

PLANETARY COMMUNITY REACTION TO DECLINING SELECTION RATES IN RESEARCH AND ANALYSIS PROGRAMS

12/23/12

I served in the military for 10+ years before I went to graduate school. It was difficult to support my family of five with graduate school pay, but I believed the sacrifice was worth it. I've been working as a post doc for 3 years and have submitted 7 proposals so far, none of which have been selected.

It appears that "breaking into the field" is now impossible. When my post doc funding runs out in June, I have no research grants with which to support myself and my family.

Accordingly, I have started the processing of going back into the military. The 8 years of sacrifices are effectively wasted, not to mention the student loans for a useless doctorate (consider Computer Science and no funding issues).

Although my experience with NASA is limited to the last 8 years, what I have seen troubling. For years, cost overruns have resulted in the raiding of R&A and EPO budgets, mostly because they have the most elastic budgets. From a management point of view, it is much easier to "not give grants" to soft money scientists (aka R&A) than to lay people off at NASA centers, but the effect is the same -- people lose their jobs. "Rephasing" money doesn't solve the problem, it only pushes the problem to the next year. While science is the driver for all the projects, science and EPO are the most frequently cut, at least during these last 8 years.

What is tragic is that the expertise, knowledge, background, and scientific context that a researcher develops over the years is not treated the same as the "sunk cost" of engineering because it is not as clear or tangible. The effort that engineers spend on a project is almost always considered when deciding whether or not to continue it. However, a similar skill set is not considered for scientist.

NASA is showing that a balance between the breadth and depth of the diverse fields is not important because R&A is getting gutted with selection rates of just over 10%. This will result in about 1/3 of the scientists in Planetary Science having to find new jobs because the field cannot support them. The only researchers that will remain will be those attached to missions (which are few and limited) or already working on Mars. People cannot just switch to Mars because we would be competing for limited funds with established researchers.

12/21/12

Collected by M.V. Sykes

Personal information has been removed to protect the identities of scientists.

The impact of ~10% success rates for planetary R&A programs for me is simple. I am leaving planetary science and have accepted a job offer as a data scientist/analyst.

Though I am fortunate to have received postdoctoral jobs and fellowships that have supported me since graduation, the emerging funding environment (and the long-term outlook) as I enter the permanent job market is unappealing. These dismal selection rates are the latest sign that planetary science no longer offers stable opportunities and career pathways. I cannot accept an unstable career path for supporting my family.

While I am very confident that my colleagues will all find suitable employment and career satisfaction, it is increasingly clear that the trajectory of the field is headed towards significant loss of science capability, as more and more of my colleagues (across all demographics) will decide to leave. I am hopeful that NASA, Congress, and the Administration will forge a long-term solution in tandem with an economic recovery, but recent history of government ineptitude, incompetence, and mismanagement suggests that our nation's tremendous solar system exploration program will cease to live up to its previous high standards.

The R&A infrastructure has funded most of our planetary science research and students. These programs have supported a broad range of investigations with significant impact in the planetary science goals set by NRC guidelines; examples include: methane in Mars' atmosphere; Titan's atmospheric dynamics; laboratory gas phase molecular spectroscopy for the accurate interpretation of spectroscopic observations; thermal structure, photochemistry and trace species in the atmospheres of Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Techniques developed in our planetary science investigations are now being applied in earth sciences. In addition, synergy generated in the programs were catalysts in developing innovative concepts for the miniaturization of infrared spectrometers; such devices have potential applications in other fields including human health. We have managed lean research programs with a high return-on-investment of R&A funds. Students participating in our projects have continued onto successful careers in varied fields. However, our research programs are no longer viable given the low award rates and funding infrastructure. Conditions are dire. Dissipation of expertise is likely a matter of months and will directly affect the ability to train the next generation of scientists. As such, the investments of past R&A programs are on the verge of being for naught.

I was one of those whose proposal was not selected by PAST. Amazingly, my proposals ranked Excellent/Very good. I heard a few others in that situation as well. The proposal was primarily on getting support for two postdocs and now I am going to lose them both. One is planning to join Google (he is an excellent programmer), which simply means giving up science (which was ranked excellent by the review panel) to go after big money. I can't blame him, but what I can say for sure is that the science will in fact be hit harshly by what is happening to the R&A funding. NASA R&A is the jewel on NASA research as it brings pure scientific progress from competent scientists. By cutting R&A budget, NASA is depriving itself, our scientific community, and our nation of great science and future scientific achievements.

Over the past few years I and others have noticed the declining odds of proposal selection. So many of us are on soft money that we worry our careers are no longer sustainable. Starting earlier this year (right after the current Administration cut planetary funding in their proposed budget) I began the long process of training for a second career, because with such low odds of proposal selection, my current career seems unsustainable. This was a difficult choice to face, because I have committed my life to this field since before earning a Ph.D. in '92 and subsequently participating in five missions: Galileo, Mars Pathfinder, Mars Global Surveyor, Mars Exploration Rovers, Mars Science Laboratory. I will resist leaving the field for as long as possible. I hope never to have to.

Of my own 6 student PhD graduating class, 3 have left the field entirely, 2 have taken support astronomer positions and I alone am still doing scientific research (and all this only a few years after we received our degrees). I was fortunate in grad school play a very active role in the grant proposal writing of my research group, but even with this added experience, it is all but impossible for a postdoc (looking to become an assistant scientist) to compete in an arena of 10% selection rates. Having explained this to my family and friends outside the field, I have come to understand that the general public doesn't grasp the idea that, not only are 9 out of 10 proposals turned down, but that ALL of those rejected proposals are coming from top-level researchers at Universities and Research Institutes. I believe the statistics show that a funding rate of ~30% results in only the Very Good and Excellent proposals getting funded... so what does a 10% funding rate do? It must result in many excellent proposals going unfunded!

On a more personal note, my spouse is also a soft money planetary scientist (we met in grad school) and we have already come to the conclusion that in order to have a family, *at least* one of us will be leaving the field. Each year, as we submit our new research proposals we realize that we face the *very real* possibility, if none of our proposals are selected, that we could both (despite having PhD's) be unemployed and without health insurance. How is that a situation anyone wants to face or put their family through, regardless of the love for one's work? So we face choosing to leave the field entirely or looking for research positions in Europe. And this is why the cutting of the R&A program is resulting in the downfall of planetary science in the US.

As an early career planetary scientist just starting a permanent position at a FFRDC, NASA's Planetary Science R&A program is critical to enabling me to establish a robust research portfolio for myself and a firm footing for a long-term career of planetary science research. Funding for my position is entirely dependent on winning competed NASA grants and missions, however with R&A selection rates dropping to as low as 10% and timelines for mission proposal calls slowing to only once or twice a decade, it is becoming impossible for me, and my generation of scientists, to make long-term research plans, or investigate difficult questions that require dedicated work over many years. A robust R&A program with adequate ability for new proposers to win funding is needed to ensure that up and coming scientists remain active in the field.

I am in the initial stages of my research career. Three years ago I was hired by a 100% soft money institute (after finishing a 3 year postdoc) as a research scientist with initial funding provided by another senior scientists research grant. I am still building up my own research funding to become an independent scientist. Therefore, with such low selection rates and my "newbie" status (i.e., lack of successful funding history), it is of great concern to me that I may not be able to accomplish my goal of becoming an independent scientist (and keeping my family fed) and have to leave research science. This is the impact that reducing R&A funding will have on me.

Yes, the low funding rates will definitely impact me. It is already requiring me to spend significantly more time on preparing proposals than I previously used to spend, just to give them a decent chance of getting funded. This is time that I cannot then spend actually doing research. It also prevents me from making firm commitments to my graduate students for RAs, since I am often not sure if I will be able to get funding for them.

The low funding rates are also making it difficult for my wife, a planetary scientist on soft money, to survive in the field.

I'm a soft money planetary science researcher at a [] research institute. I need to bring in 100% of my salary through competitively-selected research grants. Since the maximum salary I can receive on any particular grant is about 25% time, that means I need to have 4 active research grants (at minimum) funded at all times. (In reality, rather than 4 large grants, I have a month here and there on more). This means that at minimum I need one new proposal funded each year. With a previously-standard selection rate of about 25%, I would need to write at least 4 (good!) proposals each year to have a good chance of getting one funded. This is a lot of work, but is feasible (barely). With a funding rate of only 10-12%, I would need to write 8-10 good proposals per year to get at least one funded. There aren't 8 different planetary science research programs in my field from within ROSES! To write 8 proposals, I'd be spending about 6-8 months of the year, unpaid, writing proposals, meaning that this time would be taken away from my regular research time (and either require working 60 hour week, with 20 of those hours unpaid, to write those proposals, or "steal" funded time from the proposals I do have to write new ones).

This is an untenable situation. If 10% funding selection rates become the new norm, I, and many other mid-career soft money planetary scientists, will be forced to leave the field. I'm already looking at alternate careers in industry or management. Since it takes an investment of time and resources to train a planetary scientist (at least 6-8 years, for graduate school plus postdoc training), if the existing planetary scientists leave the field, it would take a significant amount of time to rebuild the workforce if at some point in the future NASA actually decided to do science again. This sort of policy is frustrating, short-sighted, and ultimately would be devastating for the future of planetary science.

Recent funding cuts to NASA R&A programs force me to take unanticipated action on my part. Non-selection of a grant proposal (which I believe would have had an excellent chance of getting funded during a "normal year" based on the comments and the grade) and the uncertainty of having the pending proposals rejected due to dismal selection rates force me to immediately cut my hours (and the paycheck) by 20%. I guess this would be my Christmas present!

This pay cut and the corresponding extension of the period that I can support myself will allow me to explore additional funding opportunities during the new calendar year (ROSES 2013). However, I'm worried about the effect that the current R&A funding cuts will have on the number of proposals submitted during the ROSES 2013 cycle and the resultant success rates in 2013/2014. Certainly, this is not the most productive model for doing science!

I was inquired by a graduate student who works with me about possible summer funding. Unfortunately, I have to say no.

Finally, a few times per year, I visit schools and talk to elementary and middle school kids about space exploration and planetary astronomy. I wonder whether I could say with a straight face that they should pursue STEM fields!

I am an early career researcher who is trying to establish myself through NASA's R&A program, but my involvement in missions offers me a sense of security that most researchers do not have.

My concern with the recent focus on Mars missions and research is that other areas of planetary science are being bled to death by the focus on one planet. We have no outer planet flagships in the pipeline and once Cassini ends we will slowly lose the capability for building and operating major flagship missions like Cassini because the engineering experts will move on or retire.

Shifting the bulk of missions to Mars will cost us technical knowledge and expertise that would be tremendously expensive and difficult (maybe impossible) to try and rebuild in future years.

The same problem applies to R&A, which tends to follow missions because of the availability of data. Sending all missions to Mars restricts the science data available for other targets and we will lose expertise as scientists either retire or shift their focus to Mars. We must design NASA's funding to at the very least maintain our level of technical capabilities and knowledge, or all we will have available in the future to rebuild what we are losing now is science publications written by people who have long ago moved on or passed away.

It may not impact me for a year or so, but beyond that I might only have 50% funding. I have 4 proposals in right now, but most of them are for 10% time and one is ~25% time. It's unlikely that they will all get funded, in the best of times, and even worse if funding percentages are 10-11%. So, I could be scrambling in a year.

I became a soft money researcher nine years ago, only three years after moving to the US to start a postdoc. I decided to stay in this country for personal and professional reasons. It is still the best place to do science and start new and ambitious projects in space exploration. My work as a

planetary scientist consists essentially in the development of instruments for ground-based telescopes and the study of small system bodies. Thanks to this double hats, I have been lucky to find and juggle between fundings provided by NSF and NASA, plus tiny, but useful, private fundings when they were available (before 2008).

Most of my colleagues at the Institute believe that I am successful since I have never had any hiatus in my funding history over the past 9 years, but I, in fact, disagree. I left a high-profile university and a job offer in Europe (EU-paid leading to a permanent position) to join a low-overhead institute with the goal of creating my own group and develop my research at a better level by hiring students and postdocs.

Over the past three years, my success rate with federal funding agencies has declined (from ~40% to 20%) limiting significantly my research plan. I had to let several of my promising students leave my research group and I never managed to get enough funding to hire a postdoc in my group. Interestingly, for my four most promising students (all american), one is finishing his PhD in a Texas University, one went to the Netherlands for a PhD, one just started at Cambridge in the UK to start a Master's program, and finally the fourth one may join USAF officer corp. I am glad that they have found an alternative and somehow will remain in the field of space exploration, but I have a bitter-sweet taste thinking that I could not offer them a job in my group, especially with two of them having to leave the country to pursue their dream.

Today, my funding projection has been reaching a new low. I submitted 8 proposals in 2012 and I am hoping that one of them will result in something positive. Most of these grants are on different research topics, so I spent at least a quarter of the year preparing them. If none are successful, I am out of work at the end of the year. If one is successful, I will still have to write 6-8 of them again since none will support my salary for 12 months of the year. I already have to limit all my trips to the bare essentials and take a part-time job (related to science but not in research though).

Reducing the selection rate to 10% will definitely have an impact on my career. The grant process is very uncertain, sometimes confusing, and I tend to think that it is becoming a lottery for the most part (who was in the panel, what are the program manager priorities, how is the program budget,...). NASA/NSF should realize that after having invested in a generation of research, reducing the success rate and forcing us to leave the field will cripple the scientific community and NASA objectives. Building a \$2B mission to Mars or Europa is a great endeavor, but if there is nobody to analyze the data and do the science, they will trek uselessly on the surface of Mars or take pictures and data of Europa that nobody will ever look at.

I am not sure I can offer a solution to this problem. The agencies are said to be in a difficult situation, however \$1.5B was found somehow for a second rover to Mars, which is not recommended by our community. How many research scientists can we pay with \$1.5B? At least 3,000 of us for three years. Saving the R&A in the US should be the priority of NASA, instead of building large and expensive spacecrafts, in this difficult time. Additionally, by having a clear roadmap where scientists could rely and rally to, NASA could gain the support of the scientific community. It will save us time by not making us think in programs & projects which exist and are being canceled suddenly. It is not appropriate that the major decisions in our field are taken

by a minority, but vocal and well-known, non-scientists. The short time span vision of some of the decisions have been damaging to our field and resulting in large costs to the tax-payers.

Finally, most of the young generation of planetary scientists are tired of being considered "more like pawns than partners" (from A. Rivkin blog post in Scientific American) and several of them are leaving or about to. Losing this task force is a lost for everybody, for this country, for its space program, and for science in general. Nothing will replace a planetary scientist with 15 years of knowledge, than another planetary scientist with the same expertise. This generation of "young" planetary scientists that can be called the "no-flagship mission generation", has made its way, like lemmings, through the bumpy hills and cliffs of the NASA erratic space program. The current hill is in fact the highest mountain that we have faced so far, but we are about to reach its summit. I am afraid that when we will be on the top, if I am lucky to make it, we will be looking around wondering why there are so few of us remaining, and what will we do with those shiny toys that were built for us. The race is over but "what now?" we may ask by then?

As a long-term in-house civil servant scientist at NASA, I am happy to support my agency with STEM initiatives and the like to encourage folks to consider a career in aerospace science at NASA, but my advice to my own children is -- stay away!

I am a soft money researcher. This means that 100% of my salary comes from writing proposals that, if selected, each fund a small portion of my time. I have not been fully funded to do science since March 2011. This is not because I am bad at writing proposals. In fact I have had a fairly good success rate. You need to fully understand the situation.

A good, solid proposal describes and seeks to test a scientific hypothesis that is relevant to the program to which the proposal is submitted. A team must be assembled, techniques must be developed, the plan of work must be outlined in detail, and every dime of requested funds must be justified. Writing a good proposal from scratch takes at least one month; writing a proposal slightly out of one's field of expertise could easily take longer.

As a soft money researcher, I am not funded to write proposals. Therefore, that one month must be carved out of my time. That time either goes unfunded, or is paid for from other grants. Most of the standard ROSES programs state that an average year of requested funds is \$100,000-\$150,000. Typically, these funds will support 2-3 scientists for ~2-3 months in a year for a duration of approximately 3 years. The selection rate in recent years has been ~25%. Let's consider the statistics here. Let's assume that I am spectacularly good at writing proposals, and that 50% of the proposals I write get selected (twice the mean value). If I submit two proposals in one year, each of which will support me for 3 months, then I can expect that one of them (50%) will get funded. That is, I spent at least two months of my time (at least one month each) writing proposals that ended up funding me for 3 months.

How much proposal-writing time would it require for me to be fully funded? At the above success and selection rates, a full year of funding would require approximately four fully funded proposals. This would require submission of eight proposals, and therefore at least eight months

of unfunded preparation time. Thus, once I am finally funded to do work, the time taken to perform the work eats into the time I have left to write proposals for the coming years.

Mind you, if my funded time dips below 75% at my institution, then I (and my children) will lose access to health benefits. You begin to see the problem.

If the selection rate drops to 10-12% then there really isn't any viable way to do scientific research in this field. At 25% it isn't really viable either, but I have made do with less than fully funded time, and by maintaining a salary that is less than competitive.

Understand my position. I am intelligent and well-trained. I worked hard in graduate school, without much pay, and didn't get my PhD until my late 20s. I put off having a family because I needed to establish my career. All of this was fully acceptable to me, because it was part of the path I chose. I could have followed the path of many of my peers in school, who also acquired technical degrees and are now putting them to good use in the technical industries. They make much more money than I do, and most are very happy and fulfilled. I wanted something equally technical, but different. My desire in life is to make discoveries about our universe, to push back the boundaries of humanity's store of knowledge. Being part of the space science community makes me part of a wonderful aspect of our country – the one that seeks to “go beyond”, which inspires countless others to look to the sky and dream of greater things. I have joyfully contributed to educating the public and sharing what I know, because the imagery and knowledge is so breathtaking. I wouldn't trade this for the world. It is the reason I am still here, doing what I do, despite the poor pay. Every time I hear bad news about NASA's funding, or funding for science in general, I stop and ask myself why I'm still here. Every year I become older, and less marketable to the other technical industries (who wants to hire and pay for a PhD with no industry experience?). My salary drops as the funding situation gets worse. My colleagues and I sit and mournfully discuss how we are going to pay for things like preschool. Is it worth it, sticking it out? I'm not sure yet, but I'm still here. I'm not sure for how long.

You have to think about the overall ramifications of this. Like my colleagues, this is where I belong, and it is where I do the most good. Is this really what you want to give up by taking away funding from fundamental research? Should people like me fade into the corporate world of Silicon Valley where we might make more money? Or should we be put to use, inspiring another generation to “go beyond”? There aren't that many of us in planetary science, and already we're wondering if we should discourage our students from following in our footsteps. If the US drops behind in research, it will stop the innovation and inspiration that drives the technical industry. NASA's planetary exploration has been the one bright flame for the US government in the past few years, and it is the one thing NASA is truly doing well. It is the one thing that others around the world see and it makes them feel amazement, rather than scorn or anger. I see the mounting hysteria regarding the Mayan calendar ending on Dec. 21, 2012. When the sun rises on the morning of Dec. 22, will anybody remember that it was NASA scientists who repeatedly explained why the scare was a hoax, or will they just latch onto the next big prediction of the end times? In times like these, when such wasteful darkness unnecessarily terrifies the ignorant and puts money in the pockets of swindlers, we most need the light of science to show us what humanity knows and can learn about the universe. If those scientists are not there to seek it out and explain it, then who will light the way?

You've probably compiled a bunch of similar responses, but the declining selection rate means more proposals and more reviews and more of our time spent chasing money. I'm currently a subpanel chair for [a research program] and I have been having a devil of a time finding panelists. Nearly all my panelists are going to end up being first-timers, first and second year postdocs. It's risky but all the more senior folks are either conflicted (this panel has 154 individual PIs and Co-Is who are off limits) or have stated they have already served on 2 or three panels this year and can't do another one. Several folks have said their institutions won't support their salary to serve on another panel.

One thing I'd like to add to the conversation about selection rates is the effect on civil servants. Supposedly NASA has to pay for our salaries whether or not we win grant funding, but of course we have to "bring in" our own salaries like everyone else on soft money. This is a weird tension to begin with, but as selection rates decline, NASA somewhere somehow is still going to have to make up the CS salaries. I don't think anyone is having a conversation about this.

I'm a 31 year old Postdoc and have put in many PI proposals each year for the last few years to try and stabilize my funding, like so many others. One thing that has me deeply trouble (annoyed frankly) is the continued practice of marking down a proposal when its perfectly fundable, just so they can justify the proposals to do want to select. My recent 2012 Planetary Astronomy was a classic case of this. Having been rated very good/good, I personally believe I received many unsubstantiated and strange comments in the review that they had to be there just to move me from a higher grade to a lower one just, so they can say why you didn't get selected. I ran this through some of the more senior people in my department and they agreed. The real reason why many people are not selected is because of lack of funding, not because the proposals themselves are not of sufficient quality.

Two points here: 1) As a young researcher in this field, I need to know if my proposals are good enough to compete with more established researchers in the field. It doesn't help my moral or help me edit the proposal for next year if they are artificially downgraded just so the program managers can have an easier time of justifying the selections. I would have been much happier if they said "Your proposal was good enough, but we just don't have the money" 2) It does our research field as a whole a big dis-service if we actually have a lot more fundable and excellent research but don't say so. We need to be saying " Look here, we have all these great proposals and we need more funding to do it", not "Lets down-grade all these proposals because we can't afford it". Otherwise, we don't have a leg to stand on when we go and ask for more funding (or a diversion of existing funding to research).

We're at a critical juncture when we talk about sustaining the field in these difficult times. Young people like us know that if we don't stabilize our funding soon, we'll have to leave the field. We love what we do, and are very privileged to do it. We want to stay in the field, but not at the expense of our families who rely on us for our income. As you say, its very difficult to reverse the loss of knowledge and expertise in short timescales. I back the idea we should be pushing as hard as possible reallocating the money for future missions to funding and stabilizing R&D. We

have tons of data and work to do right now!

Me personally, I have backup plans and they don't involve planetary science (I'm sad to say).

The impact on me from the exceedingly low selection rates in planetary science research and analysis programs is pretty obvious: it is impossible for me to operate any longer primarily as an individual investigator. I have one successful proposal for which I have been funded since July of this year. The majority of my funded work now comes from having joined a flight mission, working with an instrument for which I had no prior experience. As with most changes in life, this hasn't been without any benefit. The change to a mission has enabled me to explore another scientific area that I could never otherwise have entered without a prior track record. That change has opened new possibilities to me and enriched my ability to achieve creative solutions in the remnants of my previous work, as well as giving me the chance for accomplishments in a new field.

However, the ability to retrieve something useful from disaster does not make disasters desirable. The ever-shrinking rate of support in individual-investigator programs over the past two decades, with a sharp pinch over the last three ROSES cycles, is the strangulation from which the collapse of my individual career has freed me. It had become impossible to do anything that I had not already been doing, because I could not show a track record for new work. The requirement to work exclusively on projects for which I had been funded meant abandoning incomplete work that no longer had funding, leading to a common criticism on proposals to take up that work again: "you have no recent publication record."

In the last three years, I found myself working 40% of my time just to write funding proposals because the stakes had become so high and the chances of success had become so low. How can this be an efficient way to allocate resources? The only reason that I have been able to continue a scientific career is because of a personal connection. I value the lifeline that has been extended to me, and I'm excited by the new work that I'm doing. But we should be able to maintain that excitement and innovation and the ability to take new opportunities by making positive choices. I'm still hoping to complete my old projects and maybe revive my individual career. To do so, I'll have to work as a hobbyist on my individual projects, because professional support is practically unavailable.

I am a researcher just beginning my independent career (a year or so out of post-doc), and with a 10-12% funding rate from NASA, a rudderless Planetary Division (rudderless NASA, really), severe restrictions on where and how—as a civil servant—I may garner funding, and the general attack on civil servant salaries, retirement, etc., in Congress, I am looking for careers outside of planetary research altogether.

The NASA Planetary Atmospheres success rate was 11% this year (for new awards). My proposal was declined in this ROSES 2012 competition. I will resubmit next year, but this year I will have to forgo adding a new graduate student to ongoing research. This has two impacts: (a)

slowing down partnerships with European collaborators, and (b) shutting down my job of mentoring graduate students here at [institution].

This success rate for proposals is bad for the growth of Planetary science, especially for the training of the next generation of needed scientists.

I appreciate your interest in the low selection rates of NASA's R&A program. It has been on my mind for several years now, and has already caused disruption in my career path. I began working at [institution1] shortly after obtaining my PhD. Nominally, I was a postdoctoral fellow, but every other person who had started there as a postdoc was hired as a permanent staff member several years later. However, unlike most other people, I was unable to secure any external funding from NASA. I applied for grants at every opportunity, writing 14 proposals as a PI or Co-I. Failing to obtain any funding after 2.5 years, I began looking for other postdoc opportunities. A month after accepting a position at [institution2], my first grant proposal was selected. However, it was not enough to sustain me as a full-time employee at [institution1], so I began my job at [institution2], and am now in an awkward position of having money that I cannot spend (postdocs [at institution2] do not have the ability to PI grants). If I cannot find a position in the next 1.5 years, when my postdoc expires, I am not sure how I will continue my career.

As a result of this experience, [I have read the] blog piece on this subject - how to decide between working part-time in planetary science, or leaving the field for full-time funding:

<http://womeninastronomy.blogspot.com/2012/10/the-part-time-scientist.html>

However, as worried as I am about my own future, I am even more worried about graduate students graduating in the next year or two. These people are now competing against postdocs with two or more years experience in the field for the same positions. I have already seen a 50% attrition rate from my own PhD class, including 3 out of the 4 women. I am certain that the downturn in funding will negatively impact the number and quality of young scientists in the field, and I fear that a large majority of these will be young women. Whether from unconscious bias, or their own (rational) decision to leave the field for full-time funding, I think the leaky pipeline will turn from a trickle to a stream.

I have worked in the R&A program for about thirty years. During that time I have had a number of successful graduate students who have gone on to work for NASA or universities, or otherwise gone to good careers. One of these students led a NASA lunar mission. During the past three years I have been bumped out of the program after never failing to have a proposal chosen in the past. The purpose of funding these proposals is almost entirely to fund students, very little of this funding goes to my own salary. The work has funded analysis of planetary spacecraft data, and the development of numerical tools widely used by others. It is simply not possible to train new students with the current success rates. It takes more than 3 years to move a student through graduate school. Moreover, due to the lack of funding to further develop models, the US has already lost its leadership in planetary atmospheres, which in my opinion is now strongly

dominated by France with Japan close behind. It is also not practical to tie my funding to specific missions rather than the R&A program. The time commitment to the missions is very high, and doesn't mesh with student training and developing the fundamental understanding we need to develop new tools for understanding the data.

I should point out that the R&A programs in Earth Science remain relatively strong, and still have budgets that can support people. I am not aware of the overall funding situation in NASA, but I believe planetary is eating its seed corn.

I saw your note in the PEN this afternoon and felt compelled to tell you my story. The subject of funding is on the forefront of my mind. I graduated in 2010 with my PhD and spent almost a year and a half at [institution]. I am currently a Research Professor (i.e., postdoc) at the [University]. I came here to work on a grant-funded project, which runs out of money at the end of this month. I submitted a LASER proposal in March and have yet to hear my results either way. Next semester my best option for salary is to teach 3 classes, which will make me less than full time. Not only will my salary be cut almost in half, but I will also have to pay 50% of my health insurance premiums (as a state employee, TX pays the entire insurance premiums while full time). I am currently looking into retail positions to make up the rest of my salary. As it stands, I expect to have to move to my parents' house after the end of the spring semester, having bled my entire measly savings and without a permanent position or even grant money. Even if I get notification that my grant has been funded tomorrow, it will be months to a year before I get the money to my institution. With the current success rate in the 10% range, the life of an academic does not seem sustainable and thus I will have to make the decision whether or not I should leave planetary science. There just aren't enough funding or academic positions to keep all the current scientists funded, not to mention the dozens that graduate every year. So what this boils down to is that I will be at least underemployed next semester and likely unemployed after that (despite submitting over a dozen applications for academic jobs). Given this bleak outlook, I will likely try to find a position in industry or even leave science altogether.

Your editorial is nicely put. Of course it's even worse than it appears. The 10-15% selection rates are for awards no larger than they were in the late 90s, which means that most soft money scientists require 2+ grants to achieve full funding for themselves. This was acknowledged as untenable 10 years ago, and it's significantly less so now. It's simply impractical to expect anything other than a minimal science community to exist under these circumstances. Indeed, if things continue along these lines, the era of independent researchers will end quickly, with the less robust university-level programs following them into oblivion over the next decade. If the plan is to contract the pool of scientists engaged in planetary research to NASA centers and 3-4 university groups, then this is exactly the way to do it.

As for the specific impact to our program, we are currently sitting on THREE 'selectable' ratings from the last two rounds, including one from 2011 for which a final decision was never made. The original intent of this rating was to identify awards that were in the bottom third or so of the fundable pool, with many in this category receiving support once the final budgets were set. Instead it has become a sort of consolation prize for the top several non-selections. Given the

rarity of subsequent funding and the lack of follow up to clarify the status, the 'selectable' tag has emerged as a cruel limbo where the phrase 'rarely if ever' describes both the chance of being funded and the likelihood one will ever be definitively told you were not. Suffice to say, I expect nothing from the awards we have pending in these categories.

Overall, my group has the resources to make it through the next year or two and possibly more through the use of fellowships. However, it will not be long before we begin to eliminate positions and wind down operations. In the past I'd hunker down and try to weather the storm, but I'm not optimistic about a change coming this time. The spacing between funding crises is getting shorter and the recoveries continue to go to static or smaller awards with lower selection rates. In fact, I have come to believe this represents a strategic shift in how NASA envisions the R & A program going forward as opposed to a reaction to reduced funding overall. The situation is made worse when one considers that, as the MSL 2 'selection' demonstrates, NASA's planetary division is quickly evolving into an exclusively red-planet program at a mission level. We'll probably either have to shift our emphasis fully to Mars science to survive or consider getting out of planetary research. It's a difficult pill to swallow.

Over the last decade and a half we have been developing the ability to model low density flows (atmospheres, plumes) around bodies such as Io, Enceladus, the Moon, etc.. Key to the success of that work has been funding continuity. As our software and methods have become more capable and elaborate, we can examine questions nobody could have dared to ask before. We do not have to only model toy example problems or problems posed separate from the surrounding environment. The reviewers of our proposals point out these unique abilities. But continuity is key. Grad students take 5+ or so years from start to finish and the first years are heavily weighted by classes. We cannot just turn them on and off. The senior students are crucial for passing on their knowledge of code details to the newer students. A large code cannot simply be mothballed while waiting for a new round of funding. Our model has been to train students who must ultimately write a dissertation on their work. They cannot easily jump between projects depending on funding. And those students are our next generation of scientists. They need continuous grant activity to be successful.

As a young planetary scientist, I know that my fellow early career colleagues cannot help but consider whether we should stay in this field with such low and uncertain funding. No matter how much we love what we do, and as much as we want to contribute to the scientific greatness of our country, it is hard to justify dedicating your life to something that seems to be saying "we do not value you". They say that at 30% funding rates, it is competitive but most excellent and very good proposals are getting funded. At 10% that means many excellent or very good proposals are not getting funded. So no matter how hard you work or how good you are at your science that may not result in having money to support yourself or your family. I don't think very many people want or can afford to have a job like that.