LIGO Laboratory All-Hands Meeting

Jay Marx
All-Hands meeting
November 9, 2006
G060577-00-M

Status and news since last All Hands meeting

- Status of current science run (S5)
- Future capabilities and plans
  - » Plans to enhance initial LIGO
  - » Status of Advanced LIGO
- Status of our education and outreach program
- LIGO Laboratory- funding and staffing
  - » Current organization and leadership positions
  - » Some new hires
  - » Funding prospects-- next 2 years; beyond
- This year's NSF Review of the Lab--- how we did

LIGO's mission

LIGO is the World-leading capability for Gravitational Wave science

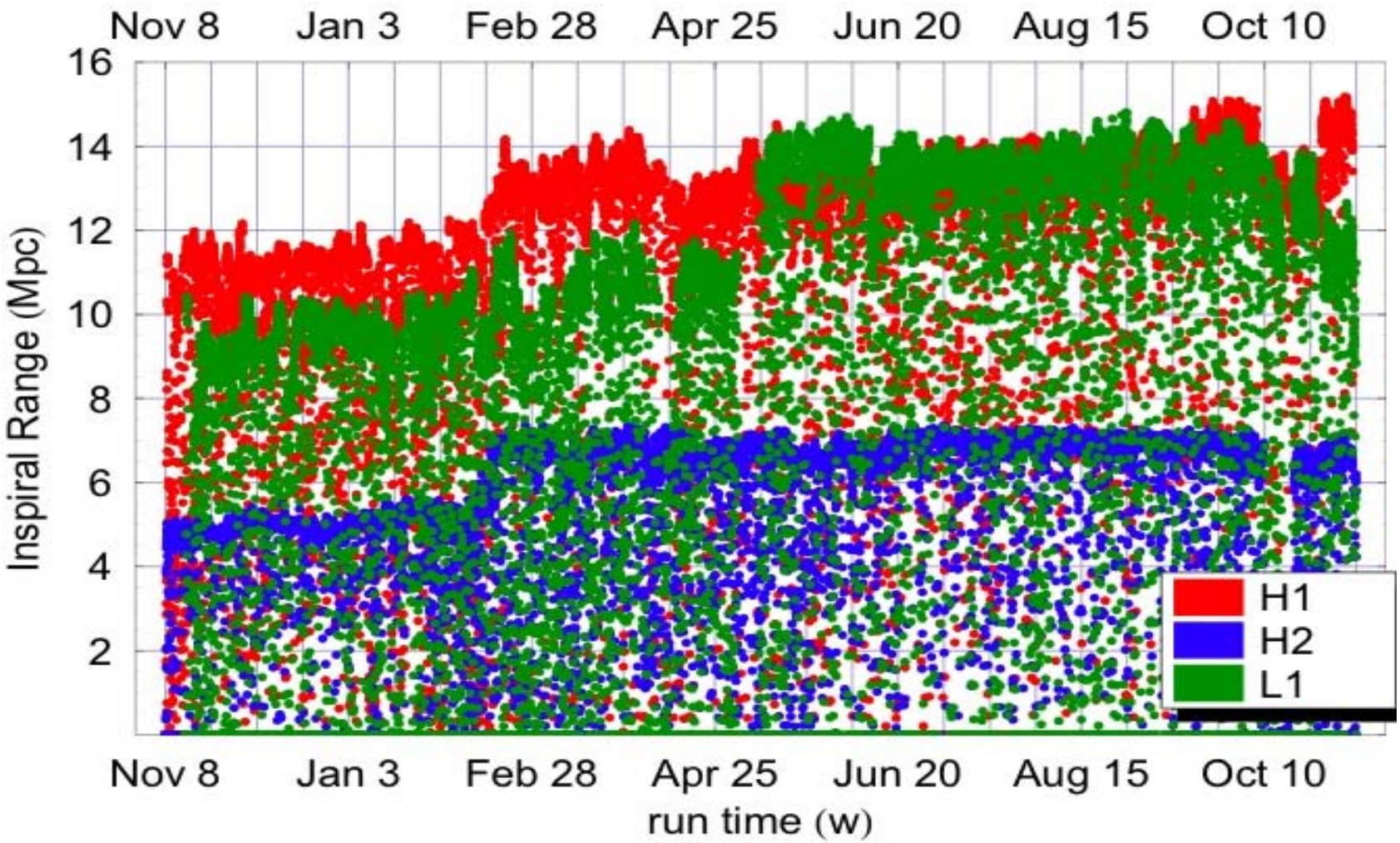
- Discovery the gravitational waves predicted by General Relativity
- Use gravitational waves as tool to do astrophysics and astronomy
- Advance the science of precision interferometry
- High quality education and outreach with significant public impact
- Train the next generation of GW scientists and provide trained scientific and technical manpower for the nation
- Work towards an international network of coordinated GW observatories

Current status of S5 science run

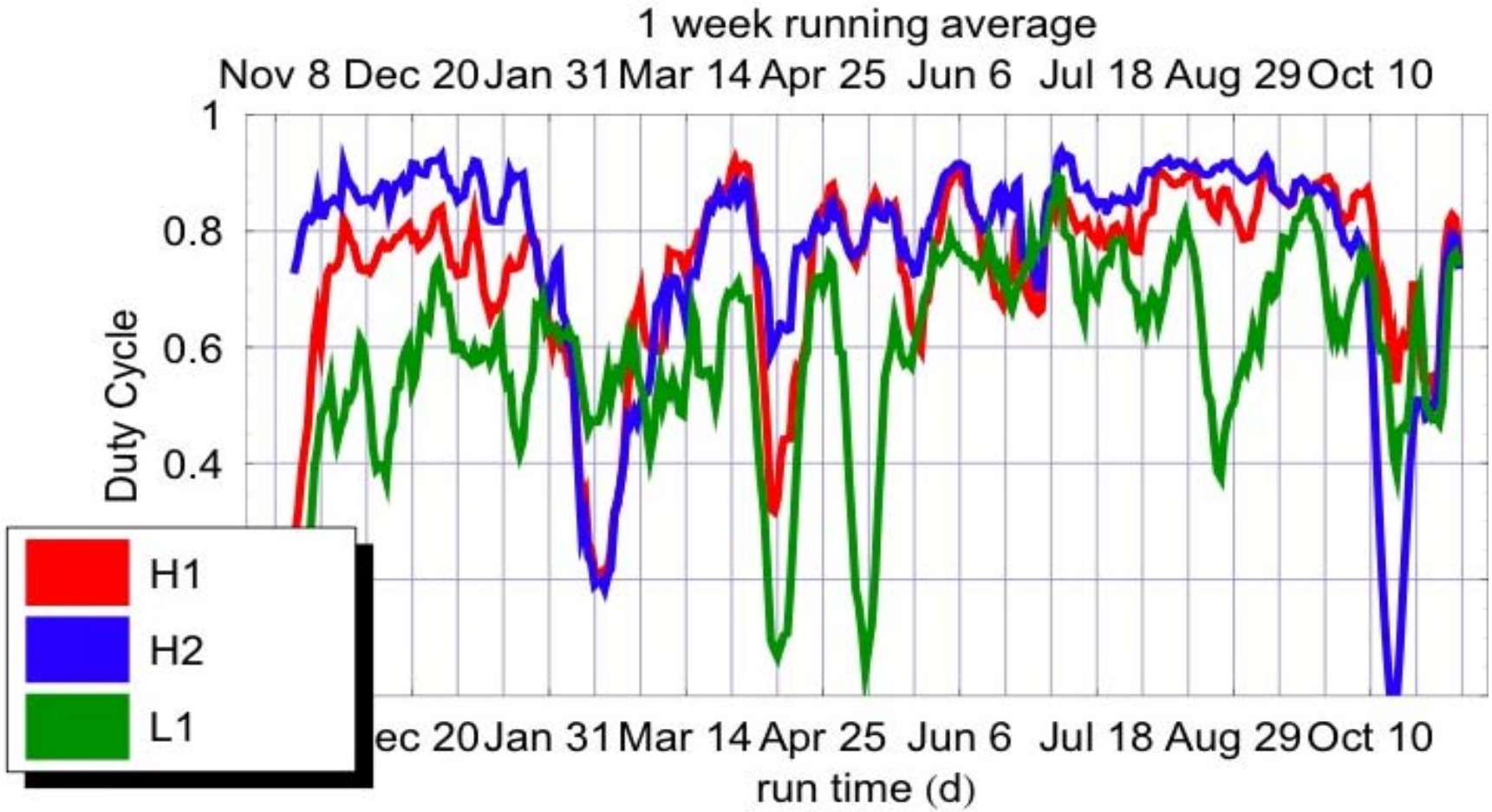
- Goal for this science run--
  - » One year's data with coincident operation of both observatories at the our science performance goal --
  - » inspiral range for 1.4 M_o neutron star pairs:
    - – for H1, L1: range over 10 Mpc,
    - – For H2: over 5 Mpc
- Run going extremely well--began run at sensitivity goal
  - » Sensitivity is now 40% greater than beginning of run
- Reliability and duty factor improving during run
- Run now ~55% complete
  - » Run should end during summer 2007

LIGO

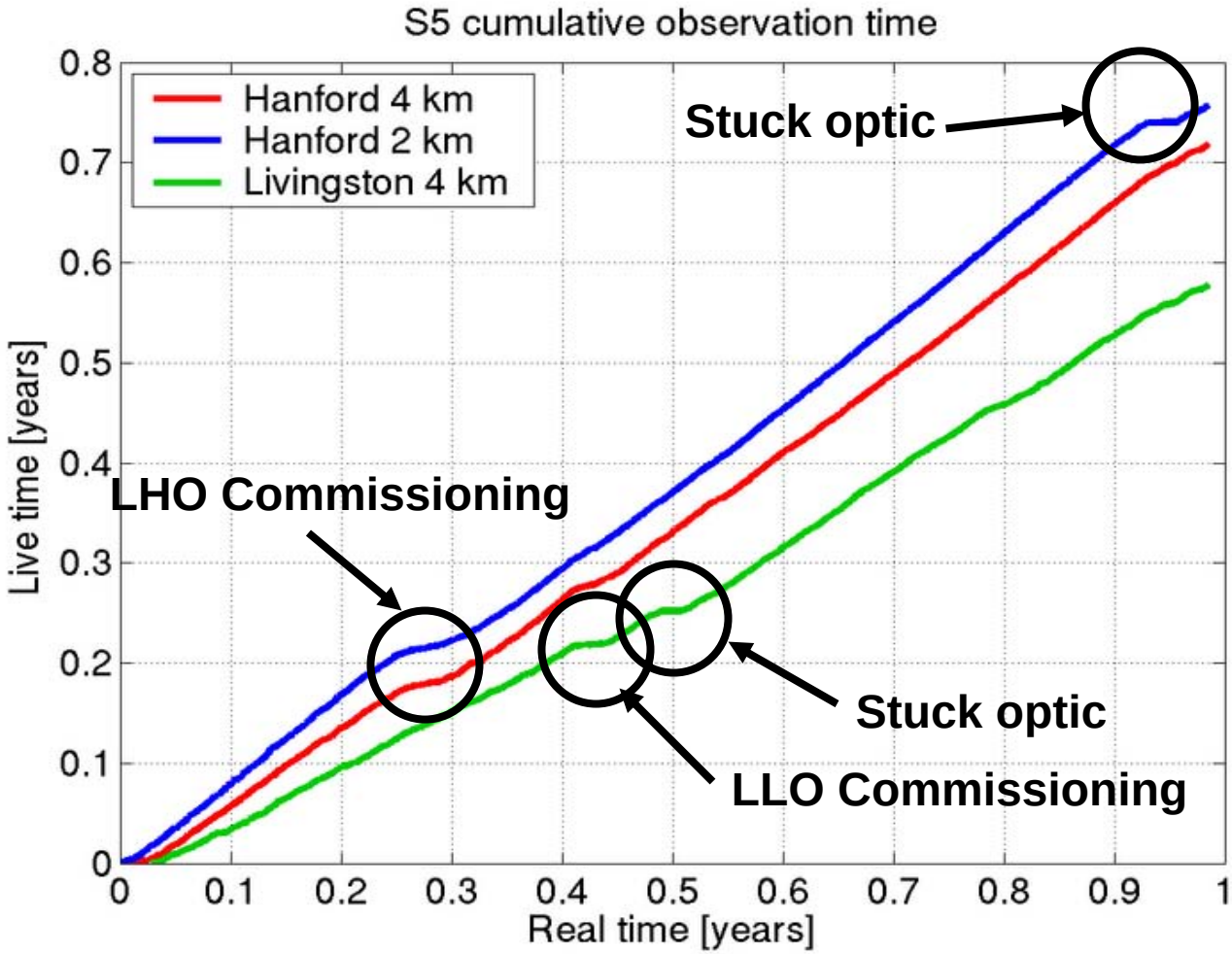
Interferometer range during S5 run



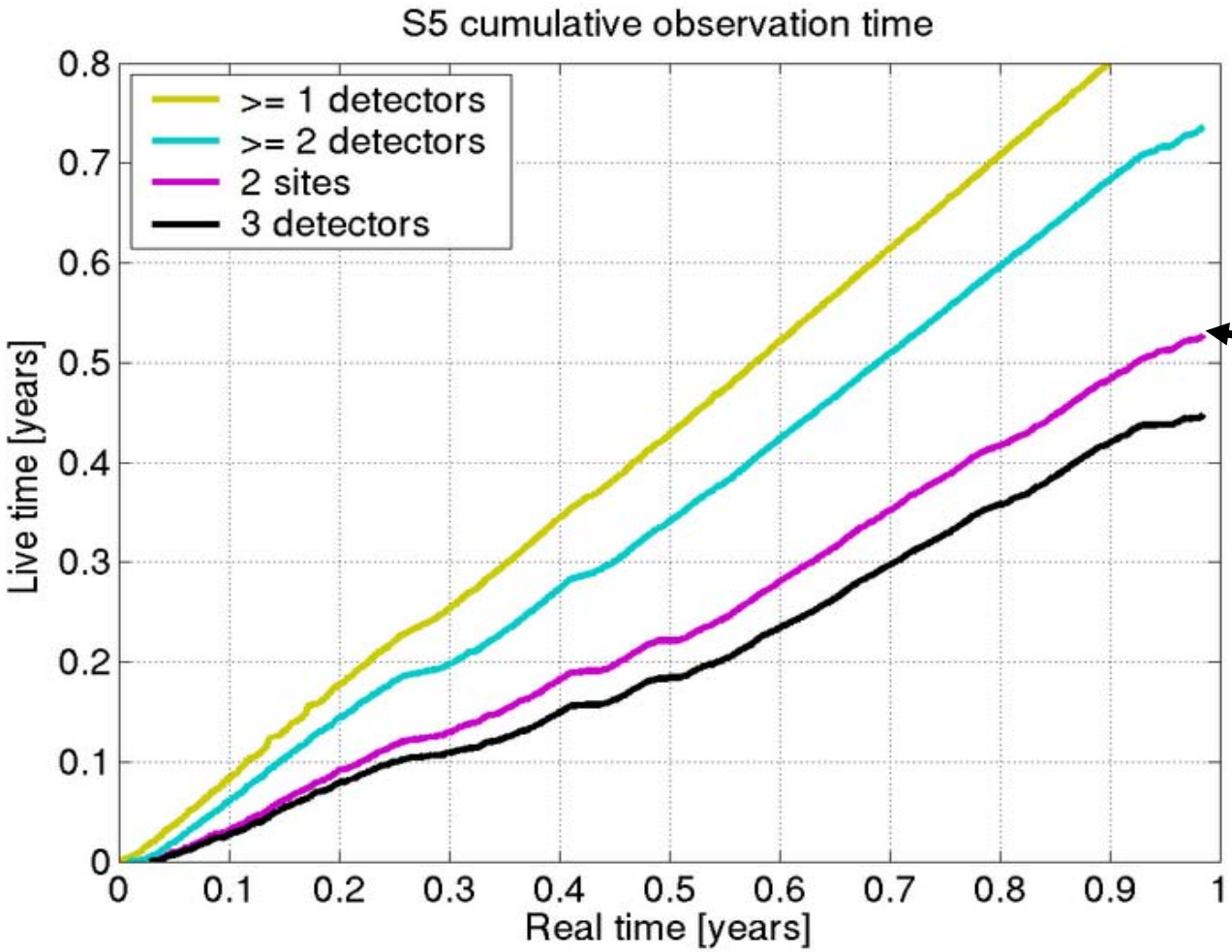
Interferometer duty cycle since beginning of run



Detector observation time



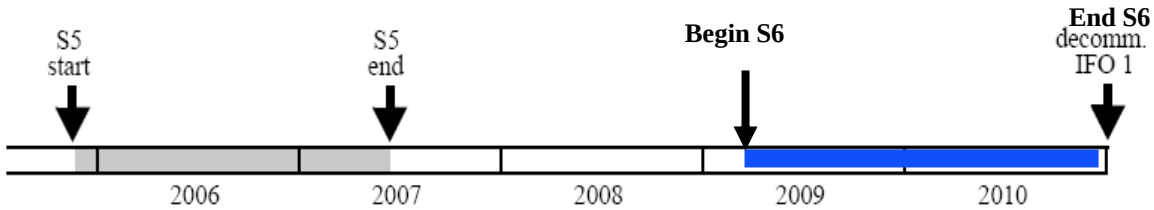
IFO coincidence observation time



LLO, LHO coincidence ~54%

Next step-Enhancements to initial LIGO

- Enhance sensitivity by ~2 to increase chances of observing GW waves between end of S5 and decommissioning of initial LIGO in ~late 2010 (for Adv. LIGO),
  - Goal- next science run with enhanced sensitivity in 2009



- Use Advanced LIGO technologies wherever possible to gain experience & save money and reduce Advanced LIGO commissioning time

- What enhancements to implement?
  - Enhance the two 4 km IFOs (one at each site), not the 2 km
  - Readout enhancement--Reduce noise and junk light at dark port sensing-- add mode filter cavity, DC readout of GW channel, move into vacuum, seismically isolate
  - Increase laser power by ~3.5-- modify things like thermal compensation to handle power

Advanced LIGO- ready for construction start in FY08

- Advanced LIGO will increase the sensitivity of LIGO by a factor of 10
  and so increase the number of sources in range by ~1000
  - Build on initial LIGO infrastructure and experience
  - Higher power laser, improved seismic suspension and isolation, signal recycling & improved readout (like enhancements), larger mirrors (to handle increased thermal load), etc.

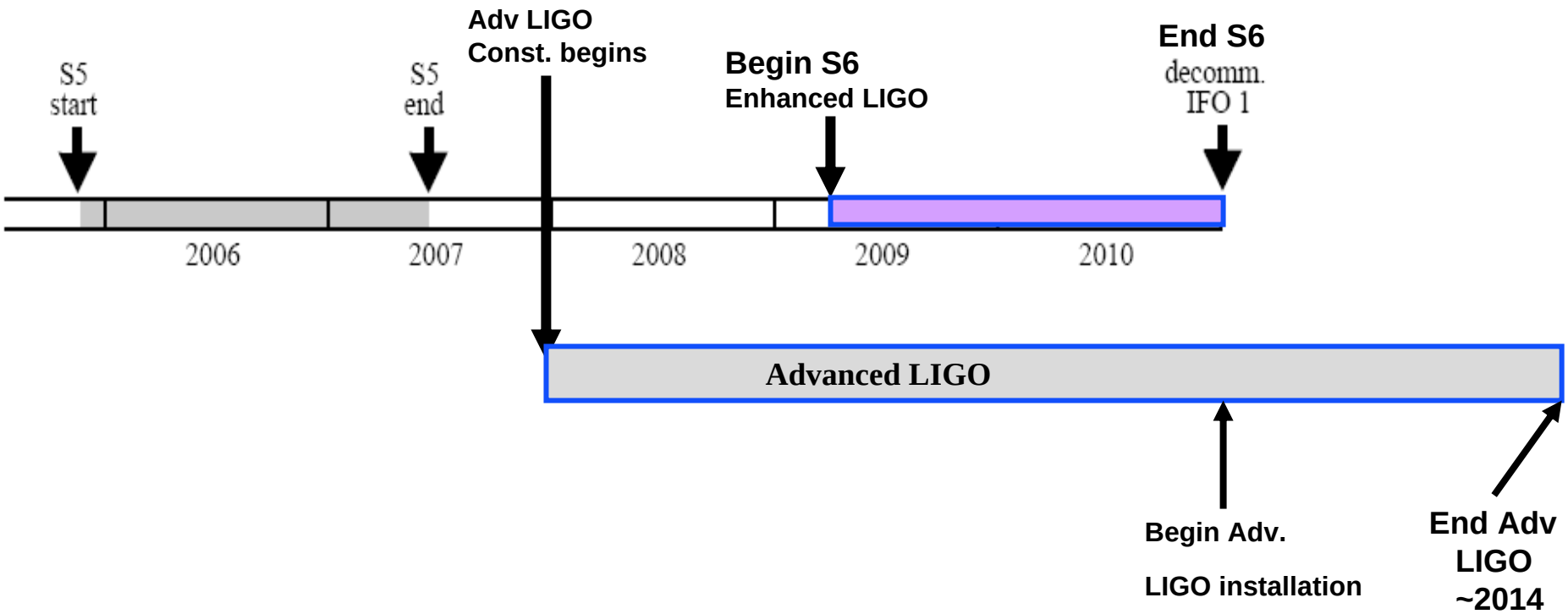
- Successful NSF Baseline Review of Advanced LIGO-
  - May 31-June 2, 2006; ~20 outside experts; chair- Don Hartill
  - *"The Panel looked carefully at the Advanced LIGO project and was impressed."*
  - *"The Panel recommends that the Advanced LIGO project go forward and agrees that the project can be constructed for (*the estimated cost*) a total cost of 172.2 M$ (FY 2006 $) on the proposed schedule and is ready for a construction start in FY 08."*

- We expect Advanced LIGO to receive construction start and initial funding in the President's FY08 Budget Request.
  - We are very optimistic about FY08 start but
  - *"it ain't over till it's over."* Yogi Berra

Advanced LIGO MREFC

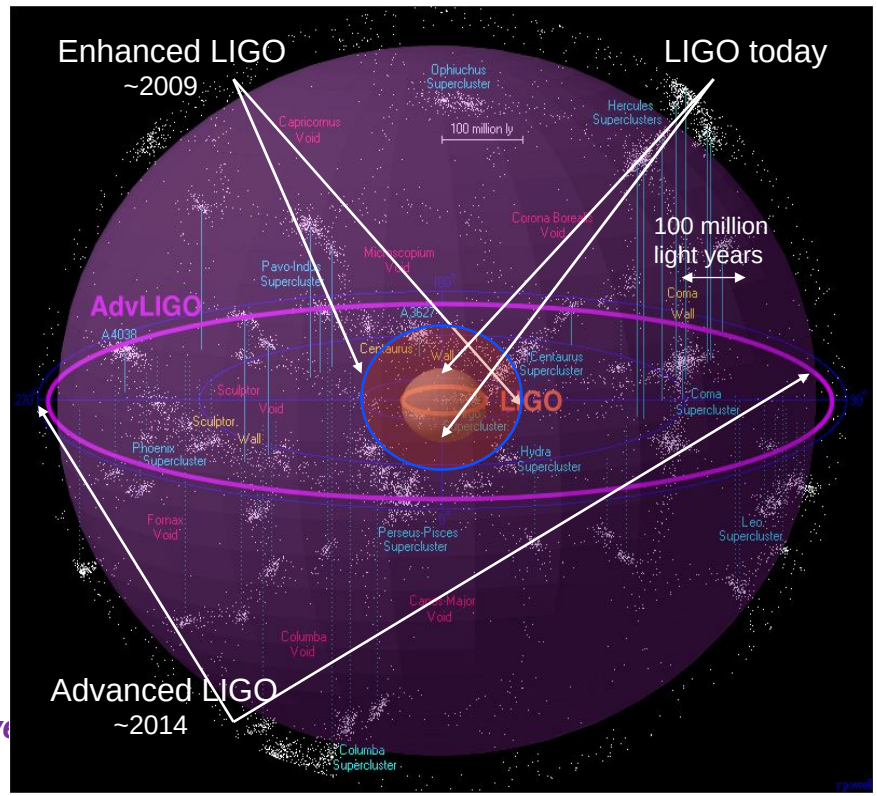
- Schedule-
  - October 2007--August 2014 including 11 months schedule contingency
- Total NSF cost (then-year $)--
  - $205M including ~4.2% inflation and 27% contingency
  - $24M equivalent contributions by UK and Germany: each worth equivalent of ~$6M for development and $6M for fabrication of hardware
- In FY07---
  - Completing needed development and design in preparation for letting contacts in 2008
  - Staffing up from within and outside LIGO Lab and LSC
  - Strengthening our management processes to get ready for the construction phase

Simplified timeline for LIGO



The scientific vision for LIGO

- 1st full science run of LIGO at design sensitivity in progress
  - » Began November 2005; >50% complete
  - » Hundreds of galaxies now in range
  - » Discovery possible but not probable during coming year
- Enhancement program
  - » In 2009 ~8 times more galaxies in range; discovery probability moderate
- Advanced LIGO project (~$200M)
  - » Construction start expected in FY08
  - » 1000 times more galaxies in range
  - » Expect ~1 signal/day- 1/week in ~2014
  - » Will usher in era of gravitational wave astrophysics



Public Education and Outreach- LIGO Livingston

- Science Education Center at Livingston LIGO site
  - » Funded through an NSF grant--8000 ft^2 facility just completed;
  - » 50 hands-on exhibits
    - – enable students and the public to understand important scientific principles
    - – 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
  - – Thanks to the team that is putting this together

LIGO Science Education Center

The Wave Wall in action

QuickTime™ and a
decompressor
are needed to see this picture.

More Public Education and Outreach

- At Hanford Observatory very active education and outreach program
  - » In 2005--- 3000 visitors to site including 700 students
- Einstein's Messengers- the LIGO DVD--
  - » Developed by NSF as a classroom tool
  - » Winner of a CINE Golden Eagle award
    - – awards for excellence in documentary and other informational film and video production; founded 1957.
- Very positive articles in major US press and increasing media attention
  - » Lead article on LIGO in NY Times "Science Times"- May 3.
  - » An article appeared in LA Times in early June
  - » Article for Discovery magazine (focus on Kip, GWs and LIGO) in early 2007
  - » BBC and National Geographic have asked about filming at LIGO

LIGO

LIGO Laboratory funding and staffing

LIGO Laboratory funding overview

- Our initial 5 year cooperative agreement has been extended by 2 years through FY08
  - » Funding of $33M/year for this year and next
  - » Our planned budget for the next two years allows us to carry out the mission of the laboratory including completing the S5 run, enhancing initial LIGO, doing our planned R&D, having a strong, successful education and outreach program
- The proposal for the next 5 year Cooperative Agreement is due in less than 1 year.
  - » NSF is comfortable with our preliminary budget estimate for FY09-FY13
- We expect Advanced LIGO (which will secure our future) to be in the President's FY08 budget request for start of construction

Bottom line---From the funding perspective we are in good shape and the future looks bright!

Change of key personnel within the Laboratory

- Stan Whitcomb has stepped down as Deputy Director to focus on science-- as Chief Scientist of LIGO Lab.
  - » Will help define the scientific focus and direction of Laboratory
  - » Mentor young scientists.
- Albert Lazzarini succeeds Stan as Deputy Director
  - » Formal appointment by Caltech President with concurrence by MIT President and NSF
  - » Transition occurred on September 4.
  - » Stan is working with Albert to assure a smooth transition

LIGO Lab Organizational changes

- Implemented standard matrix system (discussed last All hands meeting)
  - » With Advanced LIGO coming the Lab needs flexibility to staff the project and carry out its other responsibilities
  - » Operations groups (horizontal) and “projects” (vertical)
    - – “Projects” include Adv LIGO, enhancements and R&D facilities
- Explicit recognition of important functional roles in Laboratory organization
  - » LIGO Laboratory Chief Scientist (Stan Whitcomb)
  - » Education and Outreach (Jay Marx)
    - – recognize Directorate responsibility for education/outreach
  - » Laboratory Engineering Head (Dennis Coyne)
    - – Assure uniform engineering standards & practices across lab
  - » Cybersecurity (Kent Blackburn & Shannon Roddy) reporting to Directorate

Changes in Laboratory group leadership

- New head of LIGO Livingston Observatory
  - » Mike Zucker has stepping down as Head of the Livingston Observatory after a grueling commute for 3 years
    - – Mike will be working on the enhancement program
  - » Joe Giaime became the new Head of the Livingston Observatory on November 1
    - – Joe has been the Chief Scientist at LLO since 2004 and is eminently qualified
    - – Joe has become a full time LIGO Laboratory employee
- Stuart Anderson is Head of the Laboratory Computing Group
  - » Replaces Albert Lazzarini

Changes in CIT Science Group

- Group has became very large and somewhat unwieldy
- Will split into two sub-groups that will be closely connected (in January 2007)
  - » Data Analysis Group and Instrument Science Group
- New senior hire- Eric Gustafson to head Instrument Science Group (arrives 1/07)
- Alan Weinstein heads whole group now and will head the Data Analysis Group after Eric arrives

Planning for next 5 year cooperative agreement

- New 5-Year Cooperative Agreement for FY2009-2013 needed between NSF and Caltech
- LIGO to begin serious work on proposal in early 2007
  - Proposal will be ready to be submitted in August 2007
  - Will be peer reviewed in ~November 2007
  - Approved by NSB in spring 2008
  - Result-- Cooperative Agreement in place and ready to go by beginning of FY09
  - There will be lots of work to do on this proposal; we'll do our best to minimize it and shield most of you from it. But we must produce a quality proposal. That will be a high priority in the first half of 2007.

Basis for planning FY2009-2013 funding request (including experience base over past 5 years)

- Current LIGO Operations continue
  - Observatory operations (personnel, travel, infrastructure)
  - Data management and analysis
  - Incremental detector improvements
  - Management and administration
  - Education and Outreach
- Advanced LIGO construction begins in FY2008 funded by MREFC
- R&D will remain a critical part of Lab's mission
  - R&D must go on in parallel with Advanced LIGO construction and commissioning to develop techniques for risk reduction, solving problems and future improvements
  - Some R&D aimed to longer term future for good of field and to keep quality instrument scientist engaged
- Education and outreach is an essential part of our mission and will be strengthened

Components of expected increment to the current operations funding level by 2015

- Inflation
- Expand education and outreach efforts from 2% to 3% of budget
- Continue visitor's program (funded now by separate grant) on operations grant
- Modest additional staffing to reflect increased complexity of operating Advanced LIGO and increased computing and data analysis load with Advanced LIGO
- Increased funds for ongoing refreshment of computational capabilities and maintenance of Advanced LIGO
- ***Preliminary*** budget estimates were developed by LIGO and presented to NSF in July 2006
  - » Received strong endorsement that LIGO is planning responsibly and the estimate is consistent with what could fit into anticipated NSF budget

Support of LIGO by Caltech and MIT

- New Caltech faculty appointments in our field
  - » Recent appointment of 2 junior faculty members in gravitational wave science
    - – Rana Adhakari (focus on LIGO instrument science and Enhanced LIGO)
    - – Yanbei Chen (focus on numerical relativity and gravitational waves)
- Contiguous space for LIGO-- an important issue at Caltech and MIT
  - » MIT is moving to provide contiguous space for the LIGO group.
  - » We expect Caltech to provide contiguous space for LIGO, on campus, in a few years.

LIGO

Annual review of LIGO by the NSF

Annual NSF Review of LIGO- how we did

- Held November 23-25 at Hanford
- Very high grades all around
- Committee was very impressed.
- “LIGO is a class act.” -the Review Committee chair

- Very important review for LIGO because next year this committee will likely review our proposal for the next 5 year cooperative agreement (and budget). So a good impression is important.

Some comments from the Executive Summary

- "the Panel was pleased with the fine progress of science run S5 at sensitivities meeting the design sensitivity, and the rapid progress in extracting the science results. There seems to be very good progress on Advanced LIGO. The plans for Enhanced performance of Initial LIGO are very sensible and are expected not to interfere with moving forward with Advanced LIGO as expeditiously as possible."
- "The panel urges NSF to continue the funding of LIGO operations at the requested level and to provide funding for Advanced LIGO construction as rapidly as possible."
- "The panel was also very impressed with the seamless and efficient transition to the new top level management"

Comments about specific charge items--

- The improvements the LIGO collaboration have made in the sensitivity of the interferometers are impressive. The analysis of the S5 data appears to be on-track and is likely to produce interesting results. The panel was very pleased to see that data analysis is mature enough to keep up with the data in a timely fashion.
- The Advanced LIGO design, general directions and plans are well thought out, and the related research and development programs appear to be on track. Considerable work remains to be done to address specific technical issues, but we do not see any major roadblocks to the successful completion of Advanced LIGO so that it can achieve its performance goals.

Annual NSF Review--specific charge items

- Enhanced LIGO is a well thought-out phase of operations between initial LIGO and advanced LIGO, and represents a well-justified choice of improving sensitivity more aggressively than duty factor. The logistical challenges of its implementation have been anticipated.
- The Review Panel was particularly pleased with the smooth transition to the new top management of LIGO. The new management has taken over the leadership in a seamless fashion and seems to be enjoying the confidence of the LIGO community.
- The LIGO project has done a reasonable job over the past couple years of implementing basic cybersecurity measures for the Laboratory. Their security goals and the measures that they have taken so far are all reasonable. The project needs to ensure that these activities are completed and adequately maintained.

News about LIGO People

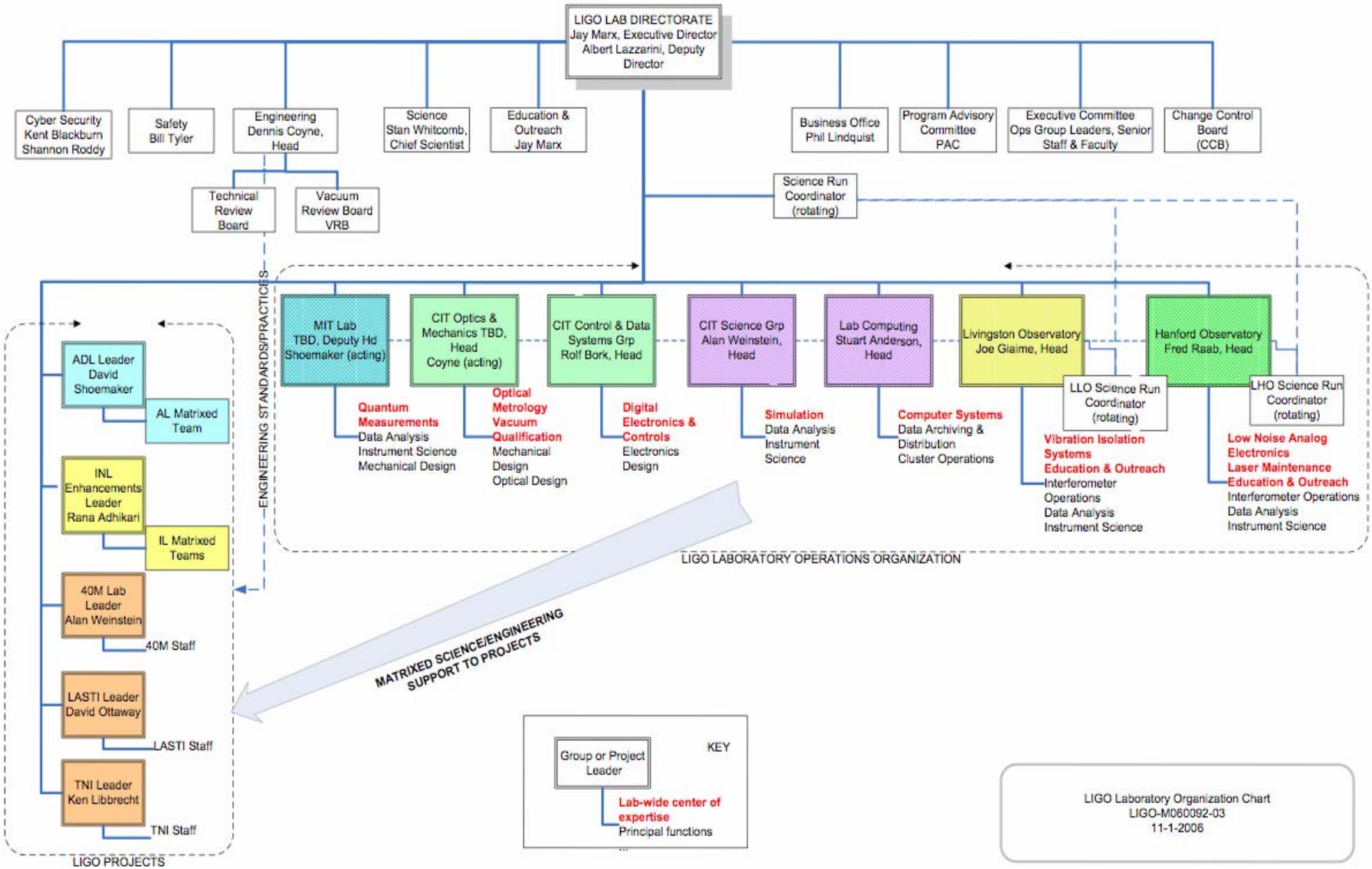
- New senior scientific hire at the Lab- Norna Robertson from Stanford will join us in early January with responsibility as Suspension Subsystem Leader and Cognizant Scientist.

- Winners of the Einstein Prize given by the American Physical Society-
  - » Rai Weiss and Ron Drevor for their contributions to the development of gravitational wave interferometry

- Winner of the APS Edward A. Bouchet Award for 2006
  - » Gabriela Gonzalez
  - » To promote the participation of under-represented minorities in physics by identifying and recognizing a distinguished minority physicist who has made significant contributions to physics research.

Conclusions

- LIGO is the world-leading gravitational wave observatory and science program
- LIGO Laboratory is very health with excellent funding prospects, a great staff, and the Advanced LIGO project that will assure our future bearing down on us.
- LIGO has a clear scientific vision for the next decade and beyond
  - » S5 is going very well; > 50% done with excellent sensitivity and improving duty cycle. Discovery possible, not probable; astrophysics results being produced
  - » Enhancements to initial LIGO will provide a strong science program into Advanced LIGO era; expect S6 start in mid-2009. Moderate possibility for discovery.
  - » Advanced LIGO is poised for construction start in FY2008 and will be on-line in 2013/14. Will usher in the era of experimental gravitational wave astrophysics
- The recent NSF Review means that high-level scientific peers recognize that LIGO is a “class act” and going a great job in all aspects of our program.


LIGO LAB DIRECTORATE
Jay Marx, Executive Director
Albert Lazzarini, Deputy Director
Cyber Security
Kent Blackburn
Shannon Roddy
Safety
Bill Tyler
Engineering
Dennis Coyne, Head
Science
Stan Whitcomb, Chief Scientist
Education & Outreach
Jay Marx
Business Office
Phil Lindquist
Program Advisory Committee
PAC
Executive Committee
Ops Group Leaders, Senior Staff & Faculty
Change Control Board
(CCB)
Technical Review Board
Vacuum Review Board
VRB
Science Run Coordinator
(rotating)
ENGINEERING STANDARDS/PRACTICES
MIT Lab
TBD, Deputy Hd
Shoemaker (acting)
CIT Optics & Mechanics
TBD, Head
Coyne (acting)
CIT Control & Data Systems Grp
Rolf Bork, Head
CIT Science Grp
Alan Weinstein, Head
Lab Computing
Stuart Anderson, Head
Livingston Observatory
Joe Giaime, Head
Hanford Observatory
Fred Raab, Head
Quantum Measurements
Data Analysis
Instrument Science
Mechanical Design
Optical Metrology
Vacuum
Qualification
Mechanical Design
Optical Design
Digital Electronics & Controls
Electronics Design
Simulation
Data Analysis
Instrument Science
Computer Systems
Data Archiving & Distribution
Cluster Operations
LLO Science Run Coordinator
(rotating)
Vibration Isolation Systems
Education & Outreach
Interferometer Operations
Data Analysis
Instrument Science
LHO Science Run Coordinator
(rotating)
Low Noise Analog Electronics
Laser Maintenance
Education & Outreach
Interferometer Operations
Data Analysis
Instrument Science
LIGO LABORATORY OPERATIONS ORGANIZATION
ADL Leader
David Shoemaker
AL Matrixed Team
INL Enhancements Leader
Rana Adhikari
IL Matrixed Teams
40M Lab Leader
Alan Weinstein
40M Staff
LASTI Leader
David Ottaway
LASTI Staff
TNI Leader
Ken Libbrecht
TNI Staff
LIGO PROJECTS
MATRIXED SCIENCE/ENGINEERING SUPPORT TO PROJECTS
Group or Project Leader
KEY
Lab-wide center of expertise
Principal functions
LIGO Laboratory Organization Chart
LIGO-M060092-03
11-1-2006

LIGO Document Control Center

Reserve a New Document Number

Print this page for your files.

New Document Number = LIGO-G060577-00-M	
Document	G060577-00-M
Author	Jay Marx
Document Date	11/09/2006
Category	G
Group	M
Title	All Hands Meeting

Reserve a Document Number | Search for Reserved Numbers | Search DCC Database