Backstory:

- 2016: The rocket was unable to be located after a test flight, hence a GPS is present on successive years packages to enable locating the rocket by transmitting the GPS coordinates of the rocket to a base station.
- 2017: One controlled launch with a Teensy 3.2 for the controller. Created board for Teensy3.6 which was used in the 2018 project for MVP. One attemped flight using the Teensy 3.2, unsuccessful as the rocket was not aerodynamically stable.
- 2018: Started with components from last year. The avionics package is based off a Teensy3.6.

Goal:

The end goal of the project is to fly a two-stage rocket from a balloon, powered by a J-motor or larger. This rocket will be able to reach supersonic speeds, it should log and transmit its coordinates.

Launch Schedule and Issues:

Launch was scheduled for 28/29 July

- Delayed as the client's 3D printer had a fan failure. The team contacted the ECS technicians to facilitate 3D printing.

Attempted Launch on 4/5th August

- Cancelled due to weather conditions

Attempted launch on 11/12th August

- Cancelled due to unresolvable technical issues found by the client.
- The rocket was returned to the team on 14th August to resolve the issues.

Issue: Voltage to the Teensy dropped, when powered by battery for launch.

- The servos had too high a current draw, forcing the regulator into thermal shutdown periodically. The client bypassed the regulator, powering the servos directly from the battery. After bypassing the servos, voltage at the input pin on the Teensy3.6 was measured to be 1.7 V.

- Try to find a different voltage regulator, the Teensy3.6 should be regulated to have a lower voltage dropoff as the LM7805 has a high voltage dropoff. The regulator regulates 7.4 V from the battery to 5V for the Teensy. We could put a 3.3V regulator instead as the Teensy can run off 3.3 V.

- The low voltage could be caused by a floating ground. Voltage level can be probed around the regulator to find.

- Power management: Check if ECS technicians have any voltage regulators or power packages. Battery elimination circuits could be utilised.

Solution:

- We replaced the 1.5A LM7805 with a TRACO TSR 0.5-2450.

- The voltage was indeed due to a floating ground. The holes in the PCB had had the copper within them worn away, leaving the voltage regulator isolated from the rest of the board.
- The regulator was connected to the rest of the board by soldering external wires to the respective pins on the outside of the board.

Issue: Radio on base station was not working properly. Successful handshake but no transmission of data.

- Radio: remote board worked, the handshake was fine but it didn't receive data. We can check them again and test.

Solution:

- Unsuccessful data transmission was due the avionics package not having a GPS lock.
- A GPS lock is required for data transmission between the on-board radio and the base station. The fix is to simply wait 10 or so minutes for a lock.

Other Notes:

- The client had fitted a D class motor in the rocket but was unable to remove it before returning it to the team. Possesion of rocket motors by the team is not covered in the Health and Safety document, the document will be amended to address this issue. The team was able to successfully remove the motor from the airframe at the request of the ECS technicians for charging of the internal battery. The rocket was stored in an ammunition drum in the technicians' office.
- The clay nozzle on the thrust end of the motor was damaged when removing the the motor from the airframe.

Launch on 22nd August

Details

- Test site was Trentham Memorial Park
- Launch vehicle specificiations can be found here and are listed below:

Centre of gravity and centre of pressure were calculated using OpenRocket to ensure the launch vehicle is aerodynamically stable. The rocket has an overall height of 286 mm and weighs 600 g when fully assembled.

- Centre of gravity: 13.75 cm from the base of the rocket when standing upright
- Centre of pressure: 12 cm from the base of the rocket when standing upright

Launch Notes

- Launch apogee was around 15 m.
- After initial analysis of the flight data, the Avionics Package performed nominally in its sensing and transmision: IMU logging, GPS cooordinate logging, radio transmission.
- The team neglected to send the revised code for the package to the client until reminded by the client that he had not recieved the updated software. The client has subsequently been given access to the

project gitlab and can access all software and documentation. The team will advise the client on the whereabouts of the software within the repository, in addition to sending the code directly.

- One of the servos on the gimbal would hard over when the rocket was initialised. This prevented the rocket from being able to stablise in one axis. The client disconnected the malfunctioning servo and flew the rocket with stabilisation in one axis. Analysis of this issue has been documented in #152
- Rocket initialisation sequence needs to be demonstrated when handing over to the client. A launch process document has been written outlining the steps to be taken and the process of setting up the package when preparing to launch, however, this document has not been updated and urgently needs to be updated.
- The rocket motor was damaged when removing the motor from the rocket. A damaged rocket motor would result in the motor thrusting off axis. When handing over to the client, the team neglected to mention the motor had been damaged. Subsequently, the client had to turn around when travelling to the launch site to get another motor. A [checklist] (https://gitlab.ecs.vuw.ac.nz/ENGR301-302-2018/Project-12/team-rocket-3.0/blob/master/Health_and_Safety/Rocket%20Handover%20Checklist.md) has been compiled of tasks to be done prior to delivery to the client.

Recording

Launch video directory

Base station logger serial terminal output

Debugger Started Setup started LoRa Init Started LoRa Init Success Setup successful

> RFSANITY All components working Changing state from STARTUP to ARMED Changing state from ARMED to PRELAUNCH Changing state from ARMED to PRELAUNCH Changing state from LAUNCH to POSTLAUNCH 871255,-41.133465,175.028915,3,38,56
> 872405,-41.133461,175.028931,3,38,57 873408,-41.133457,175.028931,3,38,58
> 874385,-41.133457,175.028931,3,38,59 876282,-41.133453,175.028931,3,39,1
> 877426,-41.133453,175.028931,3,39,2 878421,-41.133461,175.028931,3,39,3
> 879439,-41.133461,175.028931,3,39,4 881229,-41.133472,175.028946,3,39,6
> 882428,-41.133480,175.028946,3,39,7 883421,-41.133480,175.028931,3,39,8
> 884377,-41.133480,175.028931,3,39,9 886143,-41.133476,175.028946,3,39,11
> 887402,-41.133480,175.028946,3,39,12 888396,-41.133492,175.028946,3,39,13
> 889399,-41.133507,175.028931,3,39,14 891107,-41.133537,175.028946,3,39,16
> 892387,-41.133545,175.028961,3,39,17 893394,-41.133545,175.028976,3,39,18
> 896122,-41.133549,175.029007,3,39,21 897387,-41.133549,175.029007,3,39,22
> 898438,-41.133549,175.029022,3,39,23 899393,-41.133553,175.029022,3,39,24
> 901140,-41.133549,175.029022,3,39,26 902223,-41.133549,175.029022,3,39,27