

AstroSR2014: What did we do?

1. Consensus on methodology for ranking missions
 2. Argue and debate a lot
 3. Results
4. Recommendations in two cases due to tremendous uncertainty in budget
5. Confidential recommendations to NASA

Please see the full report which is publicly available

Ranking Methodology

Science Program

- A. Uniqueness and overall strength of the science case
- B. Responsiveness to the Astro2010 and NASA Astrophysics Division priorities
- C. Synergy with other missions
- D. Quality of archiving plans

Cost Elements

- A. Cost efficiency in terms of meeting proposed goals
- B. Adequacy of Science Support Program(s), including GO/GI elements or others

Responsiveness to NASA Senior Review Process

- A. Assessment of meeting goals set or recommended in the 2012 Senior Review
- B. Quality of PMO description and goals for the 2016 Senior Review

Mission	SciA	SciB	SciC	SciD	CostA	CostB	ResponseA	ResponseB	Wtd Mean
Swift									0.0
Spitzer									0.0
NuStar							na/		0.0
Fermi									0.0
XMM									0.0
Suzaku									0.0
Kepler/K2							n/a		0.0
Planck									0.0
MaxWISE							n/a		0.0
Weights	1.00	0.20	0.30	0.30	0.50	0.50	0.25	0.25	3.30

Results

Mission	Median	Std
Swift	9.2	1.9
NuStar	8.8	1.2
XMM	8.4	2.4
Fermi	8.3	2.8
Kepler/K2	8.2	0.8
Spitzer	7.8	2.2
Suzaku	7.6	1.7
Planck	7.0	1.6
MaxWISE	6.8	2.1



Fig. 2 Ranking Results

recommendations are not strictly tied to the rankings above, because the SRP was charged also with maintaining a reasonable balance among the scientific goals that addresses as many of the Astro2010 science questions as possible. The SRP recognizes that this deviation from strictly applying the ranking metric above is slightly different from the conclusions of previous SRPs, but the reasoning has to be placed in the context of the actual funding climate at this point.

Note that accounting for the Standard Deviation:

MaxWISE: 8.9 to 4.7: 2nd or 9th place

Swift: 11.1 to 7.3: 1st or 7th place

Recommendations

- Case I: Full funding could be found, deemed Ideal
- Case II: Projected funding at the time

Opinions

1. Some Missions are more appropriately reviewed at a cadence other than every two years—Change the law and give NASA flexibility in determining the cadence.
2. The 2 year cadence places significant burden on missions and NASA
3. Budget volatility creates significant confusion and leads to reduction of the efficacy of the Senior review
4. OIG Report is biased and incomplete
5. Continuing missions is of tremendous value at very low cost

OP-ED

The real end of U.S. exceptionalism

Would you be willing to pay more than 25 cents a year to understand the cosmos?

By **B.R. Oppenheimer**

STUDYING THE UNIVERSE — perhaps even modern science as a whole — is as American as apple pie and baseball.

Although America was not the first country to launch a satellite into orbit, it has, for more than half a century, pioneered the exploration of the universe from the advantageous perspective that sensors, robots and telescopes offer once they are off-world. Looking through a telescope in space — as opposed to one on the ground — is, to an astrophysicist, as revelatory as a child's first sense that shapes and faces are physical, can be touched and explored, and that vision is a meaningful way to understand where one is.

Far from the water-laden, turbulent atmosphere that protects Earth's cozy climate, a telescope can study otherwise invisible aspects of the cosmos: black holes, the evolving structure of the universe, the birthing of stars and our closest, smallest neighbors, some comparable in size to Jupiter, yet roaming the universe alone. We even have evidence that planets similar to Earth may be quite common in orbits around stars other than the sun. These discoveries made by astrophysical experiments in space have completely transformed our view of where we are and how this planet came to be.

Twenty years ago, when I started graduate school at Caltech, if I said I wanted to find planets around other stars, people in the field would laugh and say, "Go watch

'Star Trek.' " Now the study of "exoplanets" is a rich field of research that addresses fundamental questions surrounding our own origins. Much of that knowledge comes from telescopes in space.

This priceless knowledge is a result of the dedicated effort of thousands of people over several decades. It could not have been achieved without the resource-rich, forward-thinking mentality that NASA has had in the past. Today, however, our current political climate has put this groundswell of support in jeopardy.

I recently chaired an independent review committee for NASA's astrophysics division to conduct a senior review, a peer review that division of Our group of 10 experts was tasked with examining the existing telescopes and types of sensors currently in operation, some in orbit around Earth, other at huge distances and orbiting the

There are 10 current missions receiving an investment of billions of dollars over three decades, including significant contributions by the European and Japanese space agencies. All of these space agencies have unique capabilities to render faces of the universe visible for scientific scrutiny, capabilities that probably will never be

Our committee's charge involved ranking the scientific value of these missions, and helping the senior administration at NASA allocate available funds to ensure the highest-quality science for the next four years. For three weeks, we professors, researchers and other professionals, none of whom was directly involved in any of the projects, deliberated pro bono to develop a plan that would keep the field healthy within the specified budget guidelines.

When we heard what the guidelines were, we were horrified. We estimated that NASA was operating many of these mis-

sions at a level that was below 2% of the initial construction and launch expenses. Standard management practice suggests that 10% of the initial construction cost is a reasonable annual budget for operating a facility. We had to work with a total of \$75 million. That is what the government

Are we, as a nation, to be remembered by future generations for building these remarkable eyes on the universe, simply to let them drift away into darkness or vaporize in the atmosphere, when they can still see things no one has ever imagined? Are we not obliged to continue this bold exploration, with vigor, for the benefit of all of humanity?

imaginable to Ben Franklin as he established American science many years ago. Are we, as a nation, to be remembered by future generations for building these remarkable eyes on the universe, simply to let them drift away into darkness or vaporize in the atmosphere, when they can still see things no one has ever imagined? Are we not obliged to continue this bold exploration, with vigor, for the benefit of all of humanity?

B.R. OPPENHEIMER is curator in charge, professor and chairman of the astrophysics department at the American Museum of Natural History.