

How dry we are

JPL missions' data help California deal with drought | **By Mark Whalen**



California Department of Water Resources

The severity of California's current drought is illustrated in these images of Folsom Lake, a reservoir located 25 miles northeast of Sacramento. The lake is formed by Folsom Dam, in the foreground. In the July 2011 view (left), the lake was at 97 percent of total capacity and 130 percent of its historical average for that date. In the January 2014 shot, the lake was at 17 percent of capacity and 35 percent of its historical average.

Californians are suffering through one of the most severe droughts in recorded history. The relatively dry, arid landscape, below-average annual rainfall amounts, and increasing demands present a water-availability challenge that exists today and will likely remain in the future.

The best way to deal with drought is to recognize the factors that create it and be prepared. JPL is on the case, taking on these issues full force – from the ground, air and space.

While it's not JPL's business to recommend specific solutions to policymakers, the Lab is proud of its role in making sure they get accurate, con-

cise, highly calibrated data from which they can take action, said Deputy Earth Science and Technology Director Jim Graf.

Now underway is the development of an integrated strategy to help California and other parched areas survive and best deal with what has become the new normal.

Using its vast array of data and observations from its Earth science portfolio, JPL is leading the Western States Water Mission, a "virtual project" in its first year. Rather than rely on measurements by a single satellite, the new science data system takes advantage of observations from multiple satel-

lites and airborne and ground-based instruments for a comprehensive view. In this new paradigm, individual missions become nodes of information in a larger network that is tied together in an advanced hydrology modeling and data science framework.

"The Western States Water Mission has a three-year development plan, although the drought certainly underscores the urgency of putting a system in place," said Project Manager Ralph Basilio. The current focus is on the states west of the Continental Divide, but Basilio jokes about "taking over the world." He and the team envision a

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“We’re going to have a data record that goes back to 1979 or even further, so we can see these long-term trends and interannual variations in California, Arizona and other parts of the west.”

Ralph Basilio, Western States Water Mission manager

tool that will ultimately be used for just about any region on the globe.

A key aspect is the system’s web-based user interface to provide comprehensive data and standard reports on water available in the form of snow, surface water, soil moisture and groundwater. The tool is currently in the proof-of-concept stage, with a working model planned for the end of September.

“We really have no choice but to leverage, reuse and adapt work efforts already in progress at JPL. It doesn’t make sense nor can we afford to start with a clean sheet of paper,” said Basilio, also project manager for Orbiting Carbon Observatory 2 and 3. “We’re going to have a data record that goes back to 1979 or even further, so we can see these long-term trends and interannual variations in California, Arizona and other parts of the west, and we can definitely see wet years like the strong El Niño season of 1997-98 as well as dry years like the last four.”

Basilio and Project Scientist Jay Famiglietti are looking to provide actionable information for organizations like the California Water Resources Board. “We want to provide them with data on how much water we have, how much water we’ve been using, and give them an opportunity to make better-informed decisions,” Basilio said.

Other actions are underway. For example, JPL’s Airborne Snow Observa-

tory, which is measuring the snowpack in the Sierra Nevada and Rocky Mountains, is for the first time giving water districts an opportunity to measure how much of the white stuff is really there. The observatory also assesses the factors that influence the amount of the melting rate, providing a sense of how much is being released at a given time.

Just as important, though, is the timing of the melting snow’s release, noted Graf. “If you’re operating a dam, it’s critical to have accurate snow measurements,” he said. “How much water do you release out of the dam, and how much do you hold back to make sure you have drinking water at the end of the summer? It’s an interesting problem, especially when you don’t have the right data. Airborne Snow Observatory will provide the critical data to these types of users.”

Plans call for several other missions to contribute initially. Data from the twin Gravity Recovery and Climate Experiment, or GRACE, satellites are key to the new system, as is a GRACE follow-on mission, launching in 2017. Another key resource for water research, JPL’s Soil Moisture Active Passive satellite, launched in January. Its radar instrument has stopped functioning, but the project has identified other useful science measurements taking advantage of data from its radiometer, such as sea-surface salinity and

high winds over the ocean. Also, the Surface Water Ocean Topography mission, a collaboration with the French Space Agency launching in 2020, will measure the height of large lakes and rivers for a better understanding of surface water amounts and movement. “That allows us to understand more about water transport with a higher resolution than we’ve been able to do ever before,” said Graf.

“On the Western States Water Mission we’re trying to pull in all of this great information and put together a user interface that easily accessible, so that people get not only a single number but something more comprehensive,” added Basilio. “We envision a web-based tool that will create customized reports and allow people to click on certain options or focus on certain areas.”

“We’re working very closely with potential customers today so we can take their desires and requirements, and fold them into our overall development plan,” Basilio added. “That’s why I’m so interested in this. This not only brings all these missions together and will provide actionable information, but it allows us to put together a system that’s going to provide a general framework or architecture for other Earth science efforts and possibly other domains as well.”



The Martian lands at JPL

Actor Matt Damon toured JPL and set his handprints in cement in the Mars Yard on Aug. 18 as part of a press event for “The Martian,” a new film directed by Ridley Scott due for release in October. Damon, who portrays an astronaut stranded on Mars, was joined by Andy Weir, author of the book on which the film was based, as well as Scott, NASA HQ executive Jim Green and astronaut Drew Feuster.

JPL Director Charles Elachi presented Damon with a signed copy of “This is Mars,” a large book of Mars images, and two Mars Curiosity landing-night shirts—one for him and a small one for his 9-year-old daughter, who also toured JPL. While at the Mars Yard, Damon received a call from International Space Station astronaut Kjell Lindgren, who tweeted: “We heard that Matt Damon was @NASAJPL so we gave him a call! Good comm compared to what he’s got in #TheMartian.”



From the top: Matt Damon’s handprints are cast in cement at the Mars Yard, as Mars Science Laboratory Project Manager Jim Erickson (left) and astronaut Drew Feuster look on; Feuster, Damon, movie director Ridley Scott, book author Andy Weir and NASA’s Jim Green at interview; Damon in Building 230.

Blasting off

By Mark Whalen

Full house in Pickering Auditorium salutes 'The Martian'



Andy Weir (second from left), author of the novel 'The Martian,' discussed the book and upcoming movie during a panel discussion at JPL Aug. 18. Joining him in Pickering Auditorium were Mars Exploration Rovers Project Manager John Callas (left), astronaut Drew Feuster and 'The Martian' movie producer Aditya Sood.

Andy Weir, author of the science-fiction novel "The Martian," visited JPL in August as part of a press event on the upcoming film based on his book as well as NASA's plans for Mars exploration. Universe caught up with Weir for a chat about the story and JPL's role in it.

How did you come up with the idea for the story? It must have been a challenge to write about something that has never happened before, and is not likely to ever happen.

I was sitting around thinking about how a manned mission to Mars would work.

Any mission needs to account for failure scenarios. I started to realize the failure scenarios were pretty exciting, so I made an unfortunate protagonist and subjected him to all of them.

Were you shocked that the book's popularity skyrocketed as it did?

Absolutely. I never imagined it would have mainstream appeal. I thought it was a niche market.

Interestingly, the book mentions that astronaut Mark Watney was the 18th person to walk on the planet but doesn't say what year the Mars action

takes place. Is there any particular meaning?

I wanted the reader to focus on the events, and I wanted it to feel like it was taking place more or less "now." So I didn't want them detached from the narrative by thinking it's in some distant future. I made Mark part of the third crewed mission because it had become more or less "routine" for them at the time of the problem. Same as Apollo 13.

JPL was a significant "character" in your story. Please describe your tour

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NASA photo / Bill Ingalls

“I needed the reader to understand some pretty complicated concepts related to space science. By making Mark a sarcastic guy, I could get all that description done in an interesting way. Otherwise it would have read like a textbook.”

Andy Weir

of JPL and your interactions with the staff. What are some of the best lessons and advice you received here?

It was fantastic! The biggest thing I learned was that, unlike in the book, JPL would NEVER run out of Diet Coke.

What's the most fascinating thing you learned at JPL?

I learned that the entire Deep Space Network runs through JPL. Any communication with any probe, satellite or craft that's outside of Earth orbit runs through JPL.

Are any of your characters based on real people, someone you might have met through NASA?

No, I didn't know anyone in aerospace at the time I wrote the book. I only met those folks later on.

The story is infused with humor. How important was it to you to have Watney with that type of personality? Fac-

ing imminent death, most of us might not see the lighter side of things.

It was critical to the story, I think. There's a lot of exposition involved. I needed the reader to understand some pretty complicated concepts related to space science. By making Mark a sarcastic guy, I could get all that description done in an interesting way. Otherwise it would have read like a textbook.

Also, I didn't want the story to be deep or psychological. That's just not the story I wanted to tell. So I made him brave and flippant. After all, he's an astronaut, not just some normal guy. He was chosen in part because of his ability to handle stress.

At what point did you realize that a movie might come of the story? Was this your expectation while writing it?

I never dreamed there'd actually be a film made out of it. I thought it would just be for a small group of regular readers on my website.

Many times, books and the movies that follow them don't synch very well. Can you say how true to the book the movie turned out?

The film is very true to the book. I'm extremely happy with it.

To young readers and moviegoers, what are the main takeaways from the story?

The main purpose of this story is to entertain. I don't put deeper meanings or morals into my stuff. No one likes to be preached at, so I don't do that. So the takeaway is, hopefully, for the reader to say "that was cool!"

What other genres are you exploring for your future books? Or will you go to space again?

I'm sticking with sci-fi for now. But I do have an idea for a crime drama. I probably won't work on that for a while though.

Tech honor for endoscopic camera

JPL's Multi Angle Rear Viewing Endoscopic tool has received an Outstanding Technology Development Award from the Federal Laboratory Consortium for Technology Transfer.

The team includes JPLers Harish Manohara (principal investigator), Sam Bae, Ronald Komiski, Michael Shearn and Hrayr Shaninian (sponsor, Skull Base Institute).

The technology captures and displays 3-D high-definition images of the brain and enables surgeons to perceive depth and "peek around corners" that, until now, have been off limits. These images allow surgeons to perform procedures quicker, safer and more precisely resulting in better outcomes and lower costs for both hospitals and patients. For JPL, the technology will offer a new capability to perform proximity stereo imaging for planetary exploration.

The annual award is bestowed to a laboratory and staff for a promising technology development to solve problems, satisfy markets and consumers, create patents and awards, or any area related to the above. The technology does not have to be transferred to be eligible for nomination.

Brophy feted for electric propulsion

John Brophy of the Propulsion, Thermal and Material Engineering Group recently received the Ernst Stuhlinger Medal for Outstanding Achievement in Electric Propulsion, one of the highest honors in the field.

The award was bestowed at the International Electric Propulsion Conference in Japan. The medal is the highest honor in the field of electric propulsion for spacecraft bestowed by the Electric Rocket Propulsion Society, the main professional society in that field, to persons who make outstanding contributions to the science, technology or development of electric propulsion.



John Brophy

Carlson named AGU fellow

Robert Carlson of the Planetary Ices Group has been named a fellow of the American Geophysical Union.

Carlson, a senior research scientist, is one of 60 who were elected fellows this year. The honor is given to members who have made "exceptional scientific contributions and attained acknowledged eminence in the fields of Earth and space sciences."

Carlson studied Pioneer 11 Jupiter and Saturn flybys after joining JPL in 1978. His work on Galileo included obtaining the first observation of Venus in the near-infrared, Earth flyby measurements, asteroid flybys and observations of the Shoemaker-Levy

9 impact at Jupiter. He contributed to studies of Io's volcanoes and determined the distribution of sulfur dioxide on that moon.

The honorees will be recognized at the organization's fall meeting in San Francisco in December.

Passings

Robert Mackey, 73, a retired software consultant, died Oct. 30, 2014.

Mackey joined the Lab in 1969 and retired in 2006. He is survived by his wife, Sandra; daughters Stacy and Sharon; and grandson Alexander Billings.

Robert Sniffin, 75, a retired Deep Space Network systems engineer, died Aug. 6.

Sniffin joined JPL in 1969 and retired in 2009. He was the editor of design and performance handbooks used by all missions tracked by the network. He also created database structures that were the basis for Deep Space Network radar and radio science performance.

He is survived by his wife, Hilda, and son Michael. A memorial service was held Aug. 21 at St. Luke's Episcopal Church in Monrovia.

Joseph Spiegel, 95, a retired scientist, died Sept. 7.

Spiegel joined JPL in 1965 and retired in 1985. He began his JPL career focused on the space exploration programs for which he researched issues related to heat transfer in the materials used for spacecraft atmospheric re-entry. Later, he became a project manager and section lead on alternative energy research programs (Section 353) sponsored by the Department of Energy in response to the oil market price volatility in the early 1970s.

Spiegel is survived by his wife, Mindy, sons Paul and Daniel, and four grandchildren.

Letters

Thank you to all the people at JPL for their support at this difficult time. Robert is a great person, and we're happy that he is loved so much by his colleagues and friends. JPL has been a big part of our lives, and we are very happy that Robert has had over 40 years of fun there and met many great people who made him smile. Thank you again.

Robert Sniffin's son Michael and widow Hilda

Retirees

The following employees retired in July:
Paulette Cali-Kaviani, 39 years, Section 274;
Susan Elliott, 25 years, Section 921; **Leona Osborne**, 15 years, Section 2142.



Bob Sniffin

Classifieds

Ads submitted Aug. 29–Sept. 9. To submit an ad, e-mail universe@jpl.nasa.gov.

For Sale

EYEPIECE: Celestron X-Cel, 12.5 mm, 1¼", in mint condition, \$35. 626-773-2824.

FURNITURE: attractive dark wood dinette table w/4 chairs & China cabinet, \$400; Old California king waterbed head & footboards, frame, double drawer assembly w/ conventional mattress, \$40. 909-319-8338.

MISC.: Sears air compressor, twin cylinder tank type, \$50; De Walt radial arm power saw, \$75. 818-352-3588.

MISC.: Pedometer, mini steam iron, Rollerblades (men's 8), head/neck/shoulder massager, soft-sided cooler, bloody Mary/decanter set, white roller rink skates. 818-272-3262.

PROTRACTOR, Geodreieck, the standard used in German and Austrian schools; facilitates many common drawing functions beyond measuring angles; it is a transparent, plastic, isosceles right triangle with 16-cm hypotenuse, tick marks are in mm and degrees; photo at <http://bit.ly/1Ug6bJG>; 3 available, Aristo, Rumold, Stano: \$8, \$7, \$6. talcelery@gmail.com.

OLIVE OIL, Greek, extra virgin, family estate, single variety, green and fruity, unfiltered and unblended, \$15/litre. talcelery@gmail.com.

Vehicles / Accessories

'99 HUSABERG FS600 motorcycle, low hours and great condition, maintenance by Eric's Motorcycles and Malcolm Smiths, \$1,100. 909-319-8338.

'74 CHEVY Corvette 2-dr. coupe, 8 cyl., 350 cid/195 hp 4 bbl L 48, great daily driver, clean title and smog exempt, \$14,000. 818-636-7632.

Wanted

SPACE INFO/memorabilia from U.S. & other countries, past & present, for personal use (see <http://www.youtube.com/watch?v=S7PvjGp7mCU>). mrayman@alumni.princeton.edu, 818-790-8523, Marc Rayman.

Lost & Found

LOST: activity notes, April 2006–March 2007. SOSNotez@riseup.net.

Real Estate for Sale

LEBEC-area mountaintop retreat, spectacular views, 4 br./2 ba., 3,210 sq. ft. custom-built house on 20 acres, surrounded by vast fields of wildflowers in spring, but stunning year-round; only about an hour from JPL north on I-5; includes spacious workshop or artist's studio; see <http://www.tourfactory.com/idxr1308594>; \$599,000. 805-358-1626 or Robert.A.Preston@icloud.com.

For Rent

ALTADENA, 2 bedrms. plus private bathroom, avail. Sept 15–Oct. 25; will be sharing a beautiful 4-bd./2-bath house with a JPLer and her preschooler; shared kitchen & laundry, spacious, park-like backyard and BBQ area, 5-min. bike or car ride to JPL, close to Loma Alta farmers market and park; \$500 each, furnished. louise@louiseh.org, 818-653-9600.

ALTADENA, furnished room w/view for lease; non-smoker to share a 4-bedroom, 3-bath house; close to local colleges/Pasadena schools, walking distance to JPL; utilities are included, central air/heat, Internet access; near 210/134/110 freeways, bus stop, shopping, banking, entertainment and restaurants; must see; \$740/month. 818-370-0601.

ALTADENA apt., ground floor, appliances optional, freshly painted, 2 bdrms, 1 bath, fireplace, gd. size closets & bdrms., carpeting TBD, tile in kitchen & bath, miniblinds throughout, carport parking, storage, laundry on site; close to JPL/Odyssey Charter School/bus/grocery stores/shops/pharmacy/24-Hour Fitness/bank, clean; option: \$740 shared rooms or \$1,375 rent entire apt. 818-370-0601.

ALTADENA, one room in a lovely 3-bd./2-bath house, big backyard, hardwood floor, big closet, furnished or unfurn., shared bathroom, kitchen and laundry privileges; 5-min. drive to JPL, close to public transport; short- or long-term lease; must like dogs and be very clean; \$750 furn., \$700 not furn., including util. + \$650 deposit. 626-712-3451.

PASADENA, single room in 3-bedroom/2-bath house in northern part of town, just west of Lake Ave.; all appliances included, large yd. with fruit trees, garage and gated off-st. parking; close to Old Town, Rose Bowl and JPL; prefer early career hire / post doc, male, someone who will keep common areas clean; available mid-Sept., preference to those looking to lease ASAP; ~\$1,000/month, utilities split with landlord. Jeff: 765-620-4342, jrstuart1986@gmail.com.

PASADENA, unfurnished room in simple 2-bedroom/2-bath flat, avail. Oct., cross streets California/Magnolia, near Trader Joe's, easy drive or bus ride to JPL, parking included; \$800/mo. + \$500 deposit. 626-487-1476 or jleichty@gmail.com.

SIERRA MADRE CANYON, perched next to the canyon creek, this circa 1910, 1-bedrm., 1-bath, two-story house is a gem; new paint, hardwood floors, commercial-grade Maytag stove and fridge, walk-in dressing room with attached washer/dryer, copper lighting, with artisan wood/rock work throughout yard; \$2,300/month, utilities & gardening service included. 626-485-0197 or canyonclan@gmail.com.

Vacation Rentals

BIG BEAR lakefront, luxury townhome, 2 decks, tennis, pool/spa, beautiful master bedroom suite. 949-786-6548.

JACKSON HOLE, WY: Luxurious bed and breakfast on 3 acres of solitude on Snake River near Jackson Hole Mountain Resort and south entrance to Grand Teton Natl. Park; see <http://www.bentwoodinn.com/>; mention JPL for discount. info@bentwoodinn.com, 307-739-1411.

KAUAI condo, Pacific Fantasy, Kapaa: 1 bedroom (sleeps 4), \$950 per week. 818-272-3262.

MAMMOTH, Snowcreek, 2 bd., 2 ba. + loft, sleeps 6-8, fully equip'd kitchen incl. microwave, D/W, cable TV, VCR, phone, balcony w/mtn. vw., Jacz., sauna, streams, fishponds, close to Mammoth Creek, JPL discount, no pets. 626-798-9222, 626-794-0455 or valeriee@caltech.edu.

MAMMOTH, Snowcreek, beautiful updated condo, 2 bd., 2 ba. + loft (sleeps 6-8), great location by pond/meadow, new appliances, TVs, DVD players, free wireless Internet and washer/dryer, no pets. 818-952-2696 or BigMtnPrettySky@gmail.com.

OCEANSIDE condo, on the sand, watch the beautiful sunsets, charming, 1 bedroom, panoramic view, walk to pier or harbor, pool/spa, game room, sleeps 4 max, all amenities. 949-786-6548.

OCEANSIDE whitewater view beach condo; virtual tour: <http://www.previewfirst.com/mls/33034>; 2 bd., 2 ba., sleeps 6; boogie boards, wet suits, full kitchen, all linens, beach towels; Wi-Fi ready, new flat-screen TVs, daily paper, grocery stores; 2-min. walk to sand, no roads; JPL/Caltech rates: summer \$2,150/week; monthly and nightly rates available; see www.warmfocus.com/video/k/1402-999_npacificstc213/video.php; reserve w/\$500 deposit. 760-433-4459, Grace; 831-425-5114, Ginger. ■



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