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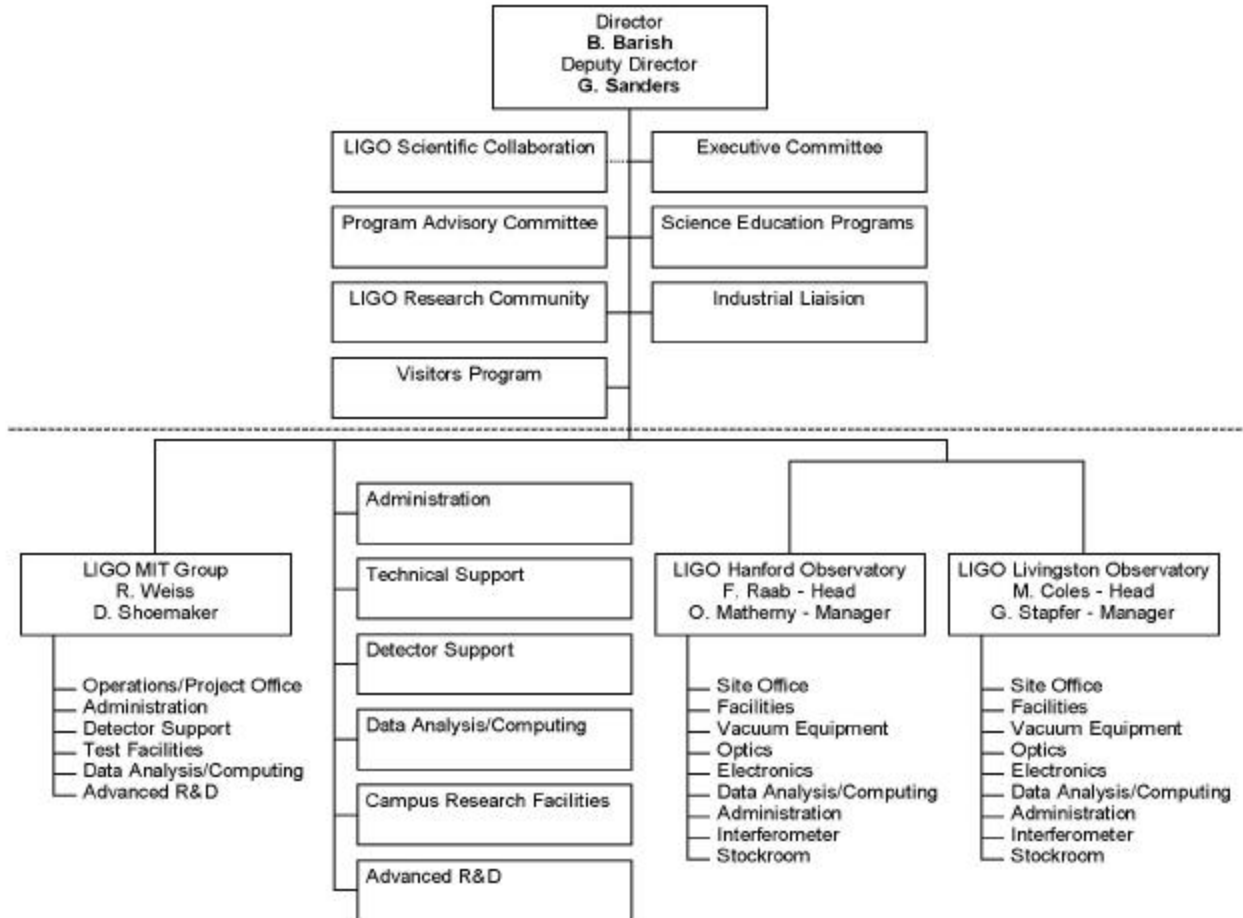
# LIGO II: LIGO Laboratory View and Role

Gary Sanders  
PAC 6 Meeting  
May 20 - 21, 1999  
LIGO Hanford Observatory




# LIGO Laboratory Organization

## Directorate



# LIGO Funding By Year and Program

MRE



Fiscal Year	Construction	R&D	Operations	Advanced R&D	Total
Through 1994	35.9	11.2			47.1
1995	85	4			89
1996	70	2.4			72.4
1997	55	1.6	0.3	0.8	57.7
1998	26	0.9	7.3	1.6	35.8
1999	0.2		20.9	2.5	22.5
2000			21.1	2.6	23.7
2001			19.1 (10 months)	2.7	22.9
<b>Total</b>	<b>272.1</b>	<b>20</b>	<b>68.7</b>	<b>10.2</b>	<b>371.1</b>



# LIGO Laboratory Planning Assumptions

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- LIGO I science run is planned for 2002-2004
- LIGO Advanced R&D program is planned to demonstrate **initial** LIGO II technologies by 2002
  - » R&D carried out by LIGO Lab and LSC
- LIGO Laboratory Advanced R&D is supported by Operations funded engineers, administrative support, and infrastructure
  - » campus interferometers (40 Meter, LASTI)
  - » engineering mostly supplied from Lab staff engineers
    - LIGO II construction may support additional contract engineering



# LIGO Laboratory Planning Assumptions (cont'd)

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- LIGO II Advanced R&D is an LSC-wide activity with LIGO Lab participating
  - » LSC takes a leading role in identifying future program and detector capabilities (LIGO II design “summit” last week is an example)
- LIGO II construction proposal to be submitted in time for 2002 start
  - » “Construction” funding through Major Research Equipment (MRE) line item account of NSF appropriation
- LIGO Lab to manage LIGO II construction just as we have managed LIGO I construction
  - » but participation in construction proposal/activities is open to LSC institutions



# LIGO Laboratory Planning Assumptions (cont'd...)

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- LIGO Lab will work together with the LSC to produce properly planned and costed LIGO II construction proposals
  - » Sept. 1999 submittals for R&D and “conceptual” LIGO II construction documents will be planned through LIGO Lab process
  - » LIGO Lab will create a LIGO II Work Breakdown Structure and this will guide cost estimate and schedule planning



# Staging of LIGO II Upgrade

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- LIGO II construction funding profile extends from 2002 through 2006
- Upgrade assumed to be implemented in two stages in 2004 and in 2006
  - » availability of the technologies suggests staged implementation
    - crystalline core optics and signal tuned configuration likely available after 2004
  - » staged implementation impacts observation
    - missed triple coincidence observation time at pre-upgrade sensitivity should be small compared to delayed observation time at improved sensitivity (lessons learned in accelerator lab scheduling)
  - » staged implementation may be dictated by funding profile



# Early Issues In Achieving LIGO II Readiness by 2004

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- Long lead-time procurements
  - » Can we accomplish initial procurement of optics blanks before 2002? Are there alternate funding sources to allow a start?
- Will R&D support be sufficient to develop technology in time? Will we focus it well?
- How will we manage the significant conflict between LIGO I and II staff (LIGO Lab and LSC)
- What is the model for LSC to be engaged?
  - » principally R&D?
  - » more subsystems at other institutions, outside of lab?

OK





# Elements of a Complete LIGO II Effort

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- Are vacuum equipment modifications required?
  - » no additional pumps for beam tube appear necessary
  - » output mode cleaner ?
  - » BSC dome height increase ?
    - Very expensive (money, cleaning, disruption, rigging) for all chambers
    - Impacts planned use of our testbed
    - Should be avoided with design ingenuity
  - » Any changes may be very expensive...
- support for infrastructure (DAQ, control, data analysis) in parallel with LIGO I efforts
  - » this will be a challenge



# Even Broader Options

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- Hanford 2k IFO --> 4k ?
- and/or second 4k IFO at Livingston ?
  - » not for astrophysical interest initially
  - » maybe vital for observing strategy



# Conclusions

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- LIGO Lab and LSC can carry out a coherent program based on a mix of sure and likely technologies
- LIGO II would be a significant step forward in sensitivity
  - » LIGO II could not guarantee observations or disprove GR
- LIGO II is clearly the right thing to do given the large investment in LIGO and the new “bang for the buck”
- The principal difficulties are in
  - » timely outcomes from R&D
    - combination of tight organization and increased funding needed
  - » competition with scientists to install/commission/exploit LIGO I



# Conclusions

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- LIGO Laboratory will take the central responsibility to implement this program of the LIGO Scientific Collaboration

