# NIWA Self-Recovering Balloon payload

## for High-Altitude Atmospheric Research


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Special Thanks: Kelvin Barnsdale, Adriel Kind & the UC Spatial Engineering Research Centre

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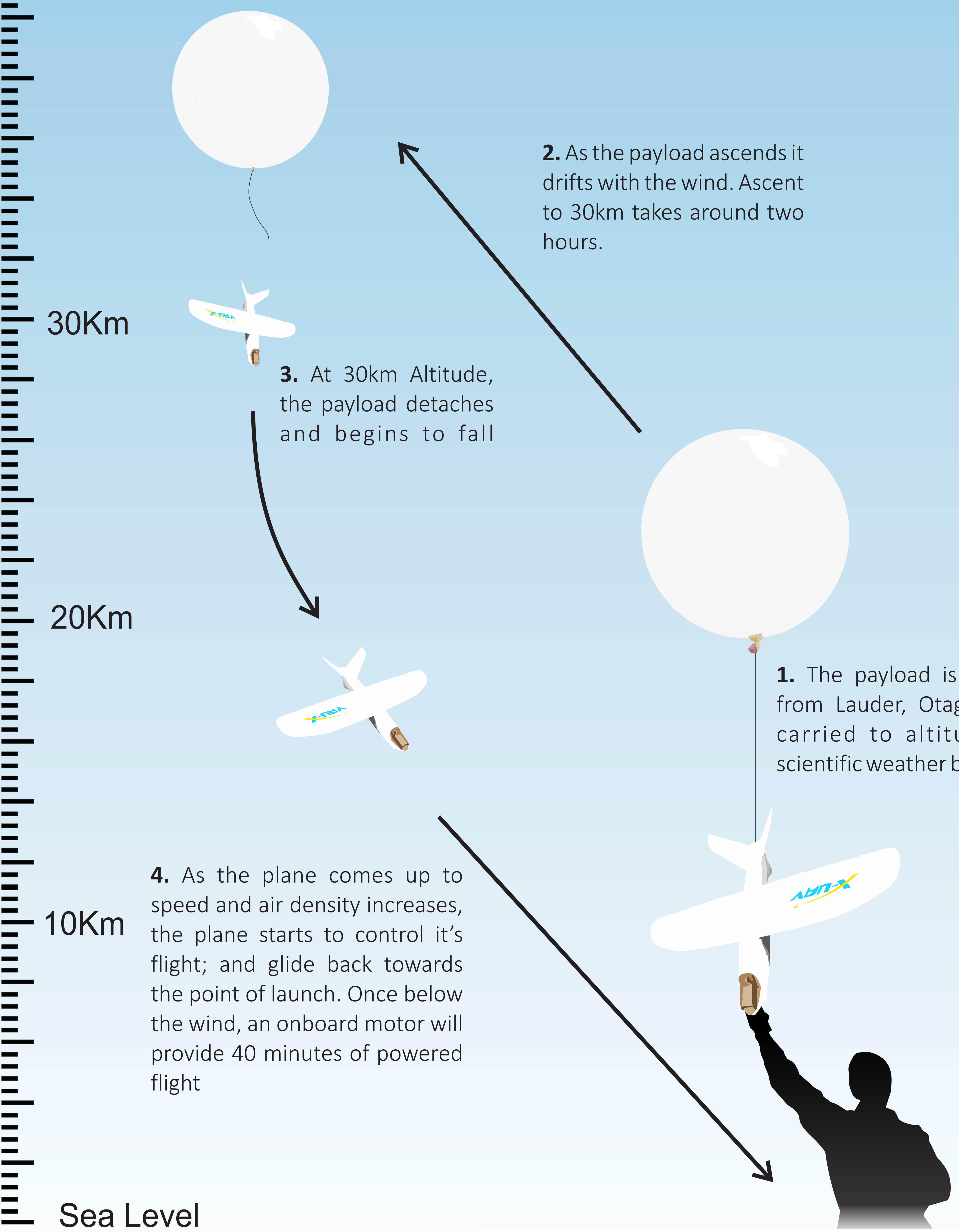
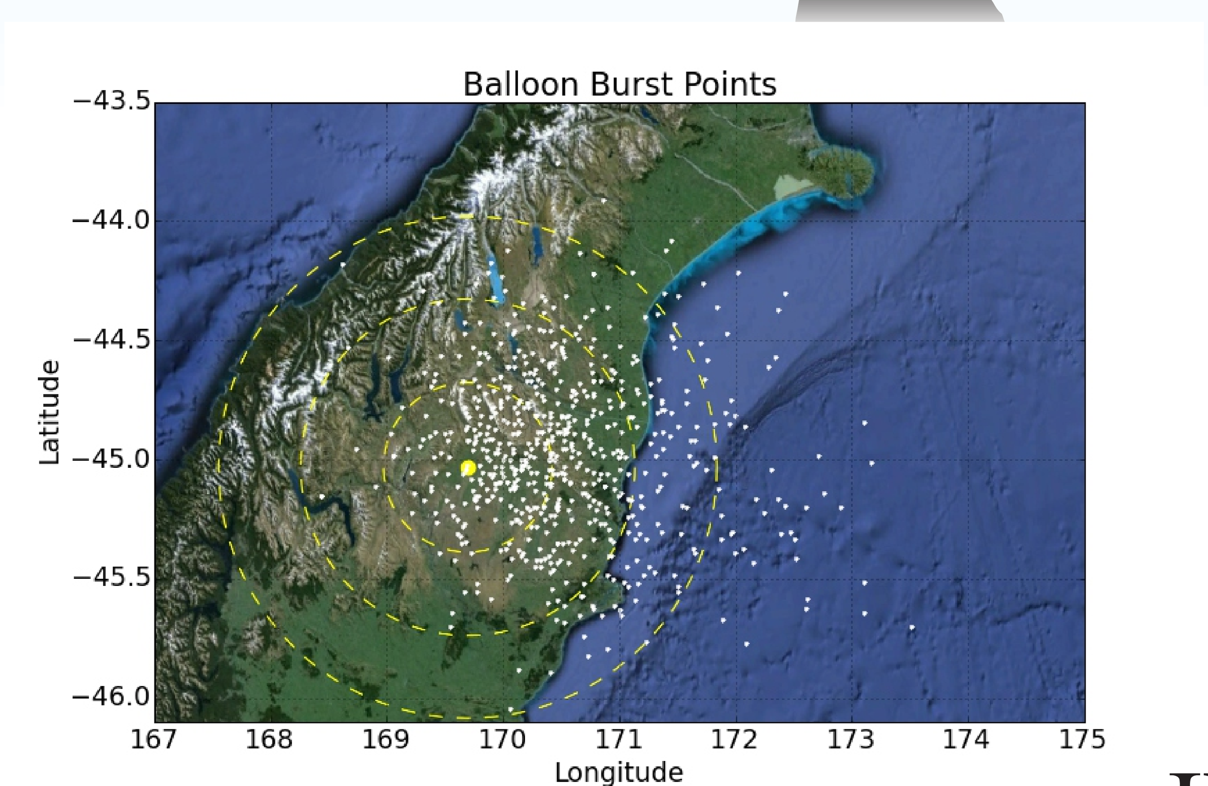



*The assembled self recovering payload*




*NIWA balloons regularly travel to distances well in excess of 100 km*

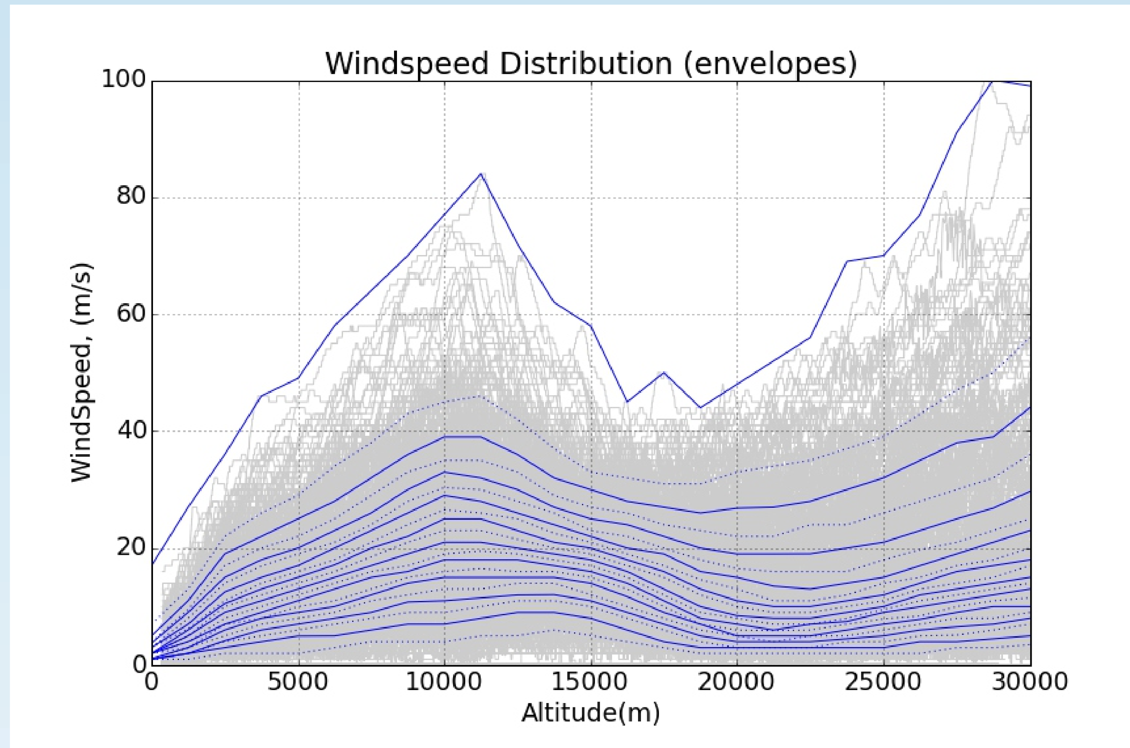
# I Introduction

On a weekly basis, NIWA launches weather balloons for high altitude atmospheric research. These balloons travel to altitudes of approximately 30km before they burst. When a balloon bursts, the on-board electronic payload falls back to Earth where it is either damaged, or lost. The payloads consist of radiosondes or ozonesondes which measure atmospheric parameters, and cost approximately NZ$800 each. The payloads are fitted with parachutes, however, these often fail to deploy. On occasions where the parachutes manage to deploy, the package is carried further from the NIWA launch location in Lauder, Otago. Currently, NIWA recovers a mere 20% of payloads, only 3% of which land within 10km of their launch base. NIWA requested that a self-recovering payload for high altitude operations be developed to return the electronic equipment to within 10km of Lauder. A successful solution would enable NIWA to launch more expensive payloads in the future.

# II Hardware & Airframe Selection

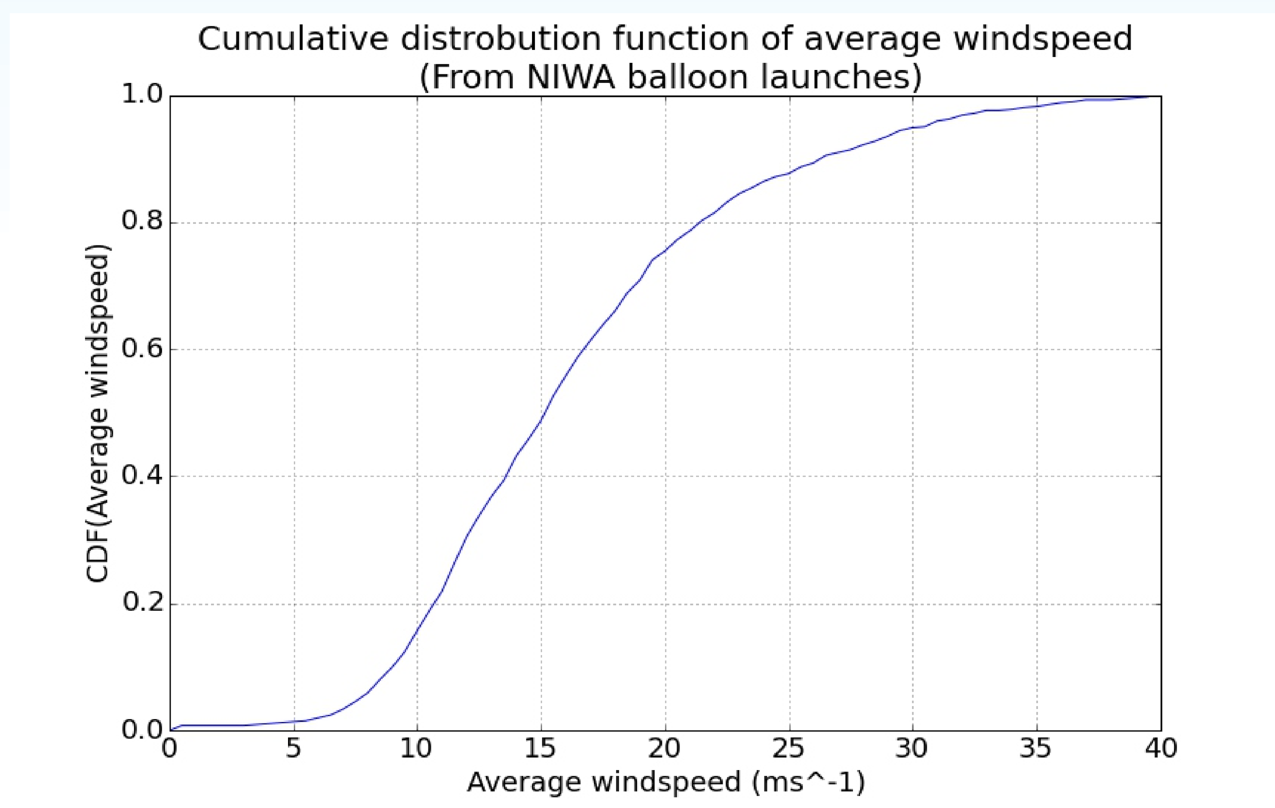
The solution to this problem was developed around the Mini Talon, fixed wing retrieval aircraft. This airframe has a short, fat fuselage and wide wings which helps it to penetrate into strong winds at high altitudes. The airframe also has the capability to keep itself from being forced out of control by strong gusts of wind. The Mini Talon features a large fuselage for carrying NIWA's electronic payloads, as well as a range of other electronics which enable recovery. A 3DR Pixhawk flight controller, with GPS, compass and airspeed sensing peripherals, is used to control the airframe's flight and navigate to the launch location. By utilising tuned PID control gains, the system is able to recover itself from potentially tumbling at high altitudes where the air density is low.

The pixhawk




# III Alternate recovery points

Overall, the Mini Talon recovery system will be able to return an estimated 30% of NIWA's electronics to within 10km of Lauder. It is recommended that NIWA should utilise secondary landing zones, such as farms or radio flyer's clubs outside of the 10km target to greatly improve the recovery rate of their electronics.




# IV Conclusion

Tests of the system prove that all hardware and software within the system is functional, and that the solution will be able to improve NIWA's payload recovery rate. Flight plans can easily be generated utilising programs written during this project. The code enables the use of secondary landing zones through the use of conditional logic to switch destinations if the aircraft is unable to return to Lauder.


## V Acknowledgements

Thank you to Richard Tier for piloting our plane, and being there when the autopilot didn't function as expected.