

Hi this is Steve Nerlich from Cheap Astronomy www.cheapastro.com and this is *Curiosity satisfied*.

Hey Cheap Astronomers. This is one of those Cheap Astronomy Live In...somewhere episodes where I travel to some place and talk about something astronomical there – except the astronomical thing I want to tell you about happened in Canberra, where I live, so I didn't actually go anywhere. The astronomical thing is what happened at 3.31pm on the 6th of August 2012 – although that's a different time to when NASA will say it happened. But here in Australia, we like to live in the world of tomorrow and Canberra really was the first place on Earth where we first received the signal to tell us that whatever happened, happened

Keen researchers of the Cheap Astronomy universe will already know that I occasionally moonlight as a volunteer explainer at Canberra Deep Space Communication Complex - which is sometimes just referred to by its Aboriginal name Tidbinbilla. Tidbinbilla is one of the three sites that make up NASA's Deep Space Network, which is the infrastructure whereby all those spacecraft out there, exploring the solar system and beyond, get their data back to Earth. It's also how we on Earth can send instructions up to those spacecraft. You need three networked sites, in the USA, Spain and Australia, because the Earth is rotating – so if there's something that needs to be tracked 24 hours a day, one station can track it for 8 hours until it drops below the horizon at which point the next station has already picked it up to track it for another 8 hours – and so on. We covered all this in an earlier Cheap Astronomy episode on the Deep Space Network.

Anyhow, when there's some major event – like the landing of the 900 kilogram Curiosity rover on Mars, there's a bit of a thrill when it's your particular tracking station that's going to be the prime site to pick up the landing signal. And this one is a major nail-biter. That signal will either herald the start of a whole new planetary adventure or a two billion dollar disaster.

So I am genuinely writing these first paragraphs well before the landing happens - and I really have no idea how this is going to work out. Once the spacecraft carrying Curiosity begins the Mars landing procedure, the so-called seven minutes of terror, there really is nothing you can do except listen and hope. The prevailing 14 minute radio delay between the Earth and Mars means that by the time you first realise that something is going wrong, the spacecraft will already have crashed and burned upon the surface.

We have a display at the Tidbinbilla visitor's centre which is a full scale representation of the Curiosity rover. You stand in front of this 2.1 metre monstrosity and think nup - no way could you land this thing on another planet - frankly, you'd be lucky to reverse park it into a tight car space, particularly with a clock-ticking and only one chance of getting it right.

But, at the Tidbinbilla tracking station visitors centre, you can also glance across to a full scale model of the Opportunity Mars rover that landed on Mars eight years ago by bouncing along the surface cocooned in air bags. And it did that flawlessly, just like its twin rover Spirit.

And nowadays, these NASA people don't even bother thinking about landing two rovers in case of redundancy - they just decide to build a single 2 billion dollar rover that fires laser beams and land it - ooh, about there.

So, here we are on the 6th of August 2012 to see how this whole thing works out. I want it to be an exemplar of brilliantly careful step-by step project management, standing on the

shoulders of successful projects of the past with just a few new experimental tweaks thrown in. Otherwise, I know it will be forever remembered as an over-the-top audacious OMG are you bleeping kidding me plan that was cobbled together by a chronically under-funded, out-of-date space agency.

Well, that's what I wrote before the final hour. Right now, at the visitors centre, I'm thinking hey it's NASA, they have deliberately put their heads on the block for this one and I can't believe that they are going to screw it up. But, at the same time, this is now the real world unfolding and sometimes you really do have to expect the unexpected.

Right now, at the visitors centre, the place is packed - standing room only. There's 25 minutes to go and the spacecraft is moving at 17,000 kilometres an hour and it's just over 7,000 kilometres out from Mars. It's already being accelerated by Mars' gravity and just before it hits the atmosphere, it will be going at about 21,000 kilometres an hour. Yikes.

Even though Mars' atmosphere is thin - hitting anything that fast is going to create massive compression forces and hence massive heating to about 2,100 degrees Celsius. Ouch.

About ten minutes out from the expected time of the landing we got the first indications of a Doppler shift in the spacecraft's signal, as it hit Mars' atmosphere and began to decelerate. And as that information came through, I had a sudden realisation that, due to the radio delay, the rover has already landed, or crashed, or whatever.

Here's the audio (*CDSCC visitor's centre - live audio 1*)

We really do live in a world where something we set up to happen really happens but it happens at such a long way away – 250 million kilometres in this case that we actually can't confirm whether or not it has happened for quite a while afterwards – 14 minutes in this case. It's a bit like the Schrödinger's cat story where there's a surreal limbo period between the event and the observation of the event, where all sorts of possibilities have a temporary potentiality.

But of course when, at last, the signal does come through, reality is locked in or if you prefer, history is made. I'll let Glen Nagle, Education and Public Outreach Manager for the Canberra Deep Space Communication Complex, whose voice you heard earlier, tell the rest of the story.

(*CDSCC visitor's centre - live audio 2*)

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, www.cheapastro.com. Cheap Astronomy offers an educational website where reality really is what you make of it. No ads, no profit, just good science. Bye.