System Test Plan

For

RTube NeMo Team

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1.0	Maegan Lucas	16 October, 2023	Initial creation of document
1.1	Maegan Lucas	16 October, 2023	Added Sections 3.1.1, 3.1.2
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Table of Contents

1.   Introduction

1.1 Purpose

This document is a test plan for RTube NeMo System Testing, produced by the RTube NeMo team. It describes the testing strategy and approach to testing the team will use to verify that the application meets the established requirements of the business prior to release.

1.2 Objectives

- ▪ Meets the requirements, specifications and the Business rules.
- ▪ Supports the intended business functions and achieves the required standards.
- ▪ Satisfies the Entrance Criteria for User Acceptance Testing.

2.   Functional Scope

The Modules in the scope of testing for the RTube Nemo System Testing are mentioned in the document attached in the following path :

1. [System Requirement Specification](#)

3.   Overall Strategy and Approach

3.1 Testing Strategy

RTube NeMo System Testing will include testing of all functionalities that are in scope (Refer Functional Scope Section) identified. System testing activities will include the testing of new functionalities, modified functionalities, screen level validations, work flows, functionality access, testing of internal & external interfaces.

Please note: Some tests will be completed next semester. These will be marked as *Testing Next Semester* in the Traceability Matrix.

3.2 System Testing Entrance Criteria

In order to start system testing, certain requirements must be met for testing readiness. The readiness can be classified into: useability and functional testing.

3.3 Testing Types

3.3.1 Usability Testing

User interface attributes, cosmetic presentation and content will be tested for accuracy and general usability. The goal of Usability Testing is to ensure that the User Interface is comfortable to use and provides the user with consistent and appropriate access and navigation through the functions of the application (e.g., access keys, consistent tab order, readable fonts etc.)

System Requirements Specification, 4.1.3.4: The user shall be able to click an airplane icon to view a popup with communication details corresponding with the selected flight path.

System Requirements Specification, 4.1.35: The user shall be able to click an airport icon to view a popup with communication details corresponding with the selected airport.

System Requirements Specification, 4.3.3.1: The application shall display a drop-down menu that drops down to show buttons upon clicking.

System Requirements Specification, 4.3.3.2: The application shall display a geographic map button and aeronautical map buttons in expanded drop-down menu.

System Requirements Specification, 4.3.3.3: The application shall display a geographic map within 10 seconds of the geographic map button being selected.

System Requirements Specification, 4.3.3.4: The application shall display an aeronautical map within 10 seconds of the aeronautical map button being selected.

System Requirements Specification, 4.3.3.5: The application shall display the appropriate airplane icon depending on the airplane's category.

System Requirements Specification, 4.3.3.6: The application shall allow a user to choose their configuration.

System Requirements Specification, 4.3.3.7: The application shall update to the chosen configuration within 10 seconds.

System Requirements Specification, 4.4.3.1: The application shall display a flight path when an airplane icon is selected by the user.

System Requirements Specification, 4.4.3.2: The flight path shall display visible waypoints to depict communication in their corresponding locations.

System Requirements Specification, 4.4.3.3: The visible waypoints shall update along flight path with airplane icon movement.

System Requirements Specification, 4.5.3.1: The icon for the frequency shall change colors to indicate communication detected on the frequency.

System Requirements Specification, 5.1.3: The application shall display an error message when the user zooms out past the map tile zoom limit.

3.3.2 Functional Testing

The objective of this test is to ensure that each element of the component meets the functional requirements of the business as outlined in the:

- Business / Functional Requirements
- Business rules or conditions
- Other functional documents produced during the course of the project i.e. resolution to issues/change requests/feedback

System Requirements Specification, 4.1.3.1: The database shall accurately store communication details in the form of callsign, time, date, longitude, latitude, audio, transcript, and a boolean value indicating whether the communication is coming from ATC.

System Requirements Specification, 4.1.3.2: The database shall be able to perform queries to recall communication details based on the callsign given by user input in the form of a flight icon selection.

System Requirements Specification, 4.1.3.3: The database shall be able to perform queries to recall communication details based on given user input in the form of an airport icon selection.

System Requirements Specification, 4.1.3.6: The database shall accurately store airport data in the form of id, type, name, longitude, latitude, elevation, country name, region name, local regio, municipality, GPS code, International Civil Aviation Code, local code, home webpage link, and a list of stream frequencies by reading an Excel file.

System Requirements Specification, 4.1.3.7: The database shall accurately recall airport information if the type of the airport is either "medium_airport" or "large_airport".

System Requirements Specification, 4.2.3.1: The application shall transcribe communication data with a 30% or better Word Error Rate (WER) when the user selects the "Transcribe" button for a specific flight within 10 seconds.

System Requirements Specification, 4.2.3.2: The application shall display transcribed audio within 15 seconds of selecting the "Transcribe" button.

System Requirements Specification, 4.2.3.3: The audio files shall be given from NearAero as .MP3 format.

System Requirements Specification, 4.2.3.4: The system shall convert .MP3 audio files to .WAV files.

System Requirements Specification, 4.2.3.5: The system shall only accept .txt files as output from NVIDIA NeMo.

System Requirements Specification, 4.4.3.1: The application shall display a flight path when an airplane is selected by the user with visible waypoints to depict communication in their corresponding locations.

System Requirements Specification, 4.5.3.2: The application shall recognize communication of a certain call sign across different frequencies.

3.4 Suspension Criteria and Resumption Requirements

This section will specify the criteria that will be used to suspend all or a portion of the testing activities on the items associated with this test plan.

3.4.1   Suspension Criteria

Testing will be suspended if the incidents found will not allow further testing of the system/application under-test. If testing is halted, and changes are made to the software or database, it is up to the team to determine whether the whole test plan will be re-executed or part of the plan will be re-executed.

Some possible incidents that would halt testing are:

- The waypoints do not line up with the proper location on the flightpath where communication occurred.
- The database does not save data properly.
- The database is unable to query data properly.
- NVIDIA NeMo does not transcribe audios with a 30% Word Error Rate or less.

3.4.2   Resumption Requirements

Resumption of testing will be possible when the functionality that caused the suspension of testing has been retested successfully.

4. Execution Plan

4.1 Execution Plan

The execution plan will detail the test cases to be executed. The Execution plan will be put together to ensure that all the requirements are covered. The execution plan will be designed to accommodate some changes if necessary, if testing is incomplete on any day.

Requirement	Test Case Identifier	Input	Expected Behavior	Pass/Fail/ Testing Next Semester
Req. 4.1.3.1 The database shall accurately store communication details in the form of callsign, time, date, longitude, latitude, audio, transcript, and a boolean value indicating whether the communication is coming from ATC.	1.1	callsign = '123456789', time = '12:00:00', date = '2023-12-01', longitude = '123.456789 E', latitude = '123.456789 N', audio = 'test.wav', transcript = 'test.txt', atc = 'FALSE'	Database shows callsign = '123456789', time = '12:00:00', date = '2023-12-01', longitude = '123.456789 E', latitude = '123.456789 N', audio = 'test.wav', transcript = 'test.txt', atc = 'FALSE' as an entry to Communications table.	Pass

Req. 4.1.3.2 The database shall be able to perform queries to recall communication details based on callsign given by user input in the form of a flight icon selection.	1.2	Test Airplane: callsign = '123456789'	Query produces: Database shows callsign = '123456789', time = '12:00:00', date = '2023-12-01', longitude = '123.456789 E', longitude = '123.456789 E', audio = 'test.wav', transcript = 'test.txt', atc = 'FALSE'	Testing Next Semester
Req. 4.1.3.3 The database shall be able to perform queries to recall communication details based on callsign given by user input in the form of an airport icon selection.	1.3	Test Airport: callsign = '987654321'	Query produces: Database shows callsign = '978654321' time = '12:00:00', date = '2023-12-01', longitude = '123.456789 E', latitude = '123.456789 N', audio = 'test.wav', transcript = 'test.txt',	Testing Next Semester

			atc = 'TRUE'	
Req. 4.1.3.4 The user shall be able to click an airplane icon to view a popup with communication details corresponding with the selected flight path.	1.4	Test Airplane is clicked on map. Callsign = '123456789'	Information popup displays with communication: callsign = '123456789', time = '12:00:00', date = '2023-12-01', longitude = '123.456789 E', latitude = '123.456789 N', audio = 'test.wav', transcript = 'test.txt', atc = 'FALSE'	Testing Next Semester
Req. 4.1.3.5 The user shall be able to click an airport icon to view a popup with communication details corresponding with the selected airport.	1.5	Test Airport clicked on map: Callsign = '987654321'	Information popup displays with communication: callsign = '978654321' time = '12:00:00', date = '2023-12-01', longitude = '123.456789 E', latitude =	Testing Next Semester

			'123.456789 N', audio = 'test.wav', transcript = 'test.txt', atc = 'TRUE'	
Req. 4.1.3.6 The database shall accurately store airport data in the form of id, type, name, longitude, latitude, elevation, country name, region name, local region, municipality, GPS code, International Civil Aviation Code, local code, home webpage link, and a list of stream frequencies by reading an Excel file.	1.6	id = '1234', type = "medium_airport", name = "Test Airport", longitude = "123.456789 S", latitude = '123.456789 E', elevation = '100', country_name = 'United States', region_name= = 'Florida', municipality = 'Daytona Beach', gps_code = 'KTA', iata_code = 'KTA', local_code = 'KTA', home_link = 'testairport.com', stream_freqs = '1, 2, 3'	Database shows: id = '1234', type = "medium_airport", name = "Test Airport", longitude = "123.456789 S", latitude = '123.456789 E', elevation = '100', country_name e = 'United States', region_name = 'Florida', municipality = 'Daytona Beach', gps_code = 'KTA', iata_code = 'KTA', local_code = 'KTA', home_link = 'testairport.com', stream_freqs = '1, 2, 3'	Pass

Req 4.1.3.7 The database shall accurately recall airport information if the type of airport is either "medium_airport" or "large_airport".	1.7.1	type = 'medium_airport'	Query recalls: id = '1234', type = "medium_airport", name = "Test Airport", longitude = "123.456789 S", latitude = '123.456789 E', elevation = '100', country_name = 'United States', region_name == 'Florida', municipality = 'Daytona Beach', gps_code = 'KTA', iata_code = 'KTA', local_code = 'KTA', home_link = 'testairport.com', stream_freqs = '1, 2, 3'	Pass
Req 4.1.3.7 The database shall accurately recall airport information if the type of airport is either "medium_airport" or "large_airport".	1.7.2	type = 'large_airport' Airport = id = '4321', type = "large_airport", name = "Test Airport", longitude = "123.456789	Query Results: Airport = id = '4321', type = "large_airport", name = "Test Airport", longitude = "123.456789	Pass

		N", latitude = '123.456789 W', elevation = '100', country_name = 'United States', region_name= = 'Florida', municipality = 'Daytona Beach', gps_code = 'KTAL', iata_code = 'TAL', local_code = 'TAL', home_link = 'testairport.com', stream_freqs = '1, 2, 3'	N", latitude = '123.456789 W', elevation = '100', country_nam e = 'United States', region_name = = 'Florida', municipality = 'Daytona Beach', gps_code = 'KTAL', iata_code = 'TAL', local_code = 'TAL', home_link = 'testairport.c om', stream_freqs = '1, 2, 3'	
Req. 4.2.3.1 The application shall transcribe communication data with a 30% or better WER when the user selects the "Transcribe" button for a specific flight within 10 seconds.	2.1	Test communication seen in Test Case 1.1 excluding the transcript.	Within 10 seconds of "Transcribe" button being clicked, the transcription is produced with an error rate of 30% or less.	Testing Next Semester

Req. 4.2.3.2 The application shall display transcribed audio to the user within 15 seconds of selecting the "Transcribe" button.	2.2	Test communication seen in Test Case 1.1.	Within 15 seconds of the "Transcribe" button being clicked, test.txt is displayed on the screen.	Testing Next Semester
Req. 4.2.3.3 The audio files shall be given from NearAero as .MP3 format.	2.3	Audio streamed from NearAero.	Audio should be format .MP3.	Pass
Req. 4.2.3.4 The system shall convert .MP3 audio files to .WAV files.	2.4	Audio streamed from NearAero.	Program produces same audio streamed from NearAero in .WAV format.	Testing Next Semester
Req. 4.2.3.5 The system shall only accept .txt files as output from NVIDIA NeMo.	2.5.1	Transcription with .txt format.	Program accepts file and outputs transcript.	Testing Next Semester
The system shall only accept .txt files as output from NVIDIA NeMo.	2.5.2	Transcription with .doc format.	Program rejects file and raises error.	Testing Next Semester

Req. 4.3.3.1 The application shall display a drop-down menu that drops down to show buttons upon clicking.	3.1.1	Web application ran.	Drop-down menu displays.	Pass
Req. 4.3.3.1 The application shall display a drop-down menu that drops down to show buttons upon clicking.	3.1.2	Drop-down menu clicked.	Drop-down menu expands to show buttons.	Pass
Req. 4.3.3.2 The application shall display a geographic map button and aeronautical map buttons in expanded drop down menu.	3.2	Drop-down menu clicked.	Geographic map button and aeronautical map buttons are visible in the menu.	Pass
Req. 4.3.3.3 The application shall display a geographic map within 10 seconds of the geographic map button being selected.	3.3	On Aeronautical Map view. Geographic map button clicked.	Geographic map is displayed within 10 seconds of the button being clicked.	Pass
Req. 4.3.3.4 The application shall display an aeronautical map within 10 seconds of the aeronautical map button being selected.	3.4	On Geographic Map view. Aeronautical Map button clicked.	Aeronautical map displayed within 10 seconds of the button being clicked.	Pass

Req. 4.3.3.5 The application shall display the appropriate airplane icon depending on the airplane's category.	3.5	Airplane category = '1' (No ADS-B Emitter Category Information)	planeCategory1.svg displayed.	Pass
Req. 4.3.3.6 The application shall allow a user to choose their configuration	3.6	Web application ran.	Choice of configuration will be shown.	Testing Next Semester
Req. 4.3.3.7 The application shall update to the chosen configuration within 10 seconds.	3.7	Configuration choice clicked.	Configuration display properties are displayed within 10 seconds.	Testing Next Semester
Req. 4.4.3.1 The application shall display a flight path when an airplane icon is selected by the user.	4.1	Airplane is selected.	Flight path is displayed.	Pass
Req. 4.4.3.2 The flight path shall display visible waypoints to depict communication in their corresponding locations.	4.2	Test Airplane data matching test communication in Test Case 1.1.	Waypoints are shown at longitude and latitude pair of test communication.	Testing Next Semester

Req. 4.4.3.3 The visible waypoints shall update with airplane icon movement.	4.3	Test Airplane moved to new location. Second test communication with different longitude, latitude, pair.	Waypoint for second test communication also shown at accurate longitude, latitude pair.	Testing Next Semester
Req. 4.5.3.1 The icon for the frequency shall change colors to indicate communication detected on the frequency.	5.1	Audio on test stream frequency	Icon changes color.	Testing Next Semester
Req. 4.5.3.2 The application shall be able to store communication details from the same callsign with different frequencies.	5.2	Test communication from Test Case 1.1. Test communication 2: callsign = '123456789', time = '2:00:00', date = '2023-12-01', longitude = '222.222222 E', latitude = '123.456789 N', audio = 'test.wav', transcript = 'test.txt', atc = 'FALSE'	Both communication from Test Case 1.1 and Test communication 2 are stored in the database.	Pass

Req. 5.1.1 The application shall not refresh plane icons in less than 5 seconds.	6.1	Starting time of 6:31:25 PM.	Next call should be after 6:31:30 PM.	Pass
Req. 5.1.2 The application shall not allow a user to zoom out past the map tile zoom limit.	6.2.1	Initial zoom > 8, New zoom > 8, Zoom limit = 8	Zoom out should occur without error.	Pass
Req. 5.1.2 The application shall not allow a user to zoom out past the map tile zoom limit.	6.2.2	Initial zoom > 8, New zoom = 8, Zoom limit = 8	Error should be displayed. Map blurred.	Pass
Req. 5.1.2 The application shall not allow a user to zoom out past the map tile zoom limit.	6.2.3	Initial zoom > 8, New zoom < 8, Zoom limit = 8	Error should be displayed. Map blurred.	Pass
Req. 5.1.2 The application shall not allow a user to zoom out past the map tile zoom limit.	6.2.4	Initial zoom < 8, New zoom > 8, Zoom limit = 8	Error message removed from display.	Pass

Req. 5.1.3 The application shall display an error message when the user zooms out past the map tile zoom limit.	6.3	Zoom level < 8, Zoom limit = 8	Error displayed. Map blurred.	Pass

Table 4.1 The execution plan with detail about tests for each requirement from the System Requirements Specification document, what the expected result should be, and whether the test for the requirement has passed or failed.

5.   Traceability Matrix & Defect Tracking

5.1 Traceability Matrix

5.1.1 Critical Requirements

- *System Requirements Specification, 4.1.3.1:* The database shall accurately store communication details in the form of callsign, time, date, longitude, latitude, audio, transcript, and a boolean value indicating whether the communication is coming from ATC.
  - *Test Case(s):* 1.1
- *System Requirements Specification, 4.1.3.2:* The database shall be able to perform queries to recall communication details based on the callsign given by user input in the form of a flight icon selection.
  - *Test Case(s):* 1.2
- *System Requirements Specification, 4.1.3.3:* The database shall be able to perform queries to recall communication details based on callsign given by user input in the form of an airport icon selection.
  - *Test Case(s):* 1.3
- *System Requirements Specification, 4.1.3.4:* The user shall be able to click an airplane icon to view a popup with communication details corresponding with the selected flight path.
  - *Test Case(s):* 1.4
- *System Requirements Specification, 4.1.3.5:* The user shall be able to click an airport icon to view a popup with communication details corresponding with the selected airport.
  - *Test Case(s):* 1.5
- *System Requirements Specification, 4.1.3.6:* The database shall accurately store airport data in the form of id, type, name, longitude, latitude, elevation, country name, region name, local region, municipality, GPS code, International Civil Aviation Code, local code, home webpage link, and a list of stream frequencies by

reading an Excel file.
  - *Test Case(s):* 1.6
- *System Requirements Specification, 4.1.3.7:* The database shall accurately recall airport information if the type of airport is either "medium_airport" or "large_airport".
  - *Test Case(s):* 1.7.1, 1.7.2
- *System Requirements Specification, 4.2.3.1:* The application shall transcribe communication data with a 30% or better Word Error Rate when the user selects the "Transcribe" button for a specific flight within 10 seconds.
  - *Test Case(s):* 2.1
- *System Requirements Specification, 4.2.3.2:* The application shall display transcribed audio to the user within 15 seconds of selecting the "Transcribe" button.
  - *Test Case(s):* 2.2
- *System Requirements Specification, 4.2.3.3:* The audio files shall be given from NearAero as a .MP3 format.
  - *Test Case(s):* 2.3
- *System Requirements Specification, 4.2.3.4:* The system shall convert .MP3 audio files to .WAV files.
  - *Test Case(s):* 2.4
- *System Requirements Specification, 4.2.3.5:* The system shall only accept .txt files as output from NVIDIA NeMo.
  - *Test Case(s):* 2.5.1, 2.5.2
- *System Requirements Specification, 4.3.3.2:* The application will display the user's choice map type with the airplane icons, airport icons, and flight paths, when applicable, over the selected map type without changing the functionality of the map.
  - *Test Case(s):* 3.2
- *System Requirements Specification, 4.4.3.1:* The application shall display a flight path when an airplane icon is selected by the user.
  - *Test Case(s):* 4.1
- *System Requirements Specification, 4.4.3.2:* The flight path shall display visible waypoints to depict communication in their corresponding locations.
  - *Test Case(s):* 4.2
- *System Requirements Specification, 4.5.3.2:* The application shall be able to store communication details from the same callsign with different frequencies.
  - *Test Case(s):* 5.2
- *System Requirements Specification, 5.1.1:* The application shall not refresh plane icons in less than 5 seconds.
  - *Test Case(s):* 6.1
- *System Requirements Specification, 5.1.2:* The application shall not allow a user to zoom out past the map tile zoom limit.
  - *Test Case(s):* 6.2.1, 6.2.2, 6.2.3, 6.2.4

5.1.2 Medium Requirements

- *System Requirements Specification, 4.3.3.1:* The application shall display a drop-down menu that drops down to show buttons upon clicking.
  - *Test Case(s):* 3.1.1, 3.1.2
- *System Requirements Specification, 4.3.3.2:* The application shall display a geographic map button and aeronautical map buttons in expanded drop down menu.
  - *Test Case(s):* 3.2
- *System Requirements Specification, 4.3.3.3:* The application shall display a geographic map within 10 seconds of the geographic map button being selected.
  - *Test Case(s):* 3.3
- *System Requirements Specification, 4.3.3.4:* The application shall display an aeronautical map within 10 seconds of the aeronautical map button being selected.
  - *Test Case(s):* 3.4
- *System Requirements Specification, 4.3.3.6:* The application shall allow a user to choose their configuration.
  - *Test Case(s):* 3.6
- *System Requirements Specification, 4.3.3.7:* The application shall update to the chosen configuration within 10 seconds.
  - *Test Case(s):* 3.7

5.1.3 Low Requirements

- *System Requirements Specification, 4.3.3.5:* The application shall display the appropriate airplane icon depending on the airplane's category.
  - *Test Case(s):* 3.5
- *System Requirements Specification, 4.4.3.3:* The visible waypoints shall update with airplane icon movement.
  - *Test Case(s):* 4.3
- *System Requirements Specification, 4.5.3.1:* The icon frequency shall change colors to indicate communication detected on the frequency.
  - *Test Case(s):* 5.1
- *System Requirements Specification, 5.1.3:* The application shall display an error message when the user zooms out past the map tile zoom limit.
  - *Test Case(s):* 6.3

5.2 Defect Severity Definitions

Critical	The defect causes a catastrophic or severe error that results in major problems and the functionality rendered is unavailable to the user. A manual procedure cannot be either implemented or a high effort is required to remedy the defect. Examples of a critical defect are as follows: ● System abends ● Data cannot flow through a business function/lifecycle ● Data is corrupted or cannot post to the database
Medium	The defect does not seriously impair system function can be categorized as a medium Defect. A manual procedure requiring medium effort can be implemented to remedy the defect. Examples of a medium defect are as follows: ● Form navigation is incorrect ● Field labels are not consistent with global terminology
Low	The defect is cosmetic or has little to no impact on system functionality. A manual procedure requiring low effort can be implemented to remedy the defect. Examples of a low defect are as follows: ● Repositioning of fields on screens ● Text font on reports is incorrect

6. Environment

6.1 Environment

In order to conduct the testing, the tester needs to have the following installed on their computer:
- Python, version 9 or greater
- Cython
- OpenSky Python API
- Leaftlet, version 1.9.3
- JQuery, version 3.7.0
- Leaftlet Rotated Marker Plug-In, version 0.2.0
- Flask, version 2.3.2
- SQL Alchemy, version 2.0.22
- Pandas, version 2.0.1
- Openpyxl, version 3.1.2

7. Assumptions

- All communication information being stored in the database are the correct file format.
- OpenSky API server is running properly.

8.   Risks and Contingencies

No risks or contingencies have been identified.

9.   Appendices