

Episode 9: Mars Invasion

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Travis: Welcome to show #9 of Slacker Astronomy, a podcast about astronomy and anything that floats over our heads. Each week we describe a news event in the world of astronomy. And when nothing happens, I will chisel Carl Sagan's image into Mount Rushmore.

Pamela: I thought you were going to carve **my** image?

Travis: I tried, but they denied my permit saying too many of your followers would overrun the park.

Pamela: We're recording this episode on a Friday night, the night when many of us try to drown away the memories of the past week.

Travis: To help us in this noble cause, we offer the First Slacker Astronomy Drinking Game. It's simple. Take a shot each time we say "deploy" in the show.

Pamela: I thought our official drinking game was to have a shot every time we get hate mail?

Travis: While Aaron is in rehab I think we should change it to something a little less tempting.

Pamela: About a week from now the American Astronomical Society will hold their spring meeting for 2005. The AAS holds two large meetings per year, one in the winter and one in the spring. Many astronomers and astronomy students come to these meetings, as do many members of the press.

Travis: In recent years the AAS Press Office has become very savvy at helping astronomers announce their discoveries to the world. At these meetings they hold press conferences, seminars and other events for the media. Our own Pamela Gay has press credentials because she writes occasionally for Sky & Telescope magazine.

Pamela: And of course with Aaron, I write for Slacker Astronomy too.

Travis: This is writing? You must be using the loosest definition of the term.

Pamela: Because astronomers like to save a juicy press release for the big new conferences, big announcements tend to die down in the weeks prior to an AAS meeting. As a result, this week's topic comes from Europe.

(escalating snottiness)

Travis: More accurately, it comes from Mars - courtesy Europe.

Pamela: Even more accurately, it comes from about 300 kilometers above the surface of Mars from a spacecraft that sends its signal to Europe.

Travis: Even more accurately than that, it comes from the end of a 20 meter boom aboard that spacecraft.

Pamela: You win.

Travis: The excitement comes from the fact that the boom deployed successfully.

Pamela: Which basically means it worked.

Travis: I wish the AAVSO would issue a press release every time I did my job!

Pamela: If you did your job millions of miles away in a room that changed temperature from -300 degrees to 450 degrees Fahrenheit every day, I'm sure they would issue a press release or two.

Travis: Not to mention give me workman's comp.

Pamela: The European Space Agency's Mars Express spacecraft has been orbiting Mars since December of 2003. It has seven instruments on it that have been studying Mars ever since.

Travis: But one of those instruments gets a little more attention than the others. It is called Marsis, which stands for Mars Express Sub-Surface Sounding Radar Altimeter. This powerful radar can penetrate up to 3 miles below the surface of Mars. Its purpose is to look for water below the planet's surface.

Pamela: In order to penetrate that deeply Marsis needs to send low frequency radio waves to the planet. Low frequency means long wavelength, and long wavelength mean you need long antennae to send and receive the signal. That 20-meter boom Travis mentions is part of what Marsis will use to transmit the energy to the surface and then use to listen for its echo as it bounces back up. The total antenna will be 40 meters long, or about 130 feet.

Travis: Similar, low frequency techniques have been used on Earth to study the polar caps, except here on Earth the antennae are usually mounted on airplanes that fly at high altitudes rather than on satellites.

Pamela: The antenna will be deployed from Mars Express as three booms in what you amateur radio nuts call a dipole configuration. For the rest of us who think amateur radio means pirate radio that means there are three booms deployed in the shape of a T. Two booms are side-by-side forming the top of the T, and one boom is attached at a right angle to the middle of those two, forming the stem of the T.

Travis: Mr. T has his own cereal so it just makes sense he's got his own antenna configuration. too

(play this link http://69.10.141.195/pv/mrt_sample.mp3).

Travis: During space flight, the booms are folded into a box like an accordion. After the satellite gets to Mars, the box opens to slowly unfurl the antennae. You know how snakes spring out of novelty store peanut cans? The antennae work along similar lines, but they aren't going to scare anyone with their spring loaded escape. It takes days, not seconds, for the antennae to expand out of their boxes.

Pamela: Marsis is one of the most important instruments on Mars Express. Unfurling of the booms was supposed to happen when the satellite reached Mars about a year ago. But shortly after launch, simulations on the ground suggested that after being deployed the booms could whip back and strike the spacecraft.

Travis: There's a lot of pent up energy in them thar booms.

Pamela: You would be the same way after being cooped up in a box for two years.

Travis: Give me baseball on TV, an iPod for podcasts and lots of hallucinogenic drugs and I'll be happy in a box. On second thought, give me that stuff *now* and I'll be happy.

Pamela: So the European Space Agency waited until after some of the other instruments were able to take data first before deploying the first boom. That way if something went wrong, they at least would have some data already sent back to Earth.

Travis: Finally on May 10 they began the process of boom deployment. And yes, there was a problem. But not the one they expected. Only 12 of the 13 segments of the boom locked into place. Flight controllers were worried about the last segment so they stopped deployment of the other booms.

Pamela: Then someone had a great idea. They figured the boom was probably very cold from being in space so long. So they turned the spacecraft around to make the Sun shine on it. It worked. The boom finally locked into place as it expanded in the Sun's radiant heat. It seemed the metal had contracted in the cold temperatures of space.

Travis: Now mission controllers and scientists are studying the results of the deployment. In the next few weeks they will decide how and when to deploy the other two booms.

Pamela: But the prognosis looks very good. We'll keep you informed via our web site.

Travis: We're also taking bets, this is Mars after all.

Pamela: You would think a Red Sox fan would finally have some faith once in a while.

Travis: That's world champion Boston Red Sox, to you. So what should we expect when Marsis is operating?

Pamela: Lots of topographic maps in the news. The radar waves will bounce off the surface of the planet and also the rock beneath the surface. The results will be used to make accurate relief maps.

Travis: Liquid water bounces these types of radio waves a lot better than rock. So if there is liquid water beneath the surface then it should show up on the maps as abnormally strong reflections among the rock.

Pamela: Scientists have speculated there could be liquid water beneath the surface of Mars like the underground aquifers on Earth. Some even think that Mars had oceans in its past and that they all moved underground, evaporated, or both.

Travis: While evidence for an ancient wet Mars grows, there is no solid evidence of liquid water on Mars **right now**. There is some evidence of frozen water on Mars just a few meters below the surface, however. Marsis will have a hard time picking up frozen water, but it may be able to do it.

Pamela: I think I can. I think I can...

Travis: If liquid water **is** found on Mars, it would be huge...

Pamela: Everywhere on Earth where we have liquid water, we've found life. Regardless of its temperature, pressure, or purity - life has always found a way to adapt.

Travis: The sad part is, if there is liquid water kilometers beneath the surface we can't go dig it up and look for life. At least our technology won't let that happen anytime in the foreseeable future.

Pamela: But would you want to? The last thing you want to do is pollute the aquifer on Mars with microbes from Earth or trash from a drill. Making sure we don't bring our germs to other world's is a problem NASA is still figuring out how to solve. And when we do find life, how do we know it's native?

Travis: This is true. It is hard to think of life on other worlds. It's just so **alien** to us.

Pamela: We had another interesting surprise from Mars in the last few weeks.

Travis: (proud) Huh? Huh? Did you hear me? *Alien* to us.

Pamela: Travis, I am woman. I have the gift of selective hearing. The other surprise actually comes from images taken years ago by NASA's Mars Global Surveyor.

Travis: In 1999, the Mars Polar Lander crashed when it was trying to land. No one knows for sure why, but the most popular theory is that the landing rockets turned off too early and the spacecraft fell 40 meters to the ground and broke apart.

Pamela: Later that year the Mars Global Surveyor satellite, a spacecraft orbiting Mars with powerful cameras, passed over the crash site and took some pictures. Scientists looked for evidence of the crash but couldn't find any. Even the US spy agencies were asked to use their expertise on the images but the effort was to no avail.

Travis: However, the same spacecraft recently took wonderful images of the landing sites of the Mars rovers Spirit and Opportunity, which are currently still exploring Mars. Landing parachutes and portions of the airbags were seen in these images.

Pamela: Planetary scientist Dr. Michael C. Malin used what was learned in those images to reprocess the older images taken back in 1999. And he believes that he has discovered the parachute, rocket burn marks and the crashed Mars Polar Lander itself. We have his pictures in our show notes at slackerastronomy.org.

Travis: Malin is an expert on Mars exploration imaging and is the principal investigator for the Mars Global Surveyor Orbiter Camera Flight Experiment. His company has been awarded a contract to build science instruments for 3 upcoming Mars missions, including a color 3D camera to be carried by new rovers in 2009. So we may continue to see his name in the news for quite some time.

Pamela: And when he does something Slacker Worthy, we'll let you know. But for now, thanks for listening to another episode of Slacker Astronomy. As always, transcripts, pictures and links are available in the Show Notes on our site.

Travis: We have recently posted our second chit chat show on the Slacker Astronomy Extra Feed. The show features a return of our friend Phil Plait. This show is also available on the site. We waste lots of bandwidth answering listener mail and following up on earlier stories.

Pamela: Also, star party and con season is coming up for the Northern Hemisphere. Aaron and I want to let the public know that we are available to give Slacker Astronomy talks. All we need is free admission and transportation to get there if it is not within driving distance of Boston.

Travis: Thanks for listening and congratulations to those who made it through our drinking game.

Pamela: Are you kidding? Drinking is the only way to make it through one of our shows.

Travis: For Pamela and Aaron, I'm Travis Searle....

Pamela: This has been Slacker Astronomy, a collaboration for fun, for you, for the voices in our heads.