

## The use of a light-weight laser rangefinder as a let-down / landing aid for UAVs

### Problem

Autonomous landings of a UAV under various conditions can lead to results that vary from acceptable to disastrous. This is primarily due to the unavailability of affordable, accurate, reliable altimeters capable of supplying readings to the flight controller at a speed that would result in timeous glide path corrections. Barometric altimeters are subject to pressure changes and ultrasonic altimeters are influenced by scatter produced by various surfaces.

Expensive and heavy laser altimeters are used in larger commercial and military drones but there exists a need for a light-weight reliable instrument that would be of use to the hobbyist and the more serious UAV enthusiast.



### Objective

To evaluate the suitability of the SF02 rangefinder module as a landing aid for use in UAVs.

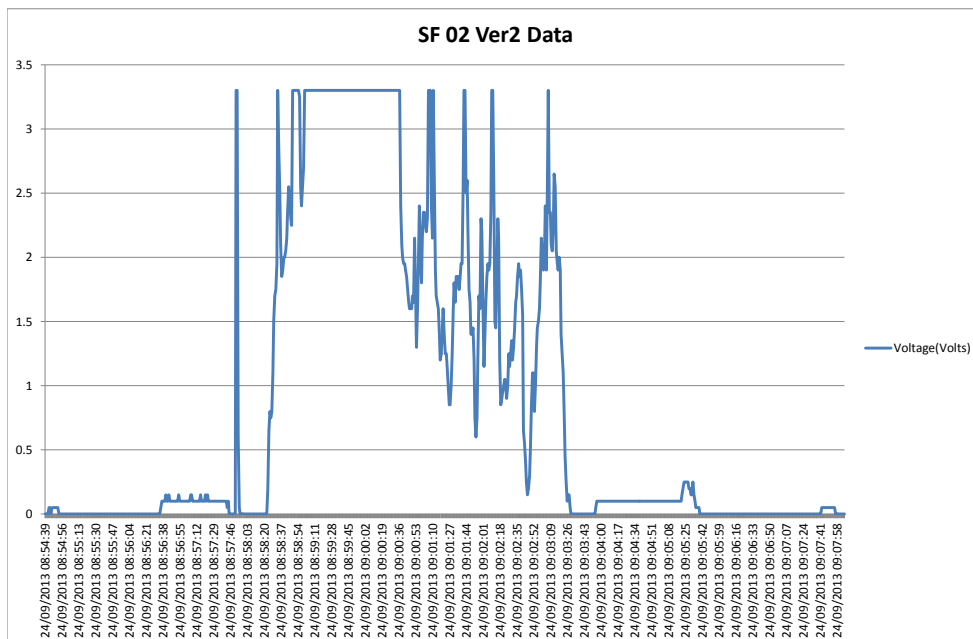
### Method

The SF02 module is a 70 gram, compact module with a useful range of 40 meters, producing 12 readings per second.

In order to test the module the following were carried out:

- The *LightWare Terminal* software was downloaded from the [www.LightWare.co.za](http://www.LightWare.co.za) website.
- The module was connected to a laptop via a USB cable.
- The *LightWare Terminal* software was opened and the "Connect" icon pressed.
- This connected the module and immediately readings appeared on the laptop. By aiming the laser at various objects it was apparent that the module was working with a high degree of accuracy.
- The next step was to attach the SF02 to the fuselage of an electric powered RC aircraft and conduct flight tests. Power to the SF02 was provided by means of a two-cell LiPo battery (7.4 volts). A data recorder was attached to the "voltage out" terminal of the SF02. The data recorder had a limit of 1 recording per second.

The results of the first flight appear in the graph below:



**Observations**

The data recorder was too slow for the purpose and produced a “stepped” tracing. The amplitude of the graph was low - small variations made the changes in altitude difficult to interpret.

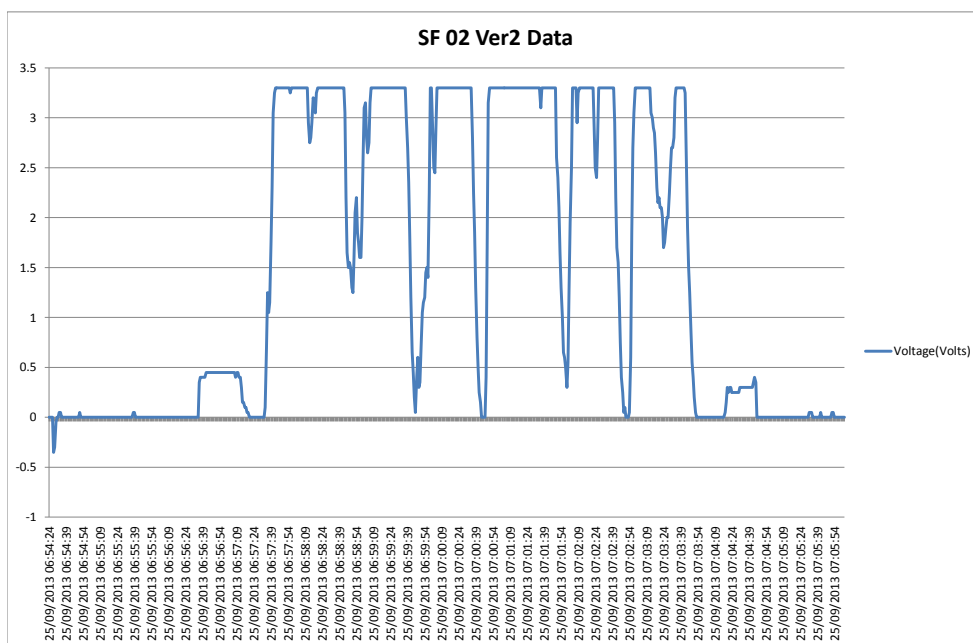
As anticipated steep banking of the aircraft resulted in the laser aiming at an angle that affected the accuracy of the measurements.

Before further flights were conducted the following changes were made:

- The amplitude of the graph was adjusted by changing the voltage output range on the SF02. This was changed from 0 volts = 0 meters & 3.3 volts = 40 meters to 0 volts = 0 meters & 3.3 volts = 10 meters.

During the subsequent flights the effect of banking was reduced by conducting “rudder turns” i.e. using the rudder to turn the aircraft while using opposite aileron to keep the wings level.

In addition to flying circuits, touch-and-goes were flown. The result of one of the flights appears below:



**Conclusion:**

The SF02 is capable of providing accurate height-above-ground measurements regardless of terrain (grass, buildings, and bushes).

**Document revision history**

| Amendment description       | Rev. | Date       | Page | Author |
|-----------------------------|------|------------|------|--------|
| Initial release of document | 0    | 2013-11-09 | All  | RDN    |