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# Advanced LIGO Construction Proposal Submission

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# Overall Strategy

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- How to optimize chance to observe gravitational waves?
- Initial LIGO – “plausible” observation, maybe unlikely ?
- Advanced LIGO – “likely” detection ?
- Minimize gap between mature exploitation of initial LIGO and commissioning advanced LIGO argues for rapid transition to upgrade
- On to the LIGO facility limit...
- Field may be healthier with vigorous progression
- Field may be under pressure if long period of searching takes place without detection
- These issues are still valid
- **March LSC meeting indicated community sense of urgency**

# Advanced LIGO Conceptual Proposal - 1999

- Lab & LSC submitted White Paper and Conceptual Project Book in late 1999
- Requested MRE funding in FY2002 to commence support of increased and vigorous R&D
- Planned to install in the vacuum system in 2005
- Cost about \$114 million (FY2000) without accounting for contributions from operations budget and international partnerships
- Peoples panel gave favorable review
- **NSF decision to support R&D through design from operating funds (R&RA) in renewal proposal**

# Renewal Proposal Scenario

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- Vigorous LSC and Lab R&D in motion
  - » Large equipment expenses to come through Lab
- R&D including most design through final design included in proposed work
  - » Consistent with new rules
- Some long lead acquisitions included
  - » Not consistent with new rules
  - » **Reduced award level prevents these purchases**
- MRE funds required to start in FY2004
  - » MRE proposal submission assumed at beginning of 2002
  - » **PAC 11 agreed with our plan to delay submission one year**
- Installation in vacuum system delayed until early 2006

# NSF Funding/MRE Situation Two Years Ago

- NSF enjoyed bipartisan support for budget doubling in 5 years with two years of the trend in place
  - » FY2001 funding increased >13%
- MRE account was transitioning to a versatile but undefined capability for NSF
  - » Proposals were invited and encouraged
  - » In the absence of a defined process, OMB and Congress were critical of NSF management process on projects
- LIGO construction success viewed as sufficient to propel MRE upgrade proposal (?)

# Evolution at NSF During 2001

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- MRE proposal logjam
  - » ALMA, HIAPER, NEON, Terascale, NEES, RSVP, Ice Cube,...
- Bush administration threatens NSF budget growth
- Internal NSF MRE process criticized by Congress and OMB
  - » NSF drafts MRE/large facility process under OMB/Congressional pressure

# NSF Situation in 2002

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- Vic Cook retires
  - » Tom Lucatorto has just arrived
- Rich Isaacson retires
  - » Beverly Berger in place
- Bob Eisenstein has left
  - » John Hunt acting as Assistant Director, has knowledge of LIGO
- NSF awards \$28 million to LIGO in first year of new cooperative agreement
  - » This award level has impacts on individual investigator awards
  - » Thus LIGO has earned unfortunate visibility

# Congress and NSF

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- Congress partly relieves MRE logjam by approving, for FY2002, ALMA, NEES, HIAPER, Terascale, Ice Cube
  - » NEON and RSVP still waiting
  - » Homestake NUSL and IceCube now the subject of a National Academy review of neutrino physics
  - » Congress requires a priority ordered MRE process at NSF
- Congressional authorization bill (not the appropriation bill) passed with very broad bipartisan support for doubling NSF budget in ~5 years





# PAC 11 Advice

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- Agreement with delay in submission beyond end of 2001
- Submit in 2002

# Some Reasons to Submit Now

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- Detecting gravitational waves is compelling and advanced LIGO “appears” crucial to detection
- Our developmental program is in concerted motion
- Delaying submission likely to linearly extend the course of our search for GW
- We are reasonably well prepared
  - » Reference design
  - » R&D in motion
  - » Could complete a cost estimate and schedule plan with a burst of effort
- Many LSC groups have focused on Adv. LIGO development
- International partners may prefer that we move forward

# GEO Role in Advanced LIGO

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- GEO is in LSC
- German group has taken a lead role in Advanced LIGO PSL development and delivery
- UK groups (Glasgow, Birmingham, RAL) have taken a lead role in:
  - » suspensions and recycling R&D
- UK groups submit project funding proposal this week for ~\$9 million to fund:
  - » Delivery of suspensions
  - » Delivery of some sapphire substrates (long lead purchases)
  - » Proposal assumes UK funds start 1Q04
- German group will also submit project support proposal

# The Process

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- Initial LIGO must have successful S1 and S2 runs
  - » Produce results
  - » Make good interferometer progress
- Work with Tom Lucatorto and Bev Berger
- Work with Joe Dehmer
- NSF leadership must be thoroughly briefed and supportive
- FY2003 funding for LIGO operations must be good
- When we submit, we have to be confident of success

# Upgrade Options

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- Phased Upgrades
  - » High power first
  - » Separate addition of signal recycling
  - » Low frequency first (most logical phasing choice)
- Full interferometer upgrades
  - » 3 IFOs
  - » 2 IFOs
- MRE account vs. program funds
- Planned option – 3 interferometer upgrade funded by MRE account
- Submission by late this year with request for long lead purchase funds
- Proposal coordinated or jointly submitted by LIGO/LSC/GEO/ACIGA