Harvard Department of
Chemistry & Chemical Biology

GREEN
is the new Crimson

Harvard Faculty of Arts and Sciences
Jacobsen Lab Renovation
Mallinckrodt Laboratory building, 12 Oxford St , Cambridge, MA 02138

LEED-CI v2.0
GOLD

Certified LEED-CI Gold in June 2010, Jacobsen Lab is an approximately 6,000 square foot organic chemistry lab located on the second floor of the Mallinckrodt Laboratory Building at 12 Oxford Street in Cambridge, MA. Mallinckrodt, originally constructed in 1928, is one of the four buildings within the Cabot Science Complex that together house all 278,000 sq.ft. of laboratories for Harvard's Department of Chemistry and Chemical Biology (CCB).

The project was a complete renovation of an existing, functionally obsolete lab space into an energy efficient 20-person synthetic organic lab. In order to support the research activities of Professor Jacobsen and his lab group, the space was renovated to accommodate 21 fume hoods, island and wall benches, write-up rooms, a kitchenette, seminar room, glove box room, instrument room and three chemical storage spaces, as well as new men's and women's bathrooms.

Sustainability was a focus throughout the project - with Harvard's Green Building Guidelines and the LEED-CI rating system guiding the selection of materials and the design of the mechanical, electrical and plumbing (MEP) systems. Jacobsen Lab serves as an example of the importance of sustainable design and construction combined with proactive strategies for sustainability within labs.

Jacobsen Lab
Photo: Jessica Eisenman Parks.
Harvard Office for Sustainability. 2009

Project Highlights

LEED® Facts

Jacobsen Lab
Harvard Faculty of Arts and Sciences
2009 Renovation

Location……Cambridge, Massachusetts
Rating System……..Commercial Interiors v2.0
Certification Achieved…… **Gold**
Total Points Achieved…….. **38 / 57**

Sustainable Sites……..4/7
Water Efficiency……..2/2
Energy and Atmosphere……..6/12
Materials and Resources……..7/14
Indoor Environmental Quality……..14/17
Innovation and Design……5/5

84% **of on-site generated construction waste was diverted from landfills.**

19% **of the total material value came from post-consumer and/or pre-consumer recycled materials.**

48% **of the total material value came from materials manufactured within 500 miles of the project site.**

6% **of the total material value came from rapidly renewable materials.**

50% **reduction in water consumption over EPAct 1992 compliant fixtures.**

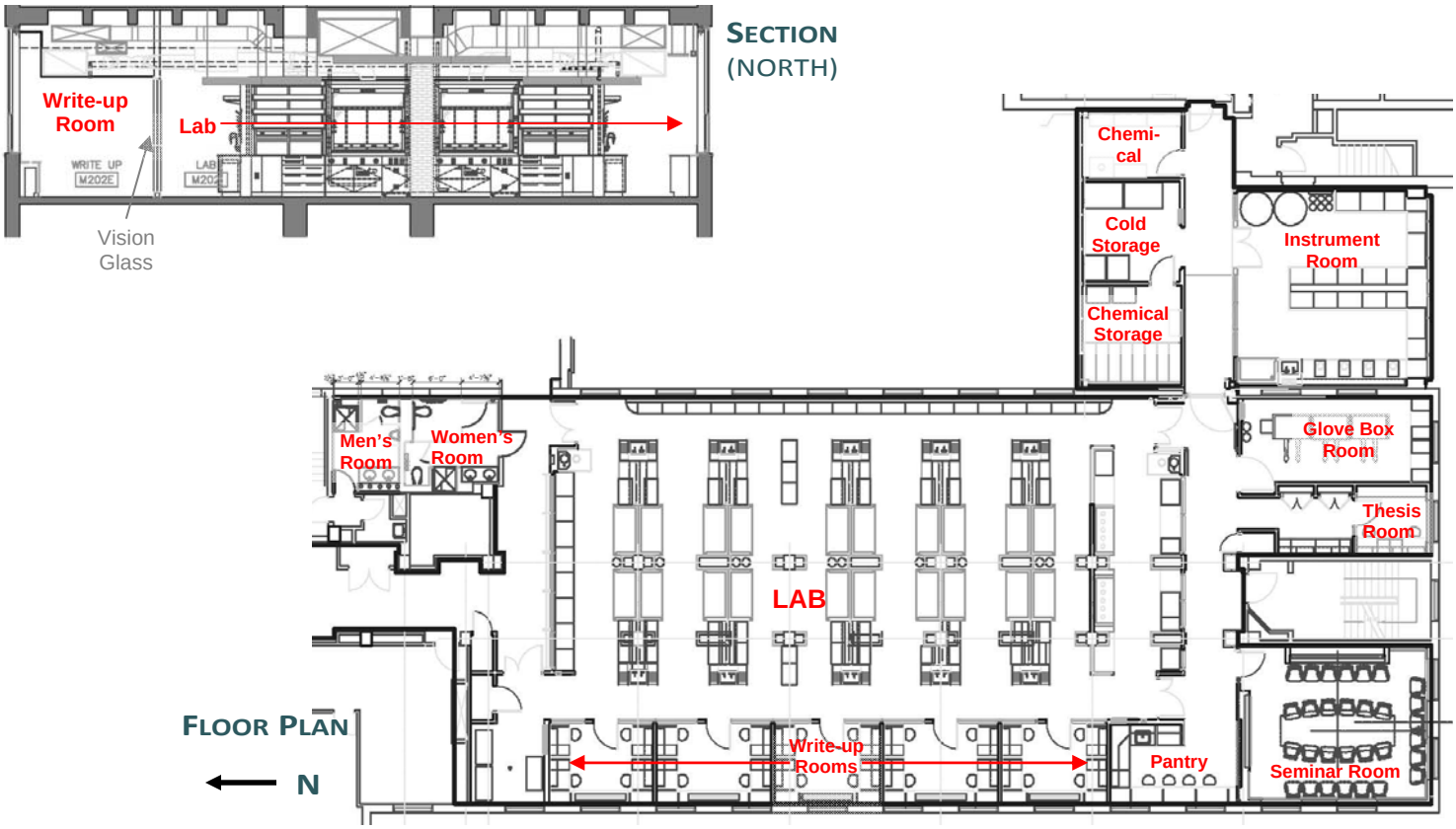
Part of the "Shut the Sash" Program to achieve greater energy efficiency in the lab.

All regularly occupied spaces have occupancy and day-light sensors to reduce the lighting levels and ventila-tion rates as appropriate.

Please print this project profile only if necessary.
If printing is required, please print double sided and recycle when finished. Thank you!

PROJECT OVERVIEW

JACOBSEN LAB ARCHITECTURAL DRAWINGS & LEED BOUNDARY

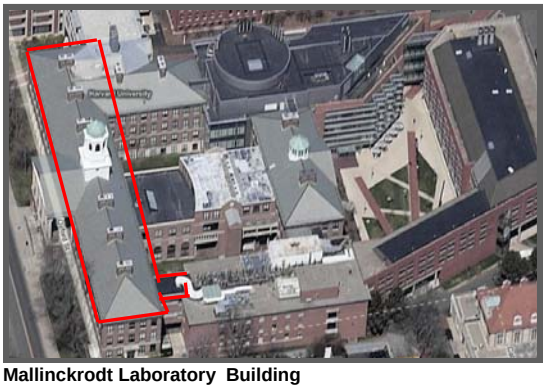


Lab looking West towards a Write-up Room
Photo: JBM General Contractors. 2009

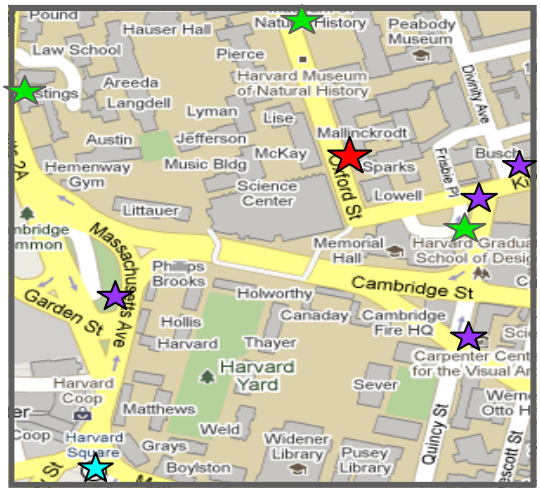
PROJECT TEAM

Owner	Harvard Faculty of Arts & Sciences
Project Manager	Harvard University, Department of Chemistry & Chemical Biology
Architect	Ellenzweig
Contractor	JBM General Contractors
HVAC Engineer	Bard, Rao + Athanas Consulting Engineers, LLC
Commissioning Authority	Energy Management Associates
Sustainability Consultant	Harvard University, Office for Sustainability Green Building Services

SITE



Mallinckrodt Laboratory Building
12 Oxford Street, Cambridge, MA



- Mallinckrodt Laboratory Building
- MBTA Bus Stops
- Harvard University Shuttle Bus Stops
- MBTA Subway Station

- To encourage alternatives to driving, all occupants of the Mallinckrodt Laboratory building have access to Harvard's comprehensive ***CommuterChoice Program***, which provides incentives and discounts for alternative transportation, carpooling and fuel-efficient vehicles.

- Four Bike Racks are located at the building's entrances.

- Within 1/4-mile radius of the building there is access to:
  - **7** MBTA Bus Lines
  - **2** Harvard Shuttle Bus Lines
  - **1** MBTA Subway Station (0.27 miles)

  These transit lines provide connections to the extensive public transportation network throughout the Greater Boston Area.

- The building is located in a dense urban area, which allows occupants to walk and easily access amenities such as restaurants, banks, churches, and retail stores.

Bike Racks at Mallinckrodt
Photo: Jessica Eisenman Parks.
Harvard Office for Sustainability. 2009

WATER EFFICIENCY

The Energy Policy Act of 1992 (EPAct 1992) established the first water conserving standards for plumbing fixtures. Since 1992, it has been determined that with even lower standards plumbing fixtures can still effectively serve their intended purpose.

The Jacobsen Lab project included the renovation of two bathrooms and a kitchenette. Per project specifications, only water efficient fixtures were installed, which reduces domestic water consumption by **50.12%** over standard EPAct 1992 fixtures. This is the equivalent of saving over 20,000 gallons per year.

Differences in the Flush & Flow Rates for EPAct 1992 Standard Fixtures and the fixtures installed for the Jacobsen Lab Project

Fixture Type	Jacobsen Lab Flush & Flow Rates	EPAct 1992 Standard Flush & Flow Rates
Water Closet [GPF]	Dual-Flush 1.6 & 1.1	1.6
Urinal [GPF]	Waterless 0.0	1.0
Bathroom Sink [GPM]	0.5	2.5
Shower [GPM]	1.5	2.5
Kitchen Sink [GPM]	2.2	2.5
GPF - Gallons Per Flush		GPM - Gallons Per Minute

FIXTURES IN JACOBSEN PROJECT SCOPE

SLOAN UPPERCUT®
Dual-Flush Flushometer
(Up 1.1 gpf and Down 1.6 gpf)

Grohe Relaxa Deluxe®
Hand Held Showerhead
(1.5 gpm)

SLOAN Solis® EAF-275
Solar Powered Sensor Activated
Lavatory Faucet (0.5 gpm)

0.5 gpm VR Aerator Spray Head (# EAF-15)

Please print this project profile only if necessary.
If printing is required, please print double sided and recycle when finished. Thank you!

ENERGY EFFICIENCY

The Faculty of Arts and Sciences (FAS) has committed, along with Harvard University as a whole, to reduce greenhouse gas emissions 30% below 2006 levels by 2016, inclusive of growth. Therefore, energy efficiency was a main goal of this renovation project.

MECHANICAL SYSTEMS

Demand Control Ventilation: Sensors located in the Seminar Room take real time, continuous CO2 measurements throughout the day and adjusts ventilation rates depending on the readings. This ensures that the HVAC only provides the actual of ventilation necessary based on occupancy level.

Occupancy and Temperature Sensors: Each room has occupancy sensors that are tied to the building's control system allowing the supply air and temperature set-points to set back whenever spaces are unoccupied. The type of space and the activities carried out within it dictate the appropriate occupied and unoccupied set-points for temperature and ventilation.

High Performance Fume Hoods Jacobsen Lab has 21 Variable Air Volume (VAV) fume hoods, which run at a face velocity of 80 feet per minute instead of 100 feet per minute, thus reducing air flow by 20% and conserving the energy that would have been required to condition the air.

Real-time displays: Hood exhaust rates are displayed in real time, reminding occupants to keep hood sashes closed when not in use. **"Shut the Sash":** A competition between labs aimed at reducing the extreme energy consumption due to open fume hoods.

Commissioning: The mechanical and electrical systems were fully commissioned by a third-party Commissioning Authority, which ensured that all energy-related systems were installed as designed, and operating efficiently prior to occupancy.

Renewable Energy: Renewable Energy Certificates (RECs) have been purchased from Sterling Planet (wind power) equivalent to 100% of the anticipated electricity over two years.

Face Velocity Meter

ELECTRICAL SYSTEMS

Plug Loads: 85% (by rated power) of the equipment and appliances in the space are Energy Star, which includes such items as the computers, printers and refrigerator.

Light Fixtures: Energy-efficient and low-mercury fluorescent lighting fixtures and lamps were carefully chosen and strategically located within each space to reduce electricity consumption while maintaining adequate lighting levels for each type of space.

Lighting controls: The lighting design consists of overhead lighting controlled by multiple switches/zones and task lights at the desks. This design allows occupants to adjust the lighting to suit their individual preferences, which not only increases productivity and comfort, but also decreases energy use.

Light Sensors: All rooms in the Jacobsen Lab without specific lighting needs have both **Occupancy Sensors** (turn lights off when not activated by motion for a set period of time) and **Daylight Sensors** (dim lighting in response to the amount of natural light coming through the windows).

Lab Bench and Real Time Display
Photo: Jessica Eisenman Parks.
Office for Sustainability, 2009

INDOOR ENVIRONMENTAL QUALITY

FAS is committed to providing a healthy indoor environment for all occupants. The project team was careful to maintain healthy indoor air quality during construction and to also ensure the space is designed to promote healthy indoor air quality during occupancy.

Indoor Air Quality During Construction: The building maintained occupancy throughout construction. Thus, a comprehensive indoor air quality management plan was implemented during construction to maintain healthy indoor air quality.

Thermal Comfort Survey: Occupants will be surveyed about their thermal comfort once per season. The Operations team will adjust the temperature and ventilation as needed.

Green Housekeeping: Jacobsen Lab participates in Harvard's Facilities and Maintenance Operations (FMO) Green Cleaning Program, which uses 100% recycled paper products and Green Seal certified cleaning solutions, among other green housekeeping practices.

Daylight and Views: In 97% of the regularly occupied spaces occupants have direct line of sight to the outside.

Only Materials with **Low or No VOC Content** were used in the Jacobsen Lab project. Volatile Organic Compounds (VOCs) are chemical compounds and known carcinogens found in many construction materials that are considered detrimental to indoor air quality. Reducing the use of VOCs whenever possible improves indoor air quality and consequently occupant health and productivity.

- **Composite Wood and Laminate Adhesives** used have no added Urea Formaldehyde
- **Carpet System:** Mohawk Karastan, Quillen Carpet, a CIR Green Label Plus Certified product.
- **Adhesives &** Sealants **and Paints & Coatings** Examples of the products used:

Product Category	Product & Manufacturer	VOC Content (g/l)	VOC Limit (g/l)	Standard
Paints & Coatings	Eco Spec Latex Flat, Benjamin Moore	0	50	Green Seal GS-11
	M04 Acrylic Metal Primer (Benjamin Moore)	53.0	100.0	SCAQMD Rule #1113
Adhesives & Sealants	Chapco 400 Cove Base Adhesive (Chicago Adhesive Products)	0.0	50	SCAQMD Rule #1168
	Super 77 Multipurpose Spray Adhesive (3M Co.)	51% by weight	70% by Weight	Aerosol Adhesives VOC Limits (Green Seal)

Construction IAQ Measures Implemented During Construction

Photos: Harvard Office for Sustainability. 2009

Source Control:
VOC-free Cove-Based Adhesive.

Housekeeping:
Protection of porous building materials prior to installation.

HVAC Protection:
Ductwork sealed before installation

New Connector between Mallinckrodt and Conant
Photo: JBM General Contractors, 2009

Jacobsen Lab Instrument Room (in new connector)
Photo: JBM General Contractors, 2009

MATERIALS & WASTE

Material Selection was a very important part of the design process and done early on in the project to ensure that the materials would contribute to the over all green design project scope. Additionally, accounting for the long lead times associated with green casework, flooring and furniture from the beginning allowed the specified materials to remain in the project rather than being cut.

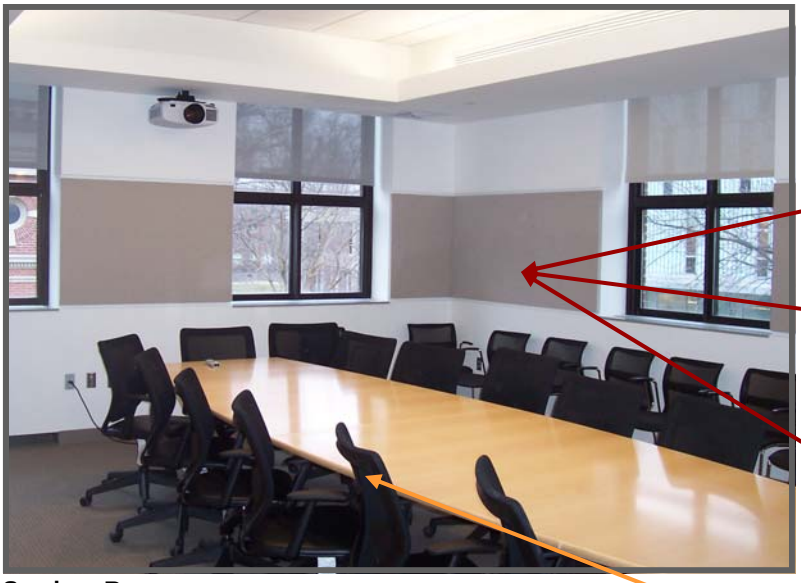
84% of the construction waste was diverted from landfills **(109 TONS).**

20% of the total material value came from post-consumer and/or pre-consumer recycled content materials.

48% of the total material value came from materials manufactured within 500 miles of the project site.

6% of the total material value came from rapidly renewable materials such as bamboo, which was used as a veneer for all of the lab and kitchen casework.

Jacobsen Lab - Pantry
Photo: JBM General Contractors, 2009



Seminar Room
Photo: JBM General Contractors. 2009

REGIONAL MATERIALS, MANUFACTURED

- G410 Energy Smart Roof Membrane (Silka Sarnafil, Inc.) - Canton, MA - **24 mi**
- Bulletin Boards (Forbo) - Hazleton, PA - **273 mi**

RAPIDLY RENEWABLE CONTENT

- Bamboo (Cali Bamboo) - **93%**
- Bulletin Boards (Forbo) - **75%** *(Linseed Oil, Granulated Cork, Pine Rosin binders, jute backing)*

RECYCLED CONTENT

Pre-consumer

- Batt Insulation (Guardian) - **5%**
- Aries MDF (Sierra Pine)- **100%**
- Bulletin Boards (Forbo) - **53%**

Post-consumer

- Batt Insulation (Guardian) - **30%**
- Misc. Metals/Steel Products - **50%-92%**
- Simple Chair (Keilhauer) - **18%**

ADDITIONAL RESOURCES

- Harvard FAS, Dept. of Chemistry and Chemical Biology: http://www.chem.harvard.edu
- Harvard FAS, Green Program: http://green.harvard.edu/fas
- Harvard FAS, Green Labs Program: http://green.harvard.edu/fas/green-labs
- Harvard OFS - Green Building Services: http://green.harvard.edu/green-building-services
- Harvard OFS - Green Building Resource: http://green.harvard.edu/theresource