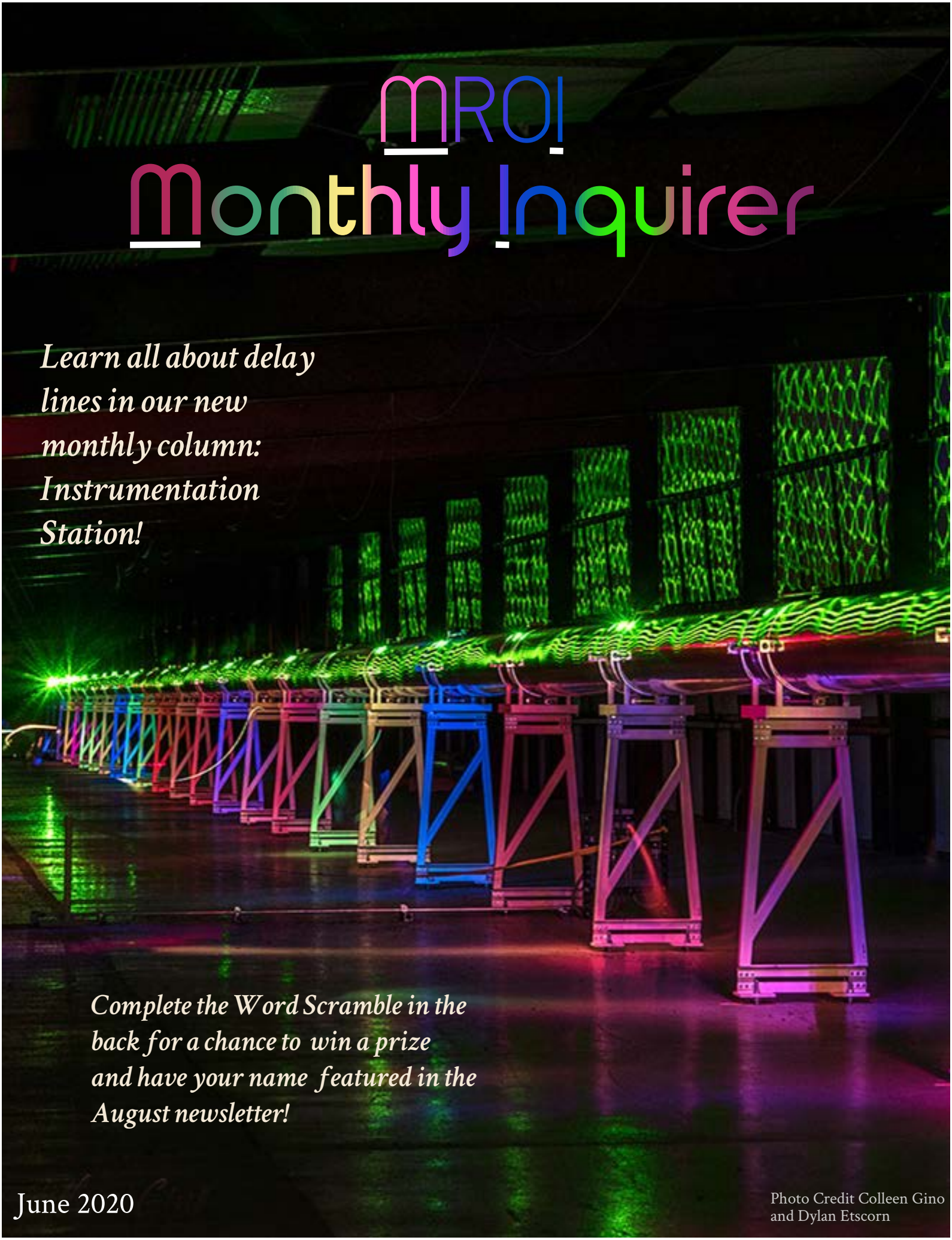
MROI Monthly Inquirer



Learn all about delay lines in our new monthly column: Instrumentation Station!

Complete the Word Scramble in the back for a chance to win a prize and have your name featured in the August newsletter!

June 2020

Photo Credit Colleen Gino and Dylan Etscorn

Letter from the Director

Dear Friends,

The clouds hang low and grey and there is thunder all around. Two hours ago the sun was shining brightly and MROI Outreach and IT staff were testing our new streaming software for the first time as the International Space Station transited the sun. That's spring in New Mexico.

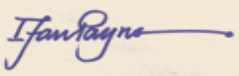
We are currently testing software and hardware in order to be able to offer online virtual star parities and this was our very first attempt at trialing the software. And it worked! Well sort of, the bright sun filled the screen and from San Antonio to Santa Fe those of us who dialed into the streaming session could make out the ISS, just. Or was that fuzzy dot our imagination?

As Thomas Edison had intoned a barely discernable nursery rhyme down the nascent telephone line to his assistant, so we are also taking our own first baby steps towards setting up virtual star parties from the Observatory.

Watch this space! We should be online and advertising those parties soon. Edison could never have imagined how his invention change the world and would spawn today's social media and cable news channels, let alone online virtual star parties.

Together, we will gaze at the wonders of the cosmos, separated by continents but joined by the umbilical internet cord.

The thunderstorm has passed and blue sky is already peeking through the clouds. It is spring in New Mexico!



Our sincerest thanks to Geraldine Klinglesmith for her generous donation given in memory of Daniel A. Klinglesmlith III. All of us at the MRO miss Dan dearly and are so very appreciative for your generosity and continued Friendship. Thank you,
Geraldine.

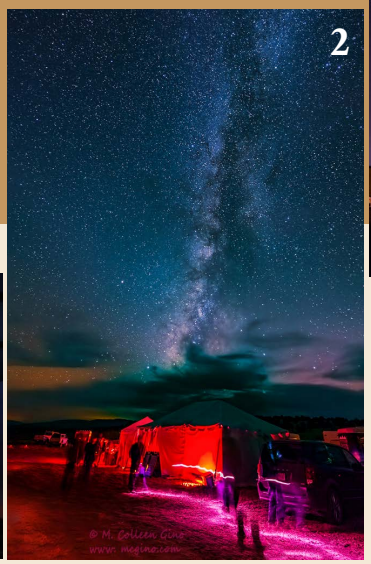
Want to be the first to know all the news and updates coming out of the MROI with early access to our monthly e-newsletter? Want our exclusive yearly newsletter mailed straight to your door? How about a private dinner and tour at the Observatory for you and seven of your friends? Or maybe you'd just like to support the advancement of science and astronomy in your community?

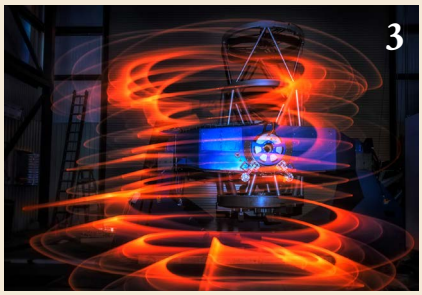
Do all of this and more by joining the Friends of the MRO. Go to our website to find out more: http://www.mro.nmt.edu/support-mro/

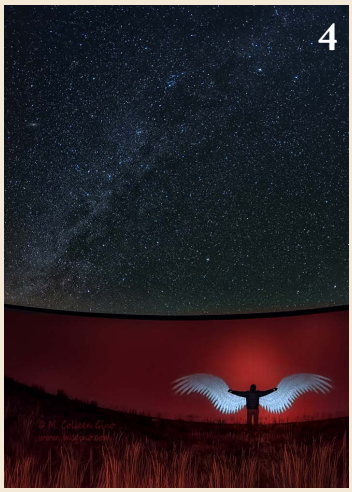
Stay up to date with all of MROI's monthly newsletters at http://www.mro.nmt.edu/news/newsletter/.
Click the links below to access new content being uploaded across all our platforms!

From the Photographer

By: Colleen Gino







Light painting is an art form using various sources of light to create a pattern or illuminate objects in a dark scene and captured by taking a long exposure photograph. Exposure times for such photographs can range from a few seconds to an hour or more, and the resulting images are unlike anything you could see with your naked eye. To create a light painting photograph you need to use a camera on which you can control the shutter speed and a tripod to keep your camera steady for the length of the exposure.

In its simplest form, parts of a dark scene are illuminated with a light source such as a flashlight. This is the method I used in the images numbered 4, 7 & 8. In image 4, the subject was illuminated with a red flashlight, then the wings were created by flashing an image of wings on the wall behind him with a camera strobe light attached to a special device much like a miniature slide projector. In image 7 I "painted" the walls of the canyon with a red flashlight, then painted the telescope observer from behind with a flash unit. In image 8 I painted the foreground and structures with a red flashlight from a distance. Had the structures not been illuminated in this way, they would have appeared as silhouettes. This method of illuminating objects was employed on the cover image as well, although it was more involved because we used a color-changing flashlight to illuminate the delay line's supporting structures, and a laser light to illuminate the delay line and walls. The camera shutter was open for more than five minutes in this image.

A more complex method of light painting is to move through the dark scene while creating a pattern with the light source(s), which is usually a specialized light painting tool such as those shown in image 5. The tool is connected to a light source (flashlight), then moved in a controlled motion to create the desired pattern. Images 1, 3, and 6 are examples of this method. The image on the back cover is similar, with the difference being that the light sources used to spell out MROI were sparklers rather than typical light tools.

It is also possible to create a light painting effect simply by taking a long exposure in a dimly lit scene, as in image 2. In this case the tent appears red not because it was painted with a red flashlight, but because the inside of the tent was lit with red lights. The light streaks in the scene were from the flashlights people were using to illuminate their way in the dark as they passed by my camera.

Another method of creating an intriguing light pattern in the dark is steel wool spinning. While it can be considered a type of light painting, it is in a category all its own. To create this type of image, you stuff a metal whisk with steel wool, ignite the steel wool using a lighter or 9v battery, then spin the whisk, which is suspended on the end of some type of cable, until the steel wool burns itself out. This is what was done in image 9. This method is not for the faint of heart, as you really are "playing with fire". Moreover, you must be extremely cautious of how and where this activity is carried out, as the sparks from the steel wool can easily start a fire. However, with the proper precautions you can safely produce a stunning image.

Since I discovered the art form of light painting about 5 years ago, it has become one of my favorite photography genres. I've involved dozens of friends in the process of creating various types of light paintings, and as far as I can tell they've all enjoyed the process as much as I have. So the next time you find yourself in a dark setting with a camera, tripod, and a flashlight or two, you might want to try your hand at painting the night with light!

To see more light painting images, you can visit the photographer's Flickr page at https://www.flickr.com/photos/inlightful/albums

Use a QR scanner app or your phone's camera on the image to the left to see a timelapse video of the image above.

MROI Vehicles Volunteered to Aid in Relief Effort for Navajo Nation

By: Shelbi Etscorn

Photo credit to Tara Jaramillo. Her facebook post regarding the incident can be found here https://www.facebook.com/photo.php?fbid=655563975001406&set=a.172011100023365&type=3&theater

Now, more than ever, it is vital that we as a community support one another. In this regard, the MROI proudly stepped up to aid the Alamo community by helping to deliver water, an undertaking that took combined efforts of local government, community members, and the quick thinking and driving spirit of Tara Jaramillo, owner of Positive Outcomes, Inc.

On May 1st, a water truck was loaned by the MROI to be filled with water from the nearby community of Magdalena. Socorro County employees then drove the precious cargo to Alamo, a rural community and the largest found in the Alamo Navajo Indian Reservation.

"They have approximately 3000 people living in the area. Many areas must haul water for daily use. Electricity is not always available nor is cell phone service. Food insufficiency is often an issue as well," Tara Jaramillo said of the issues currently faced by the people living in Alamo.

These issues were compounded by the spread of CoVid-19, but Jaramillo, Positive Outcomes, Inc, and countless others rose to the challenge to help our fellow New Mexicans. "We began a food distribution for the families whom we serve and quickly had more requests. Two weeks later we participated in an even larger food distribution campaign with donations from the City of Deming and [the] NM Wild Life association. We were able to distribute 3000 pounds of food and water. Verizon also hoped [sic] on board and brought a satellite hot spot tower and distributed 25 phones to the area. In the weeks that followed, we received donations of gallons of hand sanitizer, water and face masks from Sen. Heinrich and Rep. Torres Small and we began to share stories of homes without water."

"Water is the only vaccine we know that will stop this. We need it to sanitize and we need it to live."

One evening, Jaramillo received a phone call from a community member requesting help in getting water to the area. "Harold Peralto shared that the shelter-in-place and 57 hour curfews were making it almost impossible for people to collect and store water that was gathered at a local windmill. He asked that I come out and see the area. Harold's words, 'Water is the only vaccine we know that will stop this. We need it to sanitize and we need it to live.'"

Jaramillo reached out to Socorro mayor Ravi Bhasker and together they began to formulate a plan that would bring water to the people most in needt. Eight 500 gallon water tanks were purchased and calls for help were sent out to New Mexico Tech and Magdalena. It was at this time that the MROI water truck was offered as a means of transport.

Normally, the MROI uses the truck to bring water up to the observatory. "There is no infrastructure that pipes water up to the top of the mountain, so we have to fill up the water truck here in Socorro and drive it up all the way to the top of the mountain and fill the tank up there one truck load of water at a time," says MROI's Lead Engineer of Operations, Isaac Salayandia. "We occasionally will use the water truck for maintaining the road but that is a bit more of a rare occurrence for us."

"Many wonderful people from the community came together to solve a problem for this area", says Jaramillo. "However, the fight is not over. Alamo still requires assistance through this pandemic. This community of 3000 has had 32 cases and lost 2 members. The needs are vast and the fear immense and they are now within the "hot spot". of New Mexico's fight of Covid-19. Positive Outcomes continues with distribution of masks and gloves to the clinic and EMS, toilet paper, bleach and food throughout this pandemic and hope to support Alamo to better days in the future."

A link to a donation page and information on how to help were provided by Jaramillo and can be found below.

Donation site for tribal communities:
Native American Relief Fund - New Mexico Community Foundation

Localized donations can be made directly by contacting the Alamo Navajo Tribal Council representative Inez Herrera:
Administration:
575.854.2543
Clinic:
575.854.2626
Address:
PO Box 5907

Student Starlight

Siavash Norouzi

Masters student of Computer Science

Siavash has been working at the MROI since May of 2019.

He is currently working on developing software for the MROI's Automated Alignment System (AAS), a system being developed for automated operation of array alignment. Many functions necessary for array operation, such as star alignment and rapid drift correction "cannot be carried out manually within reasonable time constraints, so this is what the AAS does", Siavash explains, "This is what I'm working on right now as part of the software team and part of the AAS team."

After graduating, Siavash hopes to remain with the MROI as a regular staff member.

Working at the MROI has given Siavash opportunities for "making friends, developing networks, and meeting people with outstanding backgrounds and expertises: the AAS and software teams, Robert Ligon, James Luis in Cambridge, Robert Collins, Jonathon Dooley, Allen Farris, and Jennie Maes. Words can't describe how beneficial working here has been to me.

"This project is something I really love and have always wanted to do: something that is multidisciplinary. It has to do with software, engineering, mechanics, optics, high performance computing, whatever you can think of. I've learned a lot from it, and I take so much pride in it. It's something I work on throughout the night and after office hours. It's been an amazing experience."

Spargo's Sky Report

June Skies

Mercury can still be found hanging out above the western horizon for the first two weeks of June. Shining at magnitude +1.3 you'll need to catch this tiny planet during the first few days of the month. By the middle of the month it will disappear from the western horizon as it heads for inferior conjunction with the Sun on July 1st.

Both Jupiter and Saturn are slowly returning to the evening sky as they will both rise above the eastern horizon about an hour before midnight as the month begins. The two gas giants spend the month 5 to 6 degrees apart. Jupiter shines at a dazzling magnitude of -2.7 and is well placed for observing its clouds and the 4 large Galilean moons. Not to be outdone, Saturn weighs in at magnitude +0.2. With its magnificent rings at 20 degrees from horizontal it presents another good target for observing with a small to medium sized telescope.

Mars rises above the eastern horizon around 1:45 a.m. at the beginning of June and by 12:30 a.m. at month's end. The red planet continues to increase in magnitude reaching -0.5 as the month progresses. Its apparent diameter increases during the month making it a good telescopic target for finding surface features.

Venus has slipped below the western horizon and will reach inferior conjunction with the Sun on June 3rd. However, it will not be lost from our view for very long as it will rise above the east-northeastern horizon just a few days later. By the middle of the month it will rise as much as 90 minutes before the Sun and shine at a dazzling magnitude of -4.5 with only about 9% of its disk illuminated.

The Moon will be full on the 5th, last quarter on the 13th, new on the 21st and first quarter on the 28th. Looking south-southwest on the 8th and 9th of June, about an hour before sunrise, the waning gibbous Moon will be below and to the right of Jupiter on the 8th, and below and to the right of Saturn on the following morning. On the 19th, look east-northeast about 30 minutes before sunrise. The very thin waning crescent Moon will be just to the left and below Venus.

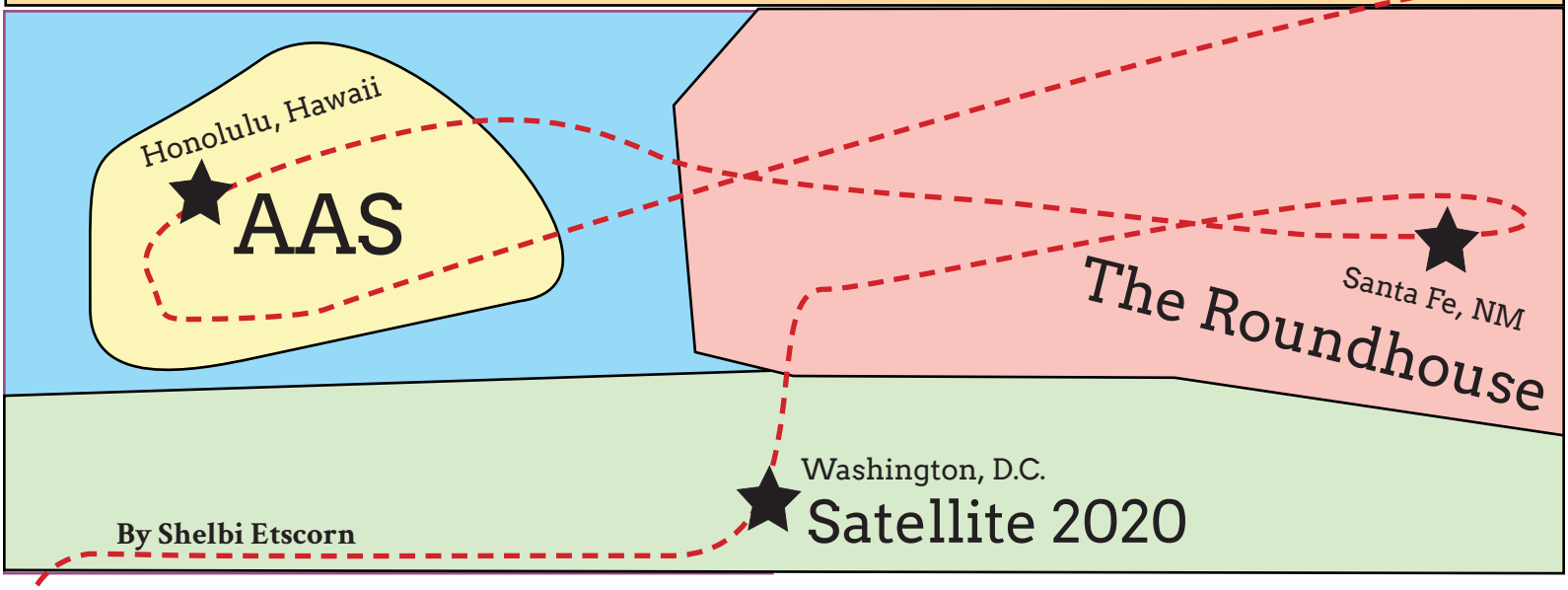
The Summer Solstice and the longest day of the year in the northern hemisphere officially arrives at 3:44 p.m. MDT on June 20th, while our friends south of the equator get to enjoy the first day of winter.

Due to the closure of New Mexico Tech because of COVID-19 virus concerns, there WILL NOT be a first Saturday of the month star party at the Etscorn Campus Observatory.

Stay safe and Clear Skies!

Jon Spargo
New Mexico Tech Astronomy Club

MROI on the Road

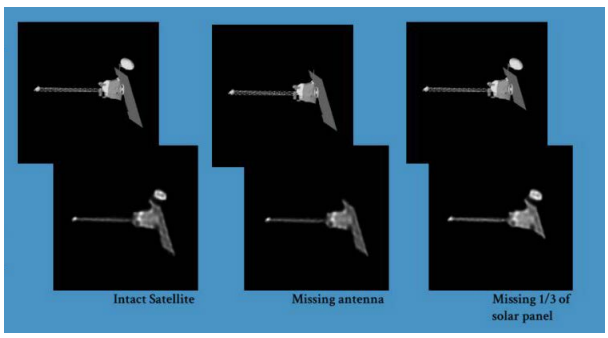


By Shelbi Etscorn

In a first for the MROI team, three staff journeyed to Washington D.C. to attend the Satellite 2020 conference this past March.

While attendees may have initially been confused by the presence of an observatory at a satellite convention, their confusion quickly abated after members from the outreach department, Colleen Gino and Shelbi Etscorn, explained the potential the MROI has in aiding satellite companies in forensic anomaly resolution (finding out what went wrong when things go wrong).

John Young of Cambridge, created the images to the left to show what the MROI is cabable of. The top row of images are simulated images of an intact 17m-sized satellite, a satellite missing its antenna, and one missing 1/2 of its solar panel. The images below them are simulations of what the MROI will be capable of seeing upon its completion. Any satellite malfunctions could be visually identified by the MROI within 25 minutes.



The images were simulated using the BSMEM Maximum Entropy algorithm from simulated measurements at 1.25 and 2.2 microns wavelength, along with realistic noise for a satellite of 9.5 magnitudes. Further details of the simulation methods can be read at: J. S. Young, et al., 2016, Proc. of SPIE, 9907, 99073I.

Instrumentation Station:

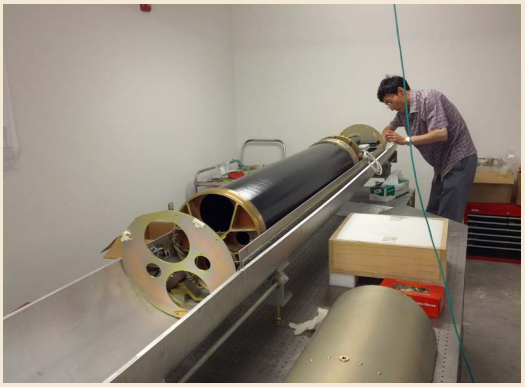
What is a Delay Line and Why Do We Need Ten of Them?

M. J. Creech-Eakman, MROI Project Scientist

One of the most common questions I'm asked when giving a tour is what are the delay lines for at MROI. The answer is very interesting, as well as how we've managed to build them for the interferometer. As the starlight travels through the galaxy from a star to us, the wavefront of the light is fairly pristine. A useful way to think of this is as a perfect picture completely in focus across a very large, extremely thin piece of paper – call this our "light paper". When the "light paper" reaches the Earth's atmosphere, it gets disturbed by the atmosphere and winds on its way down to the telescope array – it gets crumpled up and a little bit torn. In order for us to recreate that perfect picture again we have to try to reassemble our "light paper". This is the main job of the delay lines.

As our crumpled up "light paper" flies down to the array it reaches one of the telescopes first – just by a fraction of a second – but this matters. We need to "hold" that light for a little while as we collect the various parts of our "light paper" at all the other telescopes. The way each delay line does this is by adding extra path to introduce a small amount of delay for the light. The first step of the delay is calculated geometrically and just depends on where the array is pointing in the sky. This is accomplished using large wheels on the delay carts to drive each cart to the right location to make the time delay needed. The cart has two mirrors in it – a large one that catches the light (at the back) and a tiny one that bounces the light back and forth one time inside the cart. This design is called a "cat's eye" because of the way the light is reflected back out of the cart. This geometric compensation of the delay line cart is fairly slow because light is so fast – we only move the carts about 1 centimeter per second.

The view inside the delay line. Carts carrying light travel down the long tube.



Starlight travels through the two biggest holes at the front of the delay line cart, pictured above.

The second job of the delay line is to take out smaller motions due to the fast "bubbling" of the Earth's atmosphere and the winds over the telescopes. This job is done by a voice coil (just like what vibrates the sound cone in a speaker) which moves the mirror assembly in the delay line back and forth very quickly on a cantilevered mount. This motion acts to "flatten out" the crumples in our "light paper" to help us recreate our initial image more faithfully. The mirror assembly is about 1 meter long, but it only needs to move less than the width of a human hair (a fraction of a micron), which is why the voice coil is the best way to control its position. Having everything in a vacuum pipe helps with the "flattening" as well as it prevents us from introducing more crumples into the "light paper" as we move it around the array.

So how do we control all this? We have a laser interferometer (called a HeNe metrology system) inside the telescope array building that very precisely measures the location of the delay cart, using the same cat's eye mirrors that the starlight was travelling on, and sends commands to a small computer via wireless on the delay cart to move the wheels and voice coil. Power is delivered through an inductive pickup in the bottom of the pipe (just like how you charge a toothbrush or cellphone without plugging it in) and the location is checked after the delay line with the interferometer and our fringe tracking system. And why do we need ten? We need one for each telescope in the array so that each one has its own delay and atmospheric compensation. Now you know how the delay lines work!

Word Scramble

Complete the word scramble puzzle and send your name and answers to setscorn@mro.nmt.edu for your chance to win a prize from the MROI! The first to complete the puzzle and send the correct answers will win the prize; all who send the correct answers will have their name featured in the August newsletter. Good luck! (Hint: all words can be found in this newsletter!)

elyda enlis _____

tmeiroreenfrte _____

anocor _____

pexreous _____

letestial _____

lestcsoi _____

tisviope muoteosc _____

tilhg niipatng _____

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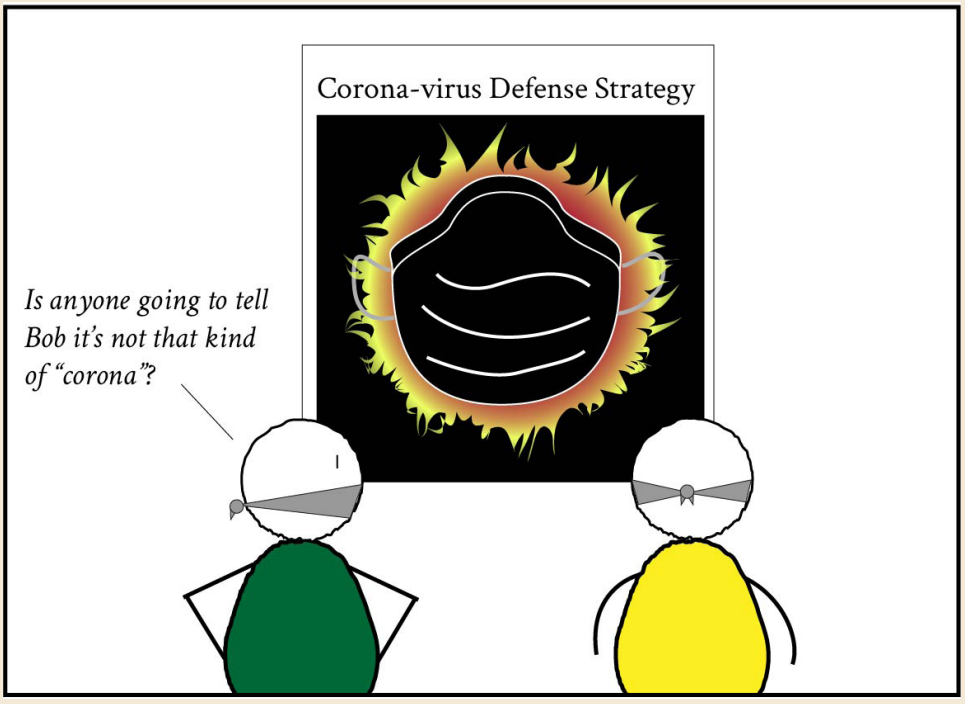

Designed by Shelbi Etscorn

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