UAVPayloadTAQ

Subsystem Unit Testing – Enclosure Design

Project: UAVPayloadTAQ-G2 **WP Name**: Subsystem Integration Testing **WP Number**: WP-IMG-5	**Type of Test**: Unit Test	
Test Article: Enclosure Application	**Part Number**: N/A	**Serial Number**: N/A
System Requirements: REQ-M-9, REQ-M-10, REQ-M-11, REQ-M-12	**Test Equipment**: Enclosure, UAV	
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Revision Record

Document Issue/Revision Status	Description of Change	Date	Approved
1.0		19 October 2020	Alexander Iftene

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Definitions

UAV	Unmanned Aerial Vehicle
UAVPayload	Unmanned Aerial Vehicle Payload
GCS	Ground Control Station
WEB	Web Visualization Subsystem
FTP	File Transfer Protocol
HLO	High Level Objective
SR	System Requirements
POC	Proof of Concept
LAN	Local Area Network
TBD	To Be Determined
API	Application Programming Interface

1 Introduction

To ensure proper intended functionality for each subsystem it is important to conduct adequate testing to ensure they each operate correctly prior to integration.

1.1 Scope

This document outlines the Unit testing for the ENC subsystem. Testing is conducted using a 3D printed enclosure using On Shape which is a web-based platform for rendering and design.

1.2 Background

The Queensland University of Technology (QUT) Airborne Sensing Lab have appointed Group 2 of the EGH455 (Advanced Systems Design) class to design a UAV Payload for indoor air quality to be installed on a S500 UAV designed for navigating in GPS denied environments. The UAVPayloadTAQ is required to conduct constant air quality sampling in a simulated underground mine. During monitoring, it must find and identify multiple markers placed by miners around the mine. Additionally, QUT Airborne Sensing Systems requires that the UAVPayloadTAQ is designed and developed using Systems Engineering to ensure QUT Airborne Sensing Systems requirements are met. Taken from RD/3.

2 Reference Documents

2.1 QUT Avionics Documents

RD/1	CN-UAVPayloadTAQ-01	UAV Payload Customer Needs
RD/2	SR-UAVPayloadTAQ-01	UAV Payload System Requirements

3 Test Objectives

RD/2 outlines the requirements for the entire project. Below are the most important requirements relating to the DAT subsystem.

i. **REQ-M-01/HLO-M-4**: The UAVPayloadTAQ shall remain under the maximum weight of 250 g. The UAV that will carry the payload is required to remain under the maximum take-off weight of 2kg.
ii. **REQ-M-09, HLO-M-5**: Preliminary designs shall be completed by week 7.
iii. **REQ-M-10, HLO-M-5**: Additional purchase orders for the UAVPayloadTAQ components shall be placed before week 7.
iv. **REQ-M-11, HLO-M-5**: Developed solution shall conform to the systems engineering approach.

These requirements enabled the project team to set up and methodically test the performance of the subsystem.

4 Test Set Up and Equipment

The functional testing of the ENC subsystem incorporates the use of a 3D printed enclosure system using the On Shape program which is a web-based program used for design and rendering. Once the enclosure was produced and ready for delivery, the integration of other subsystems could commence.

4.1 Functional Testing Setup and Equipment

Functional testing was performed through the methodology of a systems engineering approach. The enclosure was required to be tested to ensure the functionality of the design for the payload. Unfortunately, the enclosure did not meet all the desired recommendations of the system requirement document as it was unable to attach to the UAV securely and the Pi Camera was also not able to attach to the enclosure either.

The enclosure was set up by inputting the payload into the device and securely screwed into place using plastic screws and an Allen key. While this was happening, the enclosure was being fastened to the UAV via the use of zip ties to amend the design fault of the enclosure, and double sided tape was used for the Pi Camera in order for it to function as per the system design requirements.

5 Test Procedures

The testing procedures relate to the design brief (RD/2) requirements REQ-M-09, REQ-M-10, REQ-M-11, REQ-M-12 which are derived from HLO-M-04 and HLO-M-05, respectively.

The first testing procedure was to make sure that the payload weighed less than 250g as pre the system requirements, in which it did and accounting for the enclosure and the payload weighed less than the maximum 2.2kg weight limit for the attachment to the UAV.

6 Test Results

The test results relate to RD/2 and the systems and customer requirements. The results from the demonstration showed that the enclosure was not ready for deployment as further testing and debugging of the design was needed to satisfy all the system requirements for this product. The enclosure did adhere to the requirements of the maximum weight for both the enclosure and the payload as per the high level objective associated with this requirement.

7 Conclusion

This document has outlined the ENC subsystem meeting most of the requirements that were provided to the project team. Although some design flaws impacted the mounting of the payload during the testing phase, the other high-level objectives were fulfilled and if there was to be another test, the enclosure would be improved and designed accordingly to satisfy all high-level objectives.

8 Appendices

Figure 1: Enclosure used for testing (Top).

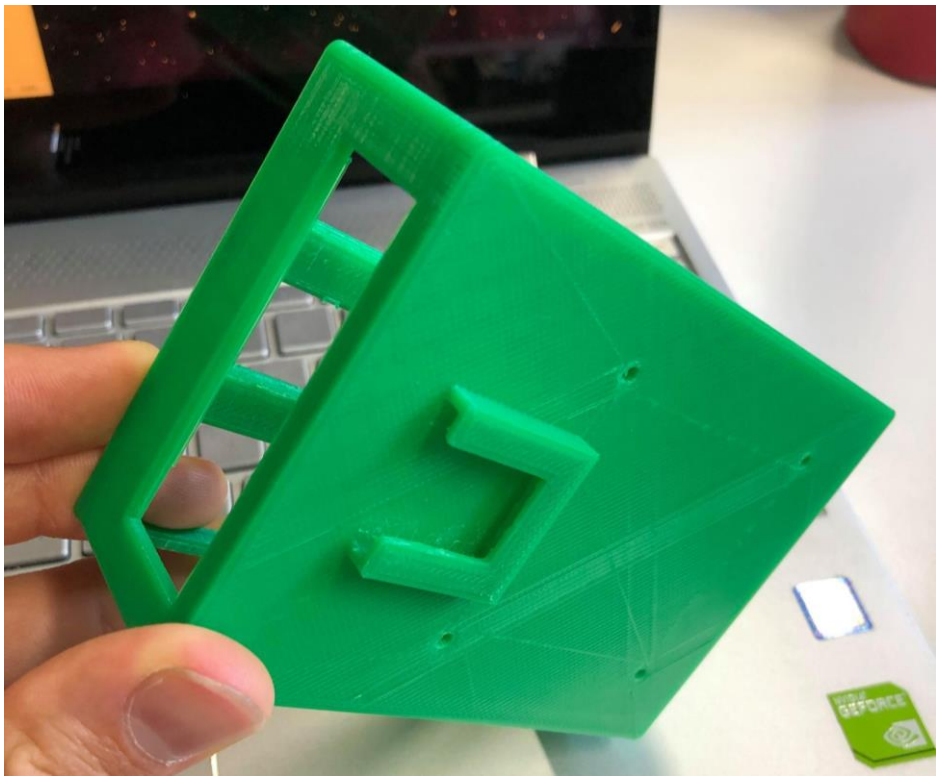

Figure 2: Enclosure used for testing (Bottom).