Student questions: Erika Hamden colloquium on "The ridiculous world of scientific ballooning"

2/13/19

Question 1: Is there any way to reduce the amount of damage or force applied to the balloon when being let go that hasn't been tried yet?
The balloon launches are controlled by a different branch of NASA, so we don't have much control over how they do the process. They will do an investigation and figure out the ultimate source of the problems.

Question 2: Is there currently any other type of material that could be used to make the balloons that would give similar results or does everyone use the same material across the world?
Everyone uses a very thin plastic, basically like saran wrap. It needs to be light but also strong enough and keep the helium from escaping. In the future, there could potentially be other materials that might work.

Question 1: Since you think that the hole was caused by the launching process, what changes/precautions will you take for 2020?
We have to talk with the balloon team to make sure they've identified and resolved whatever aspect of the process was causing the holes to form. We as the science team can't do very much because it's not related to our payload.

Question 2: You briefly mentioned that the data that you did get to collect may not be very good. Is this just because you were not at the appropriate height for long enough, or do you need to make changes your methodology for 2020?
It's because of both the height (which we can't control too much) and some stray light that was focused by the deflated balloon. We can reduce the amount of stray light, which we are already working on.

Question 1: How is the payload stabilized at altitude to keep it from spinning in order to use the telescope?
There is a pivot at the top which controls the torsion (basically the rotation). So the balloon will spin, but the gondola itself can be adjusted separately.

Question 2: Did you test the individual elements of your payload on smaller weather balloons in order to make sure they would function properly?
We tested the individual elements in the lab, and using calibration sources and lamps once it was all together. We also tested the components in a thermal vacuum chamber to mimic the effects of being at a high altitude. We didn't test it on a smaller balloon because that would be to risky (same risks of landing, etc).

Question 1: Could a stratospheric balloon telescope acquire scientifically valuable measurements of other planetary bodies in our Solar System?
Yes- if they are visible at the time and you have a science case that can be made for the balloon program. Observations of the sun are fairly common. For planetary bodies, I don't know of any science cases, but I'm sure they exist.

Question 2: How could a stratospheric balloon telescope improve Earth climate temperature models?
The balloons could be used to measure atmospheric properties- like measuring ozone for long duration flights. Or particles vs. height in the atmosphere. There are many options.

Question 1: What do you think the greatest discovery or advancement that can come from the use of scientific ballooning?
I think it's mostly good for testing out new ideas and technology. So the advancement is important, but not maybe direct.

Question 2: What is the worst thing that could possibly go wrong during a balloon flight?
The payload can crash and be destroyed. If it fell and hurt or killed someone, that would probably shut the program down.

Question 1: Is there an option to have the seams stitched in addition to some sort of adhesive seam between the panels? This would act as a backup for a failure scenario such as you faced.
Stitching could also create holes.

Question 2: When we think about rocket launches, there is significant effort to confirm the fully functioning status of the craft up to seconds before ignition. Is there a protocol for confirmation of all systems prior to launch, including the status of the balloon. I think that you could employ a simple imaging drone or network of drones to provide real-time visuals that would be able to confirm the status of the balloon structure prior to launch.
There is for the payload, which we followed. But the balloon is wrapped and very tightly pack up, so aside from a visual inspection, it's hard to do anything like what you describe.

Question 1: Is the market growing for balloon flight experiments?
There is some interest in using balloons to provide internet service in rural areas.

Question 2: What kind of regulations does the FAA impose?
The Balloon people coordinate with the FAA when the launches and descents happen. The FAA controls a certain level of airspace, but above that it's mostly the military.

Question 1: What is the overall cost for the construction of one complete FIREBall unit, including costs associated with launch?
Between all flights, both countries, and all salaries, probably $20 million.

Question 2: How will the next generation of high performance UV detectors improve upon the current FIREBall model?
These detectors are in FIREBall already.

Question 1: Do you think if we could refill helium in flight the drop in altitude could have been fixed?
Yes, but that would add a lot of weight to the balloon initially, which would reduce the altitude it could achieve.

Question 2: How high was the balloon in the picture next to the moon?
At 110,000 ft.

Question 1: Besides a difference in elevation patterns, what differences/advantages are there between super pressure and zero pressure balloons?
Super pressure stay up much much longer, so have an advantage if your payload has solar panels and can power itself indefinitely.

Question 2: You spoke about monitoring balloons through the day into the night. What data are you looking for at night that cannot be collected during the day?
We do observations of faint galaxies targets that require night hours like normal astronomy. So we can't get any data during the day, the sky is too bright.

Question 1: Early in your talk you stated it was difficult to detect gamma rays, and x rays from earth based observations. Why is this the case?
The atmosphere absorbs all of the radiation from those wavelengths.

Question 2: The data that you collect from the IGM and CGM what will this tell you about galaxy formation?
It helps to explain how much gas is available and presumably goes into a galaxy as it is forming. The amount of gas determines the star formation rate.

Question 1: At what altitude does IR become visable?
That depends on wavelength, but the IR is mostly dependent on moisture in the atmosphere, so in general it's easier. You can observe at 80,000 ft.

Question 2: You had mentioned that Fireball-2 had to be "pulled." What is the procedure for "pulling" a scientific balloon?
I'm not sure what you mean by this.

Question 1: Regarding scientific data recovered, why would someone choose a zero pressure balloon over a super pressure balloon?
The zero pressure balloons can go to a higher altitude than the super pressure. We care a lot about altitude.

Question 2: Why or why don't you find inconsistencies in the collected data from ballooning?
We are still working with the data. The inconsistencies are the same as from any data collection effort really.

Question 1: When making the budget for the balloon mission, did you have to factor in the payment for labor into recovering the payload?
That's part of the cost of the launch. We do pay our own people to go out on recovery, but that's included in the cost of the campaign.

Question 2: How well are the systematics and noise sources modeled for cleaning the data?
We have a model of the noise/systematics from the detector. It's helpful but we still do a lot of work on it.

Question 1: Were you interested in balloons initially, or did you lean towards this subject because you saw an opportunity?
I got into them because of the work on the detectors that I helped develop and I wanted to see them in a flight.

Question 2: Why were you attracted to being a chef in the first place, and what made you want to change careers?
I like cooking and working with my hands. It's a hard job and ultimately not intellectually stimulating enough.

Question 1: What are some advancements in balloon technology we can expect down the road?
Super pressure balloon with a better, higher altitude

Question 2: What is the most significant information extracted from balloon technology?
I'm not sure.

Question 1: Can you send a person up with the payload?
NASA would never do that, but it's possible.

Question 2: Is there plan to create a tethering system to keep the balloon in place?
No- although some of the Google Loon balloons and others may have tethers.

Question 1: Does FIREBall observe in both FUV and NUV and, if so, does it do so in simultanious observations?
Just the NUV.

Question 2: Why are bigger balloons not necessarily able to carry heavier payloads? You mentioned one that could go 180,000ft, I think, but could not carry your payload.
The size of the balloon sets the altitude, but it's also a function of the payload weight. So right now the really biggest size can only carry small things. Maybe they will do more tests and increase the weight limit.

Question 1: What mechanism do you use to control the movement of the Fireball?
Just pointing control. We can't control where the balloon goes.

Question 2: What features do you think would be needed to improve data collection using telescopes on balloons like the fireball?
Just more flights really. It's hard to say because every balloon telescope is different.

Question 1: Is there a certain (known) minimum barometric pressure below which balloons like the FIREBall-2 cannot be used?
No, but you run into FAA/airspace issues.

Question 2: Do you think balloons like the FIREBall-2 will ever be used outside of Earth's atmosphere, perhaps in the atmospheres' of other planets?
There are some concepts for balloons on Mars which has a thinner atmosphere. On venus, they would probably be useful down to a certain altitude.

Question 1: What went into the planning for FIREBall prior to its first flight?
A lot- mechanical design, optical design. Everything that goes into a new mission concept.

Question 2: Is weight or the risk of going over weight a serious concern when designing the balloon?
Yes- it increases the risks and also limits your height.

Question 1: Are there any applications to using scientific balloons in the future of Mars research?
Maybe- balloons can be used on anything with an atmosphere. It would be tricky to get them inflated, but it's not impossible.

Question 2: In what ways are using scientific balloons more useful at gathering data than other collectors?
It is useful mostly for test cases of new science and technology. So you only need to gather a little data as a proof of concept.

Question 1: Are there scientific advantages to using a balloon to gather hours of data rather than proposing for time on an existing space telescope?
For many questions, there is no space telescope that can answer the question you have, so time on them is not useful. So you build the balloon because there is no other way to get an answer.

Question 2: Are there any ways to make use of these instruments after they have flown their balloon flights?
You can re-fly them and collect more data. Or use some components in other things.

Question 1: Do we have any method to control balloon's trajectory?
No.

Question 2: When the camera is under balloon taking photo, how does it know where it shoots?
There was a GoPro that just took video the whole time. We set it up and let it run.