**Test plan for**

**BASE STATION AND ROVER RECEIVER RTCM RECEIVING CORRECTIONS**

**Test Plan for receiving RTCM correction verification**

*ChangeLog*

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| **Version** | **Change Date** | **By** | **Description** |
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# Introduction

The autonomous unmanned ariel vehicle group has a want for a GPS-RTK system to help provide better accuracy and precision when landing the UAV on the back of the autonomous surface vessel (ASV). In order for this to happen, the rover receiver needs to receive RTCM (Radio Technical Commission for Maritime Services) corrections from the base station the UAV group created. If the rover receives RTCM corrections, the rover receiver on the drone, will receive correct information from the help of the base station and GNSS (Global Navigation Satellite System) data from the GNSS satellites. This will provide accurate positioning information for the drone to land with centimer, even millimeter accuracy being the best hypothetical accuracy the group could achieve. RTK will be reliable and crucial when landing on the back of the ASV, having confidence that the drone will not land in the water.

In order to complete the following tasks, this testing will involve the rover receiver, the base station, wires, antenna, radio utilization with the Xbee S1, solderding tool, and a computer with u-center and SNIP. The applications on the computer will be able to read incoming RTCM corrections along with satellite reading from the base station. This methodology and work flow will also be useful in troubleshooting any of the receivers, base station, or wires.

## Scope

### In Scope

The goal of this test is to make sure the base station and rover reciever are communicating with one another: the base station sending RTCM corrections and the rover receiver receiving those corrections for better accuracy and positioning. The purpose is to confirm that RTCM corrections are being received to the rover receiver located on the drone. The functional requirements being tested involves the UAV drone using and RTK-enabled GPS receiver to allow precise positioning. For non-functional requirements, the UAV will utilizxe separate data links for telemetry and radio control to improve reliability.

### Out of Scope

This test will only focus on the RTK portion of the capstone project. All other variables such as the physical aspects or the software of the drone will not be discussed or tested today. This test will not test the drone’s camera capabilities, landing gear, physical characteristics, onboard or offboard commands, scoop mechanism, immediate shutdown, or any flight operations with a wireless controller. The non-functional requirements that will not be tested will include the flight times, voltage needed, or the physical weight of the drone or vessel.

## Quality Objective

The overall objectives of this testing is to confirm if our rover reciver is receiving and utilizing the RTCM corrections being sent from the base station. The goal is to take each module, the rover recieiver and the base station, and make sure the base station is sending out the proper RTCM corrections to the rover receiver and that the receiver is receiving and using the RTCM corrections to the receiver module. Afterwards, we plan on observing all the RTCM corrections being received from the base station as well as the corrections being sent based on the base station. In doing this, we can see if the rover and base station are working properly to move further with the autonomous flight tests.

Overall test obejctives include:

* Ensure the ZED-F9P/ZED-F9R (rover receivers) is receiving and using RTCM 3.3 corrections from the base station.
* Utilize u-center to observe the RTCM 3.3 corrections from the base station and rover receiver.
* Utilize SNIP to observe the RTCM 3.3 corrections from the base station and rover receiver.
* Save the data gathered from both the base station and the rover receiver.
* Identify bugs or errors within each module by reading the u-center and SNIP data.
* Change settings of the modules if not receiving/sending RTCM 3.3 corrections.

## Roles and Responsibilities

* **Installation and Setup Team:** configure the RTK Surveyor (base station) along with the ZED-F9P/ZED-F9R (rover receivers) to talk with one another. Also installing the XBee S1 radio module so the base station and the rover can communicate.
* **Test Manager:** record, save, and analyze the messages coming from the base station and the rover receiver. Also, the test manager is utilizing the u-center application along with SNIP to read the RTCM corrections.
* **Results Team:** save all the files regarding the observations with the tests. Identify any bugs, errors, or configurations that need to be resolved for future testing using u-center and SNIP.

# Test Methodology

## Overview

We plan on utilizing the waterfall testing methodology for this test. This methodology breaks down the testing in simple steps that help organize the test as well as complete the test. There will definitely be errors involved in this test, so making sure to not move on until fixing these potential errors will benefit the group and the project itself. This is the beginning process of making sure our modules work. As each step begins working, they build on top of each other so it is crucial that we take each step carefully and ensure proper implementations to achieve our perferred result.

2.1.1 Constraints and Assumpltions

Constraints for this testing:

* Cold/rainy weather for outside testing
* New RTK system, not experienced cadets or faculties

Assumptions that this test makes:

* RTCM 3.3 corrections streaming and being received
* Base station is functional
* Rover receiver is functional
* U-center and SNIP are proper applications to use for analysis

## Test Levels

**Test Levels define the Types of Testing to be executed on the Application Under Test (AUT**).

Level I: Complete the proper configuration method for the base station, involving the SparkFun RTK Sruveyor (the inside containing the ZED-F9P receiver) as well as the u-center application to make these configuration alterations. Using this test will be the proper action to making sure the base station is sending out the proper RTCM corrections for the receiver to receive and use.

Level II: Complete the proper configuration method for the ZED-F9P or the ZED-F9R receivers for the drone. It will also require the u-center application to make these needed configuration changes. Using this testing level will make sure that the receiver receives proper instructions to receive and use the RTCM correction being sent from the base station.

Level III: Complete tests outside using both the rover receivers and the base station. Plug each module in the computer using u-center and SNIP to read both modules. Determine if the base station is sending RTCM corrections. Determine if the rover receiver is receiving the corrections and using them to determine it’s location. Using this testing level will make sure there is proper communication between both fo the modules for the next testing as a whole group with the UAV drone (because currently, the group is just utilizing the modules rather than the module on the drone at the moment; it is easier to work and manage with if there are any errors or bugs in the module).

## Bug Triage

If the base station is not sending RTCM corrections, reset the module and repeat the configuration steps provided with the RTK website being used.

If the rover is not receiving RTCM corrections, even if the base station is sending RTCM corrections, refer back to the RTK website being used and switch the receiver out for the ZED-F9R (or ZED-F9P) depending on what receiver was being used first. If both are unsuccessful, reset both modules and follow the configuration steps once more.

If needing more assistance, refer to capstone advisors for further guidance.

## Suspension Criteria and Resumption Requirements

If there are any errors from either Level I or Level II, suspend further progression and fix the problem with the Level error. Each level builds on each other so the proper action to take is find the solution to the Level error.

## Test Completeness

* 100% test coverage
* Base station sending RTCM 3.3 corrections
* Rover receiver receiving RTCM 3.3 corrections
* Saving data from the rover receiver to observe and analyze the corrections being sent

# Test Deliverables

Here are the sample deliverables

|  |
| --- |
| * Test Plan * Requirement Traceability Matrix * Bug Reports * Test Strategy * Test Metrics * U-center and SNIP Data Analysis * Map and Chart Position Solutions |

# Resource & Environment Needs

## Testing Tools

Tools required:

* Given capstone tool kit
* Computer for data storage

## Test Environment

**Hardware:**

* ZED-F9P
* ZED-F9R
* SparkFun RTK Surveyor
* XBee S1 radio telemetry module

**Software:**

* RTK reading applications (u-center and SNIP)
* Windows 10, 11

**Locations:**

* Electrical Engineering Capstone Lab
* Cadet Memorial Field

# Terms/Acronyms

Make a mention of any terms or acronyms used in the project

| TERM/ACRONYM | DEFINITION |
| --- | --- |
| ASV | Autonomous Surface Vessel |
| GNSS | Global Navigation Satellite System |
| GPS | Global Poisitioning System |
| RTK | Real-Time Kinematic |
| UAV | Unmanned Ariel Vehicle |