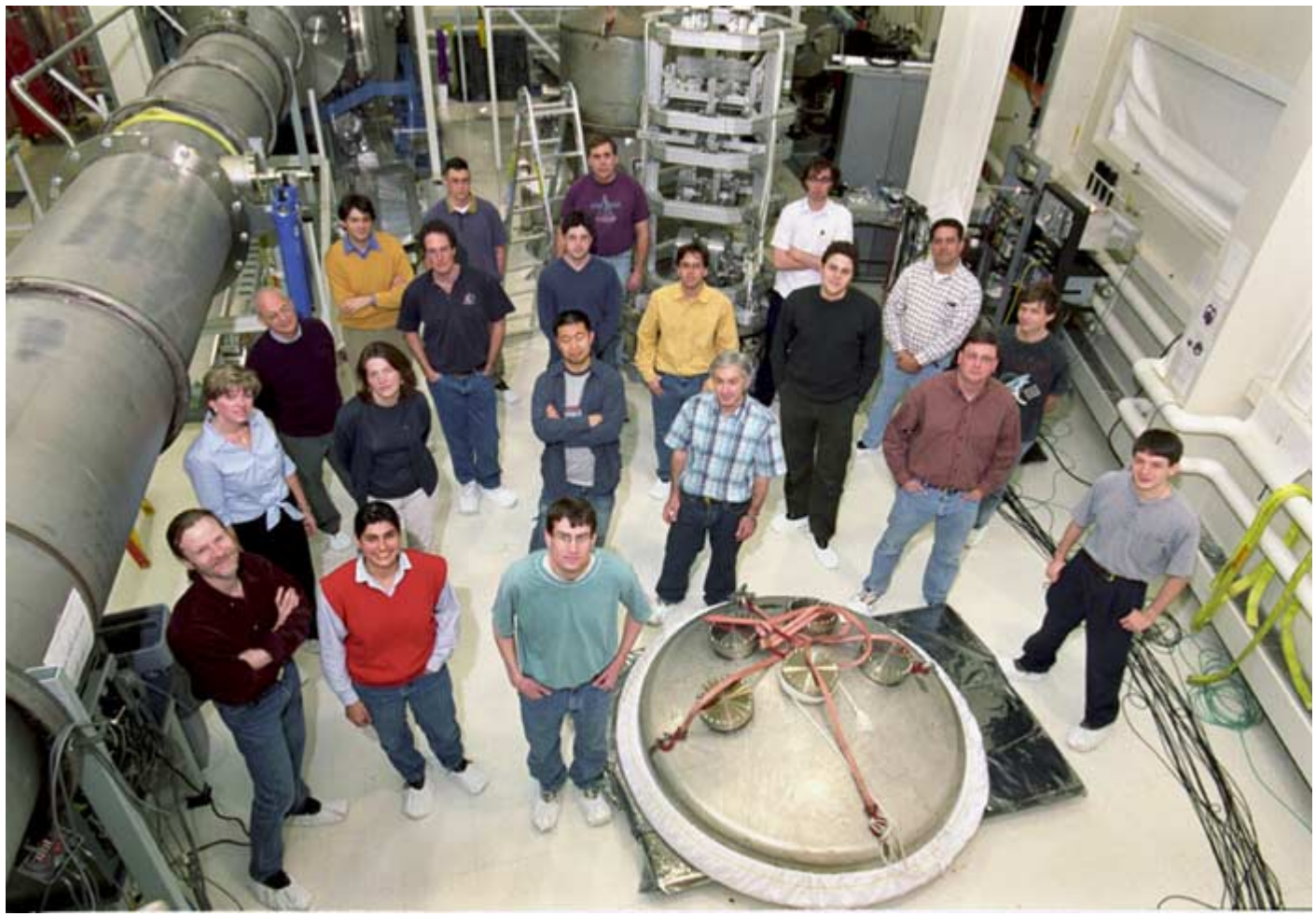
MIT LIGO

David Shoemaker

LIGO PAC 27 June 02



Support of initial LIGO commissioning

- Activity
  - » MIT Lab's first priority
  - » MIT staff led several initial LIGO subsystems from concept to hardware: Beam Tube, Vacuum Equipment, Systems Integration, Interferometer Sensing/Control, Physics Environmental Monitor
  - » Now concentrating on shaking down system
  - » Activities/staff at both MIT (hardware, e.g., new suspension sensors; analysis/remote commissioning) and at Observatories
- Individuals:
  - » Rainer Weiss – leading Livingston Commissioning, 2/3 at site
  - » Peter Fritschel – Organizing commissioning at both observatories
  - » Nergis Mavalvala – Controls, Systems, everything else
  - » Mike Zucker – leading effort to improve electronics infrastructure
  - » Dave Ottaway – continued contribution on Laer, Input Optics, etc.
  - » Rana Adhikari – Grad, Full time at Livingston; noise modeling

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Data analysis for initial LIGO

- Activity
  - » Recent faculty addition has made it ‘happen’
  - » Wide group interest in interface between instrument and data
  - » Search for ‘Un-modeled bursts’ and environmental effects
- Individuals:
  - » Erik Katsavounidis – Faculty (new students!), leading analysis in MIT group
  - » Julien Sylvestre, Stefan Ballmer – Grads, developing time-frequency-power analysis, tools for trigger evaluation
  - » Keith Bayer – programmer/sysadmin
  - » Tania Regimbau, Laura Cadonati – Postdocs, astrophysics of stochastic backgounds, trigger evaluation
  - » Fritschel, Zucker, Shoemaker, Harry, Ottaway -- leaders/participants in ‘upper limit’ initial analysis efforts

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Development of future detectors

- Activities: Advanced LIGO
  - » Systems engineering/trades (from initial LIGO)
  - » Sensing/Control expertise (from initial LIGO)
  - » LASTI (Full-scale mechanical tests of Suspensions/Isolation, Input Optics/Laser)
- Activities: beyond Advanced LIGO
  - » New group around Nergis Mavalvala, likely new NSF grant
- Individuals:
  - » Peter Fritschel – Leading System trades, Sensing/control subsystem
  - » Mike Zucker – Sensing/Control; thermal compensation; LASTI leader
  - » Nergis Mavalvala – Faculty (new students!), Sensing/Control, QND schemes
  - » David Shoemaker – LSC suspensions/isolation working group leader
  - » Ken Mason – Mech Eng for LASTI, Preisolator
  - » Rich Mittleman – Controls, LASTI
  - » Gregg Harry – Thermal Noise, LASTI
  - » Dave Ottaway – Optics/lasers
  - » Ryan Lawrence – Grad, Thermal compensation
  - » Jamie Rollins,Joe Betzwieser– Grads, LASTI
  - » Keisuke Goda – Grad, Sensing/control/QND

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Community

- Activity
  - » LIGO Scientific Collaboration
  - » LIGO Advanced System Test Interferometer: Focus for many community instrument development activities
- Individuals
  - » Weiss: LSC Spokesperson
  - » Shoemaker: Leader of LSC Suspensions/Isolation Working Group
  - » Zucker: LASTI leader

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MIT LIGO Lab

- Origin: the MIT Gravitation and Cosmology Lab
  - » CMB ballooning, COBE earlier activities
  - » Precursor of the US GW Observatory effort
  - » Presently totally supported by and focussed on LIGO
  - » May grow in scope through NSF and NASA grants to new faculty
  - » Part of MIT's Center for Space Research – connection with source modeling, astrophysics, technical support

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Relationship to rest of LIGO Lab

- One of the 4 sites (Caltech, Hanford, Livingston, MIT)
- Capitalizes on centralized administration at Caltech (like Observatories)
- Subcontract to MIT group, thus much purchasing, financial tracking, etc. local to MIT (unlike Observatories)
- Integrated into the management, planning, scientific and technical activities
- Fully participant in the commissioning at the observatories
- And the data analysis!

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MIT Staffing summary

- 3.5 Scientist/faculty FTEs (goal: 6)
- 5 Postdoc/term FTEs (goal: 3)
- 7 Graduate students
- 3.5 Engineers, Technical Specialist, Sysadmin
- 1 Administrator
- Presently 20 FTEs total, 22 individuals (+2-3 Ugrads)
  - » 6 Ugrads this summer!

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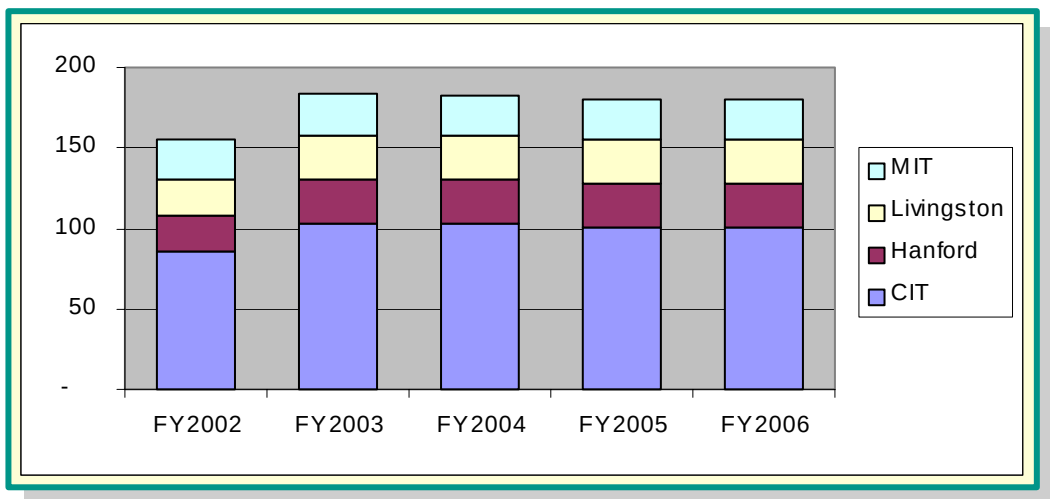
Staff (Budgeted) by Location

Location	FY2002	FY2003	FY2004	FY2005	FY2006
CIT	85	103	103	100	100
Hanford	23	27	27	27	27
Livingston	22	28	28	28	28
MIT	25	25	25	25	25
Total	155	183	183	180	180



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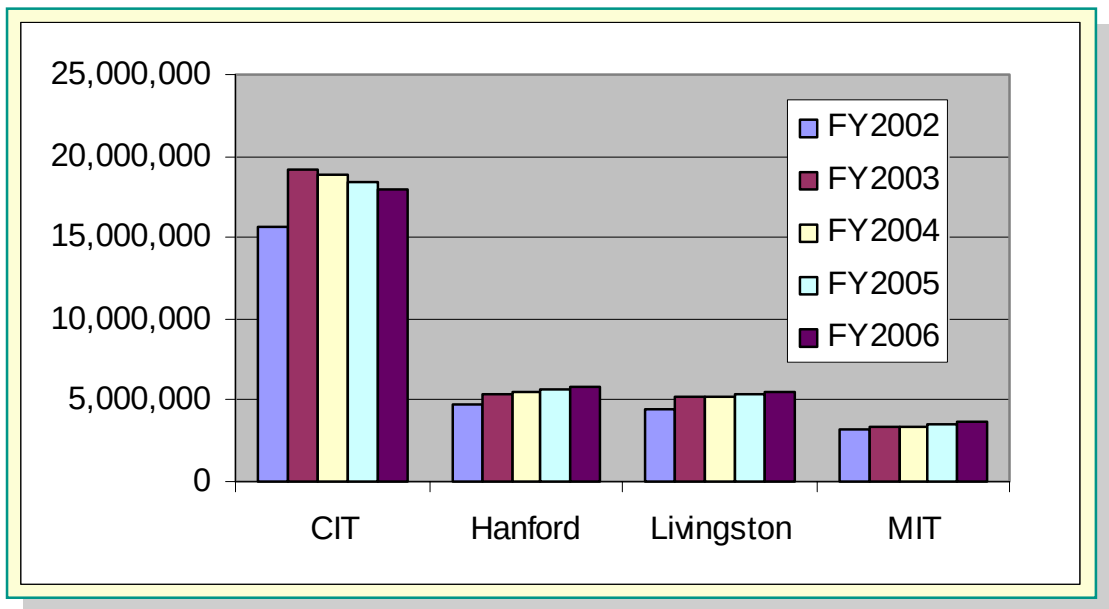
Proposed by Year and Site

Location	FY2002	FY2003	FY2004	FY2005	FY2006
CIT	15,574,955	19,129,542	18,822,123	18,415,444	17,991,714
Hanford	4,762,652	5,405,780	5,551,840	5,706,276	5,868,325
Livingston	4,459,705	5,165,062	5,226,551	5,375,890	5,531,542
MIT	3,202,687	3,299,615	3,399,486	3,502,390	3,608,419
Grand Total	**28,000,000**	**33,000,000**	**33,000,000**	**33,000,000**	**33,000,000**



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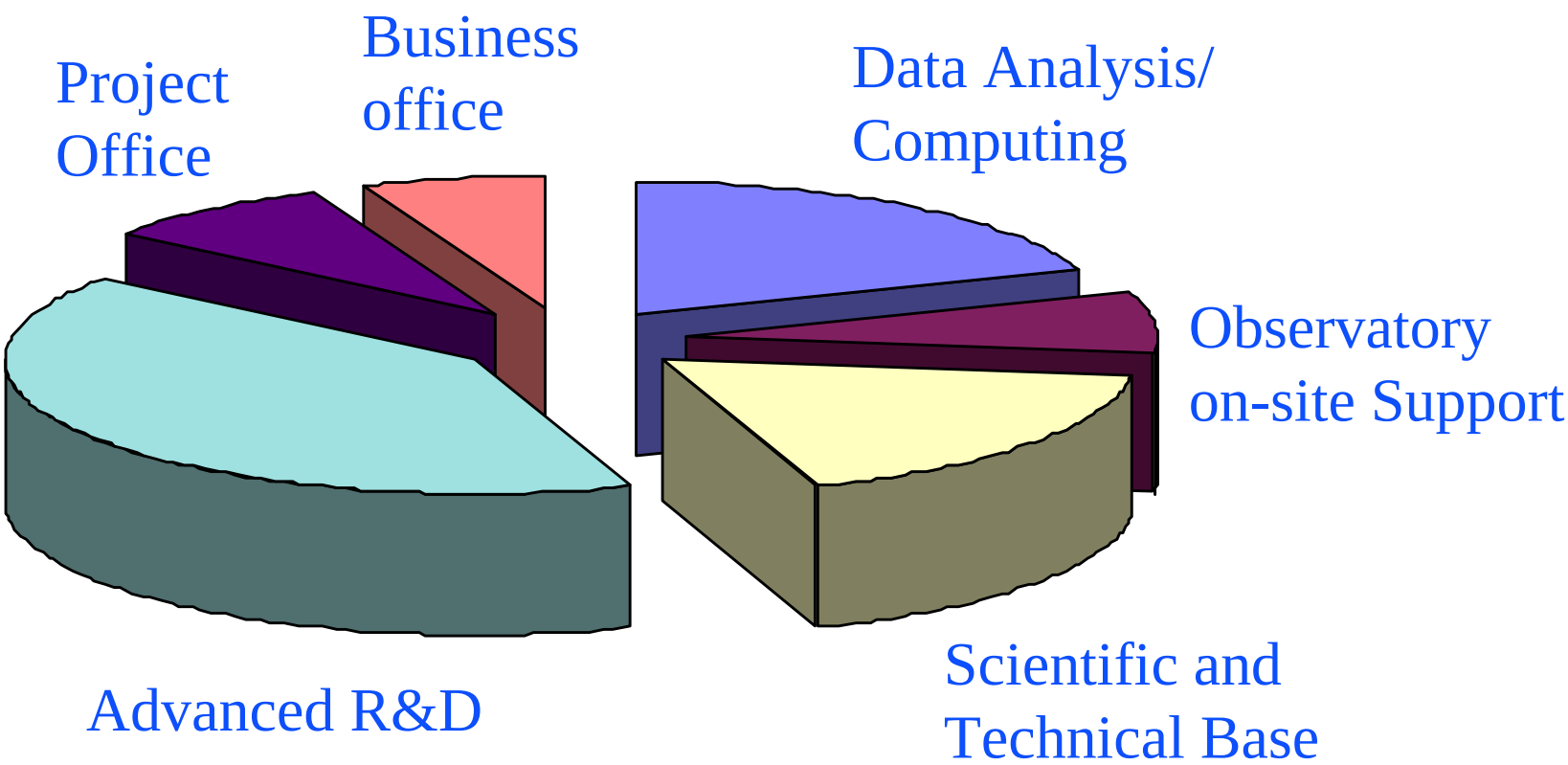
MIT 2002 Budget by Category



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Evolution

- Baseline LIGO Lab plan is for constant group size
- Significant activities in instrument development based on geographically distributed groups, not added staff
  - » Suspensions/LASTI – Caltech/UK-led
  - » Isolation/LASTI – LLO/LSU led
  - » Adv LIGO Systems, Sensing/Control – MIT led
- Data analysis: added strength from NSF etc. grants
- QND etc.: establishment of group through NSF etc. grants
- Probable ‘swing of the pendulum’ away from Suspensions etc, toward 3rd generation readout, sensing, and control schemes

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Physical Infrastructure

- Offices in NW17, NW22
  - » Not really worth a visit
- Lab in NW17
  - » 4,000 sq ft high bay, pair of bridge cranes
  - » 8,000 sq ft laser, vibration, vacuum prep labs; machine shop; electronics shop
  - » Huge vacuum system
  - » Beowulf-type computing cluster 32→64 nodes
  - » …all equipped with HEPA overpressured air, ethernet, etc.
  - » Worth a visit!