**Test Plan**

for

**Train Controller (NSECS-TNC)**

**Prepared by**

BreathlessBovine: Ben Tomasulo

**Organization**

ECE/COE 1186: Software Engineering

**Date**

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**1. Introduction**

This document shall describe the proper testing procedure for the Train Controller (TNC) module for the North Shore Extension Control System (NSECS).

**1.1. Purpose**

The purpose of this document is to guide maintenance workers in the proper testing of the TNC, and to illustrate to the stakeholders how the TNC will be tested.

**1.2. Scope**

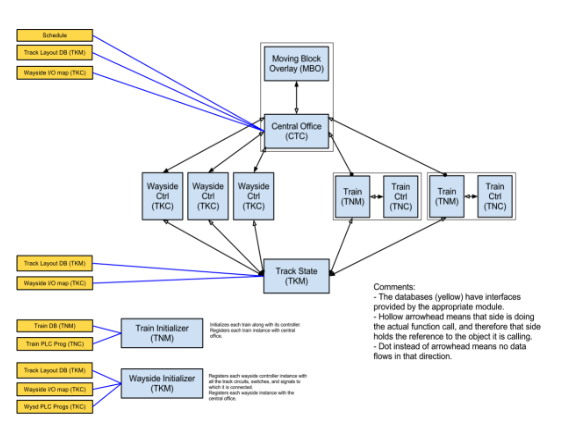
The context of this test plan is only within the confines of the TNC. Although the Train Model (TNM) normally interacts with the TNC, only the TNC’s outputs shall be verified.

**1.3. References**

* + WP2 Project Grading v1.pdf
  + Train Controller SRS submitted with Work Package 1
  + Train Controller Software Design Description submitted with Work

Package 2

**1.4. Level in the overall sequence**



**1.5. Test classes and overall test conditions**

Component tests shall be used to verify if each sub-component functions accordingly in conjunction with all of the system’s sub-components to meet the specified system requirements. Test classes shall be normal usage and error/shutdown testing classes.

**2. Details for this level of test plan**

This section shall outline the details for the test, which features are being tested and their relationship to the system requirements. Testing approach and criteria will also be outlined.

**2.1 Test items and their identifiers**

The main objects being tested in this system are the TrainControllerUI and the TrainPLC. These objects shall be tested in accordance with the specified requirements documentation and for overall system integration.

**2.2 Features to be tested**

1. TrainControllerUI-TrainPLC interface

2. TNM-TrainPLC interface

3. Emergency Response of TrainPLC

4. Engine Response of TrainPLC

5. Light Response of TrainPLC

6. Thermostat Response of TrainPLC

7. Station Response of TrainPLC

**2.3 Features not to be tested**

1. Auto TrainPLC creation upon TNM adding additional trains

2. Non-Imminent Emergency Response of PLC

* These are emergencies where applying the E-Brake is either not necessary or will be ineffective. The safety of the passengers in these scenarios is dependent on the authority velocity and the Emergency Response of TrainPLC on the other trains being accurate.

3. Improper Input

* The Train Controller UI will ignore any improper input and go with the last proper input, or the default if no proper input was given.

**2.4 Approach**

Black box testing shall be the taken approach for functional feature testing, while white box testing shall be used for non-functional feature testing.

**2.5 Item pass/fail criteria**

Criteria shall be assertion based and items shall either pass or fail depending on the expected result. Test results will be tallied up to give the user total number of assertions that pass/failed within a given test class.

**2.6 Test deliverables**

* Level Test Plan(s)
* Level Test Cases
* Level Test Logs
* Level Test Report

**3. Test management**

Owner maintenance shall be responsible for running the verification and validation tests that are detailed within this document. Note there is risk in running this test with a PLC on a real train before the Emergency Response of TrainPLC (Test 3) is verified.

**4. Test Cases**

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| **4.1 TrainControllerUI-TrainPLC Interface** | | | |
| Test that the TrainControllerUI and TrainPLC are communicating. Note that the TrainControllerUI and TrainPLC must be in the same directory and compiled or this will fail. Once that is done, run the TrainControllerUI. If the TrainControllerUI does not load, count this case as a failure. If it does load, look at the values in the left columns without overrides (“Current Power” is one such example). If they display as “-1,” this case fails. If the UI displays these as non-negative numbers, this case passes. Note that if this case fails, all other cases fail by default. | | | |
| **P / F** | **Tester** | **Date** | **Comments** |
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| **4.2 TNM-TrainPLC Interface** | | | |
| Test that the Train Model and TrainPLC are communicating. With the TrainControllerUI still open, look at the values in the left columns with overrides (“Current Velocity” is one such example). If they display as “-1,” this case fails. If the UI displays these as non-negative numbers, this case passes. Note that “Current Ideal Temperature” defaults to “22” on PLC startup and will never display “-1,” it should be ignored for this test. | | | |
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| **4.3 Emergency Response of TrainPLC** | | | |
| Test that the TrainPLC responds correctly in case of a crash-imminent emergency. For each of these emergencies, engine power should go to “0,” the E-Brake should engage and once the Current Velocity reaches 0 the doors should open. First set the Setpoint Velocity to “10”, the Track Block Number Override to “-3,” and engage the toggle. If the previous case failed set the Speed Limit Override and Authority Override to “10” and engage the toggle. Then set the Current Velocity Override to “7,” set the Authority Override to “0,” and engage both toggles. If the Current Power does not go to 0, the case fails. If the E-Brake does not engage, the case fails. If the case has not yet failed, set the Current Velocity Override to “0.” If the doors do not open, the case fails. Disengage the Authority Override (or if the previous case fails, set it to “10”). Engage the Signal Pickup Failure Override Toggle, if the E-Brake does not engage and the Current Power does not drop to 0, the case fails. Disengage the toggle. Repeat this for Broken Rail, Track Circuit Failure, Power Failure, and Brake Failure (note that for Brake Failure the E-Brake will not engage). If the case has not failed yet, it passes. | | | |
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| **4.4 Engine Response of TrainPLC** | | | |
| Test that the engine provides power when needed. Set the Setpoint Velocity to “10”, the Track Block Number Override to “-3,” and engage the toggle. Set the Current Velocity Override to less than the PLC Chosen Velocity and engage the toggle. If 4.2 failed, you will need to enter velocities in the Speed Limit Override and Authority Override and engage both toggles (10 is an example of an acceptable number for both). If the Current Power is not greater than 0 or either brake is engaged, the case fails. Now set the Current Velocity Override to equal the PLC Chosen Velocity. If the Current Power does not remain the same, the case fails. Now set the Current Velocity Override to greater than the PLC Chosen Velocity. If the Current Power does not decrease, the case fails. Otherwise the case passes. | | | |
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| **4.5 Light Response of TrainPLC** | | | |
| Test that the lights are off during daylight hours when the train is above ground, and on otherwise. Set the Track Block Number Override to “-1,” the Time Override to “12” and engage both toggles. If the lights are not off, the case fails. Set the Time Override to “0,” if the lights do not turn on the case fails. Set the Track Block Number Override to “-2” and the Time Override to “12,” if the lights turn off the case fails. Otherwise the case passes. | | | |
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| **4.6 Thermostat Response of TrainPLC** | | | |
| Test that the climate control systems work properly. With the Current Ideal Temperature set to “22,” set the Current Temperature Override to “15” and engage the toggle. If the Climate Control State does not read “Heater Active,” the case fails. Set the Current Temperature Override to 22; if the Climate Control State does not read “off” the case fails. Set the Current Temperature Override to 30; if the Climate Control State does not read “AC Active” the case fails. Otherwise the case passes. | | | |
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| **4.7 Station Response of TrainPLC** | | | |
| Test that the passenger control systems work properly. Set the Track Block Number Override to “-2” and engage the toggle. If the Current Announcement State does not read “-2,” the case fails. Set the Track Block Number Override to “-3.” If the Current Announcement State does not read “0,” the case fails. Set the Track Block Number Override to “-1.” If the Service Break does not engage, the Current Power does not drop to “0,” or the Current Announcement State does not read “0,” the case fails. Once the Current Velocity reaches 0, the doors should open for 1 minute, then close, then the service brake should disengage and the Current Power should rise above 0. (Note if case 4.2 failed you will need to set the Current Velocity Override to “0” and set the toggle. ) If any of this does not happen, the case fails. Otherwise the case passes. | | | |
| **P / F** | **Tester** | **Date** | **Comments** |
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**5. General**

This section will describe the methods by which the quality of the tests

will be ensured.

**5.1 Quality Assurance Plan**

This document shall be reviewed by another developer on the team that is not tasked with the Train Controller to ensure that all requirements are be tested appropriately. In addition this team member shall ensure that all tests aren’t written with the intention to be passed, thus preventing any test biases. Multiple test objects will be run concurrently to ensure that all objects will behave continuously as expected.

**5.2 Metrics**

The number of tests which ultimately passed (the most recent entry for a

test is (P)assed), ultimately failed (the most recent entry for a test

is (F)ailed due to lack of time to bring it to a passing status), and

were not tested will all be reported. Per test, the number of times

that a task was failed may also be reported.

**5.3 Test coverage**

As stated in section 2.5, there is no partial pass or partial failure; so all requirements in the description of a test must pass in order for that test to pass.

**5.4 Glossary**

TNM – Train Model

TNC – Train Controller

NSECS – North Shore Extension Control System

**5.5 Document Change Procedures and History**

For future versions of this document, the new document version will be appended on the end of the file name with a “v”. For example, version 3 of this document would have the file name, “BreathlessBovine-<LastName>-<FirstName>-TPv3”. Also, it is okay if the reviser fills in his/her own name and the new date on the first page as long as s/he creates an entry in the table below. If typos, spacing, or some other non-technical details are changed in the document, then a new version of the document should NOT be created.

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| --- | --- | --- | --- | --- |
| **Version** | **Reviser** | **Date** | **Sections Changed** | **Description of Changes** |
| 1 | Ben Tomasulo | 3/28/2013 | All | Created the first revision of the test plans for the train controller module. |
| 2 |  |  |  |  |