

From: CVAX::PVANDENB 13-MAR-1991 11:37
To: CVAX::GATEWAY::"TYSON@PHYSICS.ATT.COM",PVANDENB
Subj: RE: LIGO

Dear Tony,

This is a difficult subject for me - hard to be objective. As you know, I had a big battle with Bloch in front of the WV senators over Bloch's attempt to substitute LIGO for the GBT. As a result of this idiotic suggestion I continue to be haunted by LIGO: Byrd's people have forced us to propose GB as a LIGO site in the current competition. It is a lousy site and our very half-hearted proposal stands no chance in a fair competition. Still, I would feel better about the future of GB as a radio astronomy observatory if I knew LIGO was dead. (PLEASE delete this message on first reading!)

As a physicist I will admit to a certain fascination with the technology and interest in the quest to detect gravitational waves. It is not clear to me that the detection is worth in excess of \$200M though. Something that big at NSF falls in the class of a facility, something that should have a more enduring usefulness. I assume that is the origin of "observatory" in the project name. I leave it to more knowledgeable heads, like yourself, to judge how useful LIGO will be as an observatory. I am skeptical.

I mention LIGO from time to time to colleagues around the country, mostly astronomers. Most have not heard of it or at best know next to nothing about it. They are astonished to discover that it is called an observatory. As far as I know, the ACAST had a single presentation of LIGO, joint with the physics advisory committee, and that is all. It's all very well for the physicists to go their own way and do any astronomy they like (as a refugee from physics how can I argue otherwise?) but I believe they deserve all the flak they are sure to get from astronomy for their aloof independence. The whole effort has the earmarks of Marcel Bardon plus Caltech - arrogance. As I say this, I realize that we in astronomy need the support of others in MPS for our projects and I have no desire to start a war. But can you imagine the outcry if astronomy were to propose building a \$200M particle accelerator (cheap!) to better understand the early universe or dark matter or whatever? Turf battles should be avoided and ignoring sensitivities is not the way to do it.

Let me end with a political observation: there is an advantage to astronomy in having LIGO pushed hard now. It is likely to go down in flames with all the current talk about "single-investigator science." That plus the budget woes will make it near impossible to start such a big project. Once the moment for a project is past, it is impossible to revive them (recall the 25m). By the time the nation is ready for another big NSF project the MMA will be ready to go.

You see how objective I am!

Regards,

Paul

PS: I trust you when you asked for my "confidential opinion."



LIGO

NATIONAL RESEARCH COUNCIL

COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES

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ASTRONOMY AND ASTROPHYSICS SURVEY COMMITTEE

John N. Bahcall, Chairman
School of Natural Sciences
Institute for Advanced Study
Princeton, NJ 08540
Telephone: (609) 734-8058
Fax: (609) 924-7592

15 April 1991

Dr. David Heeschen
National Radio Astronomy Observ.
Edgemont Road
Charlottesville, VA 22903

Dear David:

Here is a copy of the correspondence on LIGO between Frank Press and Congressman Boucher. You may wish to keep it for your files.

Thanks for your help on this.

Best regards,



John N. Bahcall
Professor of Astrophysics

JNB:pw

NATIONAL RESEARCH COUNCIL

2101 CONSTITUTION AVENUE WASHINGTON, D. C. 20418

OFFICE OF THE CHAIRMAN

April 12, 1991

The Honorable Rick Boucher
Chairman, Subcommittee on Science
405 Cannon House Office Building
Washington, D.C. 20515-4609

Dear Congressman Boucher:

I am responding to your request for more information about the Astronomy Survey Committee's views on LIGO. I enclose a statement by the committee which has the unanimous support of its members. It carries the endorsement of the National Research Council, under whose process the survey was organized and carried out.

It is interesting to me that it is something of a tradition in the physics community to propose large-scale experiments which push the state of the art and involve instruments of record-breaking power or sensitivity. The motivation is to survey an unexplored region with the hope or expectation that an important discovery will be made. This approach has led to some important breakthroughs and has opened new areas of technology.

Yours sincerely,



Frank Press
Chairman

Enclosure

bc: John Bahcall
Norman Metzger
Roc Riemer
Walter Massey
Thomas Everhart

NATIONAL RESEARCH COUNCIL
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2101 Constitution Avenue Washington, D.C. 20418

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**Statement of the
Astronomy and Astrophysics Survey Committee**

The Astronomy and Astrophysics Survey Committee (AASC) for the 1990s reviewed the material regarding LIGO in the advocacy statement of the Interferometry Panel and considered other material relative to the astronomical importance of LIGO. The committee concluded that the secure scientific goals of LIGO for the 1990s are not astronomical. In the preliminary evaluation, there was not significant support for the astronomical aspects of LIGO among the other large new projects for the 1990s. The AASC is aware that the LIGO project has been favorably reviewed in the Brinkman report on physics and that LIGO has important goals in physics and in high technology. Since the committee's charge was to prioritize astronomical initiatives, the survey committee requested and received permission from the National Science Foundation not to rank or discuss LIGO in the survey report.

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March 27, 1991

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Dr. Frank Press, Chairman
 National Research Council
 2101 Constitution Avenue NW
 Washington, DC 20418

Dear Dr. Press:

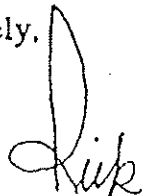
In preparing for authorization of the National Science Foundation (NSF) programs, the Subcommittee on Science is reviewing the NSF budget request for fiscal year 1992. Included in this request is a proposal to construct the Laser Interferometer Gravitational Wave Observatory (LIGO). According to NSF, an important justification for proceeding with LIGO is that the project represents the beginning stage of a valuable astronomical observatory.

The Astronomy and Astrophysics Survey Committee of the National Research Council (NRC) has recently concluded a careful assessment of facility needs in astronomy for the next decade. The Survey Committee's report, "The Decade of Discovery in Astronomy and Astrophysics", sets forth a consensus on what new facilities ought to be funded and places these facilities in priority order. Although not included among the recommended projects, LIGO was reviewed, I understand, by the NRC Survey Committee as a potential astronomical facility.

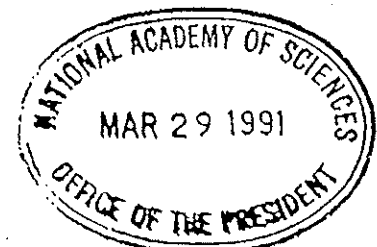
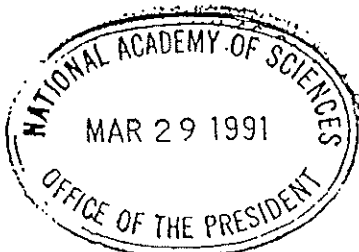
In order for the Subcommittee on Science to determine what action to take on authorization of LIGO, we need to verify whether LIGO was in fact included among the competing astronomical facilities considered by the NRC Survey Committee. We would appreciate receiving this information at your earliest convenience along with any additional findings of the NRC Survey Committee which would assist the Subcommittee in assessing the scientific value and timeliness of proceeding with construction of LIGO. Thank you for your attention to this request.

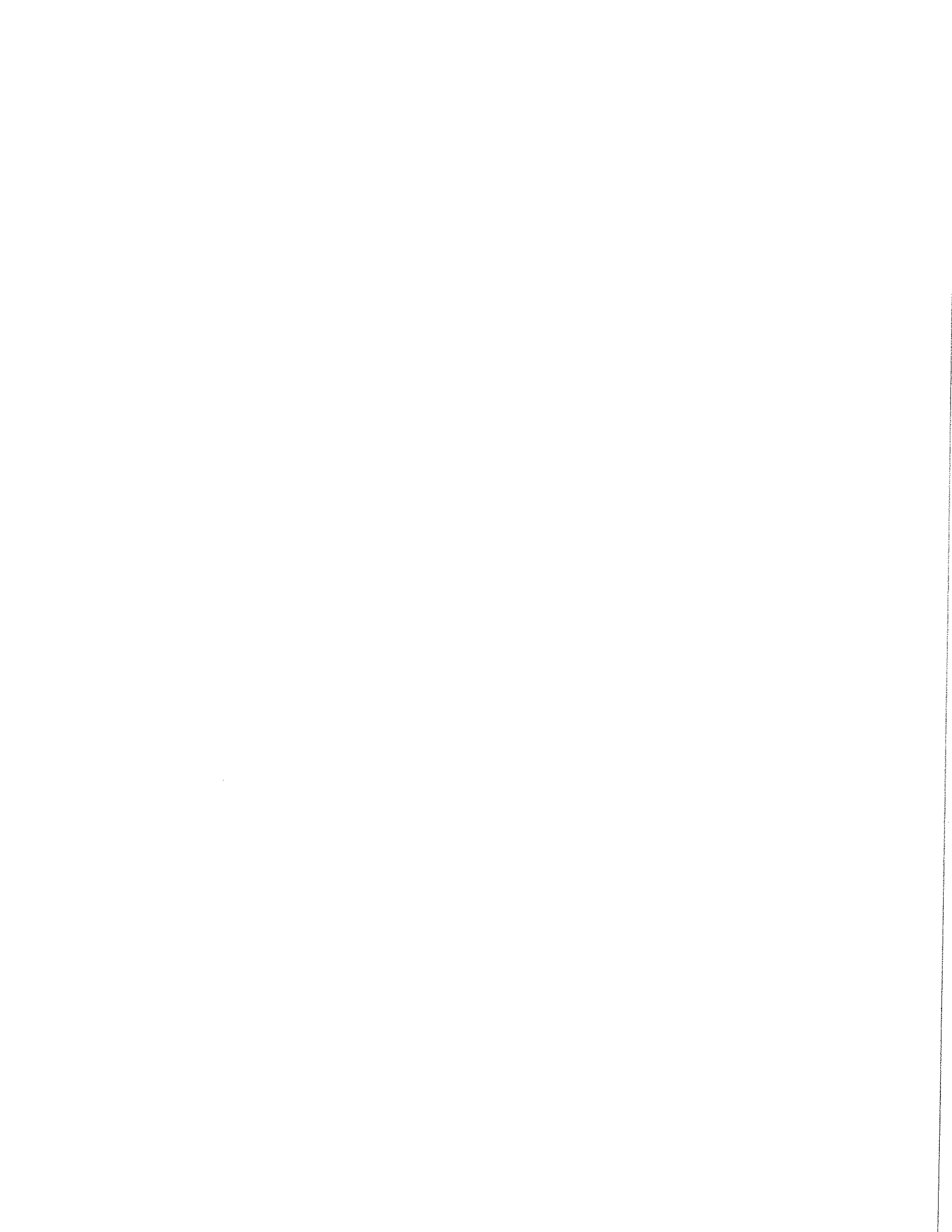
With kind personal regards and best wishes, I remain,

Sincerely,



Rick Boucher, Chairman
 Subcommittee on Science







AT&T Bell Laboratories

J. A. Tyson
Room 1D-432
(908)582-6028
(908)582-4702 - fax

600 Mountain Avenue
P.O. Box 636
Murray Hill, NJ 07974-0636
908-582-3000

April 22, 1991

Rec'd 5-9-91

Paul
Dear Colleague,

I was asked to appear before the House Subcommittee on Science on March 13. The letter, dated March 4, asks me to focus my testimony on the NSF proposal to begin construction of the \$211M LIGO. It asked me to give my "assessment of the scientific merit", "its relative priority in light of other scientific opportunities and needs, in light of the projected cost", and an "assessment of the technological risk of achieving the required measurement accuracy with the full scale facility". I was also asked to report on the opinion of the U.S. astronomical community. It was made clear from the outset that Congress wants to prioritize the various science initiatives in a "less than zero sum" fiscal climate.

My response, when learning of this assignment was to (1) request all relevant documents, including internal technical memos, from the LIGO team, (2) talk by phone with all who are closely involved with these experiments, and (3) send out an email survey to astrophysicists listed in the AAS directory who I thought might have some comment one way or another on LIGO. I felt that I had to do the quick survey (65 AAS members), since I was asked to testify as a member of the NSF Advisory Committee to Astronomical Sciences (ACAST), even though ACAST had never discussed and rated LIGO officially. I have been following the progress in gravitational wave detection over the years and have interacted with the LIGO group recently. Thus I knew what questions to ask and what data to ask for. The LIGO group and others were particularly fast in responding. My testimony (enclosed) was based on all these data.

The quick AAS survey, taking returns received by March 13, was running 4:1 against LIGO. Taking the 59/65 replies received so far, here are the results: Nine said they were not sure or did not know what LIGO was. 38 were opposed to LIGO. 12 were for LIGO, many with the qualification that it be technically feasible. So the result was 3:1 or 6:1, depending on how you count those who added the qualification. In reporting these opinions to Congress, I added that there had been very little discussion of LIGO in the astronomy community (outside that stimulated by my email), and that until it discovers credible gravitational waves LIGO would necessarily be a physics experiment. The decision to call it an "Observatory", I feel, was a mistake. Moreover, as Cliff Will also pointed out in his testimony, four LIGO facilities spaced around the world would be required. Negotiations for an international collaboration had broken down earlier.

A few days after this House hearing on the NSF FY92 authorization, the NAS/NRC Decade Survey in Astronomy and Astrophysics was made public. LIGO, among many other exciting initiatives, was considered. It did not make the cut and is not mentioned in the lists of recommended projects. The LIGO testimonies of March 13 were overshadowed by this NRC Survey report.

The question is the scientific return from a \$211M scale-up starting now, based on the achievable signal-to-noise ratio. From what we know of the prototype performance, likely and imagined sources, and other physics and astronomy initiatives, is this LIGO proposal strongly justified? My evaluation of LIGO's chance for success and scientific merit is of course my own opinion. While I think that some LIGO-like approach is ultimately the right way to pursue this field, I think the technical evidence shows that it is premature to scale up to the full LIGO at this time. There is just too much that can still be done with the prototype, particularly in the elimination of the large undiagnosed noise. While I have subsequently discovered that many physicists also feel it is premature, this testimony has not been easy. Although I feel the Congressional Record is not the place to have a technical evaluation, I really had no choice but to call it as I see it. I recommended that the exciting technology development work of the LIGO group and other gravity groups continue to receive support. I would very much like to hear your comments on LIGO.

Sincerely,

A handwritten signature in cursive script that reads "Tyson".

J. A. Tyson

Draft Bill Prohibits Construction Funds for LIGO

FYI No. 58, May 3, 1991

The Science Subcommittee of the House Science, Space and Technology Committee approved a draft bill which amends the National Science Foundation Authorization Act. The amendments bring NSF authorization levels in line with the President's funding proposals and reflect some changes in priorities.

The current NSF authorization law approved funding levels over a five-year period, from FY 1988 through FY 1993. The law calls for a doubling of the NSF budget by 1992 and, therefore, authorized approximately \$500 million more than the President's request for FY 1992. There is no real need to make amendments since the authorization is non-binding; the appropriations committee can fund NSF at levels above or below its authorization. However, this action is another indication of Chairman George Brown's interest in raising the profile and influence of the Science, Space and Technology Committee.

The draft bill lowers the FY 1992 NSF Authorization to \$2.72 billion, identical to the level of the President's request, which is 17.5 percent above the FY 1991 appropriation level. The bill makes some changes in the President's plan for NSF in FY 1992 in the following areas:

- o \$23.5 million (the President's proposed amount for LIGO construction in FY1992) is shifted from Mathematical and Physical Sciences to the Academic Research Facilities Modernization program
- o A decrease in the Academic Research Instrumentation program from \$50 million to \$33.5 million
- o The Academic Research Facilities Modernization program request is increased from zero to \$40 million
- o A prohibition on construction of the Laser Interferometer Gravitational Wave Observatory (LIGO) in FY 1992

The chairman of the subcommittee, Rick Boucher (D-Va), explained that, "The prohibition on construction of LIGO does not extend to laboratory research or design studies related to LIGO. The intention of the provision is to require NSF to reconsider the timeliness of proceeding with full scale development of LIGO in light of the recent National Academy of Sciences Astronomy survey report. The Academy's report did not endorse LIGO."

The draft bill lowers the current NSF authorization for FY 1993 to \$3.07 billion, which mirrors the three-year budget projection submitted to Congress in the FY 1992 budget request. Boucher noted, "The draft bill endorses the most recent plan to double the NSF budget by 1994." The full committee must approve the bill before it can be sent to the House floor for a vote.

Public Information Division
American Institute of Physics
Contact: Marguerite Mulhall
(202) 234-7058
##END#####

May 2, 1991

Dr. Pellerin solicited the committee's opinion on which instruments to fund, given the possibility that the funding would have to come out of other programs (unless the line item can be included in the FY91 budget). Several strong opinions in favor of flying instruments on Spectrum X-gamma were voiced, particularly for instruments which would have a large guest observer/archival program. This was noted to apply primarily to the IPC. It was pointed out that the mirrors on Spectrum X-gamma would have #10 times the AXAF area at 6keV. The problem of the reliability of Soviet missions, the difficulties of obtaining data in a digital form in a timely fashion from the Soviet Union, and the question of negotiating a useful fraction of the observing time were all discussed. The last two items were urged for strong negotiating stances. The reliability problem caused division, some members believing strongly that this is always a problem in space missions and that, for the funding needed, this was a bargain others feeling that we should not dissipate too much of our effort on other nations' programs at the expense of flying new, intermediate class, missions of our own.

It was agreed that AMOWG should write a letter urging the adoption of the line item in the FY91 budget to Dr. Fisk. The sense of the committee was that Spectrum X-gamma was a good value-for-money opportunity, and that, although all three instruments were valuable and should be funded, the most important one for the US community was clearly the IPC.

I. SHAPIRO - Replacement for the Green Bank 300ft Radio Telescope.

The collapse last year of the 300ft radio telescope at Green Bank was a significant loss to US astronomy. There is a possibility of replacing it with another telescope due to the interest of Sen. Byrd (WVA), chairman of the Senate Appropriations Committee. NSF has proposed two alternatives to Sen. Byrd: a gravity wave detector(LIGO), and a replacement radio telescope similar to the 300ft. Sen. Byrd's office has requested that NASA give its opinion of the relevance of each of these to its astrophysics program. The part of LIGO that would be at Green Bank and a 100 meter radio dish would each cost #50-60M.

There was general agreement that LIGO had no direct or immediate relevance to NASA programs, although it might have some on a long (20-year) timescale if it detects gravitational waves.

A 100 meter, fully steerable, replacement for the 300ft would complement a number of NASA programs: pulsar timing to allow sensitive pulse searches with GRO; accurate Galactic Nh measurements to allow soft x-ray and EUV photometry of esp. quasars (for EUVE and ROSAT), to investigate what is believed to be emission from the inner regions of an accretion disk around the putative black hole in the center of each quasar; sensitive all-sky surveys of radio sources to allow efficient selection of peculiar active objects ('BL Lac objects') found as x-ray sources; detailed 21cm Hydrogen line spectra to allow the study of interstellar material esp. its abundances when compared with IUE and HST spectra; and all-sky 21cm surveys with a small beam to allow detailed comparisons with the IRAS cirrus and e.g. a search for molecular clouds in formation. Finally a 100 meter radio dish at Green Bank would also form a very valuable extra antenna for space-based VLBI.

The large dishes at Bonn and Jodrell Bank are not adequate substitutes for the 300ft. US astronomers do not have access to large amounts of observing time on these telescopes. These dishes are too far north to view the Galactic Center well. The Green Bank site is unique in being in a 'Radio-Quiet Zone', which allows broad bandpasses and so more sensitive observations.

The committee agreed that a 100-meter radio dish would be useful, but

was concerned that support for a replacement not eat into funds for established NSF astronomy priorities, and that it not be implied that the gravitational wave experiment was not important. It was agreed to write a letter to Sen. Byrd. This letter will be drafted by I. Shapiro and circulated to the committee for comments.

B. BURKE - Academy Report on Space Science in the Twenty-First Century

[see attached viewgraphs]

The report pointed to several general themes: The need for access to the entire spectrum; the fact that observatories' needs evolve; the need to maintain an openness to new directions of research; the need to develop supporting technologies; and the admission that we do not know the uses of man in space. General needs through each wavelength discipline are high angular resolution; high spectral resolution; large collecting area; and high throughput. Each of these needs are for several orders-of-magnitude improvement in each parameter.

The scale imagined is, e.g., a 30sq.m. imaging, high resolution spectroscopy, x-ray telescope; an 8-16 m. uv/optical/ir Space Telescope; and an optical interferometer with #microarcsecond imaging ability. The proposed program could be carried out with a 3.4% annual real growth in the NASA astrophysics budget through 2020. [ah, the power of exponentiating - I.S.]

The moon was considered as a site for astronomy and found to be very promising at all wavelengths. (An appendix on this was written but did not appear in the final report.)

[This appendix will be circulated to the AMOWG members]

T. NAGY - LDR: A Case Study of NASA Technology Development.

[see attached viewgraphs]

The role of the Office of Aeronautics and Space Technology (OAST, Code R) is not well known to OSSA program participants. Interaction between OSSA and OAST is complex. LDR provides a new model that NASA is trying to use to improve the selection of OAST projects based on science objectives for 'post Great Observatories' missions. OAST will only support 'generic technologies', useful in many applications, but using a specific mission, such as LDR, focusses attention on trade-offs and allows valuable feedback from scientific users.

It was noted that there is a gap in NASA technology development: OAST will not work on technologies that are too near term; OSSA will not use technologies that are unproven. The tradition of technology proving missions has been lost. The suggestion that engineers from OAST should sit on SSAAC and scientists from OSSA should sit on the OAST equivalent was supported.

AMOWG members questioned several OAST members about the means by which projects were selected and by which funds were allocated. There was general surprise at, and dissatisfaction with, the current method since it includes almost no elements of peer review or competitive selection.

R. HAYMES - 'Personnel for Space Astrophysics Data Analysis' Workshop.

NASA funding for data analysis will go from its current #8M/year to funding? NASA is organizing a workshop of Deans, Provosts, Univ. Vice-Presidents, etc. to discuss programs to increase the number of active astronomers in the US from its present level of #1000. Attendees include major astronomer-producing institutions and the National Institutes of Health