

Report from the SEUS  
**Structure and Evolution of the Universe Subcommittee Meeting**  
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C. Dermer  
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If adversity builds character, then the last few months have been character-building opportunities for scientists who depend on SEU-related funding. This includes scientists proposing for explorers, and those who depend on development money for LISA and Constellation-X.

As reported by Dr. P. Hertz (NASA HQ), the SEU budget was reduced by some 75 M\$, from a FY04 budget of 450 M\$ to a FY05 budget request of 375 M\$. Where is this money taken from? The prospective April 17<sup>th</sup> launch of GP-B from Vandenberg AFB brings to an end the major development costs of this program (knock on wood), but the far larger costs are taken from the Small Missions, including explorers. (The Small Missions in SEU now include Swift, Astro-E2, Herschel, Planck, and development costs for EUSO.) This has devastating effects for scientists looking for explorer opportunities (see my notes on the FY05 NASA budget). No significant increase over the preceding year is provided for Con-X and LISA, and other costs for the Beyond Einstein program are at ~5 M\$, precluding all but seed funding on the Einstein Probes or the Vision Missions. The balloon program takes a hit, but fortunately MO&DA and R&A remain at levels comparable with or above the FY04 funding. The Swift and GLAST programs are supported.

As I see the overall SEUS picture, scientists who are part of missions in operation or under development are in good shape, but those scientists who are looking for opportunities in the BE or Explorer program should keep their resumes up to date.

Mission concept studies have been carried out for the Einstein Probes. For the Black Hole Finder Probe, the following mission concepts were selected:

- Josh Grindlay (Harvard) with EXIST
- Mark McConnell (UNH) with CASTER (Coded Aperture Survey Telescope for Energetic Radiation from Black Holes)

Five mission concept studies were selected for the Dark Energy Probe, divided according to whether it was a complete mission or joint with DOE, and further whether it was SNAP-related or an Alternative to SNAP. The good money bet is that SNAP will win (but then the good money was on Martha Stewart being acquitted). Three Inflation Probe mission concept studies were selected.

Three proposals were selected for SEU Vision Mission concept studies, including

- Advanced Compton Telescope: Witness to the Fires of Creation (Boggs, UC Berkeley) [Note to ACT scientists: this title is overheated.]
- Big Bang Observer: Direct Detection of Gravitational Waves (Phinney, CalTech)
- Gen-X, a Large Area and High-Resolution X-ray Observatory (Brissenden, SAO)

An interim report is due for the December 2004 Roadmap Workshop committee.

Dr. A. Kinney (NASA HQ) reviewed the A&P program, including the decision by NASA Administrator O'Keefe to cancel SM4. There is now a movement afoot to reverse that decision, as those of you who receive AAS policy e-mails know. Astronomers should weigh very carefully the wisdom of trying to overturn Mr. O'Keefe's decision. Suppose the decision were overturned. Not only will this create negative tensions between the upper levels of NASA management and the space scientists who depend on NASA funds, but worse, imagine a safety problem during the reservicing mission. Besides validating the original reasoning behind the decision, this would adversely impact the good standing that space astronomy now enjoys within NASA and, more importantly, with the public.

In any case, astronomers who depend on Origins funding are unlikely to go hungry anytime soon.

Speaking of the public, Dr. Kinney noted the good press that NASA receives with its Space Science Updates, including two Chandra SSUs on black hole sound waves and a giant black hole ripping a star apart. An RXTE SSU on a cosmic speed limit for pulsars, by contrast, did not receive such widespread attention, and there was some discussion by OS and SEUS committee members about why black holes excite the public and pulsars do not (as if this reflected a cosmic unfairness). As one who has written papers on black holes and neutron stars, let me just say for the record that black holes mark the boundaries of physics, portholes to new universes, destroyers of information, drivers of relativistic jets, whereas neutron stars are...big batteries. Don't even get me started on white dwarfs. "Superlatives are news."

GP-B, again, is scheduled for launch in April, and it *is* a success. Swift launches in September 2004 from Cape Canaveral. A long list of program opportunities through ROSS-04 and the GO programs was displayed, reflecting the relative health of the R&A program. (Now if I could only get a proposal funded...)

Mr. Melvin Montemerlo (NASA HQ) presented an interesting draft document on enabling technology requirements for OS and SEU missions. Each mission listed in the two Theme Roadmaps or selected as Vision Missions had their science goals, system characteristics, orbit, schedule, and optical, thermal and structural capabilities specified. The document reveals just how pre-Phase A that the ACT, Gen-X, and the Vision Missions are.

Dr. H. Tananbaum (SAO) presented a lunchtime talk on the great results from the Chandra X-ray observatory. I'm beginning to suspect that the point source at the center of Cas A is a black hole: they still haven't found pulsations. Dr. Tananbaum discussed the extended Chandra jets, and referred to the (probably incorrect) [interpretation](#) that the X-ray emission of supermassive black-hole jets is Compton-scattered CMB radiation.

After lunch, Dr. E. Weiler (NASA HQ) described "Space Science and the President's Renewed Spirit of Discovery." The vision is "to implement a sustained and affordable

human and robotic program to explore the solar system and beyond,” and to return humans to the moon by 2020 and Mars thereafter. The next flight of the space shuttle will be no earlier than March 2005. The space plane program is terminated, and will be replaced with a Crew Exploration Vehicle, with plans for operational capability before 2014. The vision is for “sustainable exploration...not one time events,” yet the plan is to make a “foray to the moon, and not to establish a permanent presence.”

It is indeed time to begin a program of Solar System Colonization: this is something with which most astronomers agree and is something even to become passionate about.

But the implementation seems all wrong. Rather than defund the Beyond Einstein and Explorer programs, the obvious source of money to implement the President’s vision is the human spaceflight program, in particular, the International Space Shuttle. Whatever the perceived merits of the ISS were in the past, it is now scaled back to become simply a laboratory for human physiology in LEO, as if years of study with the ISS and Mir have not taught us all we need to know about the radiation environment and zero-gravity effects of LEO. Huge amounts of money (about 2 B\$/year through 2016) are being allocated for completing the ISS, and to what purpose? To drive it in the ocean around 2017! This new Vision makes the ISS an incredible folly and waste of resources, not least of which are the talents of the aerospace engineers who could be reassigned to the CEV and other programs defined within the president’s Vision. The ISS is not even valuable for teaching us about human physiology for the trip to Mars: the radiation environment in LEO is very different from that in interplanetary space.

I questioned the logic behind returning to the moon, given that no permanent presence is planned, and that the natural way station for an expedition to Mars is L4 or L5, not the moon. Let’s go to Mars, by all means, but in a way that builds on our strengths and resources, not subtracts from them.

What will the historians write when they review the period following the Soviet and American conquest of space? *Opportunities lost, resources squandered, all to make circles in LEO with no meaningful objective.* I say: “End the ISS and retire the Space Shuttle as quickly and expeditiously as possible and get on with the President’s Vision to colonize the planets, all the while maintaining a robust space science program.”

We received briefings later that day about LISA and Con-X, but I don’t see the urgency in following the progress of these missions right now. (Neither did one of the presenters, who is leaving the program.) Dr. E Wright (UCLA) points out that Con-X is dangerously descopable. In the evening, some of the SEUS people went to visit the CREAM (Cosmic Ray Energetics and Mass) Lab at the University of Maryland (PI: Dr. E.-S. Seo). CREAM is a balloon-borne telescope to measure the total energy of cosmic ray ions in the 1 TeV – 1 PeV range. I wanted to know if CREAM can test our proposed [complete model](#) for the origin of the cosmic rays, which depends importantly on observations near the knee of the cosmic ray spectrum. We predict composition changes around 100 TeV, where cosmic rays accelerated by Galactic supernovae that collapse to form neutron stars

begin to be dominated by Galactic supernovae that collapse to form black holes (i.e., Gamma Ray Bursts).

Jeff Hayes (NASA HQ) briefed us the next day about the R&A program, which is one of the few bright spots in the NASA budget for bottom-feeding theorists such as myself. The R&A program comprises three main elements: “traditional R&A” (laboratory astrophysics, and instrument and detector development), data analysis (including archival data and theory), and the GO programs. Increases in the R&A budget now satisfy a concern of the 2000 Decadal Survey to increase funding for astrophysical theory, yet there are unsettling disparities in funding for the different Great Observatory GO programs. For example, *HST* receives 28 M\$ whereas *Chandra* only receives 15 M\$. To take an example not wholly at random, this still makes it hard for a gamma-ray theorist (who has to break into an X-ray program) to survive, let alone support a group.

Dr. P. Eberspacher (NASA) described the sounding rocket (suborbital) program. The sounding rockets fly out of Wallops. The new generation of High Altitude Sounding Rocket will provide 40 minutes observation, compared to the 5 minute observation time of the earlier sounding rockets. Even so, the SEUS members felt that these observing times were of limited use for SEU science, and no list of SEU-related rocket flights was presented. Dr. Vernon Jones (NASA HQ) gave an update on the balloon program, which suffers because of the funding situation, as well as having to depend on a single vendor for balloon material. The balloon program remains a vital part of NASA to train new scientists, test prototypes, and do great science (e.g., BOOMERANG). Yet it also has to fit within NASA’s new vision.

For the SEU scientists, we are still left with the quandary that although we have unique and compelling science, there are limited resources to realize the programs that provide this science. Some of the guidance provided to improve the SEU profile is always to consider “what is useful for NASA,” and to focus arguments for the “high priority, compelling science that NASA can do,” that fit within NASA’s strategic vision. With the new vision of exploration enunciated by the President, this may prove to be a formidable challenge given the character of the SEU theme (though the word “beyond” is there). Rather than try to reinvent ourselves, it seems best to give the last words to Dr. Kinney, who advises, “Be who you are—no one else is better qualified.”

Prof. E. Kolb (Fermilab, U. Chicago) chaired the SEUS, and Prof. D. Spergel (Princeton) chaired the OS.

The presentations are posted [here](#).

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