



Tech Report 5

Altimeter Adjustments

On the blog "*Rocketeer's Corner*" by Bill Cooke he posted an entry about electronic altimeters and how they work ("*Learning more about altimeters*" - <http://billsrockets.blogspot.com/2021/03/learning-more-about-altimeters.html> - on March 31, 2021). In the post he makes two observations about the altimeters used in model rocketry:

- All hobby altimeters use the same mathematical model to convert pressure to height, and
- They all assume a temperature of 59 degrees (15 degrees Celsius) in the model.

As Bill notes, this causes the reported altitudes to be off any time the temperature is not 59 degrees. When the temperature is warmer the reported altitudes are too low, and when the temperatures are colder, the altitude is too high. However, all is not lost as Bill provides a formula to calculate the correct altitude based on the temperature at launch time:

$$\text{Altitude} = \left(\frac{273.15 + T}{288.15} \right) \times \text{Altimeter}$$

T = launch temperature in Celsius

Summer Example

Our rocket is flown on a summer day with an air temperature around 29°C (84°F). The altimeter reports an altitude of 345 meters. To determine our actual altitude

- Altitude = $((273.15 + 29)/288.15) \times 345$
- Altitude = $(302.15/288.15) \times 345$
- Altitude = 1.048585806×345
- Altitude = 361.76210307
- Altitude = 361.76 meters

Winter Example

Now lets look at a winter flight where the temperature is around 2°C (35.6°F). The altimeter reports an altitude of 345 meters. To determine our actual altitude

- Altitude = $((273.15 + 2)/288.15) \times 345$
- Altitude = $(275.15/288.15) \times 345$
- Altitude = 0.9548846087×345
- Altitude = 329.4351900015
- Altitude = 329.44 meters

Despite the altimeter recording the same altitude for each flight, there was actually a difference of 32.32 meters between the two flights.

As you can see, temperature can make a big difference in the altitude of a rocket. If you are trying to determine how high your model will likely go, don't forget to include the ambient air temperature in your calculation.

If You Enjoy Rocketry, Consider Joining the NAR

If you enjoy model rocketry and projects such as the Arduino Launch Control System, Project:Icarus, The Dyna-Soar and others, then consider joining the National Association of Rocketry (NAR). The NAR is all about having fun and learning more with and about model rockets. It is the oldest and largest sport rocketry organization in the world. Since 1957, over 80,000 serious sport rocket modelers have joined the NAR to take advantage of the fun and excitement of organized rocketry.

The NAR is your gateway to rocket launches, clubs, contests, and more. Members receive the bi-monthly magazine "Sport Rocketry" and the digital NAR Member Guidebook—a 290 page how-to book on all aspects of rocketry. Members are granted access to the "Member Resources" website which includes NAR technical reports, high-power certification, and more. Finally each member of the NAR is covered by \$5 million rocket flight liability insurance.

For more information, visit their web site at <https://www.nar.org/>

