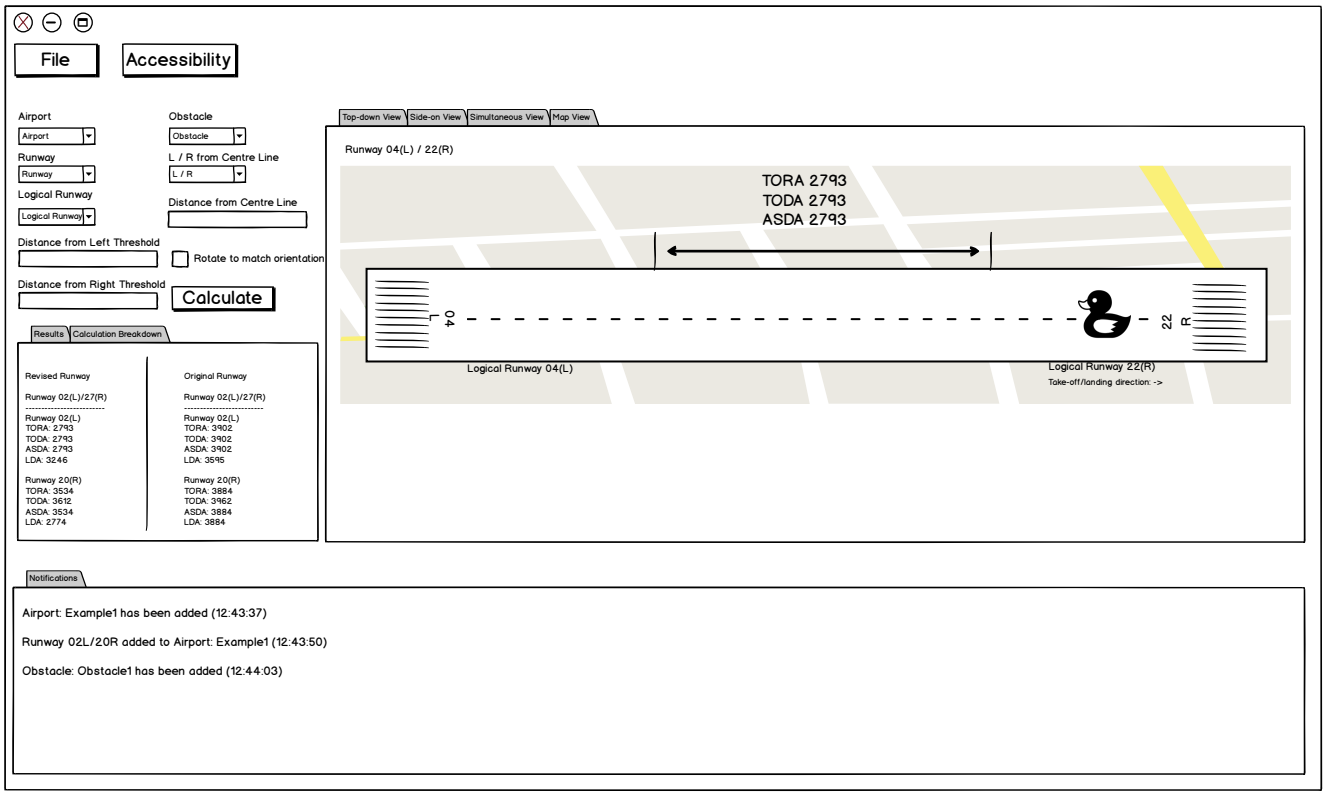
Main view window: Simultaneous view of a runway with a data comparison of the revised runway and the original runway



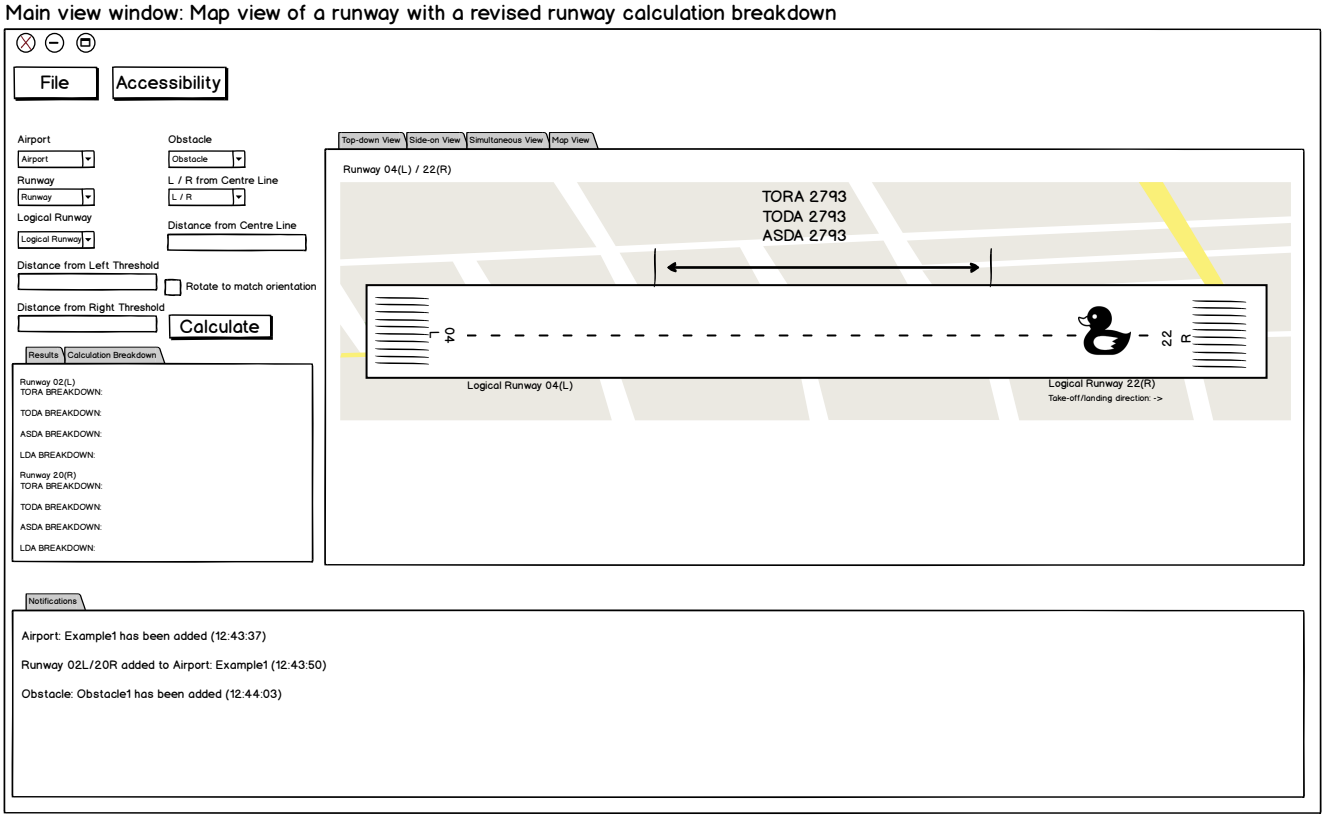
Main view window: Simultaneous view of a runway with a revised runway calculation breakdown



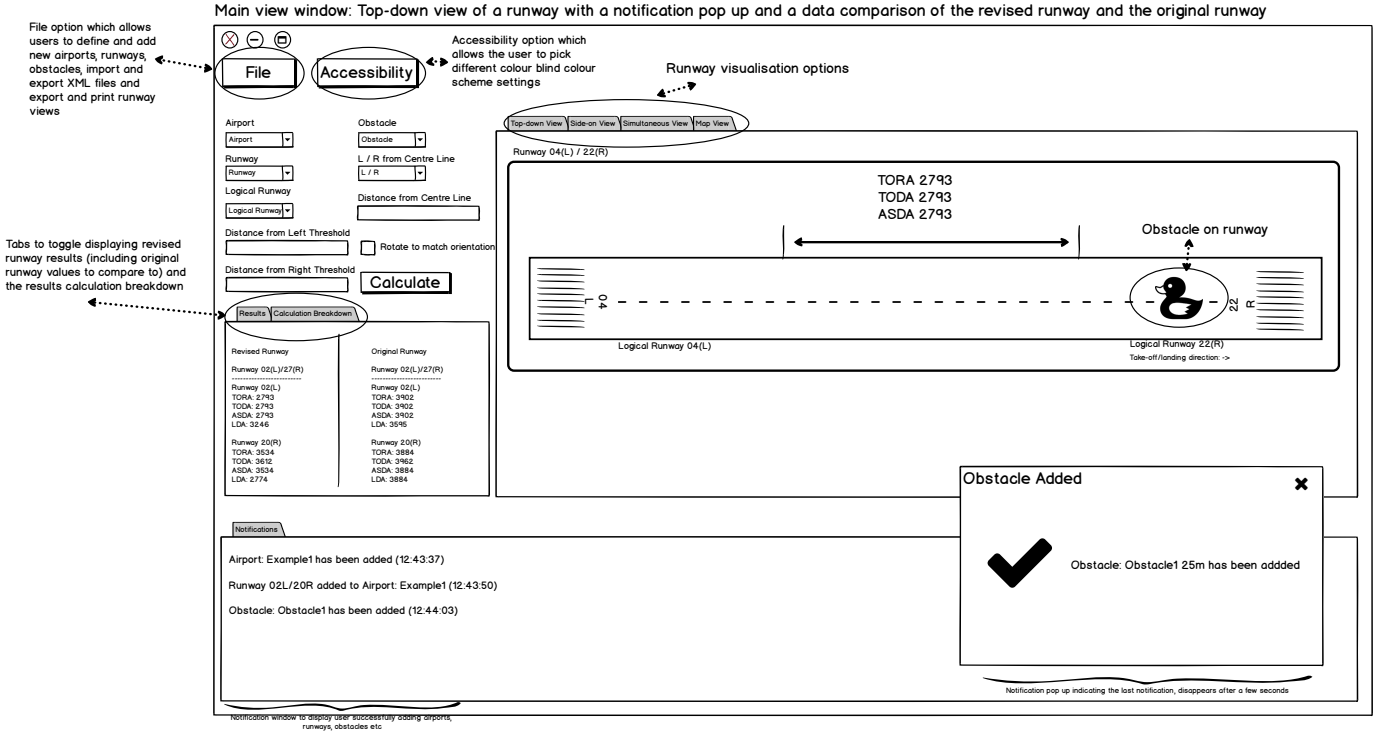
Main view window: Map view of a runway with a data comparison of the revised runway and the original runway



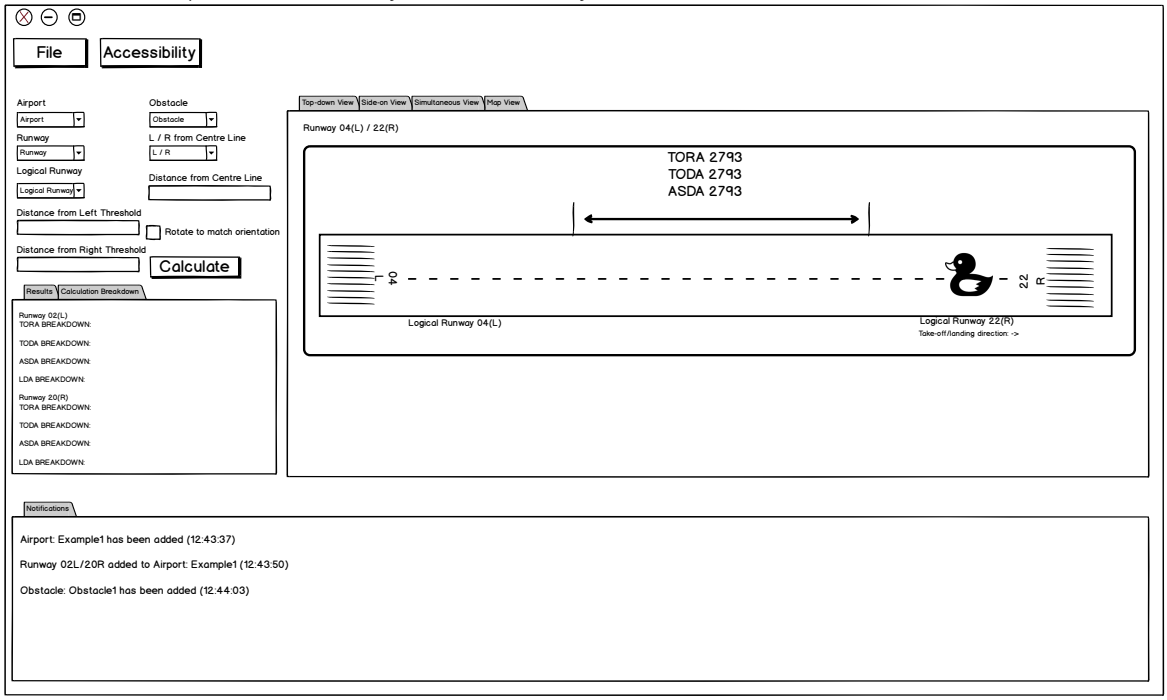
Main view window: Map view of a runway with a revised runway calculation breakdown



Main view window: Top-down view of a runway with a notification pop up and a data comparison of the revised runway and the original runway



Main view window: Top-down view of a runway with a revised runway calculation breakdown



3 Testing

3.1 Unit Testing Coverage

We have updated our test suite (re-formatted test names) in order to track our test coverage more effectively. This coverage can be seen in the table located in the "Response to Feedback" section. For example, we have tests that focus solely on the calculations of the revised runway based on the given calculation examples.

```
@Test
@DisplayName("TC1: Scenario 1 calculations test")
public void testScenario1()
{
    Obstacle obstacle = new Obstacle( name: "test",  height: 12, width: 1);
    Position position = new Position( distCenter: 0, distLThresh: -50, distRThresh: 3646);
    RevisedRunway revisedRunway = new RevisedRunway(runway09L27R, obstacle,position);

    assertEquals( expected: 3346,revisedRunway.getLogicalRunway1().getTora());
    assertEquals( expected: 3346,revisedRunway.getLogicalRunway1().getToda());
    assertEquals( expected: 3346,revisedRunway.getLogicalRunway1().getAsda());
    assertEquals( expected: 2986,revisedRunway.getLogicalRunway1().getLda());

    assertEquals( expected: 2986,revisedRunway.getLogicalRunway2().getTora());
    assertEquals( expected: 2986,revisedRunway.getLogicalRunway2().getToda());
    assertEquals( expected: 2986,revisedRunway.getLogicalRunway2().getAsda());
    assertEquals( expected: 3346,revisedRunway.getLogicalRunway2().getLda());

}
```

Figure 7: Calculation test for scenario 1

We also have designed tests which checks that erroneous input from the user is handled properly.

```
@Test
@DisplayName("TC19: Failure caused by negative obstacle height")
public void fail_obstacleNegativeHeight(FxRobot robot){
    robot.clickOn( query: "File").clickOn( query: "Define").moveTo("New Airport").clickOn( query: "New Obstacle");
    robot.clickOn( query: "#obstacleName").write("Pole");
    robot.clickOn( query: "#obstacleHeight").write("-10");
    robot.clickOn( query: "#obstacleDoneButton");
    alert_dialog_has_header_and_content(robot,  expectedHeader: "Message", expectedContent: "Please put a number greater than zero for Height");
}

@Test
@DisplayName("TC20: Failure caused by an obstacle height of zero")
public void fail_obstacleZeroHeight(FxRobot robot){
    robot.clickOn( query: "File").clickOn( query: "Define").moveTo("New Airport").clickOn( query: "New Obstacle");
    robot.clickOn( query: "#obstacleName").write("Pole");
    robot.clickOn( query: "#obstacleHeight").write("0");
    robot.clickOn( query: "#obstacleDoneButton");
    alert_dialog_has_header_and_content(robot,  expectedHeader: "Message", expectedContent: "Please put a number greater than zero for Height");
}
```

Figure 8: Tests giving undesired outputs

3.2 Boundary and Partition Testing

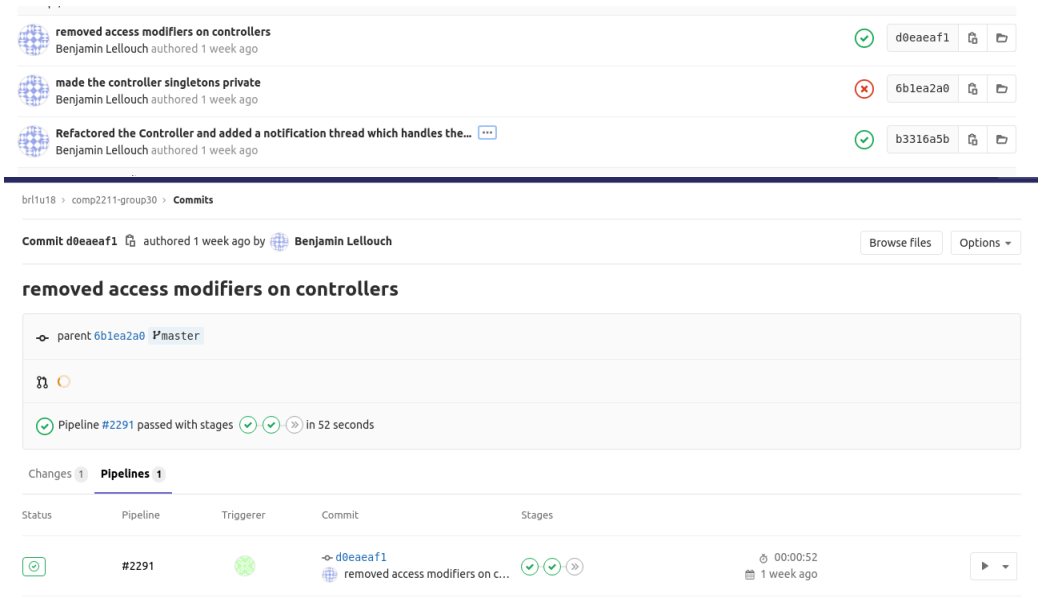
We have incorporated boundary tests into our main test suite as our application is calculation intensive with variables that represent physical quantities (height of an obstacle, length of a runway etc...). We used these tests to reduce an otherwise larger number of test cases to a manageable number of tests. For example, the obstacle height parameter has been split into three partitions: [INT_MIN,0], [1, 100] and [101, INT_MAX] with [1,100] being the only valid partition. We have chosen 100 meters to be the maximum value of our valid partition as a 100 meter high obstacle would generate a take-off/landing slope of around 5 kilometers which is longer that any active commercial runway in the UK thus rendering any runway totally unusable.

```java
@Test
@DisplayName("TC12: Lower boundary test on runway (0m)")
public void boundaryTest_Runway(FxRobot robot){
    prepareRunway(robot);
    runwayDefFillAll(robot, input: "0");
    addedNewAirportOnStartUp(robot);
    robot.clickOn( query: "#runwayBox").clickOn( query: "09R/27L");
    FxAssert.verifyThat( nodeQuery: "#runwayBox", (ComboBox<Runway> r) -> {
        String val = r.getItems().get(0).getName();
        return val.equals("09R/27L");
    });
    robot.clickOn( query: "#logicalRunwayBox").clickOn( query: "09R");
    FxAssert.verifyThat( nodeQuery: "#logicalRunwayBox", (ComboBox<LogicalRunway> l) -> {
        String l1 = l.getItems().get(0).getName();
        String l2 = l.getItems().get(1).getName();
        int size = l.getItems().size();
        return (size == 2) && (l1.equals("09R")) && (l2.equals("27L")) && (!l.isDisabled());
    });
}
```

Figure 9: Minimum valid value test

3.3 Regression Testing

In order to test for regressions, we have decided to use the CI/CD (Continuous Integration, Continuous Development) feature that Gitlab offers. We have set up runners which, at every commit on any branch, will build the application and will run our test suite on that build when the commit was made to the master branch. This helps check that our application builds in the first place but it also helps us test for regressions.



```
-------------------------------------------------------
 T E S T S
-------------------------------------------------------
Running MainTest
Prism pipeline init order: sw
Using native-based Pisces rasterizer
Using dirty region optimizations
Not using texture mask for primitives
Not forcing power of 2 sizes for textures
Using hardware CLAMP_TO_ZERO mode
Opting in for HiDPI pixel scaling
*** Fallback to Prism SW pipeline
Prism pipeline name = com.sun.prism.sw.SWPipeline
(X) Got class = class com.sun.prism.sw.SWPipeline
Initialized prism pipeline: com.sun.prism.sw.SWPipeline
 vsync: true vpipe: false
Loading Prism common native library ...
      succeeded.
Tests run: 15, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 154.854 sec
QuantumRenderer: shutdown
Results :
Tests run: 15, Failures: 0, Errors: 0, Skipped: 0
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  02:38 min
[INFO] Finished at: 2020-03-27T05:08:12Z
[INFO] ------------------------------------------------------------------------
Version:      12.8.0
Version:      12.8.0
Job succeeded
```

3.4 Scenarios

We also implemented automated tests for some of the scenarios that we defined in the envisioning process to show that the application correctly functions in the way we originally anticipated. Due to the fact that the FileChooser dialog is not itself a JavaFX dialog (and instead makes use of a form directly from the OS), we were only able to write automated TestFX tests for scenarios 1 and 2. Scenarios 3 and 4 were instead ran manually to ensure the expected behaviour was exhibited.

```java
@Test
@DisplayName("TC13: Test replicating Scenario 1 (Lauren - Runway Technician)")
public void scenario1(FxRobot robot)
{
    robot.clickOn( query: "File").clickOn( query: "Define").clickOn( query: "New Airport");
    robot.clickOn( query: "#airportName").write("Bristol").clickOn( query: "#airportDoneButton");
    robot.clickOn( query: "#airportMainBox").clickOn( query: "Bristol");
    robot.clickOn( query: "File").clickOn( query: "Define").moveTo("New Airport").clickOn( query: "New Runway");
    robot.clickOn( query: "#runwayDegree").clickOn( query: "09");
    robot.clickOn( query: "#runwayPosition").clickOn( query: "C");

    robot.clickOn( query: "#todaLeft").write("7500");
    robot.clickOn( query: "#toraLeft").write("7500");
    robot.clickOn( query: "#asdaLeft").write("7500");
    robot.clickOn( query: "#ldaLeft").write("5000;");

    robot.clickOn( query: "#todaRight").write("7500");
    robot.clickOn( query: "#toraRight").write("7500");
    robot.clickOn( query: "#asdaRight").write("-7500");
    robot.clickOn( query: "#ldaRight").write("5000");

    robot.clickOn( query: "#airports").clickOn( query: "Bristol");
    robot.clickOn( query: "#runwayDoneButton");

    alert_dialog_has_header_and_content(robot,  expectedHeader: "Message", expectedContent: "Please ensure only positive values are used for measurements");

    robot.clickOn( query: "#asdaRight");
    clearTextField(robot, size: 5);
    robot.write("7500");
```

4 Planning

4.1 User Stories

These are the following user stories that we have completed this sprint:

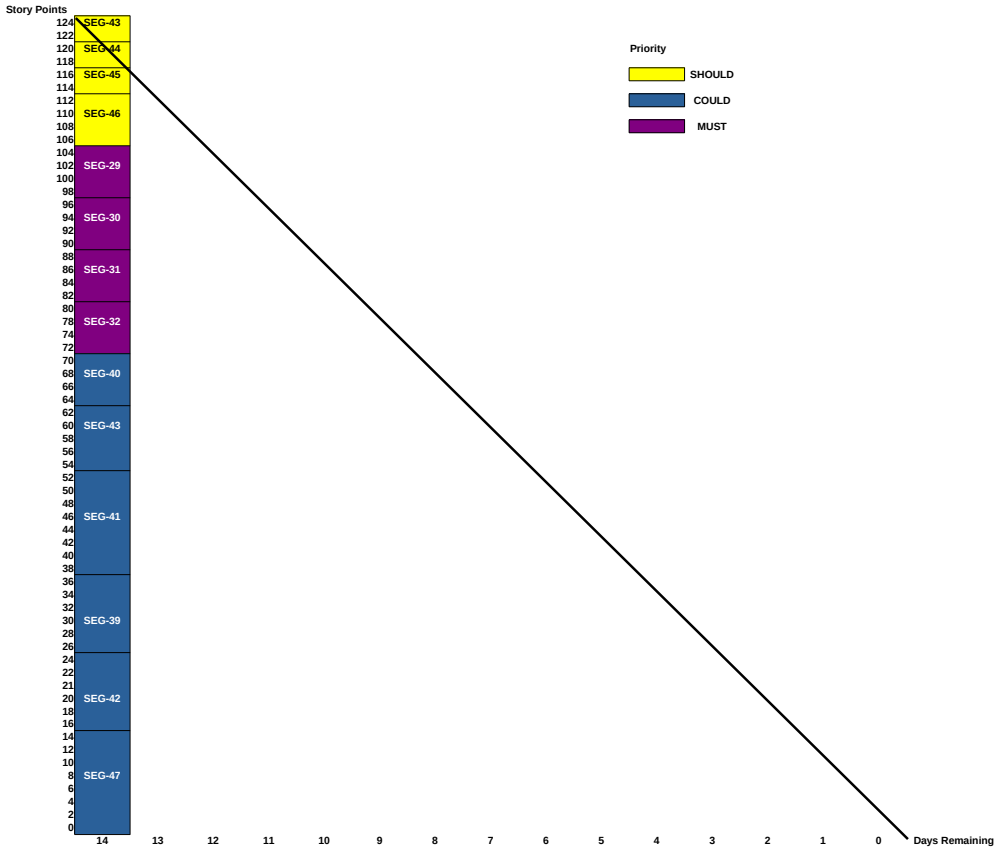
ID	Name	Description	Priority
SEG-29	XML Data Import	As a Runway Technician I want to be able to import other data via an XML file so that I do not have to manually define it every time I use the system.	MUST
SEG-30	XML Obstacle Export	As a Runway Technician I want to be able to export details of obstacles in an XML format so that I can use that data on other systems.	MUST
SEG-31	XML Airport Export	As a Runway Technician I want to be able to export details of airports in an XML format so that I can use that data on other systems.	MUST
SEG-32	XML Data Export	As a Runway Technician I want to be able to export other data in an XML format so that I can use that data on other systems.	MUST
SEG-43	JPEG Runway	As an Airfield Operations Manager I want to be able to export the displays in a JPEG format so that I can use the generated visualisation outside of the system.	SHOULD
SEG-44	PNG Runway	As an Airfield Operations Manager I want to be able to export the displays in a PNG format so that I can use the generated visualisation outside of the system.	SHOULD
SEG-45	GIF Runway	As an Airfield Operations Manager I want to be able to export the displays in a GIF format so that I can use the generated visualisation outside of the system.	SHOULD
SEG-46	Runway Colour Scheme	As an Airfield Operations Manager I want to be able to change the colour scheme of the visual representation of the runway so that if I were colour-blind, there is no mistake when viewing the visualisation.	SHOULD
SEG-40	Print Visual Representation	As an Airfield Operations Manager I want to be able to print out visual representations of redeclared runways so that information that is more understandable to most can be transferred around more quickly.	COULD
SEG-41	Real-World Overlay	As an Airfield Operations Manager I want to be able see a map view that overlays the runway diagram over a real-world image of it so that I am more easily able to visualise the obstacle(s) and proposed re-declaration.	COULD
SEG-43	Print Result	As an Airfield Operations Manager I want to be able to print out the results of the current simulation so that I can easily physically show or share this information with other people.	COULD

These following user stories have not been completed due their high complexity and a lack of time. They have been pushed to the next sprint.

ID	Name	Description	Priority
SEG-39	3D Runway View	As an Airfield Operations Manager I want to be able to view the airfield in 3D so that I can more easily judge the severity of an obstruction caused by an obstacle.	COULD
SEG-42	Extra Visual Control	As an Airfield Operations Manager I want to have the ability to zoom and pan in any of the views so that I can examine certain details of the scenario more closely.	COULD
SEG-47	Screen Reader	As an Airfield Operations Manager I want to be able to use a screen reader so that I can use the system properly if I have impaired vision.	SHOULD

4.2 Sprint 3 Progress

4.2.1 Sprint Day 0 Burndown



4.2.2 Sprint Progress Chart