

Report on Tucson Town Hall Meeting on Decadal Survey

The meeting started at 10:00 am MST March 14, 2009, in Steward Observatory Room N210. Initial attendance was 50-55 people total. After a brief review of meeting logistics, the host directors, Peter Strittmatter of Steward Observatory and David Silva of NOAO, each welcomed the attendees. Their remarks emphasized the growth in page count of the decadal reports, increase in complexity of the field, international scene (including collaborations and competition), and the growth in the scale of projects we would like to see happen. They further noted that has become a very international enterprise, and careful planning is needed to avoid have the US astronomy community be only a minority partner in large international projects. Taken together, these evolutionary changes make the current report a critical step in advancing the field.

Marcia Rieke then introduced herself and the other two members of the Survey Panel present: Jonathan Lunine and Lynne Hillenbrand. Dr. Rieke described the Survey charge, goals and process.

The Survey's three pillars are Science Assessment, State of Profession, and Activities Prioritization. For each pillar, the Panel will have: committee and panel study group structure; calls for public input; and important dates and milestones.

The last survey had a more compact structure to save money. The problem was that many people felt disenfranchised, so the Panel this time is making more effort to reach out and contact people, provide more chances for people to give input.

The charge to the committee is to survey the field of space and ground based astronomy and astrophysics, recommending priorities for US Federal investments to address the most important scientific and technical activities of the decade 2010-2020.

Science panels:

- Cosmology and fundamental physics, David Spergel
- Planetary system s and star formation, Lee Hartmann
- Stars and stellar evolution, Roger Chevalier
- Galactic neighborhood, Michael Shull
- Galaxies across cosmic time, Meg Urry

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The key differences from prior surveys: independent cost estimates; much more care exercised to avoid conflicts of interest; and all submitted material must be made available publicly.

Independent Costing: 2 people on the Program Prioritization subcommittee, S. Battel and T. Young, are engineers with experience in cost estimation. They will handle sub-contract to outside firm, to come up with standard set of information requests and put cost estimates on a level playing field. Model is NASA's BEPAC review process.

There will be problems to solve with potential conflict between costing information and the need for public release.

There are numerous calls for community input, including mainly Town Hall meetings like this one, and white papers. The deadline for science topic white papers has passed, and more than 320 were submitted. The deadline for white papers on the State of the Profession is Sunday March 16.

Technology development WP's: portal opens Mar 16. This is for things that we need to be investing in now, to have them ready for the future.

For Programs, every program that submitted a Notice of Intent has been asked to respond to a Request for Information by April 1. Subcommittees of the Program panel will review the responses and decide from which activities they need further input. Those activities will be invited to make presentations during the Survey Panel meetings in Pasadena in June, which will run in parallel with the AAS summer meeting. Not being invited doesn't mean your activity won't be in the report, but rather that the panel feels like they understand your activity well enough that they don't need a live presentation. Hillenbrand stressed: not being invited does not mean a down-select, but reflects only limitation of time. Some projects will be invited to present because they're big and important and need further drilling down; some will be invited because committee never heard of them before and needs to understand better.

Silva: what is the plan for submissions to the cost-evaluation contractor? Rieke: don't know because contractor has not been selected, but it will be a different process so there will be some opportunity to negotiate deadlines (not a public call to everyone but selective requests to some activities).

Blum: have dollar levels on break points for different project classes been set?

Rieke: not yet. Blum: is infrastructure committee scheduled yet? Rieke,

Hillenbrand: no, they are just getting organized.

Pinto: Panel has put schedule, and budget long-term may be more limited, but there are very short-term possibilities for funding; are they making any special provisions for really shovel-ready things like ATST? Depends on when NSF officially "starts" it in MREFC queue. Idea came up in last AAAC meeting that agencies should not wait for report if they think a project is ready to start.

Axelrod: How are they going to compare cost estimates from things in wildly varying states of maturity. Rieke: may recommend a phased program, where they recommend that some things are ready to go because costs are more highly developed. Not really settled on how to handle this, yet, but it will have to be recognized and called out explicitly in the recommendations. Axelrod: from inside the program, will this feel like an audit? Rieke: not that burdensome, can't afford to do that for everyone. They will work with two engineers on subcom and cost contractor to develop a written questionnaire to projects, and then will decide on what face-to-face contacts are needed to supplement.

Strittmatter: How do they propose to handle projects that have substantial non-Federal funding, and how do they go about increasing that kind of leverage? Rieke: Important because of long lead time for MREFC; that's why there is a private-public partnership study group. Their charge is to figure out how the Fed government should spend its money, but they do need to know what the total scale of the project is. They need to know how to handle situations where they want to recommend a federal investment but the Federal government can't afford the whole thing.

George Rieke: Unlike other countries, it seems like there's a long way to go to get to a unified scientific system in the US. How do we move toward a system look at what we do? At present we have Keck, LBT, Gemini, Magellan, each independent, and even a possibility of conflict of interest because one is a direct responsibility of the main federal agency that is to some extent supporting them all. Marcia Rieke: This is an issue that will have high prior, and it's a major part of charge to study group on public-private partnership.

Silva: comment on Fed budget. It looks like the integrated total of funding may be improving over last 10 years, but our appetite for funding seems to be growing faster than the available funding.

Angel: mechanics of public-private considerations are not clear. How does this get folded in? Survey is a Fed agency activity, but shouldn't they also get major private donors like Keck Foundation, Moore Foundation, etc involved too? Rieke: interesting idea, but not done this time.

Greene: NSF position is that they respond to proposals that come but don't set policy. How do you get NSF to recognize survey and set funding policy accordingly? Rieke: they will discuss how to make a recommendation that NSF can incorporate/enforce, but don't presently know how to do this. NSF once could support a much larger fraction of ground-based astronomy, but it does not have the resources to build its own 30m telescope, and the panel have to come up with some kind of guide for NSF on how to deal in this environment.

Lunine: commented on McCain twitter feed about the astronomy education project in Hawaii; is there anything we can do to help educate the Fed govt? Silva: no one ever said that the Fed govt was uniformly behind astronomy. As a field we need to

find a way to make our case better for broadly useful tech devel, for general STEM education and involvement of underrepresented groups.

At this point, the moderator, Bob Blum, introduced the discussion panel: Roger Angel, Knut Olsen, Sidney Wolff, and Dennis Zaritsky. The discussion focused on questions presented on the moderator's slides (see accompanying file), with the audience encouraged to participate.

First question: What should be the top ranked priority for the ground based community in the coming decade? What are the most compelling questions that must be attacked from the ground?

Wolff: Glad we're doing real cost estimates this time. The survey should be more sophisticated and flexible this time to take advantage of how things evolve over time. It should look at all classes of things, not just the top one or two priorities. A major problem is that there is no leadership right now at the NSF, and that makes it hard for partners in partnership projects.

Zaritsky: he's on one of science panels. The science white papers are all good, but some subfields seem much more dynamic, and some things don't have natural advocates like the big projects do (for ex: vigorous small, general grants program). Pleased that strategy looks to be more open than in past.

Olsen: Liked what Sidney said about creating a strategy for the decade; both LSST and GSMT have compelling science cases, and you don't want to set up artificial conflicts between them and their different cultures (survey science vs PI science). Catch is that they both have major funding needs and may be in collision.

Angel: In order to advance, projects have gotten much bigger. Need to understand the "Moore's Law" of astronomy to help see where advances will most likely be made. He thinks the most important things from the ground will therefore be things that take advantage of higher aperture and higher A-Omega.

Knezek: Was the assumption that ALMA and ATST would be done and winding down? Wolff: was thinking of \$300M for LSST and \$400M for a GSMT = \$700M for a decade or \$70M a year which is a lot but should be affordable.

Blum: What are big science questions?

Wolff: offended that 96% of the universe is something(s) that we don't understand at all. Wants to know how galaxies came to look the way they do. As to planets, have a picture of one is not as exciting as understanding the systematics of planetary systems. She thinks it would be bad for astronomy if we didn't have both LSST and GSMT in 10 years time.

George Rieke: don't like the split in questions between space and ground as it encourages the compartmentalization and us against them attitude. We should consider what are the compelling science topics, and then ask what needs to be

done from ground and what from space. Zaritsky: but it reflects the program panel organization. Marcia Rieke: that's largely due to technical nature of task it faces. Romeel Dave: science panels are looking at things the way George suggests.

Olsen: came up with many of science topics Wolff did: dark energy, dark matter, galaxy evolution and formation, planets. Technology: only real limitation to ground is wavelengths you can't reach. Angel: spatial resolution from ground now exceeds that available in space. And he thinks planets themselves are interesting, and that it's exciting to study them one at a time; it also gets people interested in astronomy.

Dick Joyce: LSST is self-contained, but GSMT depends on what instrumentation goes on it, and what people can build.

Eisenstein: should have a medium-sized grants program as well as small grants. Size range of 1-10 M\$ is an area where astronomy is very efficient at turning dollars into science. This avoids the feast-or-famine approach in areas like X-ray astronomy, and also lets more "flowers bloom" so that you can afford to take a few risks, and maybe hit a few home runs. Wolff: she just chaired visiting committee for AST Physics Division. They have a program on this in name only, no funding. She is telling MPS management that this is the biggest need after restoring the small grants program. This is something that could be grown within NSF.

Strittmatter: ground-based observing should have grants that come with observing time like NASA does.

Knezek: folks who work at NSF-funded facilities should not have to go to NASA to get support for their research.

Olsen: in 1990 survey, no one saw dark energy coming. Need to preserve a system that promotes flexible science and flexible responses to new discoveries.

Romeel Dave: We have a lot of telescopes around, and the Federal Government needs to get involved in sort of mid-lifetime new developments, like Sloan 3, to promote ongoing activities.

Blum: What are the most important criteria for making choices about activities?

Wolff: 1) Science merit; 2) Broader impacts (straight from NSF)

Angel: Should also consider leverage, in terms of Fed government investment supporting private funding.

Angel: will Survey still talk about GSMT, which implies the Fed government is leading it, or will it address the facts on the ground now: GMT and TMT? Rieke: have to walk a fine line in recommending a generic "GSMT" capability that does not turn off private donors to one or the other project. Angel: but talking about a general GSMT will turn off private donors. Silva: real question is, will there be Fed involvement in one or more large telescope? We have to acknowledge that there are 3 real projects, and we have to find a way that Fed government can take part

without damaging either of the US projects. It would be devastating to US astronomy if either or both failed. Angel: if you say "a GSMT" that implies only one project which is already loaded. Lunine: in science panels, there are already discussions that involve the differential science capabilities between the two US-based ELT projects; there is no real solution, but we do have to be realistic. Strittmatter: in 1980 we thought there would be 1 8-10m telescope; now there are 12. We should not be so limited as to think there will only be 1. Or 2. There may be as many as 6.

Hillenbrand: It would be useful to concentrate the science discussion on what measurement capabilities are needed, not on specific facilities.

Harbeck: how do you actually go to this large capability? What is the path towards getting the community ready to use it, and making it available to the community?

Steve Pompea: To amplify what Wolff said about broader impacts: Educational benefits of projects are essential to selling government on the importance of astronomy to the nation.

Jay Elias: working on a white paper on instrumentation, and has heard about cultural shift towards a web-based culture and away from actually building things. Need to come up with a way to reach out to people well before they get to college. Hillenbrand: why have we not done this better? Elias: need to identify people that are doing this kind of outreach and ask them what works. This affects our profession, as well as being a "side benefit" to society. Wolff: discipline of research in how to do education more effectively has come a long way in the last 10-15 years; we need to do a better job of integrating this with our science projects this time. We also need to integrate and advertise the things where our research in techniques or technology have broader benefits to society, like database query and data dissemination problems being researched for LSST.

Angel: noted that he is working in solar energy now because of the relevance of astronomy technology advances in that area. This is an example of how we can have a broader footprint.

Mighell: consider the issue of a more diverse work force and do a better job of getting undergrads into grad school (lots of minorities drop out at the BS or MS level). If one wants more physics majors, the effort has to start in high school. This is beyond the purview of the Astro2010 survey, but is an issue we have to think about.

Katy Garmany: we can make most progress in working with teachers. High school physics teachers are generally not very good, and if students don't take physics in high school they will almost certainly not go into phys sci in college.

Knezek: it's not just about scientists. We need engineers and technical managers and we need to find ways to encourage people to go into these fields and then work in astronomy.

Romeel Dave: astronomy is gaining profile at, say, society of black and Hispanic physicists. We need to work with physics community.

Scowen: having two sets of white papers on science and technology go to two separate panels forces too much artificiality.

Blum: we'll get to this after lunch, let's focus on criteria for survey now.

Olsen: fears that if we only focus on large projects we are addressing the science goals of that project, but we are putting so many eggs in one basket, which has limited access, that we may be limiting our ability to do science more broadly. Need to have balance across size of projects and across support of whole system of capabilities.

George Rieke: community is more creative than panel, and should retain flexibility to deal with new ideas that come up (ex: last survey stressed imaging of planets, but people have figured out how to do a lot of good exoplanet science with transits = networks of small telescopes). Daniel's "medium grants" program is good for this.

[Lunch]

Moderator (Blum) asked for a show of hands: how many attendees are postdocs? = ~5. How many are grad students? = 2. [Ed. Note: Not sure of exact count, but numbers are approximately correct. This was out of a total of 30-40 people returning after lunch.]

Blum: what is the role of activities such as technology development, theory lab experiments? How should they be weighted relative to projects/infrastructure?

Blum: what about balance of these efforts vs specific projects? Do we need some general development center like CfAO to develop technology that will enable the large projects?

Wolff: we have made AO roadmaps, not much came of it. We certainly need roadmaps for things like that. We also need to include technology development as part of the life cycle costs of the projects.

Blum: are we in danger of any of the known projects not going forward if we don't spend money on technology development?

Eisenstein: projects we've been talking about are ones that are now pretty mature and mostly past their technology development stages, but astronomy in general is very tech driven, and the technology development work we do now will support the projects in 2020 or 2030.

Angel: separation of technology development as a sep topic is artificial. Using physics to build instruments is as much a part of astronomy as using physics to understand the universe.

Scowen: agencies seem able to support technology development only when there is a specific mission or project it's supporting. But there are people who would like to do technology development for its own sake, without being tied to a specific goal. But there's no real money available for that.

Lucy Z: even less money available for making measurements in lab that are needed to support astronomy. Wolfe: this is getting at a problem; it often falls into the crack between astronomy and something else like chemistry or computer science. Rieke: that's why the technology development panel got broadened to include lab experiments, theory, etc.

Thompson: a science theme is the effort to understand the 96% of the universe we don't understand right now. One of the tests of certain theories is whether the fundamental constants vary over time; this requires a lot of lab measurements at higher precision, such as electron to proton mass, to get to fine structure constant. This leads to a natural cascade of large-to-medium-to-small projects all aimed at one science theme. We should focus on these themes and the cascades of projects they lead to, rather than on one or two specific missions.

Olsen: yes, but are there some activities in technology development, lab work, or theory, that we should do for their own sake?

Blum: do we have the right structure in the Survey to put that plan together?

Thompson: we are the survey, let's make it do what we wish. This also leaves flexibility to fund projects that are not on the list if they fit within the broad science theme.

Angel: origin of LSST, was that 10 years ago there was the combination of Angel seeing how to make an 8m telescope with extremely wide field, and Tony Tyson thinking of a major science problem it could address. Neither one grew up in isolation, in particular the design was not developed because of the science goal.

Eisenstein: most problems in astronomy are study of complex nonlinear systems. We are now a data-rich science; but we need a lot of theory modeling to understand, for example, how galaxies form from all the data available. Theory is very resource limited, which really comes down to people (positions). We need to give a high priority to theory. We tend to emphasize facilities in these reports, but we are not going to understand the data they provide unless we have strong theory.

Silva: theory means a different level of understanding in physics vs astronomy. In astronomy, it really means simulation, and this is resource limited. Romeel: simulations are the way we do theory. Silva: right now understanding of dark matter is all phenomenological; we may be nearing a major breakthrough, but that is why "theory" needs adequate funding.

George Rieke: we have the project-directed tech dev now, because of past experiences that lead to a lot of technology dead-ends. But we have to wrestle with the problem of focusing recommendations on technology development in support of

future goals so that important things get done. It's almost as though this panel needs to think about the projects for 2020 to know what technology development to do in 2010.

Mighell: need to keep current active groups making steady progress on basic fundamental developments, so that we can address the science questions 15-20 years down the road. For ex: to make a black hole imager, you need to get 100-1000 times the angular resolution in space: requires developments in precision metrology and formation flying, to get 1-m telescopes in orbit with km scale baselines. Blum: this ties back into Rodger Thompson's comment about major science themes.

Silva: themes of things beyond 10 years keeps coming up. How is the panel dealing with this? Rieke: formal charge deals with next decade, but they are thinking hard about what comes after. Silva: this is where identifying science horizons becomes critical.

Hillenbrand: comment about questions. There is no separate theory panel this time, because it's perceived that these areas in Bob's question are part of the infrastructure of how we do astrophysics, as much as the projects.

Lunine: responding to Silva: part of the problem is the different timescales that these projects entail. Not clear that Survey has a good idea on how to handle it. Example is JWST: it's not under consideration in this Survey, even though it hasn't launched yet. On the other hand, there are ground-based surveys that will be complete in 5 years that are under consideration. In exoplanet task force, there was some granularity, with specific recommendations for 1-5 years out, more general rec's for 5-10 years, and just notions for 10-15 years.

Thompson: you don't win any medals for being frugal. We're in bad economic times right now, but if things get better and more money is available, we won't get it if we don't have projects lined up ready to do. Hillenbrand: The charge to the committee is to consider different budget scenarios.

Eisenstein: portfolios have gotten skewed towards large projects, which biases everything towards risk-aversion (you can't afford to have a billion dollar project failing).

Dave: is NASA the only way to get to space? Can we go on commercial launches?

Thompson: NASA does have an AnnOpp out for science projects that can piggyback on commercial launches. If you want to take the risk (such as recent OSC launch failure), you can do it.

Scowen: NASA's standard modeling software for space mission costs is not good for large missions. How is Panel going to do this any better? Rieke: don't know yet. Blum: when does RFP go out? Rieke: RFP for cost contractor has not gone out yet, but is expected soon.

Blum: what about data analysis, dissemination, archiving? D Silva: VO was ranked very high in last survey; what happened? DeYoung: what was ranked highly in last survey was developing VO infrastructure; project has not been a failure. But it depends on work being done now.

Michael Cooper: on subject of multi-wavelength matching, database mining, etc: all these projects, to be successful should have some resources devoted to pipelining, data mining, etc. On the other hand, he wouldn't have a job if that was all he did; this software development work is very important but not rewarded.

Angel: UA recently got \$50M from NSF for a biology center that is very broadly spread over wide variety of topics. If we can find a way to get an astronomy center that touches on everything, we can get NSF support.

Weiner: We have a bad attitude about software, related to the same problem for instrumentalists. We could think of things like publishing a short research note on software so it gets referenced when it is used.: we have no software standards in astronomy, but we all need it. Software also is unrewarded in a career sense much like instrument building is unrewarded. Have to spend money on it, maybe through local software centers, but also through greater acknowledgement and career reward. Blum: could start by having software get publication credits and citations like papers.

Eisenstein: this sort of ongoing support is necessary for surveys to be useful. Have to pay to continue to operate and curate databases for people to use them. Really calls for some kind of national archive. But be aware that this is not the same as people getting science out. He likes the idea of people downloading data and writing their own software.

Thompson: question illustrates the problem. Need to have a total system that preserves the data for the community, in a form that's ready to do science with; doing this should be imposed on the projects as a requirement and included in their funding.

Silva: what ESO spent on its La Silla data center, over 10 years, pays for a couple of 10-m class instruments. Community has always wrestled with the issue of doing one vs doing the other. Not clear that it's worth doing with every observation on every instrument. It's one thing for a survey like Sloan, where consistent calibration, etc, is vital to the science. But it's something else for a workhorse spectrograph.

Eisenstein: yes. Brings up the point that we need a national archive center so that the cost of maintaining the data in perpetuity is not dumped on each individual project/instrument (which is not the most efficient way to do it) (responding to Thompson).

Silva: don't talk about project names. Talk about pointed observations vs surveys. Need to treat those two kinds of projects differently because they have different

needs. Kind of archiving you want to do for a general purpose facility that does a wide variety of different projects is very different from the archiving you want for a wide-field, hopefully uniform, survey.

Thompson: even for individual programs there is a multiplier effect from having proper archiving and reduction. They had to do this on NICMOS and would not have if GTO's were the deciders. But the data had to be ingested into HST archive, and even observations that RT never thought would be useful to others have been downloaded and used 15 times over.

Eisenstein: bear in mind that archives are simple to maintain when they are just catalogs, but a bear when they are searchable databases of actual data/images. This is what SDSS is finding.

Blum: Two remaining "moderator's questions: What are the most important issues impacting "State of the Profession"? and, How should agencies rebalance in light of changes in assumptions, science goals, etc.?

Zaritsky: need to think hard about how we give and distribute credit for work and for different types of work.

Olsen: We've talked about diversity issues and they're important. There are also a couple of white papers about job market and job satisfaction. Changes in the job progression (more postdocs, more moving around, etc) make it very challenging for young people. Lotz: why are we talking about attracting new people to the profession when there are so few permanent jobs? AAS job reg has 20 faculty jobs and 200 postdocs. She is 34, thinking about having another kid, does not want to move, but has to when her postdoc is up.

Knezek: maybe we should move towards a model where people work in one place but the project they work on/for changes. Internet communications makes it less important where you are physically. We need to think about how we hire and what we expect our young people to do, over time.

Garmany: doesn't want to encourage a bright high school student to go into astronomy, if their prospects of getting a real job are what they are today.

Silva: what is a real job? Is it only a tenured position at a top ten university? We still have the bias towards this, but we may need to get over it. What is the value of tenure in today's economy? How does this compare to other professions/fields? In other areas, people are moving every 3-5 years, either company to company or within a company. It's not that rare any more. There are plenty of ways to have a satisfying career that don't involve the magic words of tenure.

Dave: we really have it pretty good. We get to stay in one place for at least 2 years, we can't get laid off on 2 weeks notice (mostly) and the "failure mode" for dropouts is to go to Wall St or industry and make a ton of money. We also get to work on some very interesting stuff.

Weiner: Lots of people leave, but they are still happy in what they are doing. Not irresponsible to encourage people to go into astronomy as long as we're honest about where they might end up.

Lunine: has survey given any thought of doing research on how astronomy compares to other professional careers in these areas? And in question of getting people excited about astronomy, we should think more about just getting people excited about science in general and astronomy is a good vehicle for that. What we do is useful to nation.

Silva: makes him unhappy that our field has had such an explosion of soft money jobs that keeps people in "temporary" positions for so long. Although he doesn't think moving in itself is bad, it is difficult to keep people in holding patterns and not getting into "entry level permanent" jobs.

Wolff: yes. The profession needs structure so that postdocs are a career advancement process and not a holding pattern.

George Rieke: need to move on to another question. Demographics are such that there should be a lot of positions opening up soon, but for the fact that universities are under a lot of pressure to become more efficient which means much heavier teaching loads and fewer positions relative to the number of students.

Last bullet, about dealing with changes: Wolff: report needs to be written in certain ways so that there is obvious flexibility. Rieke: also include various decision points where priorities can be changed based on new developments.

Blum: should we swear allegiance to the Decadal Survey, or should we encourage off-cycle shifts like Quarks to Cosmos? Wolff: as astronomy becomes more interdisciplinary it is harder for us to own the process and less realistic to think we can.

Angel: have to find places where we can get exponentially better performance per dollar of funding.

Procedural Input

Olsen: not clear to him what DS panel wanted out of WPs. Some were on general science topics, some were science justification for specific projects. Also; what does DS panel think about earmarks and going around the DS process? Should someone who bypasses the DS priority-setting not be allowed to participate in the next DS?

Angel: Survey is not all-knowing. Earmarks allow things to go forward that may be good but not thought of.

Zaritsky: anything that brings money into astronomy should be thought of as good.

Wolff: AAS is on record as opposing earmarks. She is not so convinced, but hates living in a state where there is almost no prospect of getting one!

Elias: is there any plan to publish some statistics on the White Papers showing that Survey panelists have actually read them? Rieke: something will be done.

Hillenbrand: they were actually broken down by self-selection process through submission to particular panel. They were more or less evenly distributed.

George Rieke: If we have to get rapid input to econ stimulus timescale, we still have advisory structures out there – AAAC etc – and we need to use them for this purpose and not assume everything else is shut down until DS comes out.

Silva: stimulus planning is now way downstream due to Congress' onerous requirements about when Congress has to be informed, when money has to be disbursed, etc. It is already freezing out to the point where it will probably not be possible for this report to affect anything. (too late already).

[close out]