



State of LIGO Lab

--The condensed version--

Talk at LSC Meeting

March 20, 2007

Jay Marx

Executive Director, LIGO

G070123-00-M





Headlines-What's new the last LSC meeting

S5 is going very well- 75% complete, record range in H1

Enhanced & Advanced LIGO-- making good progress

People

- LIGO Laboratory changes
 - New Deputy Director--Albert Lazzarini
 - New LHO head--Joe Giaime
 - New head of Lab Instrument Science Group--Eric Gustafson



Headlines-What's new the last LSC meeting

- The LIGO Academic Advisory Council (LAAC)
 - Kip stepping down chair; Nergis becomes new chair--head LAACy
 - Rana is the new LAAC member from Caltech, replacing Kip
 - LIGO Student Fellowship Program started.
 - 2 Fellowships awarded to
 - Evan Goetz- University of Michigan
 - Tobin Fricke- University of Rochester
 - Student/postdoc gathering for this meeting arranged by Sam Waldman supported by the Directorate



Headlines-What's new the last LSC meeting

Funding

- Advanced LIGO in FY08 President's budget
- After lots of hand wringing and sweat, budgets for LIGO Lab look good

LIGO-Virgo

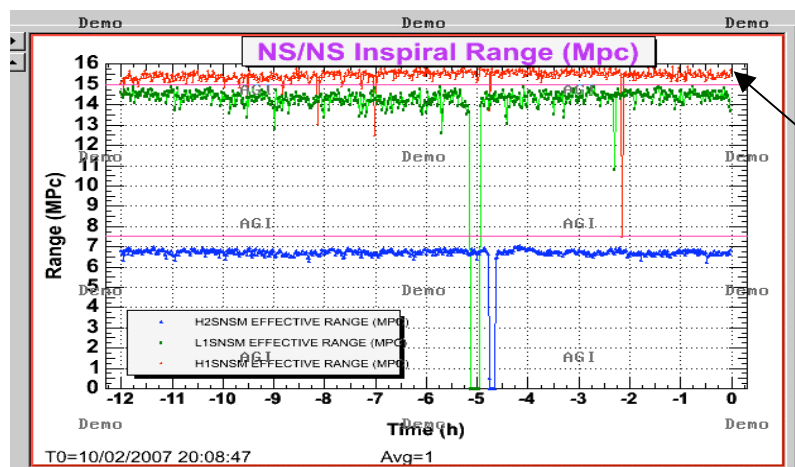
- LIGO-Virgo MOU for data sharing and operations coordination is signed

Education and Outreach

- LIGO Science Education Center has opened
- New LIGO web page up soon



S5 is doing well



** February 10, after PEPI installation-H1
Best ever!!! >15 Mpc*

*** L1 duty cycle 82% for 1st 2 weeks of
March**

- **Accumulated LLO-LHO coincidence:**
- **75% complete**
- **Predict 1 year 2-site coincident dataset
complete-September 2007**



Next step-Enhancements to initial LIGO

(Mike Zucher's talk)

- After current run, make modest changes to 4 km IFOs at both sites to enhance range by ~ 2
 - Reduce noise and junk light at dark port sensing
 - Add mode filter cavity, move into vacuum, seismically isolate
 - Increase laser power by ~ 3
 - Modify things like thermal compensation to handle power
- Increase number of sources in range by factor ~ 8
- Goal- next science run with enhanced range in 2009



Advanced LIGO

(David Shoemaker's talk)

- Project to improve the sensitivity and range of LIGO by a factor of 10
 - 20x higher power laser, improved seismic suspension and isolation, signal recycling, improved readout (like enhancements), larger mirrors (to handle increased thermal load), etc.
- Increase the number of sources in range by ~1000
 - Expect signals at few/day to few/week rate
- Go beyond discovery of GW; do astrophysics with GWs



Advanced LIGO- ready for construction start in FY08

- Advanced LIGO construction start and initial funding in the President's FY08 Budget Request.
 - \$32.75M for construction in FY2008
 - \$205.12M total construction funding
- Visit to Congress in February--- lots of support, no opposition to Advanced LIGO funding in FY08



Advanced LIGO- ready for construction start in FY08

- NSF Director Arden Bement- testimony to Senate Appropriations committee, March 8, 2007

“Scientists, engineers, and students need world-class instruments with the best capabilities, the farthest reach, and the finest accuracy. NSF proposes an investment of \$32.75 million to initiate Advanced LIGO, a gravitational wave observatory that will improve detection rates by a factor of 1000 over current earth-based facilities. Observations made with this instrument could revolutionize our understanding of the universe.”



Funding

FY07- Joint funding resolution

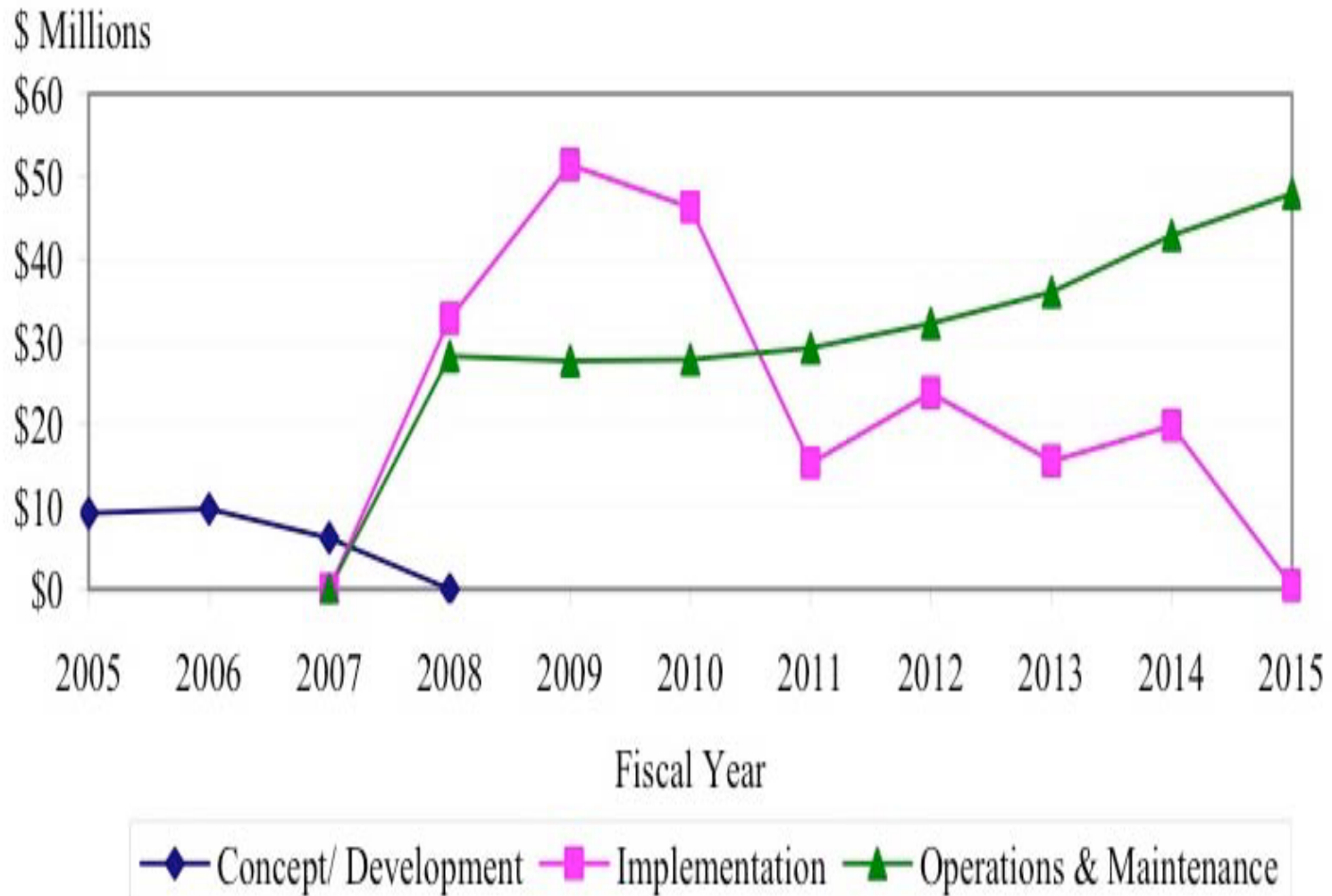
- LIGO Lab funded at full \$33M request- very good news
- Rest of NSF Gravity Program funded at FY06 level- bad news

FY08 President's Budget Request for NSF

- **NSF Overall:** +6.8% to \$6.43 billion (increase of \$409M);
- **Mathematical and Physical Science:** +8.9% to \$1.253 billion (increase of \$102.7M)
- **Astronomical Sciences:** +8.3% to \$232.97 million (increase of \$17.87M)
- **Advanced LIGO**—Construction start, funding in FY2008 of \$32.75M
- **For LIGO Lab operations in FY2008-** \$28.2M (-14.5%), but this is what we requested and represents only a shift of people to the Advanced LIGO project.



President's budget-Funding profiles- Advanced LIGO and R&RA (operations)





Next Cooperative Agreement with NSF

- Covers FY2009-FY2013
- Requires proposal from LIGO Lab
 - Final draft by July 2007
 - Submit to NSF September 2007
 - Peer review ~ November 2007
 - To NSB spring 2008 for \$\$ in October 2008
- Big deal, must be done right, lots of work by lots of Lab people



Towards a global network of GW observatories

- LSC and Virgo have concluded negotiations on joint operations and data analysis.
- - MOU is signed! Thanks to all who made it happen.
 - Joint committees (e.g. data analysis and run coordination) are working-
 - report later this morning



International scene--what's coming

- ~2009--Enhanced LIGO and Virgo+
- ~2014--Advanced LIGO and Advanced Virgo will be operating
- GEO HF will improve the sensitivity beyond GEO600, mainly at high frequencies
- The Japanese GW community is proposing LCGT, a 3 km cryogenic interferometer in the Kamioka mine.
- The Australian GW community is working towards AIGO, a 5 km interferometer at the Gingin site near Perth
- There is ongoing technology development, world-wide, towards the third generation-- even better sensitivity and lower frequency



Public Education and Outreach- LIGO Livingston

- **Science Education Center open at LIGO Livingston**
 - Funded by NSF
 - 8000 ft² facility on the LIGO Livingston site
 - 50 hands-on exhibits
 - Enable students and the public to understand important scientific principles using concepts from LIGO
 - Serve as an important regional resource for teacher training and development.
- **LIGO's partners**-- Southern University (teacher training program), the San Francisco Exploratorium (developed hands-on exhibits), LA GEAR UP (state educational reform agency under the Louisiana Board of Regents).
- **Opening event** on November 13, 2006
 - Featuring a Science Education Symposium and opening ceremonies
 - Guests include representatives of NSF, Caltech, MIT, partners, local educators, political people, media, LIGO people,...



LIGO Science Education Center



Received Award of Honor from the American Institute of Architects- New Orleans Chapter
“Form and function come together in an exciting and unexpected way in the building,
which has a dynamic exterior wall that suggests its purpose: a science education center”



LIGO Science Education Center

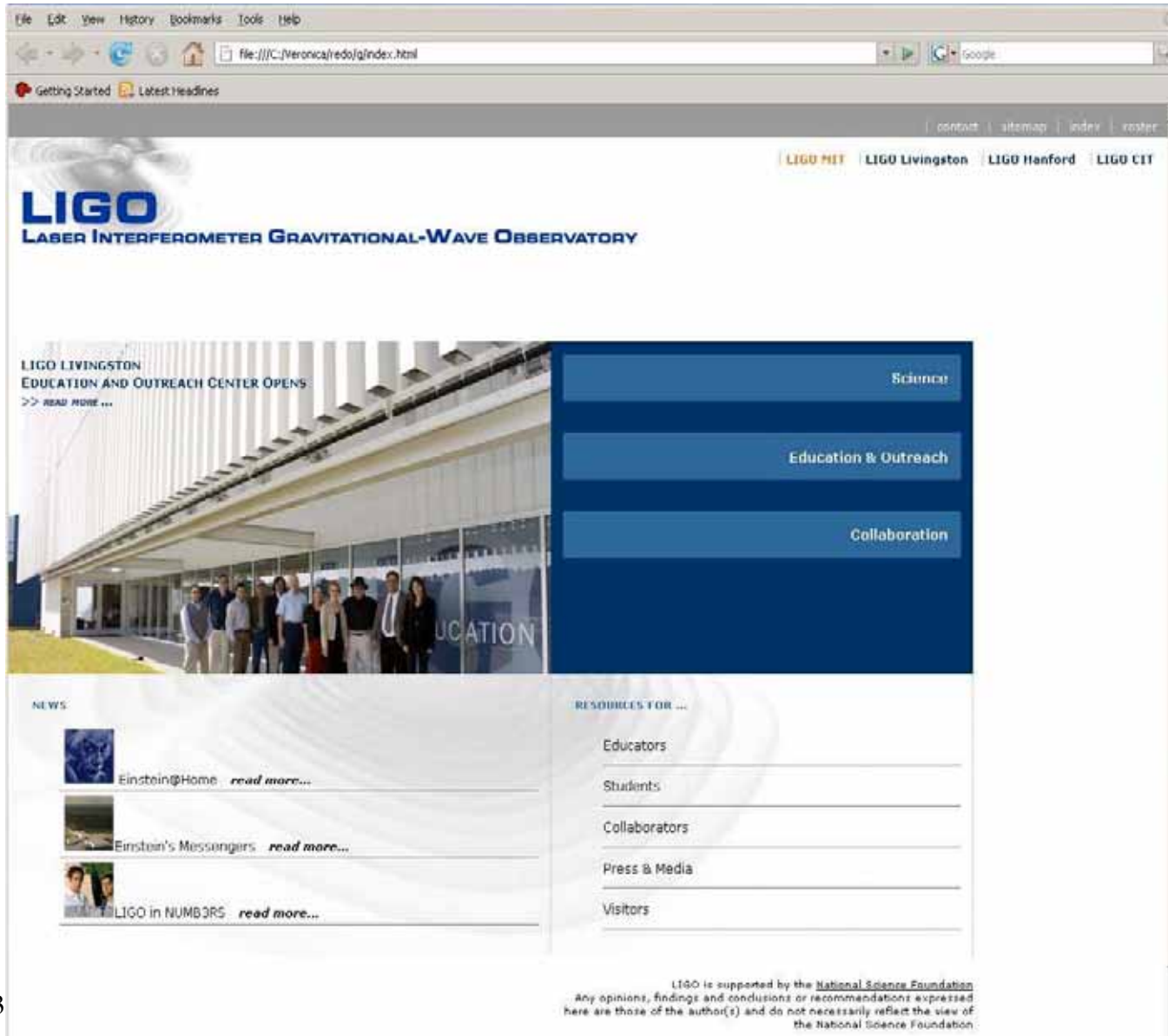
Livingston, Louisiana



me



New LIGO Webpage--thanks Veronica



The screenshot shows a web browser window displaying the LIGO website. The browser's address bar shows the file path: file:///C:/Veronica/redo/q/index.html. The website header includes the LIGO logo and the full name "LASER INTERFEROMETER GRAVITATIONAL-WAVE OBSERVATORY". Navigation links for "LIGO MIT", "LIGO Livingston", "LIGO Hanford", and "LIGO CIT" are visible. A main banner features a photograph of a group of people standing in front of a modern building with large glass windows. Text on the banner reads "LIGO LIVINGSTON EDUCATION AND OUTREACH CENTER OPENS" with a "READ MORE..." link. To the right of the banner is a dark blue sidebar with three buttons: "Science", "Education & Outreach", and "Collaboration". Below the banner, there are two columns: "NEWS" with three items (Einstein@Home, Einstein's Messengers, LIGO in NUMBORS) and "RESOURCES FOR ..." with links for Educators, Students, Collaborators, Press & Media, and Visitors. At the bottom right, a small disclaimer states: "LIGO is supported by the National Science Foundation. Any opinions, findings and conclusions or recommendations expressed here are those of the author(s) and do not necessarily reflect the view of the National Science Foundation."

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Summary

- S5 is going very well
- LIGO's sensitivity/range will be increased by ~ 2 with enhanced LIGO and another factor of 10 with Advanced LIGO
- Funding for Advanced LIGO and LIGO Lab looks solid
- Efforts towards an international network of ground-based GW detectors are gaining momentum-- joint data analysis and operations planning with Virgo
- LIGO has a 1st-class education and outreach program anchored by the LIGO Science Education Center
- (Wave Wall!!!)