# Focused

The Valley of the Moon Observatory Association Newsletter
(a non-profit science and astronomy education organization)

ROBERT FERGUSON OBSERVATORY

**Summer 2015** **Volume XVIII Number 3**

## Hey! What's Going On Out There?

*By Robert Davis*

For those of you who have been a part of RFO for as long as I have you may recognize that title. It is the title I gave my first Docent Meeting Space Exploration Update Presentation thingy. I decided to dust it off for this article because there is a lot going on out there. I've touched on a couple of current missions but mostly talking about their journeys. I'm going to start with another journey. This journey is exceptional not for its seemingly insane path (like Rosetta) or its use of new technology (like Dawn). It is exceptional because of its destination. If you haven't guessed it I am talking about New Horizons and its flyby of Pluto.

At the instant of typing this sentence, New Horizons has been travelling at over 50,000 mph for 3,435 days, 1 hour, 53 minutes and 16 seconds and will reach its closest approach to Pluto in 27 days, 14 hours, 56 minutes and 41 seconds (40, 39, 38…). Technically it didn't hit its top speed until it got its gravity assist boost from Jupiter but at the time of its launch it was moving fast enough to reach the Moon in about 8 hours and 35 minutes. This was achieved (according to a really nice video on the John Hopkins mission web site: http://pluto.jhuapl.edu/) by placing New Horizons on "America's biggest, baddest rocket tricked out with every conceivable booster". Apparently the combination of a monster rocket and New Horizon's light-weight design was "ferocious". For some reason I'm starting to feel a little older.

No matter what type of object you believe Pluto to be the fact remains that it is a relatively small object in the solar system and a long ways out there. Even Hubble has a difficult time getting a decent image of it. In theory I've seen Pluto in the eyepiece. The specs for my telescope say Pluto is "bright" enough to get at but I couldn't tell which faint pinpoint of light it was (if it was even visible). New Horizons is already sending back tantalizing images of Pluto, which is its primary target. After getting closer to Pluto than ever before the mission scientists are hoping to extend the mission to explore the Kuiper Belt, a region extending outward from Neptune some 2 billion miles. It is estimated to contain tens of thousands of objects that we are just starting to discover. We may find something very interesting out there so stay tuned.

*(turn to* **HEY** *on Page 6)*

**http://www.rfo.org**

## Public Events at Robert Ferguson Observatory

**July 11, Saturday**
Public Solar Observing 11 am – 3 pm
Public Observing Night 9 pm

**July 18, Saturday**
Public Solar Observing 11 am – 3 pm
Public Observing Night 9 pm

**August 8, Saturday**
Public Solar Observing 11 am – 3 pm
Public Observing Night 9 pm

**September 19, Saturday**
Public Solar Observing 11 am – 3 pm
Public Observing Night 8 pm

**October 10, Saturday**
Public Solar Observing 11 am – 3 pm
Public Observing Night 8 pm

**November 7, Saturday**
Public Solar Observing 11 am – 3 pm
Public Observing Night 6 pm

Evening public viewing is $3 per adult, 18 years or older, plus $8 per car parking fee. Donations accepted. Dress for cold nights!
For current observatory information call: (707) 833-6979.

### RFO Classes (see Page 3)

**Night Sky Summer Series**
July 7 & 14 August 11 & 18

**Night Sky Fall Series**
September 15 October 6 & 13
November 3 & 10 December 8

Be sure to check out our new website at http://www.rfo.org for more interesting astronomical events and information.

**Focused**

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***VMOA Mission Statement***
The VMOA is a group of volunteer amateur and professional astronomers organized as a non-profit association to provide educational programs about science and astronomy for students and the public. To that end, the VMOA operates the Robert Ferguson Observatory in Sugarloaf Ridge State Park in association with California State Parks.



# President's Message

*By Robert Davis*

The other evening I drove up to RFO to provide a presentation for a private event and it was raining. It wasn't raining everywhere, just in the vicinity of where I was going to park. It seemed I had inadvertently arrived during an inclement weather test. A couple of docents were in the process of testing the rain sensor that is in charge of automatically closing the roof of the east wing if things start getting a little wet. It is one of the remaining details of a fully functioning automated imaging system, and the docents that were testing it are members of Team RAX. While the rest of us have to climb ladders and pull ropes, a small team of dedicated insomniacs (although they may have not started out that way) have been setting up a system that will allow them to make observations from the comfort of their homes. Eventually the system may even make observations on their behalf while they sleep (thus potentially curing their insomnia). I'm joking around a bit, of course. For those of you who are not familiar with what I'm talking about, this is a project that has been in the works for years. The initial idea was to be able to go to a remote location, such as a school, set up a computer with an internet connection and a projector, link to the imaging telescope, and show folks the wonders of the Universe. In other words, bring RFO to the students instead of the students to RFO. All that one would have to do is find a way to turn the power on for all the equipment, open the roof while visually inspecting that the roof wasn't going to somehow plow into the telescope, maintain security when there was nobody actually at the observatory to keep an eye on things, and run the system from a computer at a distant location. Sounds easy enough but it has been quite an undertaking, and the vast majority of the pieces are in place. I'm not an active member of Team RAX. In fact, I wouldn't even know how to fire the system up. And that is ok. It has been fun to watch it all come together and it will be fun to watch it blossom to its full potential.

There is another team I would like to give kudos to and that is Team Project 40. At our last board meeting they announced that the mirror is ready to be coated. This project has been in the works since before I came on board back in 2002. When RFO has public star parties, I like to bring my personal telescope up to share with the visitors. There are a handful of us that are pretty regular "small scope" operators. I have a commercial dobsonian but every now and then somebody asks me if I built it myself. My usual response is "I don't have enough patience to grind a mirror". But there are people that do – and some of them have enough patience to grind really big mirrors over the course of a few years. They also have the technical know-how and patience to design and redesign optical tube assemblies and drive gear

*(turn to* **PRESIDENT** *on Page 7)*

# RFO 2015 Class Schedule

## Night Sky Classes

Each class includes a lecture on the constellations of the season, their history and mythology, and how to find objects within them. Learn the bright stars, deep-sky objects, and visiting planets of the night skies. After each presentation (sky conditions permitting), you will enjoy a review of the constellations in the actual night sky and learn how to find them for yourself. The constellations, and the objects within them, will be viewed through binoculars and telescopes, including the Observatory's 24-inch reflecting telescope, until or beyond 10:30 pm (depending upon interest and enthusiasm).

The continuing Summer Series classes will be held on Tuesday, July 7 & 14, and August 11 & 18 at 8 pm.
The upcoming Fall Series classes will begin on Tuesday, September 15 at 7 pm.
The Fall Series classes continue on October 6 & 13, November 3 & 10, and December 8 at 7 pm.
Fee: $75 for 6-class series or $23 for a single class
E-mail: nightsky@rfo.org to reserve a space in this popular class
Look for more information about RFO's Night Sky Classes online at http://www.rfo.org

## Observing Labs

An intensive telescope observing session after a brief presentation on the night's theme.
Handouts/Observing lists provided.
Attendance limited to 6.
Fee: $30.
For reservations, email: nightsky@rfo.org
The next scheduled Observing Lab, 'Star Death: The End of Stellar Fusion', is Saturday, September 12 at 7:00 pm
Look for more information about RFO's Observing labs online at http://www.rfo.org

# RFO Partners with Sonoma Ecology Center on School Field Trips

The Sonoma Ecology Center is piloting educational programming at Sugarloaf Ridge State Park for students in grade levels K-6 from all over Northern California. The programming incorporates watershed education, local flora and fauna, park stewardship and history, fitness and recreation, and now includes RFO's astronomy education. The RFO curriculum includes Solar viewings, Planet walks, and discussion of basic physics provided by RFO docent Loren Stokes.

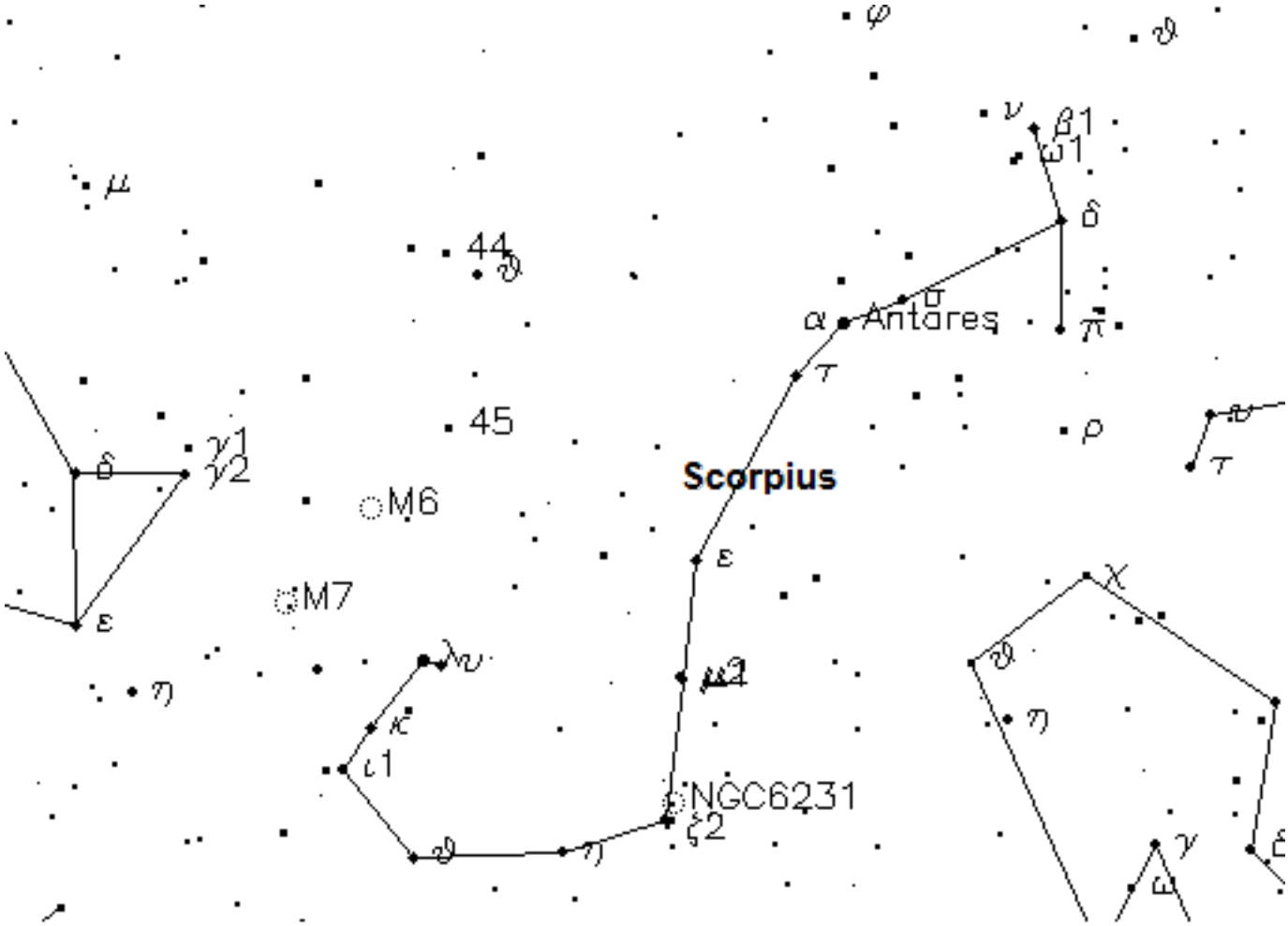
All of the lessons incorporate hands-on, active learning styles that incorporate the newly implemented Common Core standards to assist teachers in their science education outside of the classroom.

The new program began this spring and guided nine fieldtrips free of charge to the schools. With future funding, the Sonoma Ecology Center and RFO would like to continue and expand the programming to more schools in the area.

# Watching the 2015 Spring Sky

*by Jack Welch*

First, a moment to consider the lovely bright summer Milky Way constellation of *Scorpius*, with its unmistakable scorpion-shaped asterism (see accompanying figure). Scorpius rises above our southern horizon for only a short time during the evenings of late spring and early summer so we need to make an extra effort to appreciate its wonders. The very bright red supergiant star *Antares* marks the scorpion's heart. Antares is one of the closest stars that is nearing a massive supernova explosion! But, at about 600 light-years, it is probably far enough away that we needn't worry that it will harm us.




While there are many worthwhile objects in Scorpius for observers, I would like to highlight three very bright and lovely open star clusters that are often overlooked due to their southerly locations. Two are Messier objects, M6 and M7, both located near the scorpion's stinger. M7 is apparent to the naked eye as a bright patch and is very rewarding to binocular viewing. It is known as *"Ptolemy's Cluster"* in honor of the 2nd Century astronomer who first recorded its existence. It is quite close to us as such clusters go at about 900 light-years.

Moving one's binoculars a short distance northwest from M7 to spot the smaller but distinctive *"Butterfly Cluster"* (M6), which is almost twice as far as M7 at about 1600 light-years. It's not too hard to imagine the outline of a butterfly in this compact cluster of bright bluish stars (though with one bright yellow star). Small but distinct in binoculars, it is very rewarding to telescope views. Last but not least is the bright and lovely cluster *NGC6231* immediately north of the star zeta-2 Scorpii. This cluster is about 6000 light-years away in the *Sagittarius Spiral Arm* of our galaxy, the next spiral arm inward toward the center of the galaxy from our position in the *Orion Arm*. Due to its distance, this is a more challenging binocular target but is especially nice in any low power telescope.

Most noticeable as summer begins this year is the pairing of bright *Venus* and *Jupiter* in the western evening twilight. Jupiter drops even closer to Venus during June until the pair come *very* close together on the evening of 6/30. Those with telescopes will want to compare

the two planets this evening, noting that they will have almost identical disk sizes, with Venus in large crescent phase. Venus is approaching earth on our side of the sun, while Jupiter is far away on the opposite side of the sun.

Venus will disappear into the sunset by the end of July and reappear in the morning sky around the end of August. The crescent moon is near Venus on the evening of 7/18 and again around 5:30am on 9/10 when the moon will be between Venus and Mars. (*Mercury* has two very poor apparitions this summer so is not really viewable.) Jupiter disappears by mid-July and reappears in the morning during mid-September.

*Saturn* is in the evening sky all summer in *Libra* but very close to *Scorpius*. It is best for telescope viewing until about the end of August, though it will be fairly low in the sky. The moon is near Saturn on the evenings of 6/28, 7/25 and 9/18.

*Uranus*, in *Pisces*, will be good for telescope observing during a.m. hours of August and September as it approaches opposition in early October. *Neptune* is at opposition in *Aquarius* on the evening of 8/31. It reaches magnitude 7.8 and a disk size of 2.4". For telescope observers who like special challenges, *Pluto* is at opposition on 7/6, *Ceres* is at opposition on 7/25, and *Vesta* is at opposition on 9/28. (Consult references for details.)

Besides the pairings already noted, the *moon* will be very near the bright orange-red star *Aldebaran* in *Taurus* around 4am on 7/12, around 3am on 8/9, and again around 1am on 9/5. We have a "blue moon" in July with full moons on the 1st and 31st. The moon occults the bright star 82 Virginis around 8:34pm on 8/19 (telescope required). And there is a total lunar eclipse, partially viewable locally, on the evening of 9/27. The moon rises just before sunset with the eclipse in progress. Totality is from 7:11 to 8:22pm, with the moon exiting earth's umbra at 9:26pm. This full moon is the largest of 2015.

August begins a special sequence of three months with very large tides around the full moon: about 8/30 to 9/3 and again 9/28 to 10/1. The tides around 9/29 will be especially extreme due to a fairly rare combination of optimum alignments of the sun and the moon's orbital elements. (The total lunar eclipse on 9/27 is related to this alignment!)

Viewing conditions are highly favorable for the *Perseid Meteor Shower* this year with the peak expected sometime around midnight on the evening of 8/12. RFO will be open to the public that evening for meteor viewing. The Perseids last for many days around the peak and become viewable around 10pm or so until about 5am, with best viewing in the a.m. hours.

From 9/11 to 9/24 the *Zodiacal Light* is visible in the east before morning twilight. This glowing band of light is caused by sunlight reflecting off of fine particles in the plane of our solar system (the "ecliptic plane"). It appears as a tall tilted tapering triangle of light with its base in the ENE, rising through *Leo*, continuing through *Cancer* (the glare of Venus low in Cancer interfering and making discernment of the Zodiacal Light a bit more challenging) and then losing itself in the glow of the Milky Way in *Gemini*. It can easily be mistaken for light pollution if you are not aware of the phenomenon. A clear and dark eastern sky is essential. It is easily visible from Sugarloaf Ridge State Park. Look for it between about 4:40 to 5:20am.

For additional sky events and details, use the "What's Up in the Night Sky" link on our website. Or join our email list (link on website) and receive monthly emails with sky-watching details and more. The summer officially ends with the *autumnal equinox* at 1:21am on 9/23.

# "Before Telescopes"

## From Stonehenge to Galileo

Public star parties now include a popular series of presentations on the History of Astronomy by Docent John Dillon. Each lecture focuses on a different point in history.

The first two topics in the series were:

First Light: what prehistoric star gazers knew and how they knew it.

Astrologonomy: Babylonians and the Astronomy of Astrology

Exploring what early astronomers learned without telescopes—just sharp eyes and sharp minds— is a good way to understand the basics of observational astronomy.

# Finding More Near-Earth, Asteroids

*By Loren Stokes*

In 1998, the US Congress directed NASA to initiate the Spaceguard Survey to find 90 percent of Near-Earth Asteroids (NEAs) larger than 1 kilometer within 10 years. By 2011, NASA met its goal finding more than 900 NEAs larger than 1 kilometer. How do we know this is 90 percent of apparently 1,000 large NEAs? It is based on how many "new" NEAs discovered turn out to be already known, but in a new position in the sky. None of these 900 NEAs are on a collision course with Earth. The missing 100 NEAs will eventually be found when their elliptical orbits take them closer to Earth.

Recently, Congress called for NASA to find 90 percent of smaller NEAs that are larger than 140 meters by 2020. There are over 2,000 known NEAs in the 140-meter to 1,000-meter range, and over 15,000 are suspected. A small, privately funded space telescope called Sentinel will be the major tool in finding these NEAs. The $450-million project is funded by the B612 Foundation, which was founded in 2002 by Apollo astronaut Rusty Schweickart and three others. The proposed launch date is 2019 followed by 6.5 years of operation.

Sentinel has a small 0.5-meter diameter telescope with a very wide field of view of 11 square degrees. That is 50 times the area of the full moon. Sentinel will have a 30-megapixel infrared camera that needs to be cooled to -208 degrees Celsius. The telescope itself is an off-axis configuration with no telescope structure in the camera field of view. This exotic design is necessary because NEAs are very dark in the visible wavelengths, but emit heat in the infrared wavelengths. Indeed, it is absorbed visible light from the Sun that heats NEAs causing them to emit the infrared light.

Sentinel will orbit the Sun similar to the orbit of Venus, but on the opposite side of the Sun. It will look at the sky continuously in a hemisphere opposite the Sun. As it orbits the Sun, it will see the entire sky every seven months.

The algorithm to find NEAs is quite clever. Sentinel will image its present hemisphere of the sky four times every 26 days. Further, each image is actually a pair of images separated by one hour. So in 26 days, an NEA will show up as a pair of objects (separated by one hour of motion against the background stars) at four different locations along a smooth arc of sky. This arc gives an indication of the NEAs actual orbit. Over the mission life, precise orbits of each NEA can be calculated along with the possibility of a collision course with Earth.

The potential devastation caused by a 140-meter NEA is enormous. Consider the 1908 Tunguska event in Siberia. It was caused by a 40-meter asteroid with a kinetic energy of several megatons of TNT. The 2013 event over Chelyabinsk, Russia was caused by a 19-meter asteroid with a kinetic energy of half a megaton of TNT. A 140-meter NEA could have the kinetic energy of over 100 megatons of TNT. As for a 1000-meter NEA, how about a kinetic energy of 40,000 megatons of TNT!

The potential number of NEAs to be found by Sentinel is enormous. In the 6.5-year mission, 90 percent of the roughly 15,000 NEAs of 140 to 1,000 meter size should be found. In addition, some 100,000 NEAs 50 to 140 meters, and 200,000 NEAs 30 to 50 meters could be found, given Sentinel's position and sensitivity. But that is perhaps less than half the number of small (30 to 140 meter) NEAs out there.

Reference: "A Sentinel for Space", Harold Reitsema, IEEE Spectrum, May 2015.

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(**HEY** *from Page 1)*

Philae has come out of hibernation. The little lander that made history as the first spacecraft to land on a comet (67P/Churyumov–Gerasimenko) last November, landed in shadows and was not receiving enough sunlight to keep its batteries charged. Scientists speculated that as the comet got closer to the Sun Philae would receive more light, charge up and wake up. On June 13 they got the signal. At the time of this writing they have just been receiving what they are calling housekeeping data but it is enough to tell mission control that the subsystems are working nominally (or maybe I should say they are "totally kicking" … "whatever"). As it builds up power it will start sending more scientifically interesting data about its surroundings. And Rosetta is still hanging about taking in its own readings of the comet. So for the first time in history we are riding a comet towards the Sun. We may learn something very interesting so stay tuned.

And let us not forget about Dawn and those bright reflective patches on Ceres. In our last episode I was hoping they would turn out to be observatory domes, but the closer Dawn gets the less it looks that way. Dawn is currently orbiting Ceres at a height of 2,700 miles,

but after June 28 it will start working its way to down to 900 miles above the surface. While ice seems to be the most likely candidate, some sort of mineral salt is still in the running. Whatever it is, nothing like it, on this type of object, has been seen before. It could be interesting so stay tuned.

There is a new thing to watch for in the sky. If you are not familiar with the website Heavens Above (www.heavens-above.com) you might want to check it out. One of the services it provides is a listing of man-made satellites that can be seen from your specific location on Earth. Things like the International Space Station and Iridium Flares, which are fun to watch. I logged on the other day and there was a new object in the list: LightSail. It turns out that The Planetary Society launched a new experimental spacecraft that uses a solar sail for propulsion. They launched phase one in May and will launch the full-fledged craft in 2016. It is a citizen-funded project, which has raised over 4 million dollars. Citizen-funded space exploration – could be interesting. Stay tuned.

This next bit has nothing to do with the exploration of outer space. It is more like exploring inner space, which I also find fascinating. The Large Hadron Collider is back in business. After discovering the Higgs particle the LHC was shut down for a major overhaul. At 10:40 am on June 3rd, the LHC operators declared "stable beams" meaning that the LHC experiments can start slamming protons together at an unprecedented energy of 13 TeV. I'm not quite sure how to translate that but at the very least it's epic. They are expecting to get up to 1 billion collisions per second. They already found "The God Particle" so what are they after now? They would like to understand things like why did matter win out over antimatter in the Big Bang. They could prove or disprove Supersymmetry as an extension to the Standard Model of particle physics. They might even discover the nature of dark matter, or find something completely unexpected. Do I even need to say it?

(**PRESIDENT** *from Page 2)*

assemblies and the like. Sometimes I overhear some of them talking to each other and I don't always understand what they are talking about. And that is ok. I'm going to enjoy looking through a forty-inch telescope, even if I don't understand the gear ratios and torque of the drive motors.

One more group that needs calling out is the group that makes RFO happen – the docents. There are times when the observatory gets a little busy. This June is a prime example. Looking at the calendar, I see two public star parties, seven (SEVEN!) private events, two Night Sky classes, and a work party. I've seen emails come through from docents that have gone up to do maintenance, and there are docents that manage the other docents that volunteer to work all of these events, and print schedules, and keep the books, and schedule the private events, and get the mail, and the list goes on. At the time of this writing we are half way through the month and while it hasn't been absolutely smooth sailing we've managed to get the job done, and I have complete confidence that we will get through the rest of the month just fine. Just a few examples of groups of dedicated individuals achieving amazing things.

# Current RFO Weather

As a side benefit from the remote observing Team RAX project described in the President's Message, the RFO web site now posts current weather directly from the observatory's own weather sensor. Docents and visitors no longer have to wonder whether the weather report they are referencing accurately represents the weather up in Sugarloaf Ridge at RFO. Just check the RFO web site!

Temperature

75.7°F

Humidity

33%

Wind

1.5MPH

Clear, Calm, Dry, Very Light

Jun 19, 2015, 9:25 AM

***Current weather is updated every five minutes with data collected by the Boltwood Cloud Sensor-II installed at the Robert Ferguson Observatory.***

# Valley of the Moon Observatory Association

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